Impacts of East Coast Refinery Closures

Prepared by EnSys Energy

For the American Petroleum Institute

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Abbreviations & Acronyms Used in this Report

bbl	barrel
bpd	barrels per day
mbd	million barrels per day
tpa	tonnes per annum
mtpa	million tonnes per annum

AEO	Annual Energy Outlook (of the EIA)
DOE	Department of Energy
EIA	Energy Information Administration
EPA	Environmental Protection Agency
NYH	New York Harbor
PADD	Petroleum Administration for Defense District
ULS	Ultra low sulfur
ULSD	Ultra low sulfur diesel

Key Findings

The shutting down of the Phillips66 Trainer, Sunoco Philadelphia and St. Croix HOVENSA refineries, whether narrowly averted, still pending or actual, continues a series of regional closures and substantially reduces the volumes of petroleum products supplied into the U.S. Northeast that are produced locally.

These refineries have closed, or have been threatened with closure, because they have specific disadvantages, notably reliance on premium cost low sulfur crudes and an orientation to gasoline which is currently less economic to produce than distillates; but also because they are operating in a market where there is intense international competition and flat to declining demand. In addition, they, as other U.S. refineries, have been incurring substantial and rising environmental compliance costs. Together, these factors have led to substantial financial losses.

Sourcing replacement product supply for Summer 2012 gasoline could be an issue but a more major concern is supply of distillate fuel, especially in Winter 2012/13, and beyond. This concern is magnified by the plans of the Northeast States to progressively move to ultra-low sulfur standards for heating oil, led by New York State whose standard is scheduled to come into effect July 2012.

U.S. Gulf Coast – and potentially Midwestern – refineries can supply the replacement volumes. In the short term, there are concerns over the adequacy of logistics capacity to move replacement products into the Northeast, notably from the Gulf Coast, but options exist and the industry is already reacting with additions to pipeline and Jones Act tanker capacity and to terminal flexibility.

Although U.S. refineries can replace product lost by closures, so can foreign refiners. Actions at the federal, state and local levels will influence how the situation evolves. Of central importance is support to infrastructure developments that (a) bring domestic crude oils to remaining Northeast refineries so as to help them stay open (b) deliver adequate and stable Lower 48 and Western Canadian crude supplies to Gulf Coast refineries so that they (and Midwest refineries) can replace lost East Coast products and (c) ensure efficient movement of products into the Northeast from the Gulf Coast and Midwest. Enabling/supporting such projects as Keystone XL, Seaway reversal and expansion, and other pipeline and rail developments, will have a critical impact on the extent to which East Coast refineries can stay open and/or other U.S. refineries – not foreign refiners – can resupply the region.

1 Introduction

The recent recession, among other factors, reduced petroleum product demand across OECD regions and has precipitated widespread refinery sales and closures. Several of these closures have occurred or are threatened in the U.S. Northeast as summarized in Exhibit 1-1, taken from a February 2012 EIA report on the topic[1]. In 2010, two East Coast refineries were closed (Sunoco Eagle Point/Westville New Jersey and Western Refining Yorktown Virginia) with a combined capacity of over 210,000 bpd. In 2011, Sunoco also shut its 178,000 bpd Marcus Hook Pennsylvania refinery. In September 2011, ConocoPhillips idled its 185,000 bpd Trainer Pennsylvania refinery and announced it would be permanently closed unless a buyer was found this Spring. (Since then, Delta Airlines has agreed to purchase the refinery and operate it primarily to source jet fuel. Thus the prospect is that the refinery will reopen.) Sunoco has stated its 335,000 bpd Philadelphia Pennsylvania refinery will be closed this July unless sold before then[2]. Together, if all these closures were to turn out to be permanent, EIA estimates a loss of over 900,000 bpd of regional capacity. Accounting for the reopening of the Trainer refinery however would somewhat mitigate this loss.

In addition, Hess, in January, announced permanent closure of the 375,000 bpd HOVENSA refinery in St. Croix, US Virgin Islands. In March, Valero announced that it is idling and potentially closing its 235,000 bpd Aruba refinery[3]. Also in January, Swiss independent refiner Petroplus announced bankruptcy and at least the temporary closure of its five refineries in Europe. In mid-May, Imperial Oil Ltd., (ExxonMobil's Canadian subsidiary), announced it is considering selling its 80,000 bpd Dartmouth, Nova Scotia, refinery or converting it to a terminal[4].

[1] EIA, *Potential Impacts of Reductions in Refinery Activity on Northeast Petroleum Product Markets*.
[2] As of the date of this report, discussions are understood to be active for the potential sale of the Sunoco Philadelphia refinery to a group whose announced intention is to keep the refinery open.
[3] The Aruba refinery has had a recent history of being idled and restarted. The refinery was reported as closing, inter alia, by OGJ Newsletter, March 26, 2012. More recent press reports indicate that Petrochina may buy the refinery; http://www.reuters.com/article/2012/05/09/us-petrochina-valero-aruba-idUSBRE8480C620120509.
[4] http://www.reuters.com/article/2012/05/17/us-imperialoil-idUSBRE84G0PH20120517.

U.S. East Coast Refineries Operating Capacity					
Owner	**City**	**State**	**Operating Crude Unit Capacity (bbl/calendar day)**	**Percent of Region**	**Status**
Operating and Idled Refineries					
Phillips66	Linden	NJ	238,000	17%	operating
PBF Energy Co. LLC	Delaware City	DE	182,200	13%	operating
PBF Energy Co. LLC	Paulsboro	NJ	160,000	12%	operating
United Refining Co.	Warren	PA	65,000	5%	operating
American Refining	Bradford	PA	10,000	1%	operating
Ergon West Virginia	Newell/Congo	WV	20,000	1%	operating
Hess Corp	Port Reading	NJ	0*		operating
Sunoco Inc.	Philadelphia	PA	335,000	24%	operating, for sale
Sunoco Inc.	Marcus Hook	PA	178,000	13%	idled 12/2011, for sale
Phillips66	Trainer	PA	185,000	13%	idled 9/2011, sold**
Total Operating & Idled			**1,373,200**		
Recently Shut Refineries					
Western Refining	Yorktown	VA	66,300		shut 9/2010
Sunoco Inc.	Eagle Pt./Westville	NJ	145,000		shut 2/2010
* Hess Port Reading has a production capacity of 70,000 bbl/calendar day but no crude capacity					
** Phillips66 Trainer refinery has been sold to Delta Airlines					
Listed refineries exclude two that produce primarily asphalt					
Source: EIA					

Exhibit 1-1

This paper, prepared by EnSys Energy for the American Petroleum Institute, reviews the East Coast refining situation, the underlying drivers and outlook. The paper focuses on:

- The facts of what is happening;
- The potential short and medium term consequences for refined product and regional crude oil markets;
- The underlying drivers of these changes; and,
- The opportunities – if any – to mitigate the evolving situation.

In order to address key logistics questions, EnSys has worked jointly on this assignment with marine specialists Navigistics Consulting and pipeline specialist Dr. Robert Luckner.

Section 2, Summary, briefly summarizes the key aspects as we see them.

Section 3 focuses on the specifics of the refineries that are closing; hence the reasons for closure.

Section 4 discusses the broader national and international market trends and regulatory driving forces that are contributing to refinery closures in the U.S. and elsewhere.

Section 5 reviews the status of East Coast refinery closures and the potential impacts on product markets and logistics, especially short term, this Summer and Winter 2012/2013. As such, the Section draws heavily from a recent study by the EIA.

Section 6 presents conclusions arising from the review with a focus on factors and actions that could influence either positively or negatively the outcome of these closures.

Section 7 – Appendix – provides a detailed overview of the current and projected environmental regulations impacting the U.S. refining sector.

2 Summary

The actual, narrowly averted or still pending closures of the Phillips66 Trainer, Sunoco Philadelphia and St. Croix HOVENSA refineries continue a series of closures and substantially reduce the volumes of products supplied into the U.S. Northeast that are produced locally. Resulting concerns and questions center on why the refineries are closing, how replacement product will be supplied into the region in the short term, Summer 2012 through Winter 2012/13, and what the implications are for longer term supply and import dependency.

REFINERY DISADVANTAGES

These refineries are closing because they have specific disadvantages, notably they rely heavily on premium cost low sulfur crudes and they are oriented to gasoline which currently is less economic to produce than distillates. In addition, they are relatively old, do not have the advantages of local crude supply, cannot accept crude delivery via the largest crude tankers (VLCC's), lack significant production of specialty products or integration with petrochemicals – and they would face significant costs to comply with pending environmental regulations on both fuels products and the refineries' own stationary source emissions.

EAST COAST AND INTERNATIONAL MARKET DEVELOPMENTS

In addition to these specific factors, the East Coast refineries are operating in a difficult broader market context. They have full exposure to international markets and to intense competition from multiple sources to supply products, notably gasoline, into the East Coast. This competition is growing with the arrival of new, highly efficient export refineries in India and the Middle East, as well as being sustained from more traditional suppliers in Eastern Canada, Europe and the U.S. Gulf Coast.

In addition, the East Coast refineries are operating in a market where demand is flat to declining. While distillate demand in the U.S. – and also Europe – is projected to continue to grow, that for the key gasoline sub-sector is shrinking on both continents. Total gasoline demand in the U.S. has been declining since the recession. Relatively high gasoline prices and the lingering impacts of recession combined with more fuel efficient vehicles have acted together to keep gasoline demand flat to declining. Driven by cost and efficiency trends, gasoline demand is projected to continue to trend downward[5]. In addition, Federal renewable fuels mandates have led, to date, to ethanol displacing almost 10% of gasoline supply - reducing

[5] In their 2012 Annual Energy Outlook, Early Release Reference Case, the EIA estimate U.S. gasoline demand as declining from 9.0 million bpd in 2010 to 8.6 million bpd in 2020 and 8.2 million bpd by 2030.

that needed from refineries correspondingly. These same mandates call for additional, continuing ethanol supply growth, further cutting into the fraction of gasoline to be produced from refineries in the future[6]. As a result, Atlantic Basin refining capacity is in surplus and is expected to remain so unless and until there are significant refinery closures in the U.S. and Europe.

FINANCIAL IMPACTS

The combined effects of the above factors have led to a situation where the East Coast, U.S. Virgin Islands and Aruba refineries that have closed or where closure is threatened have all suffered heavy financial losses. A statement by HOVENSA on January 18th, 2012, sums up the situation.

> "Losses at the HOVENSA refinery have totaled $1.3 billion in the past three years alone and were projected to continue. These losses have been caused primarily by weakness in demand for refined petroleum products due to the global economic slowdown and the addition of new refining capacity in emerging markets. In the past three years, these factors have caused the closure of approximately 18 refineries in the United States and Europe with capacity totaling more than 2 million barrels of oil per day. In addition, the low price of natural gas in the United States has put HOVENSA, an oil-fueled refinery, at a competitive disadvantage."

Similar statements have been made by Sunoco in reference to the Marcus Hook and Philadelphia refineries and by Phillips66 with reference to the Trainer refinery.

CLOSURE IMPACTS ON PRODUCT SUPPLY

The combined product supply impacts of most or all of Sunoco Philadelphia and Marcus Hook, Phillips66 Trainer and HOVENSA St. Croix all closing are significant[7]. The EIA estimated supply deficits for the U.S. Northeast of 160,000 bpd for gasoline in 2012 rising to 240,000 bpd in 2013, on the basis of Phillips66 Trainer, Sunoco Marcus Hook and HOVENSA St. Croix all staying shut and of the Sunoco Philadelphia refinery closing in July 2012. 2013 would thus be the first year for the full impact to be felt. For ULS diesel, EIA projected deficits of 90,000 bpd in 2012 and 180,000 bpd in 2013 on the same basis. Underlying these annual averages are seasonal effects such that the gasoline deficit could be expected to be higher in the Summer when seasonally

[6] Again, in their 2012 AEO, the EIA project U.S. ethanol supply as rising from 0.85 million bpd in 2010 to 1.1 million bpd in 2020 and 1.5 million bpd in 2030.

[7] As of the date of this report, the Phillips66 refinery has been sold to Delta Airlines with the intention that it be re-started and negotiations are under way which could lead to the sale and continued operation of the Sunoco Philadelphia refinery.

adjusted for the Summer driving peak and the distillate deficits (ULS diesel + heating oil) higher in the Winter because of seasonal heating oil demand increases. Since 2007, EIA estimates in-region supply of gasoline will have declined by 400,000 bpd by 2013, heating oil and diesel by 250,000 bpd, on their basis of all the stated refineries being closed. To this should be added other co-products from the closed refineries, for a total annual supply loss of over 800,000 bpd (allowing for part of the HOVENSA output coming into the Northeast).

LOGISTICS IMPACTS & DEVELOPMENTS

The actual and pending closures on the East Coast, at HOVENSA and in Europe (several Petroplus refineries recently closed - some may reopen however) have tightened gasoline markets. New York Harbor gasoline prices are higher relative to crude (Brent) than they were a year ago. Industry is already putting measures into place to adapt logistics to fit the changing situation. A combination of Colonial Pipeline spare capacity plus new Jones Act tanker deliveries indicates much – but not all - of the supply loss could be replaced this Summer by shipments from Gulf Coast refineries in the event both Sunoco Philadelphia and Phillips66 Trainer are shut. A reopening of Phillips66 Trainer under its new ownership would allow essentially all the supply loss to be covered in conjunction with Gulf Coast refineries. In addition, the industry has a range of other potential logistics flexibilities that could be brought into play, including options which could involve Midwest refineries contributing to supplying into the inland areas of Pennsylvania and New York State which the EIA considers especially vulnerable under any supply shortage.

Potential also exists to fairly readily adapt the equipment and tankage at the Sunoco Philadelphia and/or Phillips66 Trainer facilities to take in product by tanker or barge over the dock, store in the refinery and then feed into the existing (Sunoco and Buckeye) pipeline systems that serve Pennsylvania and New York. Significant delays could, however, result from (a) uncertainties over sale of the refineries and hence new ownership and/or (b) the permitting that would be required to enable the facility changes.

Rapid closure on the refinery sales and expediting any associated permitting would all help to ease market pressures in the Northeast – and reduce the potential for market volatility. The converse is also true.

POTENTIAL SHORT TERM CONSEQUENCES

Short term, the situation could be tightly balanced especially this Summer (2012) and Winter 2012/13, (although somewhat relieved should Phillips66 Trainer indeed reopen and/or Sunoco Philadelphia continue to operate). Overall, we share the EIA's concerns but believe there may be more capacity and flexibility to deal with the Summer 2012 situation than the EIA had

identified. Like the EIA, though, we believe that Winter 2012/13 could represent the primary challenge both in term of finding adequate distillate volumes to meet a (cold) Winter demand peak and in terms of having the logistics fully in place to efficiently route supplies into the Northeast, should the threatened refineries indeed close.

Given tightness in ULS diesel markets, New York State's decision to go ahead with its requirement for ULS standard heating oil from July 1st of this year could run the risk of exacerbating the regional heating oil supply situation in the Winter of 2012/2013, especially if that Winter resembles 2010/2011 rather than the Winter just passed. In addition, essentially all the other Northeast states, from Pennsylvania to Maine, either have passed or are considering legislation that would require ultra-low sulfur heating oil, in most cases starting in 2014 with a 500 ppm intermediate standard.

In the immediate short term, delaying the New York State ULS heating oil requirement by at least one year would potentially help ensure more plentiful supplies, especially for Winter 2012/13, and reduce the risk of potential market volatility across the Northeast. There is also, though, the issue of finding adequate supplies to meet the broadening Northeast market demand for low and ultra-low sulfur heating oil from 2014 onward, as standards in other states become operative. Deferrals of several years may be needed, especially if the threatened Northeast refineries do indeed close, to allow the industry needed time to put the necessary processing capacity and infrastructure in place in order to bring the requisite product to market.

POTENTIAL LONGER TERM CONSEQUENCES

The industry will adapt and new supply chains will evolve. A central issue both short and long term is though whether these adaptations will lead to the bulk of the replacement product supplies to the Northeast coming mainly from within the U.S. or from overseas. There are two potential scenarios. Under one, "high imports", the bulk of the replacement products come from non-U.S. sources and U.S. refineries contribute only the minority. Under the second, "high U.S.", the supply situation that evolves sees the bulk of replacement product refined in the U.S.

There are reasons why "high imports" could be the outcome. Sweet crudes (mainly from Africa and Europe) displaced from the closed East Coast refineries and also HOVENSA can readily be re-routed to Europe where suitable spare capacity exists. Undertaking the processing there would boost refinery utilizations and viability and enable European refineries to produce more distillate needed in Europe and export the co-product gasoline to the U.S. In addition under this scenario, new efficient refineries in India (Reliance and Essar) could increase their product

exports to the U.S., potentially using storage terminal capacity in the Caribbean, (including possibly HOVENSA), in New York Harbor (Reliance already leases tankage there) and/or at the closed East Coast refineries to feed their products into the Northeast distribution system. New export refineries coming on line in the Middle East in the next few years could reinforce this effect. Broadly, a "high imports" scenario goes with increased U.S. dependency on foreign sources for products supply, longer product supply lines, refining "value added" and jobs sourced outside the U.S. and/or a greater level of foreign ownership of U.S. fuels infrastructure.

Avoiding a "high imports" outcome means ensuring U.S. Gulf Coast – and potentially Midwest – refineries have the supply sources and the logistics needed to be competitive and to feed products to the Northeast. It also means acting swiftly as, once supply patterns are in place, they can be difficult to shift.

Driven by growing supplies of Western Canadian and Lower 48 crude oils, Midwestern refineries have been investing and expanding capacity. This is leading to reduced product inflows from Gulf Coast refineries. It also opens up the opportunity for Midwest refined products to be supplied into at least the western regions of Pennsylvania and New York State; longer term, potentially further into the Northeast region.

U.S. Gulf Coast refineries currently have spare capacity; movements of their products to the U.S. Midwest have been declining, as refineries there have raised throughput to take advantage of increased Lower 48 and Western Canadian crude supplies, and product exports from the Gulf Coast to regions outside the U.S. have been rising.

Minimizing future dependence in the Northeast on non-U.S. product sources therefore hinges primarily on ensuring U.S. Gulf Coast refineries can efficiently move their products to the Pennsylvania / New York region; also that those refineries in the Gulf can efficiently access stable crude supplies, namely from the U.S. Lower 48 and from Western Canada, notably via Seaway reversal and expansion, Keystone XL, or other pipeline and rail projects. Delivering heavy crude oils from Western Canada is particularly important given declining imports of such crudes from Mexico and Venezuela.

Both factors center on logistics, having the pipeline capacity in place to (a) move products from the Gulf Coast to the Northeast and (b) move crudes from the U.S. Midwest/Midcontinent and from Western Canada to the Gulf Coast. Enabling stable secure supplies to reach Gulf Coast refineries will encourage processing and expansion/investment there to make additional product available to the Northeast. Enabling adequate logistics will keep the refining value added (and jobs) in the U.S. – and *vice versa*.

IN SUMMARY

How the supply situation develops and evolves will depend in part on actions taken by state and federal authorities, in addition to stakeholders in the private sector, in:

- Supporting refinery sales in order to avoid a situation where lack of certainty or clarity over ownership leads to delays or a period of "paralysis" where there is no action to either continue refinery operation under new ownership or initiate conversion to functional product terminals
- Supporting and expediting permitting activities related to either re-purposing the refineries or to enabling pipeline expansions, terminal modifications and other logistics changes that will either directly or indirectly support supplying product into the Northeast
- Assessing whether a July 2012 changeover to ULSD standard for New York State heating oil is in the best interests of the residents of the Northeast and U.S. consumers as a whole, versus a delay to provide more leeway for Winter 2012/13 and needed time for industry to adapt. More broadly, assessing whether the standards for low and then ultra-low sulfur heating oil, that will start applying in other Northeast states from 2014 onward, could result in supply shortages, especially given the competitive pressures facing Northeast refineries
- Monitoring the supply/demand/logistics situation on a frequent basis to identify any adverse developments at an early stage
- Should refinery sales move in the direction of the refineries staying open, supporting initiatives, e.g. via timely permitting etc., to supply to them discounted Lower 48 crude oil and low priced natural gas
- Supporting the development of infrastructure for PADD3 refineries to (a) access secure crude supplies and (b) be able to route products to the Northeast
- Similarly supporting PADD2 refineries in, as necessary, supplying product into the Northeast.

3 Specific Aspects of Closed Refineries

While the closures of the three Pennsylvania refineries, and HOVENSA St. Croix, have been driven in part by the national and international trends enveloping them, they have also – and ultimately – been driven by the specifics of the refineries themselves. While these refineries are closing or may close, others across the U.S. – including on the East Coast – are staying open, and some are expanding or investing.

3.1 Factors Which Influence Refinery Viability

A series of factors influences the viability of individual refineries. These include:

- **Scale:** larger refineries are able to more efficiently spread significant fixed costs across each barrel of product. Today, major new refineries and expansions are typically in the 300,000 to 600,000 bpd capacity range. Whereas, in the past, refineries at or above 100,000 bpd were generally considered to be viable, today, even refineries as large as 300,000 bpd are not necessarily so, as the case of the 335,000 bpd Sunoco Philadelphia refinery shows.
- **Ability to process heavy, high sulfur (in other words cheaper) crudes and upgrade them** to light, clean, high quality products, i.e. a high level of processing complexity that incurs higher capital carrying and operating costs but enables the refinery to create substantial value-added by maximizing production of high quality, high value products from low cost raw materials.
- **Flexibility to vary product yields** in line with changing market conditions and, especially today, the ability to produce high quality distillate products (notably diesel and jet fuel) which are in global demand. This capability is closely tied to refinery process configuration, notably whether the refinery employs catalytic cracking, (gasoline oriented), or hydro-cracking, (distillates oriented providing more flexibility to swing from distillates to gasoline); also how high the capacity is of secondary process units relative to crude capacity.
- **Access to stable sources of crude oil supply**.
- **Production of specialty products**, such as solvents, lubricating oils, waxes, asphalt, high grade petroleum coke, since these typically serve more specialized (although limited scale) markets which command premium values.

- **Integration with petrochemical facilities** since this can allow the refinery to supply petrochemical feedstocks and/or to receive back petrochemical by-products which can further boost the refinery's economics.
- **Access to other refineries, locally**, thus opening up opportunities to further optimize operations by trading and exchanging intermediate streams.
- **Access to low cost natural gas** for supplemental refinery fuel and as a feedstock for production of hydrogen for use in hydro-cracking and hydro-desulfurization processes that enable production of high quality distillate products.
- **Access to deep water ports** which enable crude oil to be delivered more cheaply using Very Large Crude Carriers (VLCC's) rather than smaller, more costly vessels.
- **Age and operating efficiency**. Newer refineries tend to be more efficient in terms of their energy consumption and operating costs per barrel of throughput. Larger scale (capacity) can also aid in achieving higher operating efficiencies.
- **Costs of construction and fixed operating costs**. Costs for construction of the same process plant vary from region to region, as do factors, such as labor rates, which affect fixed operating costs. In the U.S., costs are generally taken as lowest on the Gulf Coast and highest in California with other regions falling in between. Outside the U.S., costs are generally high in Europe and Japan but China, India and several Middle Eastern countries are now capable of building and operating large, complex, new refineries at costs that are highly competitive internationally.
- **Costs of Environmental Compliance.** The costs refineries incur to comply with environmental regulation of both their stationary emissions and the quality of the products they produce vary widely from country to country and even from state to state. As further discussed in Section 7, Appendix, these costs have been substantial and rising for U.S. refineries.

3.2 Characteristics of the Pennsylvania Refineries

Against these characteristics, those of the Pennsylvania refineries now threatened with closure (or recently closed) do not stand up well.

In terms of scale, the main East Coast refineries in Pennsylvania, New Jersey and Delaware range from 160,000 to 335,000 bpd (excluding the smaller inland and/or asphalt refineries). This places them in the middle range, and therefore neither as immediately secure as high capacity refineries (in the 400,000 to 600,000 bpd range) nor immediately vulnerable through lack of scale. However, as Exhibit 3-1 shows, despite being in the middle range of capacity,

refinery utilizations in PADD1 have declined substantially since 2006, whereas those for PADD3 (Gulf Coast) and PADD2 (Midwest) dipped during the recession but have since recovered. The lower utilizations are the results of difficulties in competing. They lead to the refineries' significant fixed costs being spread across fewer barrels of product, thereby creating a "downward spiral" of reducing profitability.

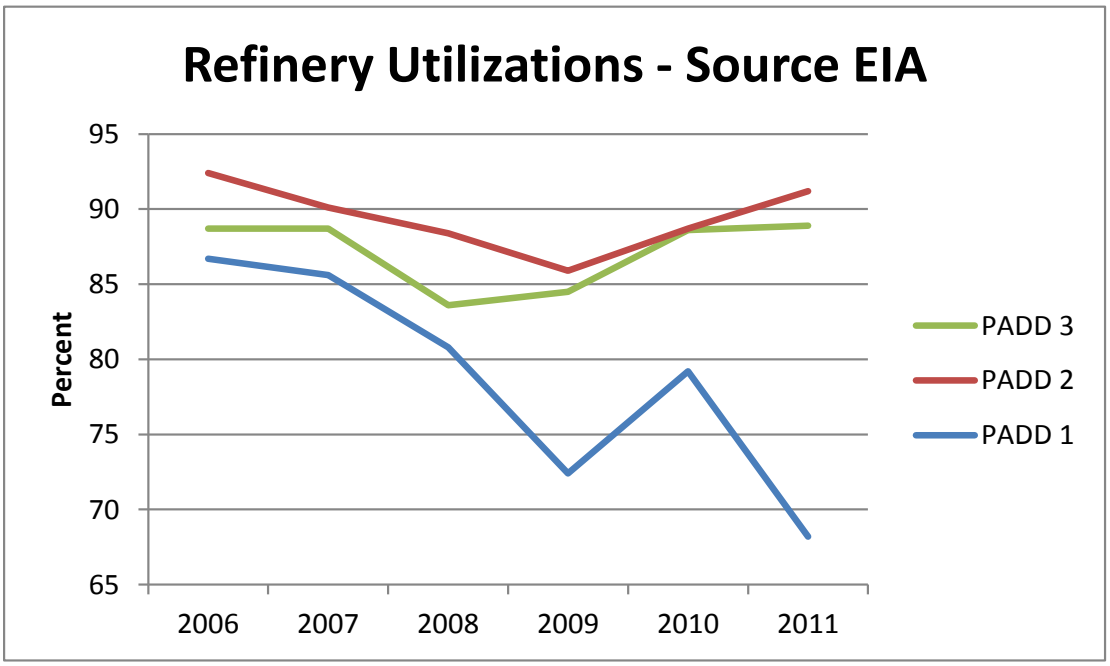


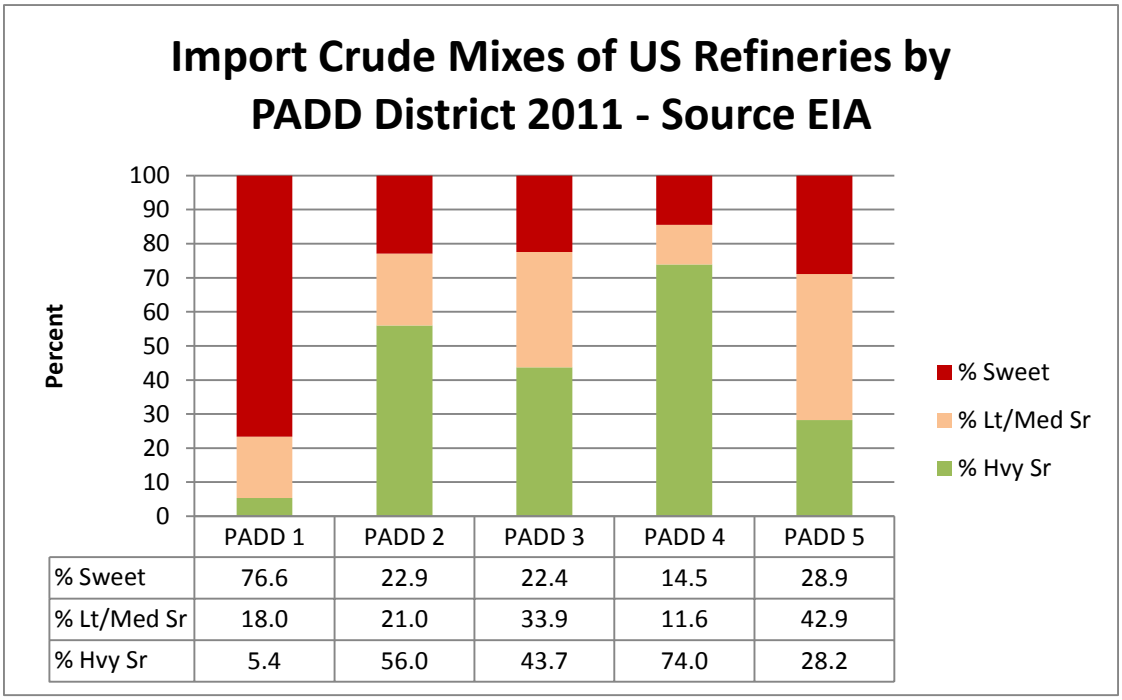
Exhibit 3-1

3.2.1 Crude Oils Processed

A primary factor that makes the East Coast refineries that are closing stand out from others in the region, and in the U.S. as a whole, is that they process almost entirely sweet crude oils. Exhibit 3-2 compares the imports of crude oil into each PADD in 2011. Recognizing that only PADD1 (the East Coast) processes entirely imported crudes whereas all other regions of the U.S. process a mix of imports and domestic crude oils, the data nonetheless illustrate the contrast between the high proportion of sweet crude imported into and run in the East Coast refineries versus the much lower proportions processed elsewhere in the country.

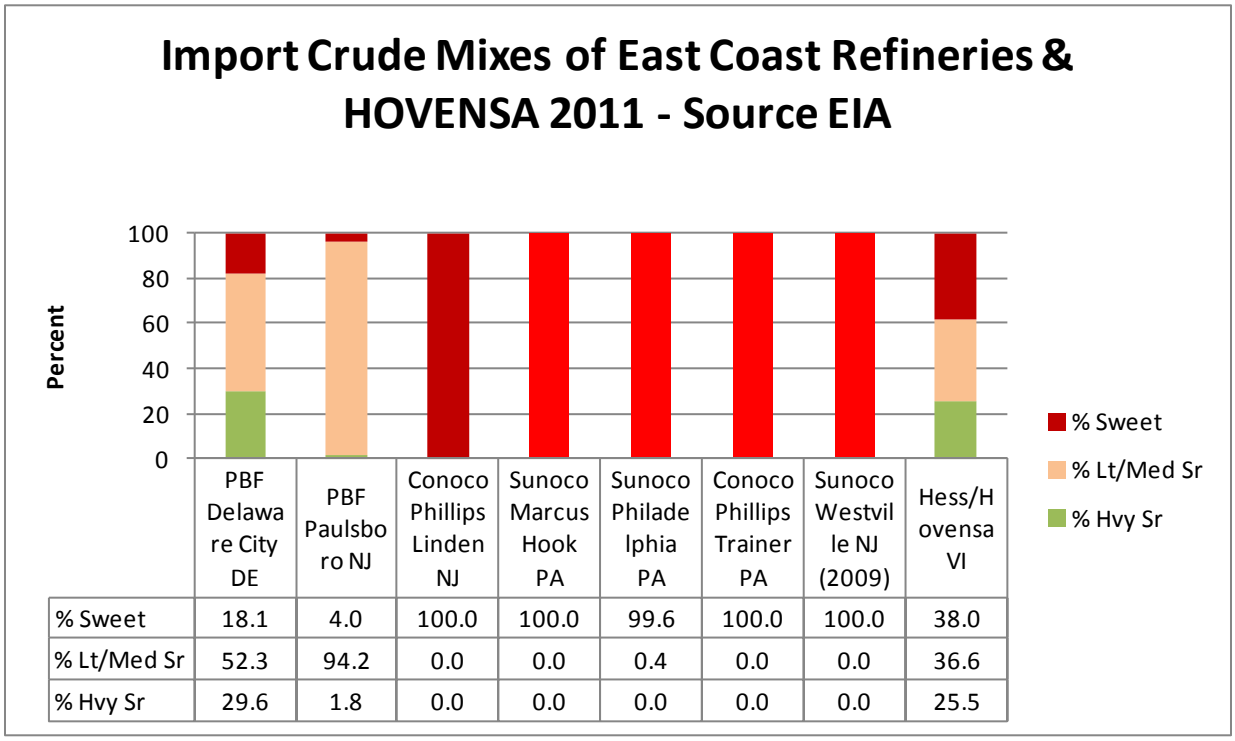
Exhibit 3-3 further illustrates the contrast among the East Coast refineries. The two refineries that have come closest to closing in 2012, Sunoco Philadelphia and Phillips66 Trainer, both process entirely sweet crude, as did the Sunoco Marcus Hook, PA, refinery closed in 2011; also the 145,000 bpd Sunoco Westville, NJ, refinery closed in 2010. In contrast, two East Coast

refineries that have been purchased by PBF Energy and are the subject of investment and restart, the Delaware City and Paulsboro refineries, both process predominantly sour crude oils including, for Delaware City, a proportion of heavy sour crude. Also significant is that the 238,000 bpd Phillips66 Linden, NJ, refinery again processes essentially 100% sweet crude. (EnSys has not, however, seen any announcements relating to any possible sale or closure of this refinery.)



	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5
% Sweet	76.6	22.9	22.4	14.5	28.9
% Lt/Med Sr	18.0	21.0	33.9	11.6	42.9
% Hvy Sr	5.4	56.0	43.7	74.0	28.2

Exhibit 3-2



	PBF Delaware City DE	PBF Paulsboro NJ	Conoco Phillips Linden NJ	Sunoco Marcus Hook PA	Sunoco Philadelphia PA	Conoco Phillips Trainer PA	Sunoco Westville NJ (2009)	Hess/Hovensa VI
% Sweet	18.1	4.0	100.0	100.0	99.6	100.0	100.0	38.0
% Lt/Med Sr	52.3	94.2	0.0	0.0	0.4	0.0	0.0	36.6
% Hvy Sr	29.6	1.8	0.0	0.0	0.0	0.0	0.0	25.5

Exhibit 3-3

The reliance on sweet crude oils has meant these refineries process among the most expensive crude oils on the market, as illustrated by Exhibits 3-4 and 3-5. Firstly, using Brent as the "marker" price for most internationally traded grades of sweet crude oil and Mayan as a marker price for internationally traded heavy grades, Exhibit 3-4 shows that, in the early 2000's, Brent was priced generally around $6/barrel above Mayan but that, since 2005, the premium has averaged closer to $12/barrel (outside of the recession). This shift has greatly increased the incentive to process heavy sour crudes – because they have become significantly cheaper relative to light sweet crudes – and, conversely, has increased the premium that any sweet crude refiner pays for feedstock. While a perception that supplies of sweet crude oils were adequate in the early 2000's may have led East Coast refiners in particular to stay with such crudes and thereby minimize investments, the widening of the light-heavy crude differential has led to an economic disadvantage for any refinery processing sweet crude that is internationally priced.

More specifically, in the time frame of the early 2000's, crude prices were around $30/barrel and few anticipated that they would rise to the $60 - $120/barrel range. That price increase has itself been a prime driver of the widening differential between light/sweet and heavy/sour crude oils. In any refinery, a major part of the fuel consumed is derived directly from the crude

oil being processed. Therefore, as crude prices rise, so does the effective cost of a refiner's fuel. This tends to make the more heavily processed products, such as gasoline and diesel, more costly to produce. That, in turn, widens the differential between them and heavy residual fuel type products which require little or no processing. That wider differential is then reflected back in the form of wider differentials between light/sweet and heavy/sour crudes since the former contain intrinsically more gasoline/diesel etc. and the latter intrinsically contain more residual type content.

Post recession, global demand growth and such factors as the upheaval and lost production of sweet crude in Libya have served to sustain high prices, especially for premium quality light/sweet crudes. This has served to further aggravate the problem for refiners processing internationally priced light/sweet crudes.

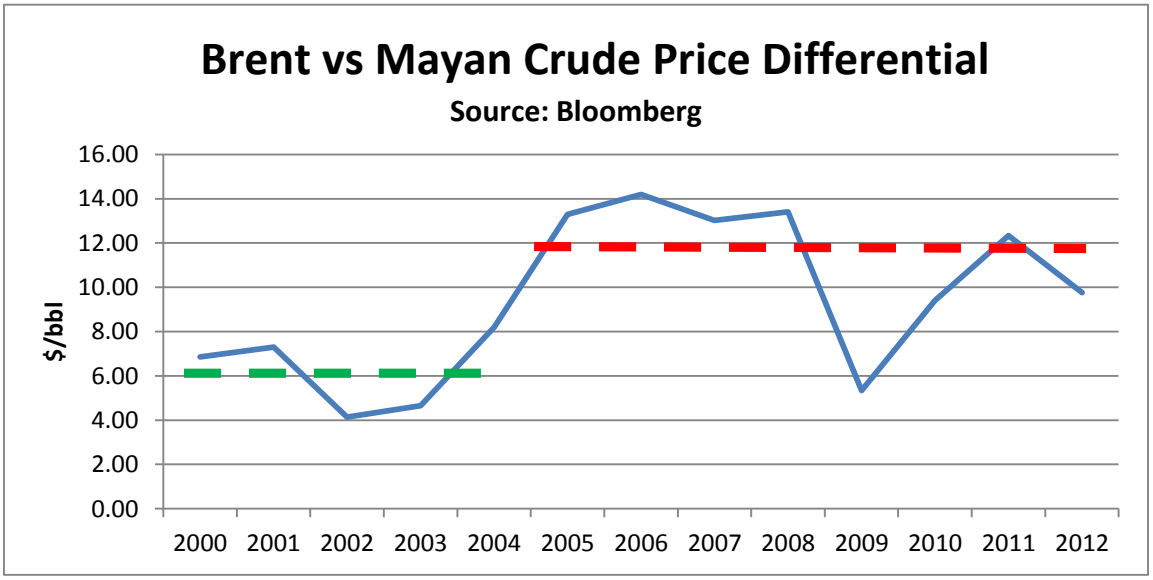


Exhibit 3-4

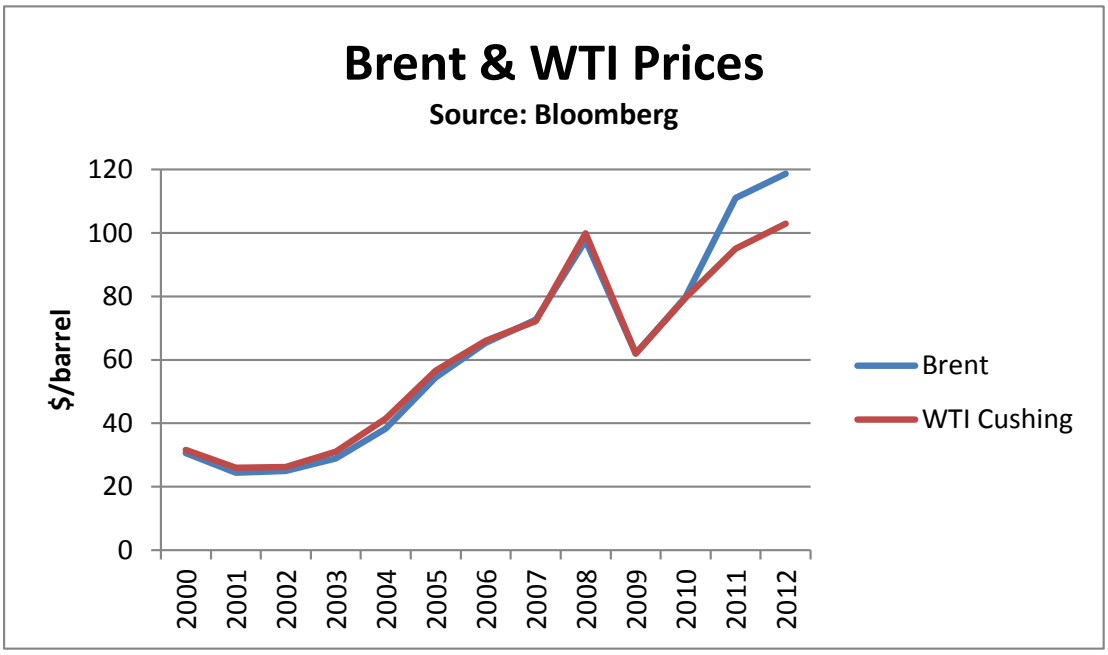


Exhibit 3-5

For East Coast refiners, there has been yet another "twist" regarding crude oil which has impacted their position. As has been widely recognized, "congestion" in the U.S. crude oil logistics system, centered on Cushing and driven by rapid increases in U.S. Lower 48 "tight oil" production together with rising Western Canadian production, has led to substantial discounts for prices of inland crude oils, notably WTI and essentially all other inland grades, U.S. and Canadian, since they are almost invariably priced off WTI. As Exhibit 3-5 shows, historically, WTI and Brent prices essentially matched each other and moved in close unison. Since early 2011, though, prices for WTI have been consistently discounted below Brent prices by generally $10- $20/barrel because of the inability of the current logistics system to cope with the supply increases and move the incremental production fully to market.

Midwestern and Midcontinent refiners have had ready access to the discounted inland and Western Canadian crudes and have consequently enjoyed exceptional refining margins as illustrated by Exhibit 3-6. In contrast, the refineries on the East Coast have had essentially no ability to access these discounted inland and Western Canadian crude oils. They have therefore continued to pay "full" international prices based off Brent. Again, this "congestion" has worked against East Coast refiners while benefiting U.S. refiners who are inland. Recent data do show an upturn in East Coast refining margins in 2012, presumably resulting from the closures in the region and in Europe.

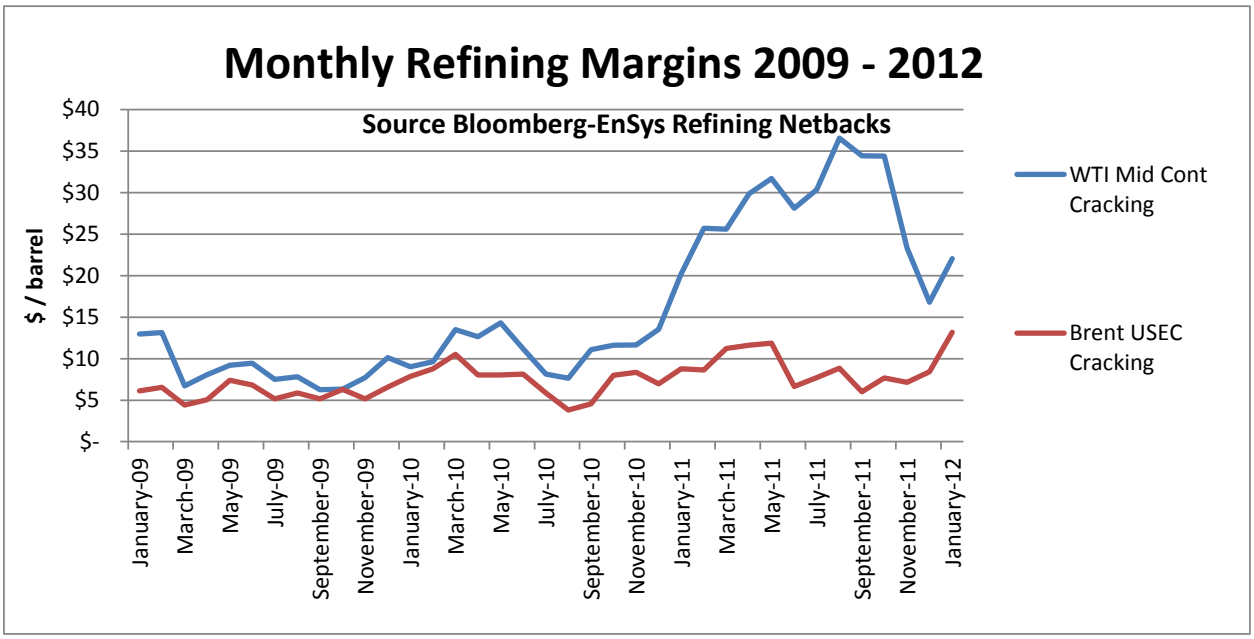


Exhibit 3-6

3.2.2 Product Yields and Secondary Processing

East Coast refineries have also suffered because of their reliance on high yields of gasoline and relatively limited adaptations made to increase distillate (diesel and heating oil) yield in place of gasoline. Exhibits 3-7 and 3-8 compare gasoline and distillate yields for the PADD1 East Coast refineries versus all PADD3 refineries. The data show that the East Coast refineries have maintained their gasoline yield at roughly 46-47% since the late 1990's; and have grown distillate yield only slightly, from around 27% in the late 1990's to around 30% recently. In contrast, over the same time period, PADD3 refineries have cut their gasoline yield from around 45% to around 42% and have markedly increased their distillate yield from around 21% in the late 1990's to 30% today.

This is significant today because producing gasoline has become less profitable whereas producing distillates has become more so. As illustrated in Exhibit 3-9, in the early 2000's, it mattered little whether a refiner produced gasoline or diesel; their prices relative to crude oil were very similar on an annual average basis, indeed gasoline had a slight advantage. However, this has changed. Since 2005, on the East Coast and, in fact, in the whole Atlantic Basin, distillate prices have commanded a much higher premium over crude oil than have gasoline prices. Dieselization in Europe and global trends toward distillate demand have been

the driving force behind rising relative distillate prices; also a factor is the increasing need to use relatively expensive hydro-cracking to produce incremental distillate fuels. In contrast, gasoline demand has been in decline in Europe, (the reverse side of dieselization); has been flat to declining in the U.S. and partially displaced by ethanol. These factors have led to the strength in distillate prices relative to gasoline. As Exhibits 3-7 and 3-8 show, PADD3 refiners have adapted whereas East Coast refiners broadly have not.

Exhibits 3-10 and 3-11 provide further perspective. Among the East Coast refineries, the use of gasoline oriented catalytic cracking has been consistently higher than in PADD3 and has risen whereas in PADD3 it is lower and has declined. Similarly, the use of coking (for upgrading heavy sour crudes) and hydro-cracking (for production of distillates) has been low and declining in the East Coast refineries versus higher and increasing in the PADD3 refineries. The effect has been to disadvantage the PADD1 refineries as distillates have been relatively more in demand and gasoline relatively more in surplus.

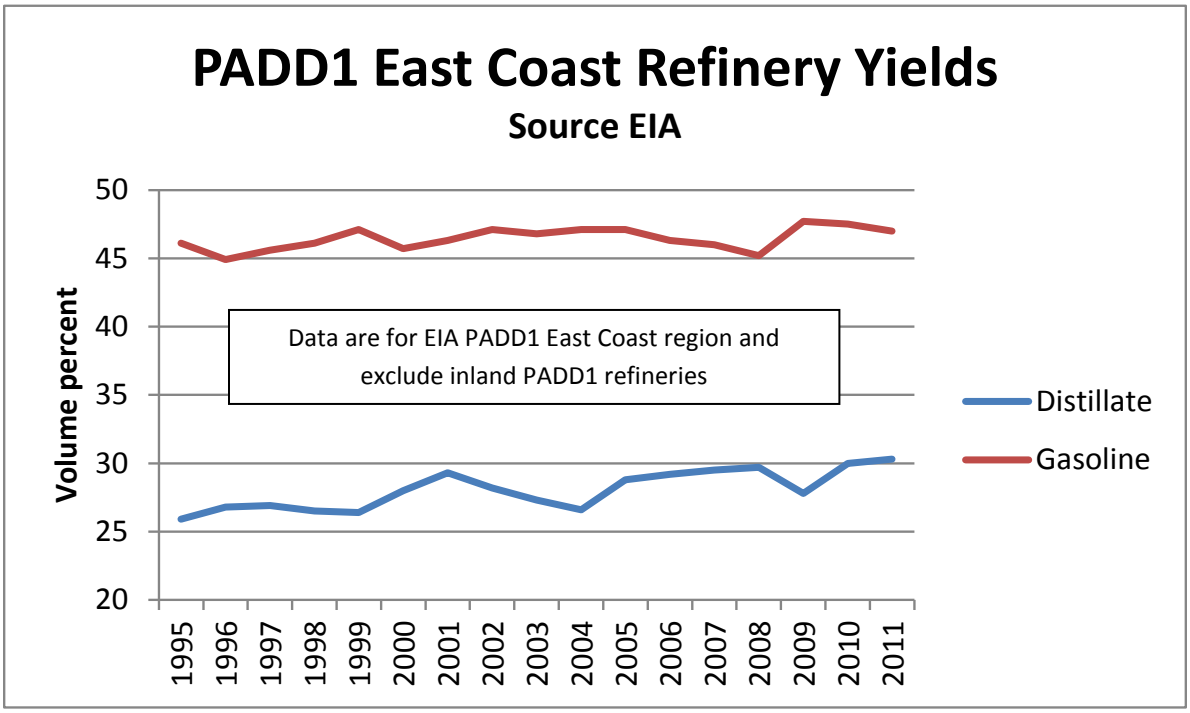


Exhibit 3-7

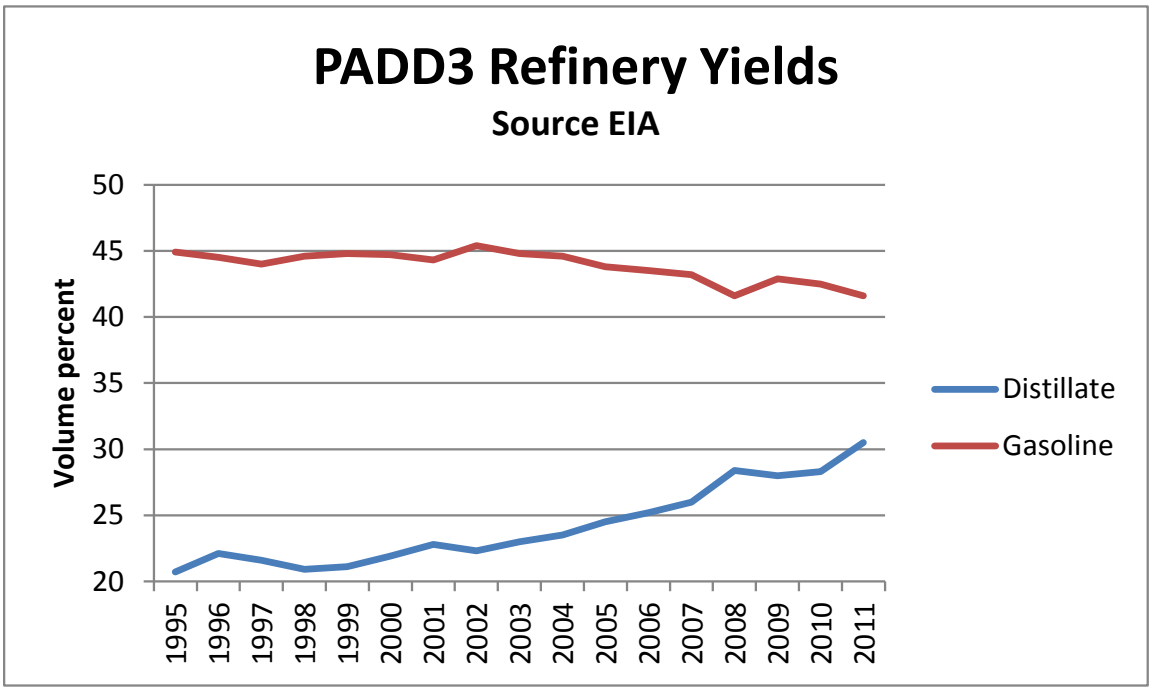


Exhibit 3-8

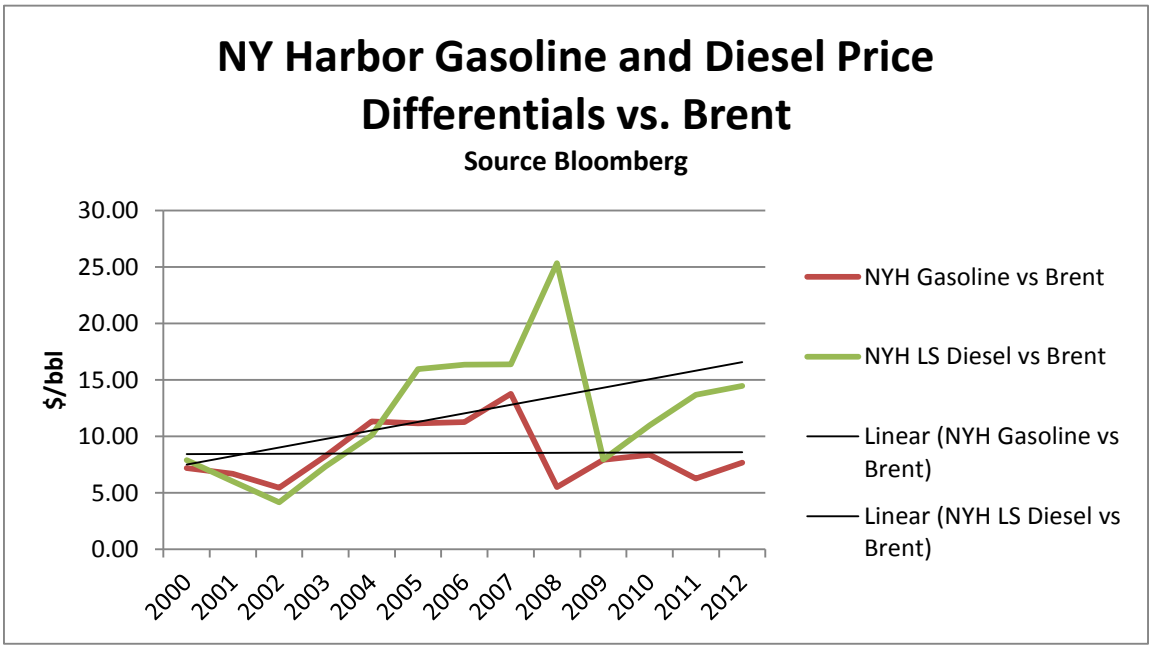


Exhibit 3-9

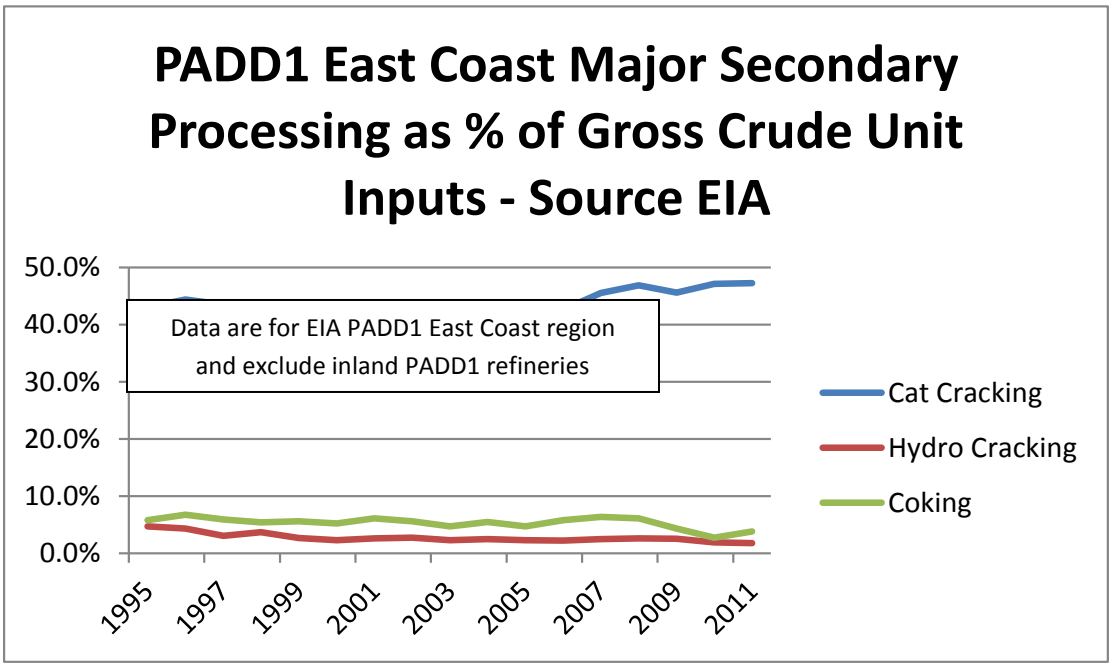


Exhibit 3-10

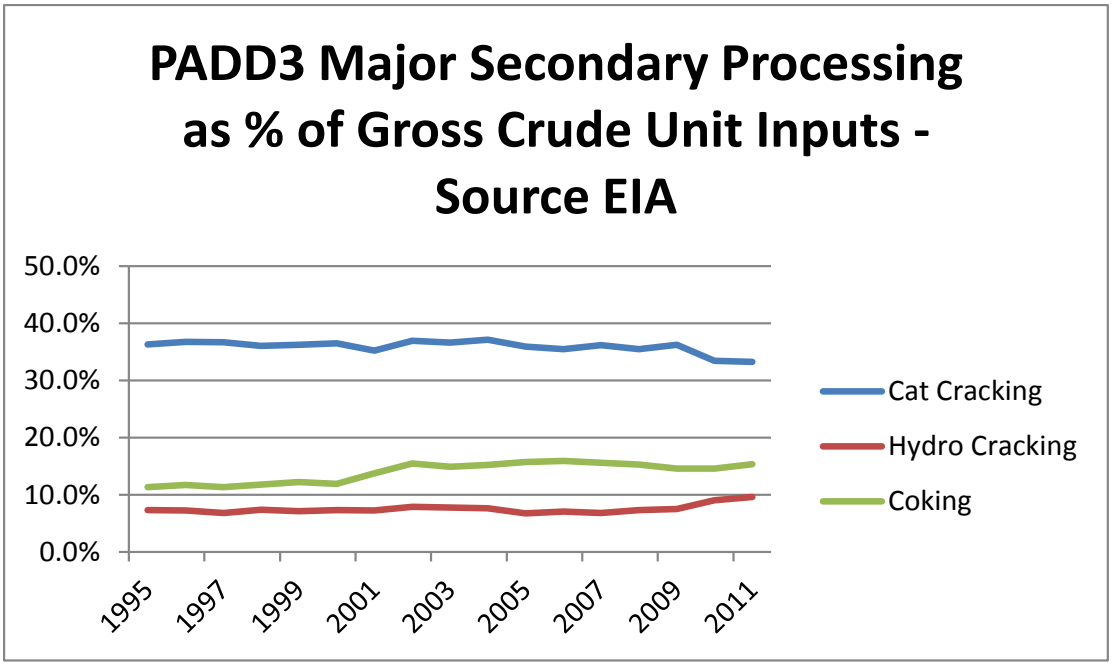


Exhibit 3-11

3.2.3 Competition

The above factors, crude slate/pricing and processing / product yield have been critical in impacting the viability of the East Coast refineries. Another significant factor is the exposure of East Coast refineries to intense international refinery competition, due to the refineries' location along the East coast. As described in Section 4.3, the East Coast is a focal point for competition for product markets from multiple sources, within and outside the U.S.

3.2.4 Other Factors

On other measures, as outlined in Section 5.1, the East Coast refineries have had little in their favor. Although there has been some degree of linking to petrochemical facilities, the main East Coast refineries have limited output of specialty products, limited scope to extensively exchange intermediate streams with other refineries, they – compared to Gulf Coast refineries – do not have access to low cost natural gas; they are comparatively old, and by implication have lower operating efficiencies, and they are in a region where costs of construction and fixed costs such as labor are relatively high. They also are located in ports, several on rivers, that are not deep water and are thus not able to take advantage of VLCC class tankers for crude delivery. Instead, they must rely on smaller tankers with their higher per barrel freight and, in some instances, the use of lightering which further raises crude delivery costs.

3.2.5 Financial Results

Together with the environmental burden and outlook described in Sections 4.5 and 8, these specific factors have contributed to the competitive pressures that have led to the situation we see today - a series of refinery closures in the region. The cumulative impact has been substantial, unsustainable operating losses.

Sunoco has stated its refining division lost a total of nearly $1 billion over the past three years[8]. ConocoPhillips has stated it lost money at its Trainer refinery for each of the last 3 years before idling the unit. The following citations from recent company reports and announcements provide further illustration and context.

Sun-Set? Sunoco idles Marcus Hook refinery; lays off 490 workers

Daily Times, Delaware County, PA, December 02, 2011

[8] http://www.businessweek.com/articles/2012-03-01/east-coast-gas-squeeze-expected

Kathleen E. Carey(reporter) quoting Sunoco Chairman and CEO Lynn Elsenhans

"Market conditions have deteriorated significantly and the outlook for both motor fuel demand and refining margins remains weak." "Our retail and logistics businesses are performing well, but given the negative realities of the Northeast refining marketplace, we need to accelerate the timeline for idling our Marcus Hook processing units". Also, "Both refineries are losing money but Marcus Hook is losing more money," Sunoco spokesman Thomas Golembeski said, referring to Philadelphia and Marcus Hook.

Sunoco, Inc Form 10K for fiscal year ending December 31, 2010

"Additional capital outlays totaling approximately $150-$200 million dollars related to projects at the Marcus Hook refinery are currently required to be made under the 2005 Consent Decree prior to June 30th, 2013." [this to settle alleged violations under the Clean Air Act]

ConocoPhillips News Release Sept 27 2011 ConocoPhillips Seeks Buyer for Trainer, Pa., Refinery

"After exploring a wide range of alternatives for the refinery, the decision to sell is based on the level of investment required to remain competitive," said Willie Chiang, senior vice president of Refining, Marketing, Transportation and Commercial. "U.S. East Coast refining has been under severe market pressure for several years. Product imports, weakness in motor fuel demand, and costly regulatory requirements are key factors in creating this very difficult environment. This action is consistent with our stated strategic objective to reduce our refining portfolio," added Chiang.

ConocoPhillips 2011 Summary Annual Report

"We continue to optimize our asset base to deliver value across all market cycles. In 2011 we sold the Wihelmshaven Refinery in Germany and idled, and intend to sell or permanently close in 2012, the Trainer Refinery in Pennsylvania. These actions are consistent with our strategy of enhancing returns through divesting low-returning assets" (Page 28).

3.3 Characteristics of the HOVENSA Refinery

On January 18th, 2012, HOVENSA, a 50:50 joint venture between Hess and the Venezuelan national oil company PdVSa, made the following announcement (www.hovensa.com):

"Losses at the HOVENSA refinery have totaled $1.3 billion in the past three years alone and were projected to continue. These losses have been caused primarily by weakness in demand

for refined petroleum products due to the global economic slowdown and the addition of new refining capacity in emerging markets. In the past three years, these factors have caused the closure of approximately 18 refineries in the United States and Europe with capacity totaling more than 2 million barrels of oil per day. In addition, the low price of natural gas in the United States has put HOVENSA, an oil-fueled refinery, at a competitive disadvantage."

EnSys has direct experience of the historical financial performance of the HOVENSA refinery, having been retained in 1998 by the Senate of the Virgin Islands to advise on the Hess/PdVSa joint venture that was to combine supply of heavier crude oils with construction of a coker at the refinery. It was clear from Hess corporate financial statements that the St. Croix refinery (which had cat cracking facilities but no coking at the time) had been incurring significant losses. John Hess stated at the time that the joint venture with PdVSa and the installation of a coker were critical to the survival of the refinery. Difficulties in competing with U.S. Gulf Coast refineries were a listed concern.

Even with the coker in operation, EIA imports show the HOVENSA refinery in 2009/10/11 processed only around 25% heavy sour crude, nearly 40% sweet crude and over 35% light/medium sour, i.e. it still had a heavy reliance on premium sweet crude grades. It had advantages of scale (the capacity was traditionally rated at 500,000 bpd but was cut back to 375,000 bpd in early 2011), was relatively complex, possesses a deep water port and was excluded via special treaty from needing to use Jones Act tankers for shipping to the U.S., but was isolated from other refineries for intermediates trading, fully open to international crude pricing and competition and, as stated above, incurred high fuel costs because of a total lack of access to (low price) natural gas. It also fell fully within the orbit of the EPA and, in January 2012, had entered into a consent decree with the US Environmental Protection Agency and the Department of Justice, agreeing to invest $700 million on pollution controls as well as a $5.4 million penalty for violating the Clean Air Act[9].

3.4 Characteristics of Other Regional Refineries Threatened with Closure

3.4.1 Valero Aruba Refinery

Reasons similar to those leading to the HOVENSA closure were given by Valero in March 2012 for suspending operations at its 235,000 bpd refinery in Aruba. Announcements by the

[9] http://www.ogj.com/articles/2012/01/hovensa-to-close-500000-bd-virgin-islands-refinery.html.

company referred to poor margins and to the possibility that the refinery would, in the future, operate as a storage terminal. In addition, Valero CEO Bill Klesse was quoted by Reuters as saying that "the refinery - which uses fuel oil to fire boilers, make steam and power other operations - was at a disadvantage to refineries in the United States that have access to the cheap, plentiful supplies of natural gas for operations. The difference can add up to $2 a barrel to operating costs, he added"[10]. The Aruba refinery was less directly involved in supplying product to the U.S. but did supply some blendstocks and finished products to the Gulf Coast and New York Harbor. As such, if it remains closed, it will represent yet a further loss of refined product supplies in the Atlantic Basin[11].

3.4.2 Imperial Dartmouth Refinery

In mid-May, Imperial Oil Ltd, the Canadian subsidiary of ExxonMobil, announced that it is "looking for prospective buyers for its Dartmouth refinery in Nova Scotia, as it grapples with low demand for refined products in the Atlantic basin"[12]. "Imperial CEO Bruce March warned earlier this year that business for the company's easternmost refinery, Dartmouth, is under pressure from the same factors that have hit other refineries along the Atlantic coast of North America"[13]. "Demand for refined products in the basin has declined in recent years and, despite tremendous efforts by our workforce, the refinery has not met expected financial returns"[14].

Imperial has indicated it is considering converting the refinery to a terminal and that "it hoped to make a decision about a sale or other alternatives by the first quarter 2013"[15].

At 80,000 bpd capacity, the Dartmouth refinery is comparatively small, but its closure would represent yet a further reduction in products produced locally within the broader East Coast region.

[10] http://www.reuters.com/article/2012/03/19/valero-aruba-idUSL1E8EJ22420120319.
[11] Recent press reports indicate Petrochina may buy the refinery. http://www.reuters.com/article/2012/05/09/us-petrochina-valero-aruba-idUSBRE8480C620120509.
[12] http://www.reuters.com/article/2012/05/17/us-imperialoil-idUSBRE84G0PH20120517.
[13] Ibid.
[14] http://www.montrealgazette.com/business/Imperial+considering+sale+conversion+Dartmouth+refinery/6637125/story.html.
[15] Ibid.

3.5 Characteristics of US and East Coast Refineries Remaining Open

Should the Phillips66 Trainer, the Sunoco Marcus Hook and Philadelphia refineries all close , that would leave three major refineries open on the East Coast, namely, the 238,000 bpd Phillips66 Linden New Jersey refinery and the two PBF Energy refineries at respectively Delaware City, 182,000 bpd, and Paulsboro New Jersey, 160,000 bpd[16].

3.5.1 PBF Refineries

In contrast to the sweet crude refineries that are closing, the PBF Delaware City, Delaware and Paulsboro New Jersey refineries have the benefit that they are able to process heavier, higher sulfur – and therefore cheaper – crude oils. Together, they process a mix of mainly medium and heavy sour crudes from the Middle East, Latin America and elsewhere[17]. The Paulsboro refinery has significant capacity to produce lubricating oils and asphalt as specialty products[18].

The Delaware City refinery was shut down in November 2009 by then owner Valero (who also sold the Paulsboro refinery to PBF Energy). After purchasing the refinery in December 2010, PBF invested a stated $450 million[19] in operational improvements which included a major revamp of the refinery's catalytic cracking unit. The refinery restarted in October 2011. In addition, in December 2011, PBF announced a 3 year $1 billion Clean Fuels Project that will enable both refineries to maximize yields of profitable ultra-low sulfur diesel[20]. The project centers on the construction of a mild hydrocracker and associated hydrogen plant at the Delaware facility that both refineries will feed into. The project will also enable the Delaware refinery to process a heavier crude slate, further cutting crude costs. A stated goal is to "ensure the long-term survivability of the Delaware City and Paulsboro Refineries in good markets and bad"[21].

[16] In addition, Hess operates a catalytic cracking facility at Port Reading New Jersey with a production capacity of 70,000 bpd of fuels products - mainly gasoline (see Exhibit 1-1). NuStar owns two asphalt refineries, an 80,000 bpd facility at Paulsboro New Jersey and a 30,000 bpd plant in Savannah Georgia. Chevron owns an 80,000 bpd asphalt refinery located at Perth Amboy New Jersey.
[17] Source EIA crude oil import statistics.
[18] Lubricants capacity of 11,500 bpd and asphalt capacity of 16,000 bpd according to *Oil & Gas Journal* 2012 Refining Survey.
[19] http://www.blackstone.com/news/news-views/blackstone-portfolio-company-pbf-energy-marks-official-reopening-of-delaware-city-refinery.
[20] The two refineries are located 35 miles apart, enabling transit between them of intermediate streams requiring additional processing or blending.
[21] PBF News Release Clean Fuels Dec 2011.pdf

In short, the two PBF refineries have advantages of processing medium to heavy sour crudes, production of specialty products (at one facility) and substantial recent and planned investment, totaling around $1.5 billion, that will increase production of desirable ultra-low sulfur diesel and cut crude oil costs.

3.5.2 Phillips66 Linden Refinery

The other major East Coast refinery is the 238,000 bpd plant at Linden New Jersey owned by Phillips66 – or strictly now Phillips 66, the refining company that results from the division of ConocoPhillips into two entities[22]. The Linden refinery shares characteristics with the refineries that are closing. It processes entirely sweet crudes, predominantly African and eastern Canadian and it has a process configuration oriented to gasoline. (The refinery includes a large 130,000 bpd catalytic cracking unit with associated alkylation and FCC gasoline deep desulfurization units.) However, the refinery also has an associated chemical plant for the production of a range of lubricants and additives. In addition, it feeds a second chemical plant built in 2003 for the production of polypropylene. (The large catalytic cracker would provide the feedstock.) Polypropylene is an essential building block petrochemical and demand worldwide has been exhibiting sustained high growth rates. This integration with value-added chemicals arguably offsets the refinery's potential disadvantages as a processor of premium grade crude oils.

[22] The ConocoPhillips board confirmed April 3rd that the company would on April 30th split into two corporations; the refining company is to be named Phillips 66 while the exploration and production company will keep the ConocoPhillips name.

4 Market & Regulatory Factors

The East Coast refinery closures are occurring in a broader U.S. national, Atlantic Basin and global market context. After a brief "golden age" between 2005 and 2008 when refineries almost everywhere were profitable, a series of post-recession national and international drivers – reduced demand, increased refined product supply, competition and capacity - is combining, to render weaker refineries uneconomic and surplus.

4.1 Crude Oil Prices

EIA's AEO 2012 projection is for a higher world crude oil price trajectory, an increase (in constant dollars) from today's level of around $100/barrel (U.S. average crude oil import price) to nearly $116/barrel by 2020. (See Exhibit 4-1.) This compares to an increase projected in AEO 2010 from $73/barrel in 2012 to $98/barrel in 2020; i.e. the EIA is now projecting oil prices to average over $22/barrel higher (at around $111/barrel average) for the 2012 to 2020 period. As further described in Section 3.2.4, a projection for higher sustained crude prices translates into higher fuel costs for refineries that do not have access to low cost natural gas and, as a consequence, tends to support wider light/heavy crude price differentials which – in turn – tend to maintain the price premium and thus competitive disadvantage for processing light sweet crudes. In short, the prospect of higher sustained crude prices works against the viability of the East Coast refineries that rely on light sweet crudes. (See Section 3.2.)

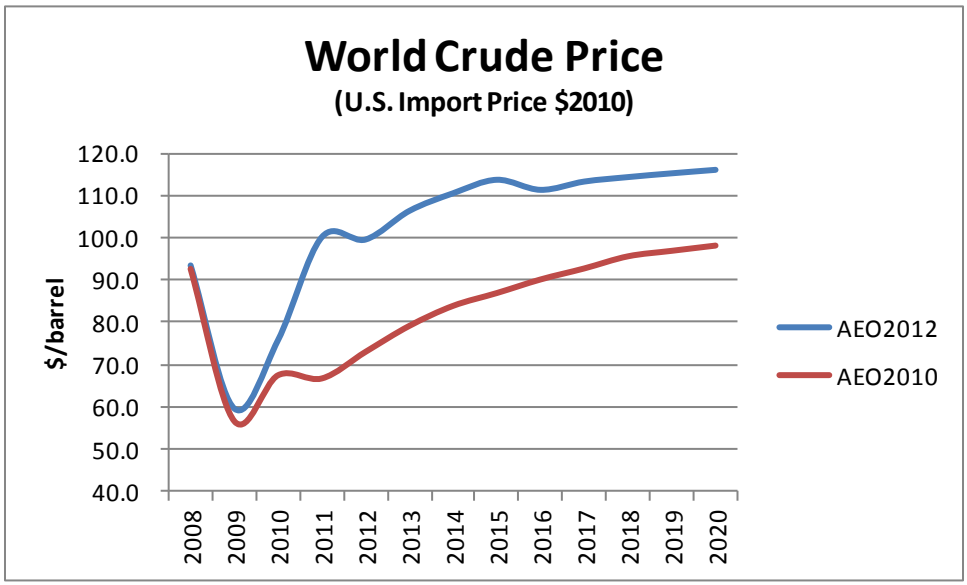


Exhibit 4-1

4.2 Product Demand

4.2.1 US and Broader Atlantic Basin Demand Trends

In AEO 2012, the EIA is projecting U.S. product demand to average nearly 1.2 million bpd (5.7%) lower in 2012 through 2020 compared to their AEO 2010 outlook. (See Exhibit 4-2.) Similarly, other OECD regions are projected to have lower average consumption across the same period: Canada some 0.16 million bpd (7%) lower, OECD Europe 0.17 million bpd (1%) and OECD Asia (Japan, Australasia and South Korea) 0.8 million bpd (9%) lower. These reductions are projected to be more than offset by higher demand in non-OECD regions, such that total global demand is projected by EIA to run around 1 million bpd higher through 2020 than in the 2010 AEO Reference Case.

Nonetheless, a key implication is that the outlook in the northern Atlantic Basin (USA, Canada, Europe) is for flat refined product demand, (Exhibit 4-3), and thus for either potentially more regional refinery closures over time to remove surplus capacity and/or for regional refineries to turn increasingly to competing for growing non-OECD markets as a means to survive. It is this dynamic that has led U.S. Gulf Coast refineries in particular to expand product exports, thereby preserving capacity, jobs and the value-added of processing crude oil into product in the U.S. rather than elsewhere. For East Coast refineries, the picture has been more mixed. The region is one where the vast majority of product movements are inflows and where opportunities to respond to dropping regional demand are limited.

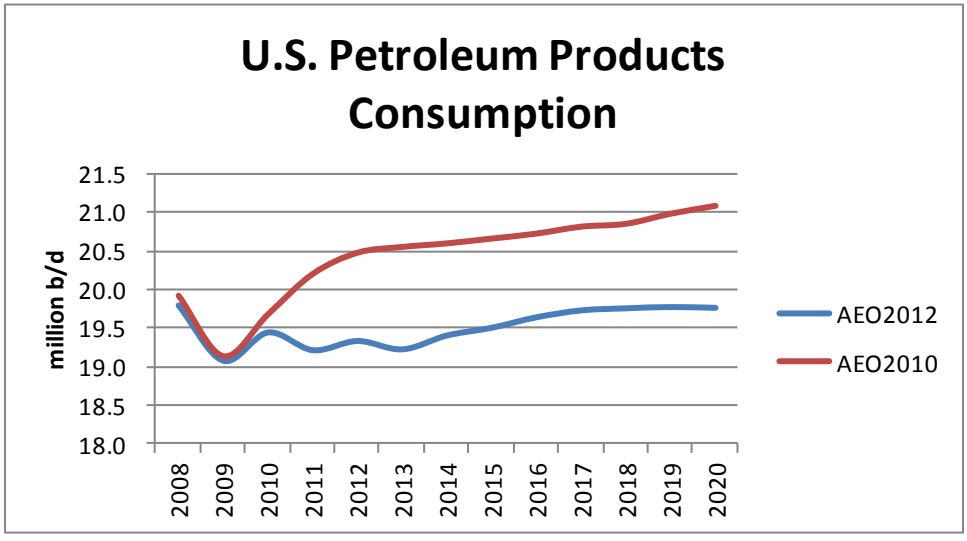


Exhibit 4-2

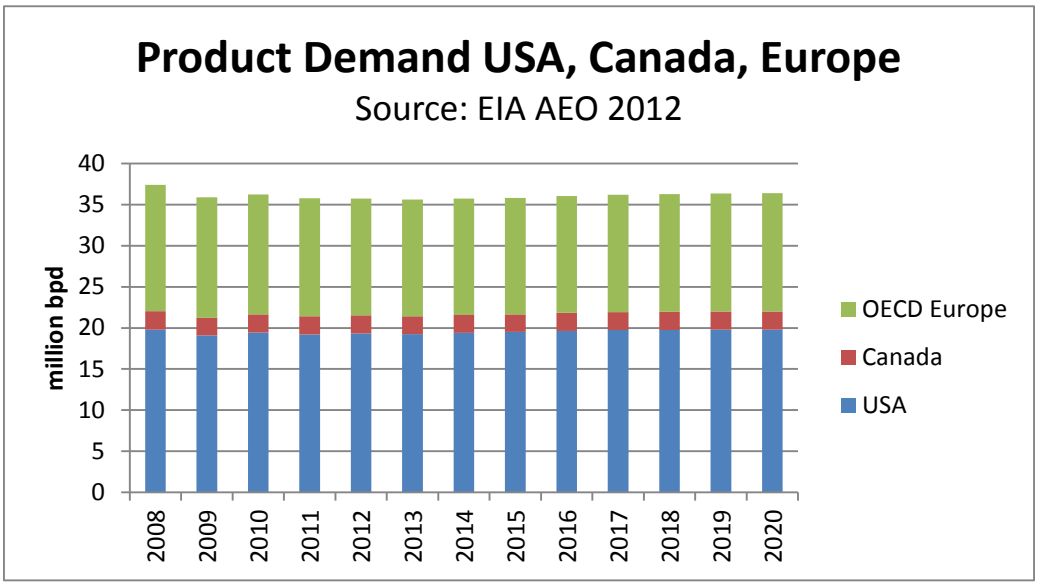


Exhibit 4-3

4.2.2 Displacement of Refined Products by Alternative Fuels

While total transportation fuel demand across the USA, Canada and Europe is projected to be essentially flat, the proportion of that demand being supplied by refineries (from crude oil) is declining. Growing biofuels supply under Federal Renewable Fuels Standard (RFS) mandates is a primary factor, as illustrated in Exhibit 4-4[23]. Although much smaller in volume, supplies of biodiesel and other biomass derived liquids are also projected to grow.

In addition, on-going shale gas and shale oil developments have substantially increased U.S. production of natural gas and also natural gas liquids. One consequence has been a huge divergence between crude oil and U.S. natural gas prices. Versus a price ratio (crude in $/barrel divided by natural gas in $/million Btu) based on equivalent heating value of just over 6:1, and historical ratios often in the 8:1 – 9:1 range, recent and current ratios have reached 20:1 and today stand at over 40:1 based on Brent prices around $120/barrel and natural gas prices (Henry Hub) currently below $3/million Btu. (See Exhibit 4-5.) While this extreme ratio is not

[23] According to EIA Petroleum Supply Annual data, in 2011, ethanol supply reached 9.65% of total gasoline supplied in the U.S., i.e. ethanol supply had almost reached the "blend wall" of 10% ethanol maximum in U.S. gasoline blends other than E85 (85% ethanol). In 2009, the EPA was petitioned by ethanol manufacturers to increase the E10 limit to E15 under a provision of the Clean Air Act. In October 2010, the EPA announced a partial waiver that would allow up to 15% ethanol (E15) in model year 2007 vehicles and newer vehicles. (http://www.epa.gov/otaq/regs/fuels/additive/e15/420f10054.htm). In July 2011, EPA extended the waiver to 2001 through 2006 model year vehicles (EPA-420-F-11-003). One effect of these waivers is to remove the otherwise imminent E10 blend wall.

considered sustainable, (natural gas prices are expected to rise to the $4-5/million Btu range as current prices do not cover production costs[24]), we are in an era of wide divergence between prices for crude oil and for U.S. natural gas, as illustrated by Exhibit 4-6.

These developments are starting to have a range of impacts that have the potential to eat in to crude-oil based product demand. Bus and other fleets are increasingly being converted to natural gas (or to electricity which increasingly is being fired off natural gas). Proposals exist to increase compressed (CNG) or liquefied natural gas (LNG) use in trucks and possibly trains. Honda for one has recently expanded sales of its compressed natural gas (CNG) cars to 35 states. In addition, low natural gas prices relative to crude oil, and thus heating oil, are likely to encourage continuing displacement of heating oil in the Northeast. Finally, two major companies, Shell and SASOL are each considering construction of gas-to-liquids (GTL) plants in the U.S. which would produce mainly diesel fuel from natural gas. Over time, other routes may develop whereby natural gas and/or natural gas liquids displace crude oil refining, either directly or indirectly.

All of these trends, more efficient vehicles, biofuels, CNG/LNG, heating oil displacement and possible GTL supply, have the effect of curbing and creating a declining demand for products refined from crude oil. Moreover, these are trends that are occurring across the USA, Canada and Europe and so affecting potentially all refineries in these regions.

[24] The EIA AEO 2012 Reference Case (Table 13), for example, has Henry Hub natural gas prices recovering to $4.27/million Btu by 2015 and $5.00 by2021.

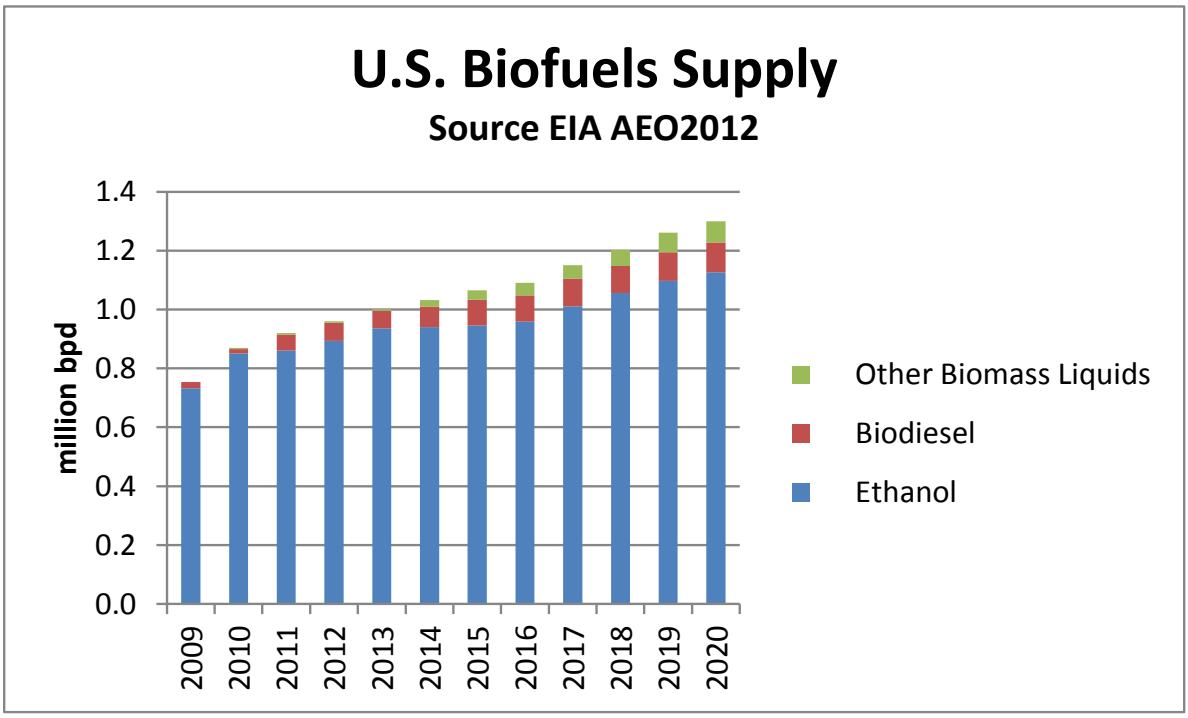


Exhibit 4-4

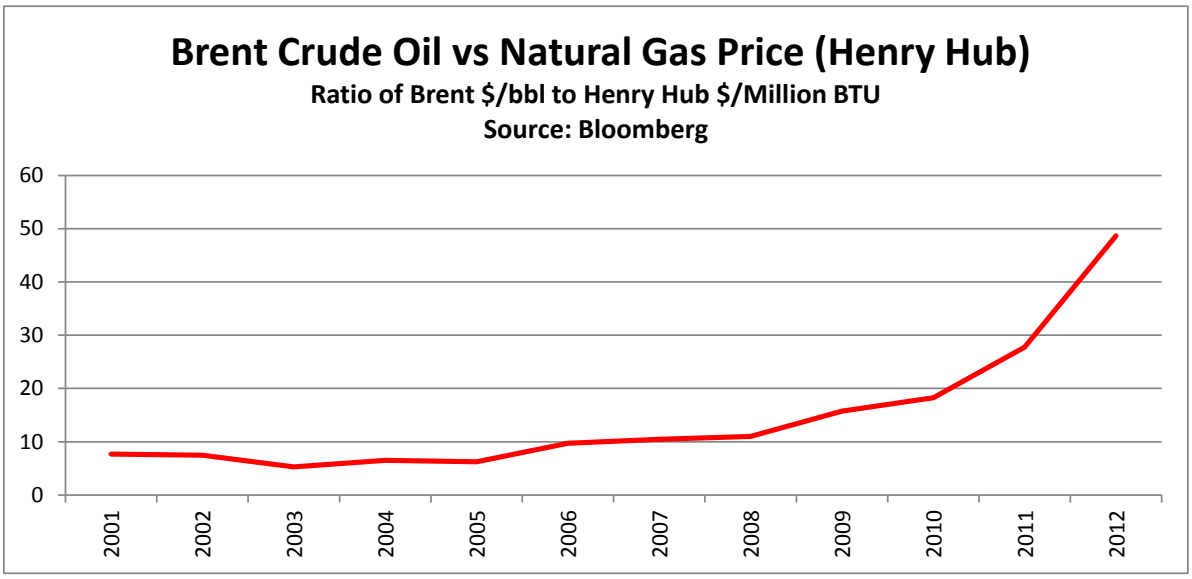


Exhibit 4-5

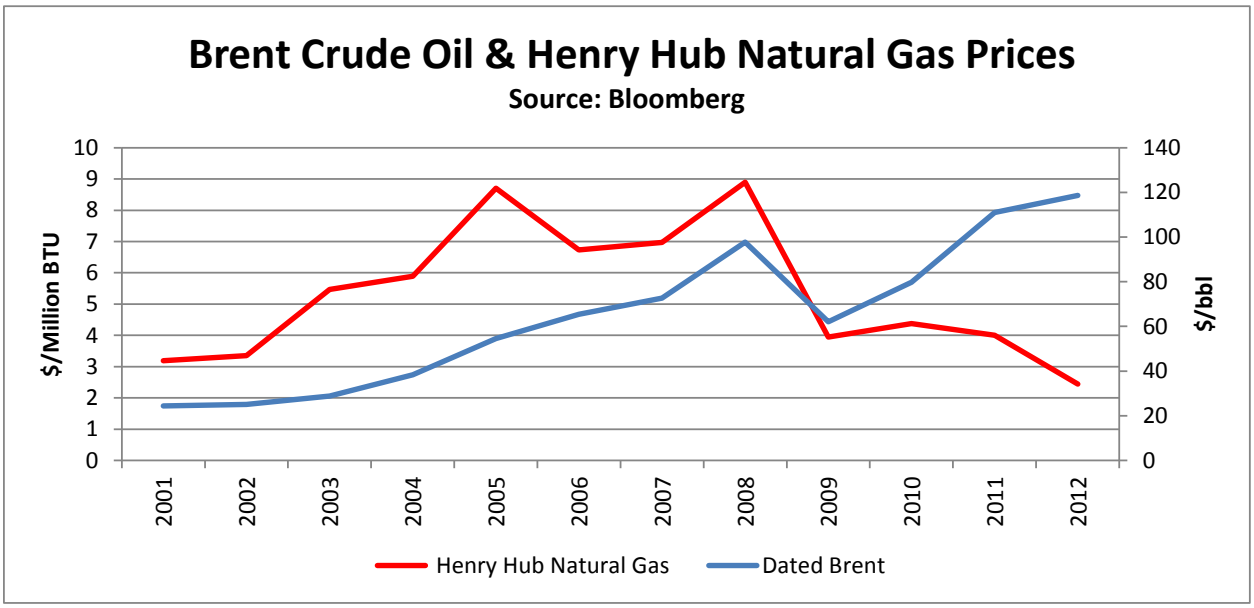


Exhibit 4-6

4.3 Product Supply Competition

Due to their geographic location, the East Coast refineries are subject to particularly intense international competition. The bulk of U.S. product imports move into the Northeast with New York Harbor (NYH) the focal delivery and pricing point. The product imports come from multiple sources but the majority are from Western Europe, Russia/Eastern Europe and Eastern Canada. The U.S. Virgin Islands (HOVENSA St. Croix) was also a significant supplier until its closure. Imports from India have started to edge up, reaching 50,000 bpd in 2010 and 2011. In addition, the region takes in substantial product volumes from the Gulf Coast. Total product movements by pipeline, tanker and barge from PADD3 into PADD1 as a whole have averaged 3 million bpd since the late 1990's.

This situation renders the Northeast a focal point of competition, especially for imports of gasoline. Product imports from Canada, mostly from Eastern Canadian refineries into the U.S. Northeast, increased throughout the 1990's and early 2000's to reach a level of around 550,000 bpd. This level did drop in 2011 by 65,000 bpd indicating Eastern Canada may be in a position to build imports to the U.S. back up as a result of the East Coast closures. Before the recession, more than one plan had been announced for major (300,000 bpd) refinery projects in Eastern Canada. These appear to be no longer active but any expansion plans that do arise would almost necessarily be export oriented.

"Dieselization" policies in Europe have raised the proportion of diesel vehicles and demand at the expense of gasoline. European refineries thus have a strong incentive to produce more gasoline for the U.S. since that enables them to co-produce more diesel fuel for consumption within Europe. Although the European Union is changing its tax policies on fuels in a way that will reduce the comparative advantage for diesel, this is likely to slow dieselization rather than bring about any rapid reversal. (It takes years to turn over a vehicle fleet and the majority of Europe's older automobiles are gasoline powered so, when replaced, almost inevitably result in a mix of gasoline and diesel vehicle purchases.) Refinery closures in Europe may help to curb gasoline volumes flowing west over the long term but, in the short term, surplus capacity in Europe can contribute additional volumes to replace supplies lost due to Northeast refinery closures.

Also significant is the growth in major new export refineries in India and the Middle East. Led by Reliance Industries' twin 600,000+ bpd refineries in Jamnagar, India, and with growing capacity from Essar Oil in India and from Saudi ARAMCO and others in the Middle East, these refineries are setting new benchmarks for scale and efficiency, are geared to producing clean products to advanced standards, often have the benefit of petrochemicals integration and/or special economic zone status, and are mainly export oriented. Reliance has obtained product storage capacity in NYH and is believed to be interested in expanding exports into the USA. Essar has a program of expanding its refining capacity. ARAMCO is set to add at least two new 400,000 bpd refineries geared to meeting domestic demand but also supplying exports. These trends are likely to keep the U.S. Northeast highly competitive as a market into the foreseeable future.

In summary, increasing supplies and competition for the PADD1/Northeast market include:

- Steady product supplies coming in from Eastern Canadian refineries
- Impacts of dieselization and demand decline / refining surplus in Europe in providing economic incentives for European refiners to send gasoline to the U.S. / PADD1
- Rising capacity from major new large scale export refineries in the Middle East and Asia together with increasing terminaling capacity in the Caribbean to facilitate breaking down large scale product batches for distribution into East Coast markets
- Growth in US Gulf Coast (PADD3) refining capacity
- Increasing refining capacity in PADD2 which, if combined with logistics changes, could increase supplies into PADD1.

4.4 Refining Capacity Surplus

Refining experienced a "golden age" from 2004 to 2008 when surging global demand and limited expansions led to tight capacity and historically strong margins. Since 2008, though, the recession has cut demand while, at the same time, significant refining capacity has been added. Demand reductions have been centered on the industrialized/OECD regions of the world and capacity additions mainly on the developing/non-OECD regions. As a result, refineries in the Atlantic Basin have been suffering from reduced refinery utilizations, i.e. higher surplus capacity. The current East Coast refinery closures are just one part of a continuing string of closures that has been concentrated in Europe, the U.S. – especially the East Coast, and also Japan. According to an April IEA announcement, additional closures are considered as likely necessary, at least in Europe, in order to bring refined product supply and demand back into balance and to raise refinery utilizations to levels that are economically viable[25].

Exhibit 4-7 illustrates how global spare refinery capacity went from a low in 2004 through 2008 to a peak in 2009-2010. Assessment of medium term additional refining requirements versus new capacity expected to come on stream indicates that this surplus is likely to increase over the next several years, maintaining the competitive pressure on refineries in surplus regions especially.

Several major oil companies have made deliberate strategic decisions to either split off or sell their refining assets. The April 2012 decision by ConocoPhillips to split off its refining activities into a new entity, Phillips 66, is one such instance. One effect is that a large number of refineries are currently up for sale and that we are witnessing both closures and a gradually changing face of refining as a range of newer companies moves in to buy refining assets. Again, the current East Coast refinery sales/closures are part of this pattern.

[25] In April 2012, the International Energy Agency "estimated that an additional 2.3 million b/d of European refining capacity may need to permanently close by 2016 to bring the refining market into balance"; http://www.platts.com/RSSFeedDetailedNews/RSSFeed/Oil/8313778. See also http://www.ft.com/intl/cms/s/0/09728c00-37ab-11e1-a5e0-00144feabdc0.html#axzz1vpwhjrjE.

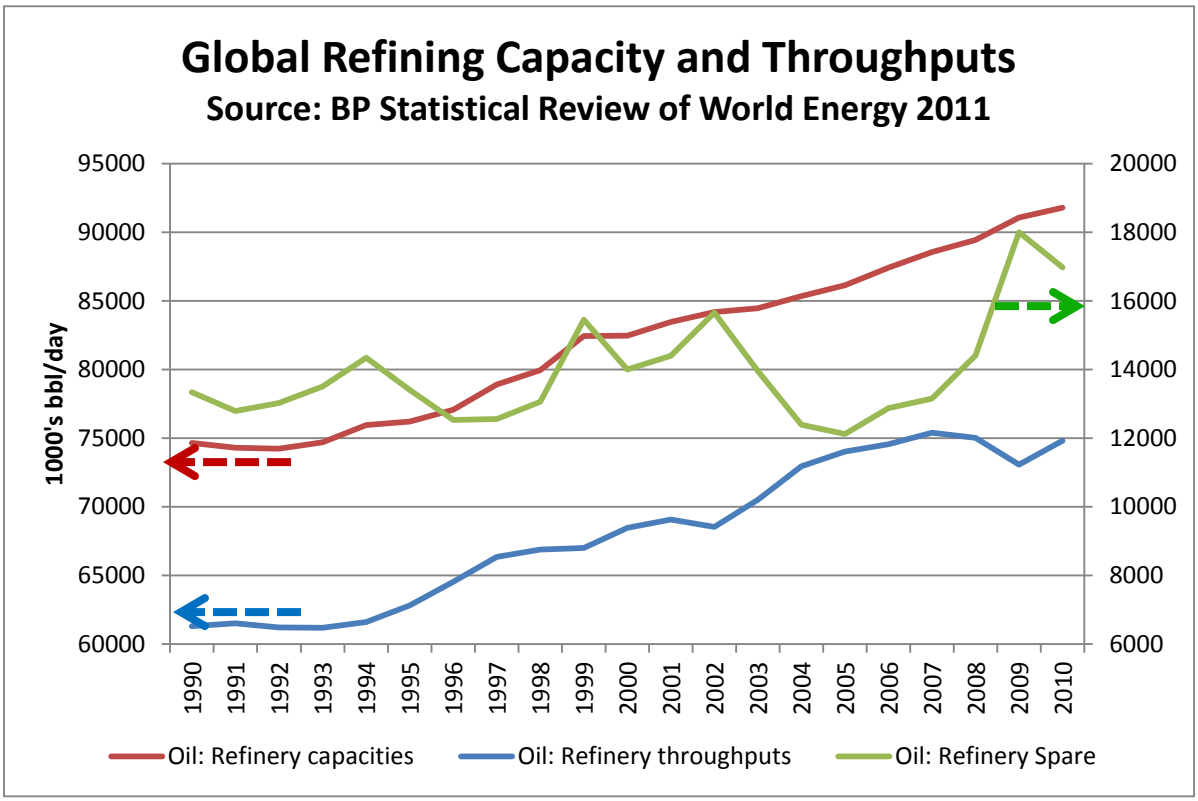


Exhibit 4-7

4.5 Environmental Regulations

Petroleum refining has been called one of the most heavily regulated industries in the United States. Section 7, Appendix, provides a detailed review of the status of current regulations, their costs to the industry and of the outlook for new regulations. These regulations cover both the direct "stationary source" emissions from refinery operations and also the regulations associated with multiple products and multiple product specifications. Regulation of refined products is highly complex since, for example, gasoline formulations are controlled differently depending on season and geographical market location. In addition, both products and stationary source emissions are frequently governed by federal and state regulations.

Maintaining air quality is the predominant focus of regulations on refinery operations and fuels products. Additional regulations are imposed for water pollution and solid waste handling and disposal. Refined products regulations are today designed both to ensure good product

performance and to control air quality impacts, with emphasis on limiting ozone formation and release of toxic hydrocarbons, sulfur and nitrogen oxides and particulate matter.

In aggregate, (see Section 7, Appendix), the historical costs of environmental expenditures made by the industry have been substantial. These costs have risen in recent years and the industry faces a range of new fuels and stationary source regulations. These costs have been and will continue to be a factor influencing the viability of all U.S. refineries, including those on the East Coast.

5 Closures Status and Impacts

Refinery closures on the East Coast, and in the Caribbean and Europe, are impacting East Coast product supplies, and thus creating implications for supply and pricing, both short and longer term. An EIA report[26], updated in February, presents a thorough overview of the potential supply losses from the current and pending East Coast and St. Croix (HOVENSA) refinery closures, of the associated logistics implications and of the potential evolution of the situation this Summer 2012, Winter 2012/2013 and beyond. This analysis draws from the EIA February report as well as from other public sources.

5.1 Projected Product Supply Losses and Alternative Sources

The EIA report estimated product supply losses and balances for the Northeast through 2013 for gasoline, ULSD, and heating oil[27]. The EIA analysis was on the basis of Phillips66, Trainer, Sunoco, Philadelphia and HOVENSA, U.S. Virgin Islands all closing. On this basis, the EIA projected significant deficits for ULSD and gasoline and a small surplus for (traditional high sulfur) heating oil. The ULSD balances were based on the premise that New York State will in fact proceed with its announced rule to require ULSD sulfur standard for all heating oil sold in the State starting July 1st 2012.

The EIA estimated that the gasoline deficits of 160,000 bpd in 2012 and 240,000 bpd in 2013 will not be difficult to fill since sufficient capacity exists at Gulf Coast (PADD3) refineries, European refineries and new export refineries, notably in India (Reliance and Essar Oil) to fill the gaps.

EIA expressed a greater concern over ability to meet a potential distillates (diesel plus heating oil) demand peak in Winter 2012/13. They note that:

> "Looking ahead, ULSD demand in the Northeast is expected to increase considerably. The improving economy is expected to increase transportation-related demand and a new requirement by New York State will reduce the maximum allowable sulfur level in heating oil to 15 ppm effective in July 2012. Heating oil currently has no Federal sulfur

[26] Potential Impacts of Reductions in Refinery Activity on Northeast Petroleum Product Markets, EIA, February 2012; an update of Reductions in Northeast Refinery Activity: Potential Implications for Petroleum Product Markets, December 2011.
[27] Tables 2, 3 and 4 in the EIA report detail the agency's supply/demand assessment for each fuel.

> requirement. The new limit on sulfur content in heating oil sold in New York has several implications for the ULSD market. First, the volumes are sizable. Heating oil consumption in New York has averaged around 70,000 bbl/d on an annual basis, while ULSD consumption in the entire Northeast was about 360,000 bbl/d in 2011. The switch will increase ULSD consumption in the Northeast by about 20% and, in addition, will add a stronger seasonal component to the ULSD market."
>
> "During the winter months, increased imports to meet peak demand have come in large part from countries that have little, if any, capability to produce ULSD. Eastern Europe, mostly Russia, is a large surge supplier not only during a normal winter, but also during severe cold snaps (Figure 5). With the Northeast States moving towards the use of ultra-low-sulfur heating oil, winter supply sources of ULSD will be limited, but supply sources for high-sulfur heating oil should be readily available."

In summary, EIA estimated ULSD deficits of 90,000 bpd for 2012 and 180,000 bpd for 2013.

EnSys broadly supports the EIA's conclusions regarding impacts and the opportunities for replacement supplies. We concur that finding alternative sources for gasoline is likely to be easier than finding alternative supplies of ultra-low sulfur diesel (ULSD) whether used as diesel or as heating oil. (Gasoline made to U.S. specifications is in relatively broad supply in the Atlantic Basin, including from Europe which has a surplus, whereas there are currently fewer sources for diesel produced to ultra-low sulfur standards – and Europe has a deficit.) Therefore we, as EIA, have a greater concern with regard to replacement supply volumes for diesel/heating oil in Winter 2012/13 than for gasoline in Summer 2012.

5.2 Logistics Challenges

In their February 2012 report, the EIA expressed considerable concern over potential short term logistics issues regarding: (a) limits to moving replacement products from Gulf Coast refineries to the Northeast; (b) the time needed to modify the Philadelphia and Trainer "offsites" facilities so that they can take in products by water over their docks, store these and feed them into the existing Sunoco Logistics and Buckeye pipeline distribution systems and; (c) difficulties in supplying product into the western parts of Pennsylvania and New York State given the assumed difficulties in feeding products into the distribution system as per item (b). (See box.)

Since the logistics questions are critical to how tight the supply situation is likely to be for product into the Northeast over this Summer and into 2013, EnSys worked with our long time marine and pipeline associates, respectively David St. Amand head of Navigistics Consulting and Dr. Robert Luckner, to further examine the concerns the EIA have highlighted. Their examination included review of direct contacts with senior industry personnel at Sunoco Logistics, Colonial Pipeline, Buckeye Pipeline, Crowley Marine (a Jones Act tank vessel owner/operator), OSG (a Jones Act tank vessel owner/operator), American Petroleum Tankers LLC (a Jones Act tanker owner), Mid Ocean Marine (a Jones Act vessel owner/operator), Aker Philadelphia (a Jones Act tanker shipyard), Poten and MJLF, (Jones Act tanker brokers) and others, in addition to reviewing published materials.

EIA February 2012 Report, page 4

Replacing lost volumes presents a challenge in terms of both logistics and alternate supply sources, but the challenge posed by logistics is significantly greater. Two major logistical hurdles must be overcome. The first is moving product from the Gulf Coast to the Northeast, which will require overcoming both pipeline and tanker constraints. The pipeline that delivers products from the Gulf Coast to the Northeast is at or near capacity. As a result, additional volumes will need to move from the Gulf Coast to the Northeast by water. Shipments between two U.S. ports require tankers that meet Jones Act requirements. Generally, Jones Act ships are chartered months in advance, limiting their short-term availability. The second logistical constraint is receiving products at ports and connecting into the product pipelines that originate in the Philadelphia-area refining complex to serve inland Pennsylvania and western New York markets. Unloading systems and related equipment that had been used for the receipt of crude oil at idled refineries require considerable modification before they can be used to receive products. Moreover, there is little or no connectivity from existing crude oil terminals to product pipelines at ports that have been receiving crude oil for use as a refinery input.

As discussed below, the net effect of this inquiry was that we still share some of the EIA's concerns but believe the short term logistics situation may be somewhat more optimistic than they assessed, although we see Winter 2012/13 as potentially a critical period.

In their report, the EIA estimated supply deficits for the U.S. Northeast of 160,000 bpd for gasoline in 2012 rising to 240,000 bpd in 2013, this on the basis that the Sunoco Philadelphia refinery would shut down in July 2012 (and that the Phillips66 Trainer refinery would remain closed) and therefore that 2013 is the first year for the full impact to be felt. For ULS diesel, EIA projected deficits of 90,000 bpd in 2012 and 180,000 bpd in 2013. Underlying these annual averages are seasonal effects such that the gasoline deficit could be expected to be worse in the Summer (including Summer 2012 post July) and the distillate deficits (ULS diesel + heating oil) worse in the Winter. U.S. Gulf Coast refineries have sufficient capacity to replace the lost supplies that EIA estimate; therefore a central question concerns whether the capability exists to transport adequate replacement volumes from the Gulf Coast to the Pennsylvania / New York Harbor area and to do so in a time frame to meet the 2012 Summer gasoline driving peak; also to meet any possible surge in heating oil demand due to unexpectedly colder weather in Winter 2012/13.

In making our assessment, EnSys used EIA's basis of both Sunoco Philadelphia and Phillips66 Trainer closing. As of the date of this report, Phillips66 Trainer has been sold to Delta Airlines with the plan that it will be operated and negotiations are under way for a possible sale of the Sunoco Philadelphia refinery.

5.2.1 Product Supply from the Gulf Coast

Products can be moved from the Gulf Coast to the Northeast by pipeline and by tanker/barge. All marine movements must employ Jones Act vessels, i.e. tankers or barges (henceforth tank vessels) that have been built in the U.S., and which are owned and operated by U.S. companies and crewed by U.S. nationals or residents. In their report, the EIA express concerns regarding the short term adequacy of both pipeline and Jones Act tank vessels to move sufficient volumes, especially on the basis that the Sunoco Philadelphia refinery does indeed close in July 2012.

Regarding pipelines EIA states:

> "The Colonial pipeline extends into the Northeast, but the majority of its volumes supply the Southeast. Still, more than 500,000 bbl/d of gasoline and distillate are delivered into the Northeast via the Colonial pipeline, which terminates in Linden, NJ (part of New York Harbor). This pipeline may be able to move slightly more product into the Northeast in the coming summer. In the short term, however, additional movements into the Northeast are unlikely to exceed 100,000 bbl/d – well less than the expected production shortfall if the Sunoco Philadelphia refinery is closed."

Regarding tanker/barge:

> "With the Colonial pipeline running near capacity, moving the needed product to the Northeast will require Jones Act tankers, which may be in short supply." Also: "Generally, Jones Act ships are chartered months in advance, limiting their short-term availability."

5.2.1.1 Pipeline Capability

Two pipeline systems bring products from the Gulf Coast to the Northeast. The Plantation Pipeline runs as far as Fairfax/Dulles Virginia, the Colonial Pipeline to Linden New Jersey. Total capacity on Plantation is approximately 600,000 bpd, on Colonial 2.5 million bpd. Both lines, however, deliver the bulk of their product at points along the route in southern and lower mid-Atlantic states. Colonial is the only line that runs all the way through to the Pennsylvania / New York Harbor region and is therefore the critical pipeline for getting product to that area.

The southern segment of the Colonial Pipeline comprises two physical lines, Lines 1 and 2. These carry respectively gasoline and distillate (jet, ULSD, heating oil) from Houston/Baton Rouge to Greensboro North Carolina. Line 3 is a combined gasoline/distillates line that runs from Greensboro to Linden. Colonial Pipeline has been periodically full recently and during these periods used prorationing to allocate capacity among shippers on the Line 3 pipeline from Greensboro to New York Harbor. However, based on discussions with senior Colonial management, current Line 3 capacity is 814,000 bpd and in first quarter 2012 it ran at an

average 720,000 bpd throughput, i.e. had 94,000 bpd spare capacity[28]. Colonial press releases of 3/21/2011 and 3/21/2012 confirm the capacity figure[29].

The related timeline of refinery closures is a critical factor. Sunoco Marcus Hook closed in December 2011, Phillips66 Trainer the previous September. In 2011, HOVENSA product shipments to PADD1 as a whole had dropped to 160,000 bpd (from around 300,000 bpd in 2007), further declined to 86,000 bpd in January 2012 and then ceased in February with the closure of that refinery. Therefore, the 720,000 bpd first quarter throughput on Colonial Line3 would appear to equate to – and accommodate the effects of - all current closures except for Sunoco Philadelphia. This refinery is still operating. EIA data show imports to Sunoco Philadelphia of 256,000 bpd on average in 2011, well below the refinery's 335,000 bpd capacity. Listed imports for January 2012 were higher at 332,000 bpd. Applying PADD1 East Coast refinery yields for 2011 indicates shutdown of Sunoco Philadelphia would cut gasoline supply by 120,000 bpd and distillate by just under 100,000 bpd based on 2011 average throughput at the refinery.

The refinery's implied 332,000 bpd run rate in January may have been associated with either recent or pending maintenance. Given the refinery's poor stated economics, the intention to sell or close, and the average 2011 utilization of around 76%, it would appear unlikely that the January run rate would be sustained. If it was the refinery's average rate through the first quarter, then the implied loss from closure would be around 155,000 bpd of gasoline and 125,000 bpd of distillates. Thus the total gasoline plus distillates loss to be made up is indicated as in the range of 220,000 to 280,000 bpd. This is consistent with the EIA's estimate in their February report of 240,000 bpd supply deficit with closure of the Sunoco Philadelphia refinery.

Again, according to Colonial, Line 3 capacity will grow by an additional 20,000 bpd by mid 2012, making for total spare capacity of around 114,000 bpd by midyear or approximately half that needed to fully replace lost Sunoco Philadelphia clean products production.

[28] Also, since January 2011, NYH prices have only fully supported Gulf Coast to NYH gasoline movements by Colonial in 4 of the 13 months (from January 2011 through January 2012) and distillate movements in 6 of the 13 months (from January 2011 through January 2012), indicating one would not expect the Colonial Pipeline to have consistently run full.

[29] Colonial Pipeline, "Colonial Announces Expansions, Discusses Long-Range System Upgrades", March 21, 2011. http://www.colpipe.com/press_release/pr_109.asp
Colonial Pipeline, "Platts report from NPRA," March 12, 2012. http://www.platts.com/weblog/oilblog/2011/03/21/some_thoughts_f.html, http://forum.prisonplanet.com/index.php?topic=229750.0, http://www.marketwatch.com/story/colonial-to-expand-northeast-us-pipeline-flow-2012-03-12

Further expansions are planned which would increase line capacity to PA/NYH by another 40,000 bpd by mid 2013 and a further 65,000 bpd by 2014[30], thus a total increase of 125,000 bpd beyond first quarter 2012 capacity over the next two years. Adding this to the current 94,000 bpd of spare capacity implies an ability to handle an additional 219,000 bpd of product by 2014 to PA/NYH. Thus, this is sufficient – provided the planned expansions go ahead and do so on time – to eventually offset Sunoco Philadelphia supply losses – but in stages and not fully until 2014. In short, by itself, it does not appear as if Colonial's northern Line 3 segment would be able to offset more than half the Sunoco Philadelphia loss this Summer (with Phillips66 Trainer closed) and would still be short Winter 2012/13 and Summer 2013. Conversely, the implication is that a combination of Phillips66 Trainer staying open (capacity 185,000 bpd) and available Colonial capacity would be sufficient to deal with the deficit should Sunoco Philadelphia in fact close.

Colonial has also announced (3/12/2012) that it is connecting to the closed Eagle Point refinery, now operating as a terminal, to both deliver products (for transshipping by barge or by Buckeye Pipeline) and/or receive imported products for reshipment to NYH. Further, it is improving its connection to Buckeye Pipeline to serve PA and NY via Philadelphia to Malvern, Pennsylvania. These developments will improve shipping flexibility.

Another factor, though, is available capacity on the southern Line 1 and Line 2 sections of the Colonial Pipeline. These have recently at times been at capacity and in proration. According to press releases of 6/29/2011[31], 12/21/2011[32] and 3/21/2011[33], Colonial is expanding Lines 1 and 2 from Houston/Baton Rouge to Greensboro by 215,000 bpd by first half 2013. Again, the implication is that Colonial would be unable to fully replace lost Sunoco Philadelphia (and Phillips66 Trainer) supply until 2014 as capacity on Line 3 would be limiting.

If necessary, some distillate could be run in the Colonial gasoline Line 1 with increased transmix generation. However, shipping distillate on a pipeline such as Colonial generally takes 20% more capacity than for gasoline because of higher density and viscosity. Thus the actual volumes that Colonial can handle, now and in the future, will depend on the actual versus the "design basis" mix of gasoline and distillate. Moving higher proportions of gasoline this

[30] Source, Colonial Pipeline public announcement at American Fuel and Petrochemical Manufacturers (formerly NPRA) International Petrochemical Conference, San Antonio, March 12th, 2012.
[31] Colonial Pipeline, "Colonial Adding Capacity to Distillate Mainline", June 29, 2011. http://www.colpipe.com/press_release/pr_110.asp
[32] Colonial Pipeline, "Colonial Directors Approve New Expansion of main Gasoline Line, December 21, 2011. http://www.colpipe.com/press_release/pr_114.asp
[33] Colonial Pipeline, "Colonial Announces Expansions, Discusses Long-Range System Upgrades", March 21, 2011. http://www.colpipe.com/press_release/pr_109.asp

Summer, would therefore raise effective capacity, but higher distillate proportions, as potentially in Winter 2012/13, would cut effective capacity.

Plantation Pipeline is periodically constrained between Baton Rouge (its origin) and Collins, MS. Kinder Morgan and Valero are building a new 110,000 bpd Parkway Pipeline from New Orleans to Collins to alleviate this bottleneck. Start-up is 9/2013[34]. Beyond this southern section, Plantation has spare capacity which could allow for shifting barrels off Colonial should it become constrained.

Another factor that plays in to the ability to deliver products to the PA/NYH area by pipeline is the two PBF refineries at Paulsboro New Jersey and Delaware City. The Delaware City refinery feeds in to the Sunoco Pipeline at Philadelphia (Twin Oaks Pump Station, PA) via the Delaware Pipeline Company pipeline from the Delaware City Refinery but only began restart in December 2011. Therefore, Delaware City can serve the Pennsylvania and New York State markets directly and without any logistics modifications. The Delaware Pipeline is owned by PBF Energy. The capacity of the pipeline from Delaware City to Philadelphia is about 120,000 bpd; the remainder of the Delaware City Refinery output (about 40,000 bpd) goes by barge to NYH or New England. The Delaware pipeline does cross the Colonial Pipeline near Philadelphia and in the past connections have been discussed but not made. A connection would only serve to feed NYH and not Pennsylvania and New York states.

PBF Energy stated that the Delaware City refinery was restarted December 2011 after a lengthy shutdown and significant investment. EIA company level crude oil import data indicate that, in January 2012, the refinery imported (and by implication ran) around 92,000 bpd of crude oil, i.e. had reached about half its full capacity[35]. To the extent that the Delaware City refinery comes back to full throughput, it will aid in adding supplies into the Northeast. EnSys' presumption is though that the supply deficits estimated by the EIA assumed both Delaware City and Paulsboro running full.

5.2.1.2 Marine Capability

Based on discussions with Jones Act tank vessel owners, operators, shipyards, and brokers, EIA are correct to state that essentially all the fleet of Jones Act tank vessels is currently under term charter. It should be recognized, though, that they are under charter primarily to move U.S.

[34] Kinder Morgan Energy Partners, L.P. Parkway Pipeline LLC, September 14, 2011. http://www.parkwaypipeline.com/.

[35] The EIA data also showed the PBF Paulsboro refinery imports in January equivalent to around 97,000 bpd versus the refinery's capacity of 160,000 bpd.

products from the U.S. Gulf to PADD 1 destinations (primarily Florida) and can be redeployed to move products to the Philadelphia and New York regions if needed. It is also possible that the existing fleet of Jones Act Articulated Tank Barges (ATB's) can be redeployed to maximize fleet efficiency to back fill for Jones Act tankers shifted into longer haul trades (e.g., into U.S. Gulf to Philadelphia/New York from U.S. Gulf to Tampa).

There are also five large (330,000 barrel) Jones Act tank vessels under construction. Given the round trip transit time between the U.S. Gulf and the Northeast, each can each provide 20,000 - 25,000 bpd of deliverability on the US Gulf to Philadelphia/New York trade. These vessels are:

Shipyard	Owner	Vessel Type	Capacity barrels	Delivery
BAE Sys.	Mid Ocean Tankers	45k DWT Tanker	330,000	June 2012
VT Halter	Crowley Marine	750 Series ATB	330,000	June 2012
Aker Phila.	Aker (spec)	47k DWT Tanker	330,000	August 2012
Aker Phila.	Aker (spec)	47k DWT Tanker	330,000	February 2013
VT Halter	Crowley Marine	750 Series ATB	330,000	April 2013

Exhibit 5-1

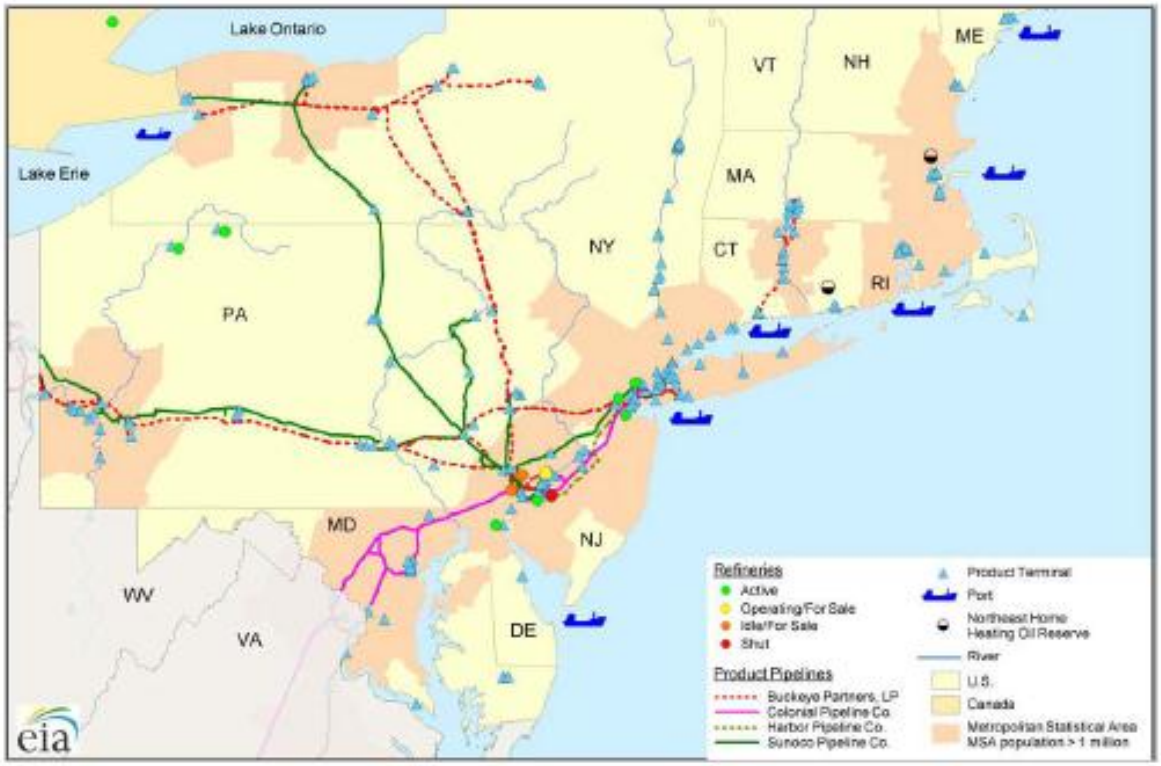
Two of these vessels will be available in June 2012 with a third delivered in August 2012. They should therefore be able to add 40,000 – 50,000 bpd of deliverability from the U.S. Gulf to the Northeast by around July 2012 and a further 20,000 – 25,000 bpd by September, i.e. a total of an additional 60,000 – 75,000 bpd by or soon after the expected closure date for the Sunoco Philadelphia refinery. The deliveries in February and April 2013 should add a further 40,000 – 50,000 bpd by second quarter 2013.

The foreign flag product tanker fleet is currently over supplied and has sufficient capacity to handle all the required volume for moving foreign manufactured petroleum products to the Philadelphia/New York regions that may be needed to cover any shortfall created by the potential closure of the Sunoco Philadelphia refinery.

5.2.2 Product Supply into the PA/NYH Distribution System

The second logistics issue EIA refers to, and the one they consider the most challenging, is difficulty in feeding products from the water, whether they arrive from the Gulf Coast, Europe or elsewhere, into the product delivery system as shown in Exhibit 5-2 below. Their stated view is that the system is not designed to bring in products at the docks of the refineries that are closing or to route them from the docks through to the terminal and pipeline connections on the "back end" of each refinery and that making the necessary modifications could take time.

Figure 1. Petroleum Product Assets in the Northeast



Source: U.S. Energy Information Administration.

Exhibit 5-2

The EnSys team review of this aspect of the situation likewise indicates concerns, especially over timing for conversion, but also paints a somewhat brighter picture.

Firstly, during second half 2011, EIA data show PADD 1 to PADD 2 movements (via the Buckeye and Sunoco pipelines from Philadelphia & NYH to Ohio) increased by 69,000 bpd to 243,000 bpd. These movements could be cut back if market conditions altered, through either reduced availability of product to move west from the Philadelphia/NYH area and/or increases in supply from refineries in or that can feed into the Ohio region[36]. The East Coast refinery closures are contributing to the former development and Midwest refinery expansions to the latter.

Also, Buckeye Pipeline currently delivers 120,000 bpd of clean products to Pittsburgh from Philadelphia refineries via their Laurel Pipeline as well as an additional 40,000 bpd to intermediate points such as Altoona, PA. Sunoco also has a pipeline from Philadelphia to

[36] Pittsburg does, however, require a low RVP gasoline in the summer which is currently only blended in Philadelphia and may be more difficult to obtain via imports (custom blending). Some lead time to arrange for alternative blending or an EPA waiver may be required if a shortage/price spike occurs.

Pittsburgh and currently moves approximately 25,000 bpd on this to Pittsburgh plus a volume to Altoona as well as on to Ohio. Pittsburgh could be supplied from PADD 2 Ohio Refineries (or indirectly via spare capacity on the Explorer Pipeline from Houston to Chicago replacing Eastern Michigan receipts (Bay City, Flint from Toledo and Lima) or via barge from PADD 2 or 3). These, and the volumes moving to Ohio as noted above, all constitute product volumes that could be supplied by means other than moving east on the Buckeye and Sunoco pipelines. As indicated, options include supplies from PADD2 (Midwest) refineries in Ohio or elsewhere and/or movements by barge up the Mississippi, Ohio and other river systems to Pittsburgh and other destinations. The latter have occurred historically. Also, movements by barge to Nashville Tennessee could be used to partially offload volumes from Plantation and Colonial, thereby creating additional potential capacity to the Northeast.

Secondly, there are current terminal developments already in place or under way that should directly add more flexibility:

- Colonial is taking steps to connect to idle refineries to make Gulf Coast deliveries for transshipment to other pipelines (like Buckeye Pipeline) that used to receive the refineries' production when they were active.
- Buckeye Pipeline is acquiring the NYH Chevron terminal at Perth Amboy, NJ. The transaction close is scheduled for 2Q2012 for $260 million plus an anticipated additional $200 million new investment over the next three years. For example, Buckeye plans to build 1.3 million barrels of new clean product tankage.[37]
  - This terminal has good tanker berths (1 tanker, 3 barge; 37' draft) and will allow integration with new product import transshipping tankage being built at their BORCO, Bahamas terminal.
- Buckeye will install a new 16" pipeline (125,000 bpd) to connect Perth Amboy to their pipeline origin at Linden. It will use existing right of way but permitting issues could slow down implementation[38]. Buckeye is now starting-up a 30,000 bpd expansion of their Linden to PA pipeline and will add an additional 45,000 bpd expansion (75,000 bpd cumulative) by 1Q2013[39].

Thirdly, converting a refinery into a terminal could take less time. Sunoco has indicated that converting a refinery into a product terminal is not as long and complicated as EIA indicates – in terms of the physical modifications that need to be made. Most East Coast refineries currently

[37] Buckeye Partners, L.P. "Perth Amboy Terminal Acquisition Presentation", February 10, 2012, pages 19 and 23. http://www2.buckeye.com/LinkClick.aspx?fileticket=ATlHYbBwj_Y%3d&tabid=610&mid=1701
[38] Ibid.
[39] Ibid.

ship product by barge as well as pipeline. Since dock lines already exist to ship products, simple manifold and valve changes would allow receipt of waterborne barrels. Increasing clean products capacity by converting crude dock lines and tanks would take longer because of the need to clean the crude oil tanks. Generally, refineries possess enough intra-refinery piping and pumping "offsites" for connections to be made through to products tanks, whence the onward connections already exist to product pipelines and terminals. Thus, undertaking the needed physical changes could be relatively straightforward and quick. A key factor though, which the EIA do highlight, is that permitting requirements could lead to substantial delays and lead times. Delays in sales and changes of refinery ownership would likewise engender delays in modifying the closed refineries to product terminals.

Fourthly, product imports into PADD1 as a whole have recently dropped very substantially. From a peak of 2.0 million bpd in 2005, the level dropped to 1.3 million bpd in 2011. This reduction of 700,000 bpd is far greater than the supply loss estimated by EIA at 240,000 bpd (2013) and indicates that there is spare capacity available to build product imports back up if necessary.

5.2.3 Combined Options

Taken together, there is a range of options for supplying replacement product into the Northeast. In summary, these include:

1. Spare capacity on the Colonial Pipeline, currently close to 95,000 bpd and increasing to approximately 115,000 bpd by mid 2012, 155,000 bpd by mid 2013 and 220,000 bpd by 2014, assuming all planned expansions go ahead
2. New Jones Act tankers and ATBs being delivered with potential to supply up to 75,000 bpd by third quarter 2012 and an additional 40,000 – 50,000 bpd by second quarter 2013
3. Potential (of 65,000 to possibly 240,000 bpd) to reduce PADD 1 to PADD 2 product movements and replace with supplies from Midwest refineries and/or barge movements from the Gulf Coast into PADD2
4. Similarly, potential to replace up to 120,000 bpd of movements from the PA/NYH area to Pittsburgh (which is in PADD1) by movements from PADDs 2 and 3 on inland barges. However, a source of low RVP summer gasoline will need to be identified as noted above.

5. Spare PADD1 refinery capacity with PBF refineries still increasing throughput after extended shutdown (and now the prospect of Phillips66 Trainer staying open after its purchase by Delta Airlines)
6. Increased foreign imports either directly into the NYH area and/or into terminals such as Sunoco Eagle Point now becoming operational, or by moving imports into New England (New Haven, Providence, Boston, Portland, etc.) thereby backing out product coming from Philadelphia/NYH.

Other options not included above may also exist or become evident. The above indicates a direct capability through use of spare pipeline capacity and new Jones Act tank vessels to meet most of the projected supply deficit should Sunoco Philadelphia close (and all of the deficit with Phillips66 Trainer open). By third quarter 2012, these modes should be able to provide around 175,000 bpd of capacity to move product from the Gulf Coast to the Northeast. Depending on the extent of Summer seasonal upswing in gasoline demand, this capability should take care of over half of the base 240,000 bpd deficit projected by the EIA (on the basis of both Phillips66 Trainer and Sunoco Philadelphia being closed). Other options for domestic supply increases and logistics adjustments, items 3 through 5 above, should take care of much of the rest of any supply shortfall. Option 6, foreign imports, provides a backstop with considerable availability.

These options also, at least partly, address the issue EIA foresaw over difficulties in moving product from the water into the Pennsylvania area and thence to markets in western Pennsylvania and New York State. For example, the existence of spare capacity on Colonial and the ability of Midwest refineries plus possible inland barge movements to back out supplies that currently run west from the Delaware River / Pennsylvania area should alleviate the pressure on getting products across the docks of the closed refineries in order to feed in to the Sunoco and Buckeye pipelines. In summary, while we agree with the EIA that the refinery closures could, were they all to go ahead, create some supply tightness this Summer, we believe there may be more optionality in the supply/logistics system than the EIA had identified.

Winter 2012/13 could, however, be more of a potential concern. As the EIA pointed out, the supply/demand balance for distillates in general and ultra-low sulfur diesel in particular is tighter than that for gasoline. Should the State of New York go ahead with its plan to convert this July to the planned ultra-low sulfur standard for heating oil consumed in the State, that will further tighten ultra-low sulfur distillates supply next Winter. EIA quotes recent annual average heating oil volume in New York State of 70,000 bpd. However, EIA Prime Supplier data show

that volume can double in the Winter to over 140,000 bpd[40]. Therefore, if one accepts EIA's projection of a 180,000 bpd annual average ULS distillate supply deficit for 2013, the implied deficit for Winter 2012/13 with New York State at ULS standard could be around 250,000 bpd, (180,000 bpd annual average plus an extra 70,000 bpd under Winter peak demand)[41]. (Again, EIA's projection was on the basis of both Phillips66 Trainer and Sunoco Philadelphia being closed.)

Such a shortfall would arguably be short-lived but could represent a significant challenge, given the generally tight distillates market. Ability to rely on imports to meet a Winter peak may be less in the future than has been the case historically, especially for ULSD standard distillate. As stated previously, more heating oil could be shipped via pipeline to the Northeast but that has the consequence of cutting a pipeline's effective capacity because of the heating oil's higher density and viscosity. Therefore, meeting any significant peak, such as would be brought about by a cold winter, could require all of the options 1 through 6 above to be brought to bear. In short, our concern, as EIA's, is more about meeting demand in Winter 2012/13 than it is about Summer 2012. Should New York State decide to defer its ULSD standard for heating oil by one year, that would provide a measure of increased supply flexibility as around 70,000 bpd (average) of heating oil would be required not as ULS distillate but as much easier to provide higher sulfur heating oil.

5.2.4 Longer Term

Longer term, the expansions and flexibility described above should enable lost East Coast supply to be fully replaced, potentially from within the U.S. The industry will adapt, building new supply chains into the Northeast. How these evolve will depend in large part on who – if anyone – buys the East Coast refineries and how they are subsequently used, specifically whether as operating refineries or solely as terminals. Transport economics will also be an important part of the picture. The ability of different supply regions, including the Gulf Coast, to compete over the longer term will depend on costs of transporting both crude and product.

[40] For instance, New York State No 2 fuel oil sales/deliveries by Prime Supplier for January 2011, (a cold Winter month) were 6,021,000 gallons per day which equals 143,000 bpd.

[41] EIA Product Supplied data for the whole of PADD1 shows that total product supplied in Winter can be 500,000 bpd to 700,000 bpd higher than in Summer (January versus July / August); further that this variability is predominantly due to seasonal variations in demand for distillates – and thus essentially for heating oil in the Northeast. (Demand for diesel has little seasonal variability.) Until 2012, Northeast heating oil has been high sulfur. Therefore, it has been possible for a range of suppliers, Russia et al, to meet Northeast Winter peak demand, as pointed out by the EIA in their report. As other Northeast states progressively follow New York to ULS standards, then meeting Winter peak demand at the tighter standard could be an issue across the Northeast region.

Ownership factors and economics could result in either the bulk of the replacement supply coming from non-U.S. sources, a "high imports" scenario or the opposite, from primarily U.S. refineries, "high U.S."

There are reasons why "high imports" could be the outcome. Sweet crudes (mainly from Africa and Europe) displaced from the closed East Coast refineries and also HOVENSA can readily be re-routed to Europe where suitable spare capacity exists. Undertaking the processing there would boost refinery utilizations and viability and enable European refineries to produce more distillate needed in Europe and export the co-product gasoline to the U.S. In addition under this scenario, new efficient refineries in India (Reliance and Essar) could increase their product exports to the U.S., potentially using storage terminal capacity in the Caribbean, (including possibly HOVENSA and BORCO), in New York Harbor (Reliance already leases tankage there) and/or at the closed East Coast refineries to feed their products into the Northeast distribution system. New export refineries coming on line in the Middle East in the next few years could reinforce this effect. Broadly, a "high imports" scenario goes with increased U.S. dependency on foreign sources for products supply, longer product supply lines, refining "added value" and jobs outside the U.S. and/or a greater level of foreign ownership of U.S. fuels infrastructure.

Avoiding a "high imports" outcome means ensuring U.S. Gulf Coast – and potentially Midwest – refineries have the supply sources and the logistics needed to be competitive and to feed products to the Northeast to replace supplies lost from closures of refineries there[42]. It also means acting swiftly as, once supply patterns are in place, they can be difficult to shift.

Driven by growing supplies of Western Canadian and Lower 48 crude oils, Midwestern refineries have been investing and expanding capacity. As noted above, this is leading to reduced product inflows from Gulf Coast refineries. It also opens up the opportunity for Midwest refined products to be supplied into at least the western regions of Pennsylvania and New York State; longer term, potentially further into the Northeast region.

U.S. Gulf Coast refineries currently have spare capacity; movements of their products to the U.S. Midwest have been declining, as refineries there have raised throughput to take advantage of increased Lower 48 and Western Canadian crude supplies, and product exports from the Gulf Coast to regions outside the U.S. have been rising. Minimizing future dependence in the Northeast on non-U.S. product sources therefore hinges primarily on ensuring U.S. Gulf Coast refineries can efficiently move their products to the Pennsylvania / New York region; also that

[42] Nearly 500,000 bpd of U.S. Gulf Coast and Midwest refining capacity expansions under construction will add to the product supply in these refining regions which could potentially be available for shipping to the Northeast.

those refineries can efficiently access stable crude supplies, namely from the U.S. Lower 48 and from Western Canada.

Both opportunities, to replace lost East Coast supplies with domestically produced products from either the Midwest or the Gulf Coast depend on logistics; having the pipeline capacity in place to (a) move products from the Gulf Coast and potentially Midwest to the Northeast and (b) move crudes from the U.S. Midwest/Midcontinent and from Western Canada to the Gulf Coast[43]. Enabling stable secure supplies to reach Gulf Coast refineries will encourage processing and expansion/investment there to make additional product available to the Northeast. Enabling adequate logistics will keep the refining value added (and jobs) in the U.S. – and *vice versa*.

[43] Enabling Lower 48 crude oils from the expanding shale plays to reach the East Coast could also support the economics of the refineries still operating in the region.

6 Conclusions

As laid out in the EIA February 2012 report, key short term challenges center on (a) achieving adequate gasoline supplies into the Northeast this Summer 2012, (b) achieving adequate distillates supplies for Winter 2012/2013 and (c) overcoming the logistics issues that will exist especially if the Sunoco Philadelphia refinery does in fact close. In short, the next 12 months or so are likely to be a critical period where, if matters do not go well, there could be product supply problems. Winter 2012/13 looks to be more of a concern than Summer 2012. Over the next twelve months and beyond, the industry is likely to adapt with the "mid-stream" in particular adapting the product supply routes and logistics system into the Northeast. Such adaptations are already under way in response to market drivers.

The market will adapt and be the primary driving force of change, but the implication from this review of the refinery closures is that actions taken at federal, state and local levels over the next weeks and months could help ensure an efficient transition. Actions taken could impact the outcome between whether the bulk of the lost East Coast refined product supplies are made up by non-U.S. – potentially long distance – suppliers or predominantly by increased supplies from other domestic U.S. refineries.

U.S. refineries can replace product lost by closures, however, so can foreign refiners. Actions at the federal, state and local levels will influence how the situation evolves. Of central importance is support to infrastructure developments that:

(a) bring domestic crude oils to remaining Northeast refineries;

(b) deliver adequate and stable Lower 48 and Western Canadian crude supplies to Gulf Coast refineries so that they (and Midwest refineries) can replace lost East Coast products; and

(c) ensure efficient movement of products into the Northeast from the Gulf Coast and Midwest.

Enabling/supporting such projects as Keystone XL, Seaway reversal and expansion, and other pipeline and rail developments, will have a critical impact on the extent to which East Coast refineries can stay open and/or other U.S. refineries – not foreign refiners – can resupply the region.

7 Appendix – Detail of Environmental Regulations

7.1.1 Overview

Petroleum refining has been called one of the most heavily regulated industries in the United States. Refineries are regulated on the direct "stationary source" emissions from their operations and also on the qualities of their production involving multiple products and multiple product specifications. Regulation of refined products is highly complex since, for example, gasoline formulations are controlled differently depending on season and geographical market location. In addition, both products and stationary source emissions are frequently governed by Federal and State regulations.

The predominant focus of regulations governing environmental impacts from refinery operations and fuels products is on air quality. Additional regulations are imposed for water pollution and solid waste handling and disposal. Refined products regulations are today designed both to ensure good product performance and to control air quality impacts, with emphasis on limiting ozone formation and release of toxic hydrocarbons, sulfur and nitrogen oxides and particulate matter.

7.1.2 Scope of Regulations Impacting U.S. Refineries

7.1.2.1 Stationary Source Regulations

Key stationary source regulations include:

- The Clean Water Act which regulates the discharge of pollutants into the waters of the United States[44]. The Act establishes protective standards, programs and permit requirements. A principal source in refineries is refinery process wastewater. Large quantities of cooling water are also discharged by refineries into U.S. waters and are regulated.

[44] Clean Water Act of 1977, P.L. 95-217, U.S.C.1251-1387 and subsequent 33 U.S.C.1251-1387.

- The Resources Conservation and Recovery Act (RCRA) which authorizes EPA to regulate the handling, storage and disposal of hazardous solids and wastes[45]. Refinery sources include process sludges, spent catalysts and storage tank bottoms.
- The National Emissions Standards for Hazardous Air Pollutants (NESHAP) which cover refinery emissions to air of a wide range of listed toxic and dangerous hydrocarbons[46]
- Also NESHAP emissions control regulations affecting the operation of the catalytic cracker, catalytic reformer and refinery sulfur plant process units[47]
- Oil Pollution, Spill Prevention, Control and Countermeasures Rule (SPCC) which covers hydrocarbon spills, leaking storage tanks and pipes, and leaks/spills during receiving and shipping[48].

Other Federal regulations impacting the industry include:

- Safe Drinking Water Act (SDWA)
- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)
- OSHA Health Standards and Process Safety Management Rules
- Emergency Planning and Community Right-to-Know Act (EPCRA).

In addition to the above there are individual state regulations which govern the operation of petroleum refineries, as well as health and safety standards.

7.1.2.2 Fuels Products Regulations

Multiple product performance specifications have existed for many years on the key transportation fuels: gasoline, jet fuel and diesel[49]. Especially in the past twenty years, these have been supplemented – and to a large degree overshadowed – by regulations to control air quality performance, especially of gasoline and diesel.

[45] Resource Conservation and Recovery Act (RCRA) 1976 Amendment to the Solid Waste Disposal Act, Subpart C of 40CFR261.
[46] National Emissions Standards for Hazardous Air Pollutants (NESHAP), Section 112 of the Clean Air Act of 1990, published in CFR parts 61 and 63. Covers emissions to atmosphere from, *inter alia*, process vents, equipment leaks, wastewater treatment systems, gasoline loading racks, marine tank vessels.
[47] NESHAP refineries; Catalytic Cracking Units, Catalytic Reforming Units and Sulfur Recovery Units,63FR48889, May 2002.
[48] 1990 Oil Pollution Act and Spill Prevention Control and Countermeasure Plans and EPA Administrator, January 14, 2010 Amendments to the Oil Pollution, Spill Prevention, Control and Countermeasures Rule (SPCC).
[49] Such standards include, for example, octane, distillation and other specifications for gasoline, cetane and cold weather flow specifications for diesel fuels.

The Clean Air Act Amendments of 1990 have had a major impact on petroleum refining operations and economics[50]. Under the CAAA, the EPA established new standards which limit summertime gasoline volatility, control emissions of volatile organic compounds (VOC) and nitrous oxides (NO_x) that are major contributors to ground-level ozone (smog), and limit gasoline content and emissions of toxic compounds. Strict reformulated gasoline (RFG) standards were established for regions of the country that were ozone non-attainment areas. A Phase II program commencing in 2000 was designed to further improve air quality in non-attainment areas by tightening the standards for reformulated gasoline. Beginning in 2004, refiners were required to produce an annual average refinery gasoline with a maximum of 30 ppm sulfur.

Associated rules have covered:

- An "antidumping" provision preventing refiners, blenders and importers from dumping into conventional gasoline those fuel components that are restricted in reformulated gasoline, i.e. the provision has prevented deterioration in the quality of conventional gasoline

- A Mobile Source Air Toxics (MSAT1) rule which regulated the toxics from the RFG/anti-dumping program and which was succeeded at the beginning of 2011 with the Mobile Source Air Toxics (MSAT2) rule which limits the benzene content of gasoline and replaces the toxics limits in MSAT1.

In addition, the Energy Policy Act of 2005 Renewable Fuel Standards, (RFS1 and subsequent expanded RFS2), require the use of renewable fuels, predominantly ethanol. In addition to cutting the volume of gasoline that refiners need to produce, the regulations have required refiners to adapt their processing and gasoline blending facilities and operations to allow for the high volatility of ethanol as a gasoline blendstock.

Diesel Fuel Regulations setting standards for ultra-low diesel fuel were brought into effect by the EPA in December 2000 and have led to now 100% of both on-road and off-road diesel fuel having to meet the maximum allowable sulfur content of 15 ppm.

In addition to these Federal regulations, several states have enacted their own fuels regulations. California has enacted standards for gasoline and diesel that are stricter than the Federal standards and has introduced a Low Carbon Fuel Standard which if implemented could have substantial impacts in California and which may spread to the Northeast and possibly

[50] Clean Air Act Amendments of 1990, PL101-549, Title 40 of the Code of federal Regulation (CFC) as amended 42 USC7401 et seq.

other regions of the country[51]. Other states have also mandated fuels quality rules which do not match the Federal standards with the result that the country now has a patchwork of "boutique" fuels, Exhibit 7-1, which increases the complexity and cost of supply.

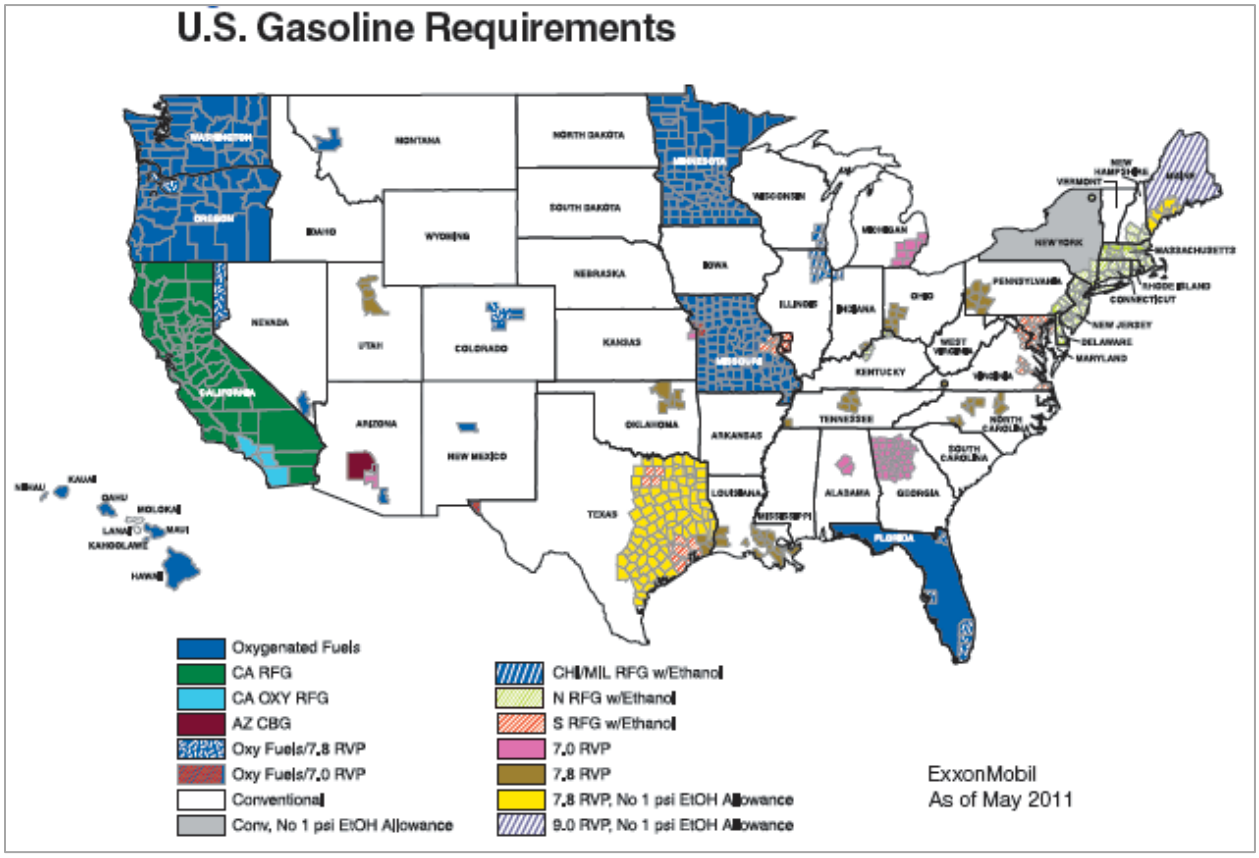


Exhibit 7-1

7.1.3 Cost of Regulations Impacting U.S. Refineries

The cumulative costs to U.S. refining of these many regulations is substantial. A 2011 report by the American Petroleum Institute illustrates the scale of costs involved[52]. Between 2001 and 2010, the total ten year environmental expenditure amounted to $77 billion in the refining sector, with $11 billion expended in 2010 alone. (See Exhibit 7-2 below, API report Table 3).

[51] In 2006, the State also enacted the Global Warming Solutions Act, Law AB32 which would progressively require fuels consumed in the state to possess lower "life-cycle" carbon footprints. These requirements are expressed through a Low Carbon Fuel Standard which calls for a progressive reduction over time in the life-cycle carbon content of fuels consumed within the State. The Act is the subject of litigation but, if enforced, would require California refiners to markedly alter their crude processing and product formulations over time.

[52] Environmental Expenditures by the U.S. Oil and Natural Gas Industry 1990-2010, the American Petroleum Institute.

What is also evident from the API estimates is that annual refining – and total U.S. oil industry – environmental expenditures have increased considerably. Versus total expenditures for refining in the range of $4-5 billion annually between 1990 and 1999, costs reached over $7.5 billion in 2005/2006 and averaged $10 – 11 billion per year between 2008 and 2010. The trend illustrates the increasing burden on the U.S. refining sector.

Exhibit 7-2

Summary of Estimated U.S. Environmental Expenditures: 1990-2010 (In millions of dollars)

Sector	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total	10-Year Total
E&P[1]																							
Capital	653	729	743	859	828	596	762	928	772	658	984	855	670	967	696	1,020	1,298	1,252	1,904	1,222	1,068	19,465	10,953
O&M[2]	872	824	823	704	731	726	820	776	805	1,135	744	920	617	614	909	889	1,276	1,962	2,511	1,642	2,086	22,386	13,426
Subtotal	1,525	1,553	1,566	1,563	1,559	1,322	1,582	1,705	1,577	1,793	1,728	1,776	1,287	1,580	1,605	1,909	2,574	3,214	4,415	2,864	3,154	41,852	24,379
Transportation																							
Capital	277	291	365	374	288	246	257	258	468	484	324	311	293	345	253	251	429	327	310	441	450	7,040	3,409
O&M[2]	389	446	601	598	584	563	757	388	347	371	798	638	708	637	640	587	626	348	691	228	698	11,644	5,801
Subtotal	666	737	966	972	872	809	1,013	645	815	855	1,122	948	1,001	982	893	838	1,055	675	1,002	669	1,148	18,684	9,211
Refining																							
Capital	1,286	1,809	3,282	3,215	3,118	2,158	826	519	1,078	597	864	1,156	2,376	3,243	3,363	4,398	3,511	3,529	6,696	4,502	7,385	58,912	40,160
O&M[2]	2,424	2,309	2,526	2,483	2,815	3,351	3,132	3,637	3,361	2,970	3,077	3,430	2,838	2,824	2,869	3,376	4,012	4,373	4,884	4,229	3,634	68,554	36,469
Subtotal	3,710	4,118	5,808	5,698	5,933	5,509	3,958	4,156	4,439	3,567	3,941	4,586	5,214	6,068	6,232	7,774	7,524	7,902	11,580	8,731	11,019	127,465	76,629
Marketing																							
Capital	229	329	366	395	393	211	165	249	384	130	91	200	224	110	135	133	102	116	284	83	35	4,364	1,422
O&M[2]	211	317	275	347	339	297	267	297	256	305	148	160	154	153	138	90	76	81	102	65	98	4,177	1,118
Subtotal	440	646	641	742	732	508	432	545	640	435	239	360	378	263	273	223	178	197	386	149	133	8,541	2,541
Other																							
R&D[3]	175	227	214	227	175	156	103	90	102	79	120	162	225	184	111	131	103	78	115	145	135	3,055	1,388
Corporate Programs	147	121	78	246	194	141	187	183	170	118	54	43	203	122	228	225	237	267	385	365	302	4,017	2,378
Grand Total	6,663	7,402	9,273	9,448	9,465	8,445	7,276	7,324	7,743	6,846	7,205	7,875	8,308	9,199	9,343	11,101	11,671	12,333	17,882	12,922	15,891	203,615	116,525

1 Exploration and Production.
2 Operations, Maintenance and Administration.
3 Research and Development.

The cost in 2010 equates to 5 c/gal on every barrel of product produced in U.S. refineries. In a world of $3 - $4 / gallon gasoline, 5 c/gal may not sound like much. However, 5 c/gal equates to $2/barrel which must be put in the context of refinery profitability. Given that the refining margin for East Coast refineries has averaged only $6-8/barrel over the past five years[53], the data suggest that the costs of environmental compliance have had a significant adverse impact on East Coast refining, contributing to the result we see today. In testimony to a Congressional Hearing in March 2012, Charles Drevna, president of AFPM, the American Fuel & Petrochemical Manufacturers, stated that "Sunoco notes in its Open Letter to the Community regarding its Northeast refinery closures that environmental regulatory costs consumed approximately 15 percent of its operating budget" and that "Similarly, over the last 10 years ConocoPhillips invested 100 percent or more of its profit into its Trainer refinery in the Philadelphia area to meet regulatory requirements before idling the refinery last year[54].

It is also evident that such costs impact the international competitiveness of the vast majority of U.S. refineries. A Department of Energy report issued in March 2011 concluded that the cumulative burden of federal regulations was a significant factor in the closure of 66 petroleum refineries in the United States in the past 20 years[55]. Exhibit 7-3, taken from the DOE report, tracks the timeline of major environmental regulations impacting the refining industry and sets that alongside refinery closures.

[53] Source Bloomberg / EnSys refining netbacks, U.S. East Coast Brent (FCC) cracking margin. Note, these margins are calculated as gross product revenue minus refinery variable operating costs minus delivered crude cost. They exclude capital and fixed operating costs, i.e. the bulk of the costs incurred for environmental compliance.

[54] WRITTEN STATEMENT OF AMERICAN FUEL & PETROCHEMICAL MANUFACTURERS AS SUBMITTED TO THE SUBCOMMITTEE ON ENERGY AND POWER Committee on Energy and Commerce United States House of Representatives on "The American Energy Initiative" March 7, 2012,

[55] U.S. Department of Energy, Office of Policy and International Affairs, Small Refinery Exemption Study – An Investigation Into Disproportionate Economic Hardship, http://www.epa.gov/otaq/fuels/renewablefuels/compliancehelp/small-refinery-exempt-study.pdf.

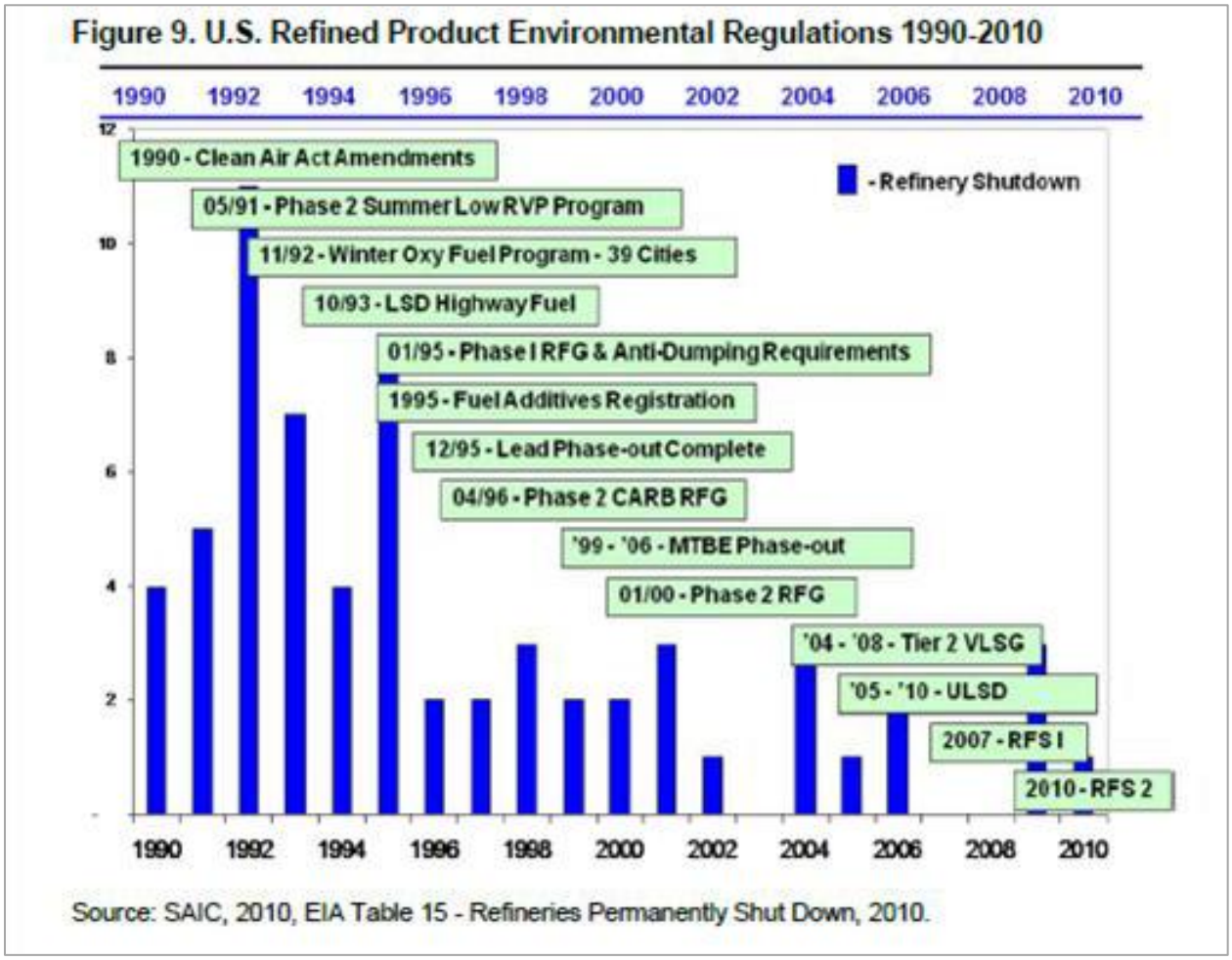


Exhibit 7-3

7.1.4 Potential Additional Future Regulations

Even though the costs to U.S. refiners of environmental compliance are very substantial – and rising, the regulatory picture is not static. Refiners face several additional regulations; a prospect that may have been a factor in the decisions of Sunoco, ConocoPhillips and Hess to close refineries in or serving East Coast markets.

7.1.4.1 Fuels Regulation

7.1.4.1.1 Tier 3 Gasoline

The EPA is considering "Tier 3" rules which would further advance the existing "Tier 2" rules which govern gasoline qualities[56]. Tier 3 would cut allowed U.S. gasoline sulfur levels to as low as 10 ppm, (from the current 30 ppm), and, potentially, would also lower summertime gasoline volatility. The timing of these regulations is uncertain and the EPA has indicated it will delay (or possibly not pursue) the gasoline volatility standards but a recent study for the American Petroleum Institute estimated the marginal costs of sulfur reduction alone at 6 to 9 c/gal and of both sulfur and volatility reduction at 12 to 25 c/gal[57]. Referring to the report Figure 10 and sensitivity Case 4, a case which reflected sulfur reduction alone, estimated average costs for sulfur reduction appear to lie in the 2.5 to 3 c/gal range. EPA's stated estimates are much lower, with average costs at somewhat over 1 c/gal for sulfur reduction alone, but nonetheless recognize the need for additional refining investments and operating costs should the rule be implemented.

7.1.4.1.2 Marine Fuels

Marine bunker fuels are among the products supplied by refineries on the East and other coasts of the USA. The International Maritime Organisation, an arm of the United Nations which sets standards for international maritime trade, including for bunker fuels, introduced new "MARPOL Annex VI" rules which went into force in July 2010. These apply progressively tighter global quality standards, to be fully introduced by 2020 or latest 2025, which will potentially impact all coastal U.S. refineries that supply bunker fuels[58]. More significant, under the Annex VI rules, the USA and Canada have agreed to introduce the tighter Emissions Control Area (ECA) standards contained in Annex VI to apply to all shipping within 200 nautical miles of the U.S. and Canadian coasts. Introduction of the ECA standards will affect all marine traffic in and near U.S. and Canadian coastal waters, requiring the use of bunker fuel that has a maximum sulfur content of 1%, dropping to 0.1% in 2015, for movements within the 200 nautical mile coastal zones. The U.S. ECA goes into effect August 2012. .

[56] http://www.epa.gov/rfa/tier3.html. The EPA website lists Tier 3 as currently in "pre-proposal" phase with July 2012 as the planned date for a Notice of Proposed Rulemaking; http://yosemite.epa.gov/opei/rulegate.nsf/byRIN/2060-AQ86.

[57] Addendum to Potential Supply and Costs Impacts of Lower Sulfur, Lower RVP Gasoline, Baker & O'Brien, March 2012.

[58] The global standard calls for a reduction in sulfur content for the main class of bunker fuel from 3.5% to 0.5% or the application of alternative means, notably onboard exhaust gas scrubbing equipment, to achieve equivalent reductions in Sox emissions.

In practical terms, this is expected to mean that some 40% of the bunker fuel produced by U.S. refineries[59] will need to switch from a mix of minority marine diesel at maximum 1% sulfur and majority heavy residual type bunker fuel at maximum 3.5% sulfur to 100% marine diesel at 0.1% sulfur[60]. Since it is coastal refineries that generally supply marine bunker fuels, those on the East and other coasts will be the most directly affected.

7.1.4.1.3 Heating Oil

The U.S. New England and Central Atlantic states are significant consumers of heating oil. Volumes have been declining in recent years, in part because of the steady encroachment of increasing natural gas supplies. Nonetheless, most states in the region have now enacted regulations that will progressively tighten the sulfur standards from the current 2,000 ppm to the same 15 ppm standard as applies for ultra-low sulfur diesel. As discussed in Section 5.1, New York State plans to introduce the ULSD standard for heating oil, effective July 2012. Other Northeast States have announced dates to phase in ULSD for heating oil as follows:

- Maine—2016-2018
- Massachusetts—2014-2018
- New Jersey—2014-2016
- Vermont—2014-2018.

In general, the first stated date above relates to a July 1 change to 500 ppm sulfur maximum and the second date to a July 1 change to 15 ppm maximum. Connecticut has also passed legislation but dependent on the other states requiring ULS standards for heating oil. Pennsylvania too is considering legislation to reduce heating oil sulfur to at least 500 ppm and possibly 15ppm[61].

[59] Global Trade and Fuels Assessment - Future Trends and Effects of Requiring Clean Fuels in the Marine Sector, prepared for the EPA by RTI International, EnSys Energy, Navigistics Consulting, November 2008.
[60] Global standard marine fuels would still be supplied for use by ships once outside the ECA zones.
[61] Proposed Rule to Reduce the Sulfur Content of Commercial Fuel Oil, Summary of Comments, AQTAC, June 23, 2011.

7.1.4.2 GHG Emissions Rules

In May of 2007 the Supreme Court ruled that the EPA was empowered to establish standards for GHG emissions under the provisions of the Clean Air Act. Following the issuance of an "endangerment rule" in December 2009, EPA issued a "tailoring rule" in May 2010 which limited air permitting guidelines to the largest sources of GHG's and proposed a three-year deferral for smaller emitters. In December of that year EPA issued guidelines to states for implementing the new GHG guidelines.

In January 2011 GHG permitting began for new facilities that would emit more than 100,000 tons per year of carbon dioxide equivalent per year and in July 2011 this was extended to 75,000 tons per year.

According to settlement agreements reached by the EPA with a number of states and environmental groups in December 2010, "EPA will propose standards for power plants in July 2011 and for refineries in December 2011 and will issue final standards in May 2012 and November 2012, respectively."[62]

EPA announced last November that it would not meet the above December 2011 deadline. March 2012 press reports indicated that EPA's first priority is to put in place a rule for power plants, since they have GHG emissions over ten times greater than those of refineries[63]. Also March of this year, EPA Administrator Lisa Jackson, before members of the House Energy and Commerce Committee, indicated that the slowdown would delay final oil refinery standards until beyond 2012[64]. The implication is, nonetheless, that this is a delay by the EPA but not an abandonment of their agreement under the December 2010 settlement to implement GHG emissions standards for the U.S. refining sector.

7.1.4.1 Stationary Source Emissions

Other stationary source regulations that could be implemented by the EPA over the next five years include refinery emissions controls to achieve more stringent air quality standards for ozone, PM, etc. and new requirements for boilers and incinerators (Boiler Maximum Achievable

[62] http://epa.gov/carbonpollutionstandard/settlement.html
[63] http://www.ntaatribalair.org/index.php?option=com_content&view=article&id=1302:jeny&catid=58:jeny.
[64] Ibid.

Control Technology [MACT]). Again, these rules would potentially impact all refineries in the U.S[65].

7.1.4.2 Low Carbon Fuel Standard

Under the banner organization NESCAUM, (Northeast States for Coordinated Air Use Management), a group of states, comprising Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, New Jersey and New York, provides "scientific, technical, analytical, and policy support to the air quality and climate programs of the eight Northeast states". In 2009, NESCAUM introduced proposals for the introduction of a California-like Low Carbon Fuel Standard, later called the Clean Fuels Standard (CFS). In studies undertaken in 2010 and 2011 on a potential ten year program to require low carbon fuels, NESCAUM concluded that "gasoline and diesel use decreases by 12 to 29 percent (4.0 to 8.7 billion gallons annually) once the 10% CFS is fully implemented"[66].

There has been considerable commentary on the NESCAUM proposals and projections from a wide range of organizations, including criticism of their feasibility and economic underpinnings[67]. (A 2012 report by SAIC found that establishing an LCFS in the eight Northeast states would cost at least $306 billion and at least 147,000 jobs over 10 years and also projected that "Nominal gasoline prices would at least double, and diesel and jet fuel prices would increase by at least 18-23% by 2022 from 2012."[68]) Nevertheless, from the perspective of a refiner in the Northeast, the NESCAUM LCFS proposals represent yet another potential downward impact on refined products demand in the region.

7.1.4.3 Combined Impact of Potential Additional Regulations

The pending and possible additional regulations discussed above all equate to additional costs to comply with stationary source emissions regulations, additional costs to meet more advanced fuels standards, and/or would lead to further reductions in demand for refined

[65] The US Environmental Protection Agency issued a final rule updating Clean Air Act standards for refinery flares and process heaters on June 1. http://www.ogj.com/articles/2012/06/epa-issues-final-rule-for-refinery-flares-process-heaters.html.
[66] Final Results: Economic Analysis of the Northeast/Mid-Atlantic (NE/MA) Clean Fuels Standard, NESCAUM, September 2011, Boston, MA and Baltimore, MD.
[67] See http://www.nescaum.org/topics/clean-fuels-standard and http://www.nescaum.org/documents/stakeholder-comments-on-the-cfs-analysis/.
[68] http://www.ogj.com/articles/print/vol-110/issue-4/general-interest/cea-backed-study-contests.html.

products demand in the Northeast – these on top of an environmental compliance burden that has been rising and oil price impacts. Given East Coast refiners' predominant use of low sulfur crude oils, see Section 3.2, the pending switches to 0.1% sulfur (1,000 pm) marine diesel and 15 ppm heating oil might at first glance appear to represent an opportunity. However, both standards would, even with low sulfur crudes, potentially require significant investments in additional desulfurization unit capacity and/or process capacity to upgrade heavy residual type marine fuel to marine diesel.

For refineries that are in a strong position competitively and financially, tightening fuels regulations can be a positive factor but, for refineries as those now closing in the Northeast and USVI that have recently been incurring substantial losses, the prospects of higher costs and investments resulting from additional fuels regulations and more stringent stationary emissions standards, plus further demand reduction, represent major forces against staying in business.