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Potential Impacts of Reductions in Refinery Activity on Northeast Petroleum Product Markets

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This report updates and expands upon a December 2011 U.S. Energy Information Administration (EIA) report, *Reductions in Northeast Refining Activity: Potential Implications for Petroleum Product Markets*.[1] Since September 2011, two refineries in the Philadelphia area (ConocoPhillips Trainer refinery and Sunoco's Marcus Hook refinery) and one major Caribbean export refinery supplying the East Coast (HOVENSA's U.S. Virgin Islands refinery) have closed. In addition, Sunoco has announced plans to idle its remaining Philadelphia-area refinery (Sunoco Philadelphia) in July 2012 if no buyer is found. The three Philadelphia-area refineries (Trainer, Marcus Hook, and Philadelphia) taken together represented 50% of total East Coast refining capacity as of August 2011.

To date, the market transition following the closing of two Philadelphia-area refineries in September and December 2011 has been relatively smooth, but the situation could change. Those closures have been partially offset by the startup of PBF Energy's Delaware City refinery in October 2011, which had been shut down in late 2009 by Valero before its sale to PBF Energy. However, if Sunoco's Philadelphia refinery, which alone accounted for nearly a quarter of refinery capacity on the East Coast in 2011, were to shut down in July 2012, petroleum product markets in the Northeast could be significantly impacted.

Refining capacity is available outside of the East Coast to replace products historically supplied by the capacity that has been or may be idled, including potential production losses from the Sunoco Philadelphia refinery, but transportation constraints may hinder the delivery of products to the Northeast in the short term. Ultra-low-sulfur diesel fuel (ULSD) will be the most challenging product to replace as there are few alternative supply sources outside of the U.S. Gulf Coast. Transportation constraints may also hamper the movement of all replacement products through Pennsylvania and into western New York, areas currently supplied by pipelines originating in the Philadelphia area refinery complex. The industry may not be able to overcome all of the logistical challenges in the Northeast for a year or more, as infrastructure changes will be necessary to accommodate the changing product flows.

If the Sunoco Philadelphia refinery closes, price impacts are highly uncertain. If areas cannot be adequately supplied in the short term, prices can spike. In the longer run, higher prices and possibly higher price volatility can result from longer supply chains. The potential loss of the Sunoco Philadelphia refinery presents a complex supply challenge, and no single solution has been identified by industry participants that will address all of the logistical hurdles that must be overcome. The industry will have a financial incentive to serve all markets in the Northeast, and companies are currently investigating options. However, companies are not likely to make significant investments in new logistical arrangements until the status of Sunoco's Philadelphia refinery is known. EIA will continue to monitor this situation as it evolves.

[1] http://www.eia.gov/analysis/petroleum/nerefining/prelim/.

1. Introduction

This report is an update to a previous U.S. Energy Information Administration (EIA) report, *Reductions in Northeast Refining Activity: Potential Implications for Petroleum Product Markets*.[2] Since September 2011, two domestic refineries in the Philadelphia area and one major Caribbean export refinery supplying the East Coast have closed, and another domestic refinery will potentially be idled this summer (Table 1). ConocoPhillips idled its Trainer refinery (185,000 barrels per day [bbl/d]) in September 2011, Sunoco's Marcus Hook refinery (178,000 bbl/d) was idled in December 2011, and HOVENSA's U.S. Virgin Islands refinery (350,000 bbl/d) closed in February 2012. Sunoco has announced plans to close the Sunoco Philadelphia refinery (335,000 bbl/d) in July 2012 if no buyer is found. (Note: In this report, the terms "refineries in the Philadelphia area" and "Philadelphia-area refineries," refer to the ConocoPhillips Trainer, Sunoco Marcus Hook, and Sunoco Philadelphia refineries as a group. The terms "Sunoco Philadelphia refinery" and "Philadelphia refinery" refer to the one specific refinery with that name.)

Table 1. 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					
ConocoPhillips	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*	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
ConocoPhillips	Trainer	PA	185,000	13%	Idled 9/2011, For Sale
Total Operating and Idled			**1,373,200**	**100%**	
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 unit capacity.
Notes: Yellow shading indicates operating refineries for sale and at risk of shutdown. Orange shading indicates idled refineries for sale and at risk of shutdown. Red shading indicates shut refineries. Total refinery capacity excludes two refineries that primarily produce asphalt, as well as the Yorktown VA and Eagle Point refineries that were shut down in 2010.
Source: U.S. Energy Information Administration.

To date, the market transition has been relatively smooth, in part because the closures so far were partially offset by the October 2011 startup of PBF Energy's Delaware City refinery, which had been shut down in late 2009 by Valero before its sale to PBF Energy. There have been no volume disruptions, although product prices have increased somewhat relative to crude oil prices, and the impacts of the U.S. Virgin Islands' HOVENSA refinery closure are just beginning to be seen. (See box.) But the situation

[2] http://www.eia.gov/analysis/petroleum/nerefining/prelim/.

could change. If Sunoco's Philadelphia refinery closes in July 2012 as announced, the Northeast could be significantly impacted as the additional loss of volumes and reduced access to distribution systems may create temporary, localized shortfalls and associated price surges. Adequate refining capacity is available outside of the East Coast to replace the lost capacity, but logistical constraints on the delivery of product to certain areas within Northeast in the short term may present significant challenges. Ultra-low-sulfur diesel fuel (ULSD), a distillate fuel, will be the most challenging product to replace. However, all replacement products will face difficulties moving through Pennsylvania and into western New York, which have historically received a major portion of their product supplies through product pipelines originating in the Philadelphia area refinery complex. The industry may face significant logistical challenges in the Northeast for a year or more, as infrastructure changes will be necessary to accommodate replacement product flows.

HOVENSA

HOVENSA (a joint venture between Hess and Petróleos de Venezuela), is a large refinery, located in St. Croix, U.S. Virgin Islands, that historically sent most of its output to the United States. In January 2012, HOVENSA announced plans to shut down the St. Croix refinery in mid-February and convert it to a petroleum storage facility. HOVENSA sent most of its product to the U.S. East Coast, but in recent years, it had increased its sales in other markets. In 2007, HOVENSA shipped two-thirds of its output to the East Coast; that share had declined to 55% in 2011 (through August). At the same time, the refinery's output dropped in 2011 after HOVENSA announced it was reducing its capacity from 500,000 bbl/d to 350,000 bbl/d.[a]

[a]Hess Corporation, "HOVENSA L.L.C. to Close Some Units and Reduce Crude Oil Distillation Capacity" (St. Croix, U.S. Virgin Islands: January 26, 2011), website http://phx.corporate-ir.net/phoenix.zhtml?c=101801&p=irol-newsArticle&ID=1520023&highlight.

This report focuses first on the short-term supply issues associated with gasoline, ULSD, and heating oil resulting from the closures of the ConocoPhillips Trainer, Sunoco Marcus Hook, and HOVENSA refineries and the potential closure of the Sunoco Philadelphia refinery, and ends with a discussion of longer-term implications. The issues raised with gasoline, ULSD, and heating oil illustrate problems facing other products. The remainder of this report describes the issues in more detail (Section 2), focuses on the logistical issues (Section 3), reviews the ULSD, heating oil, and gasoline markets (Section 4), discusses key drivers of potential price impacts (Section 5), and touches on long-term implications for the East Coast (Section 6).

2. Overview of the Short-Term Refinery Closure Issue

The entire East Coast region, which for the purposes of this report consists of States in Petroleum Administration for Defense District 1 (PADD 1) can expect some impact from recent refinery closures and announced plans for an additional one. However, short-term impacts will be concentrated in the Northeast (New England, PADD 1A and Central Atlantic, PADD 1B), where almost all the production from Philadelphia-area refineries is consumed. Most refining capacity on the East Coast is located in eastern Pennsylvania, New Jersey, and Delaware. East Coast refineries send products by pipelines through Pennsylvania and into western New York as well into New York Harbor.

Liquid fuels are supplied in the Northeast by local refinery production, imports, and pipeline and tanker/barge receipts of product from the Gulf Coast. This report is focused on gasoline and distillate fuel oil, which includes ULSD and heating oil. In recent years, the Northeast refineries have supplied about 40% of the gasoline, 60% of the ULSD, and 45% of the heating oil consumed in the Northeast, with imports and receipts from the Gulf Coast making up most of the remainder.

If the Sunoco Philadelphia refinery shuts down in July 2012, suppliers may need to find 240,000 bbl/d of gasoline and 180,000 bbl/d of ULSD by 2013 in addition to the amounts that have been supplied historically. The ULSD gap is not simply from lost production. Under current rules, New York State is requiring that heating oil meet the same low sulfur levels as ULSD starting in July 2012. This requirement will effectively increase ULSD consumption by 70,000 bbl/d, with annual consumption of ULSD in the Northeast increasing by 20% on average, however, heating oil consumption is highly seasonal, and the ULSD increase will be concentrated during the winter.

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 vessel 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 vessels that meet Jones Act requirements. (See box.) Generally, Jones Act ships are chartered months in advance, limiting their short-term

Jones Act (Updated 5/11/2012)

The Merchant Marine Act of 1920 (P.L. 66-261) is a U.S. Federal statute that regulates maritime commerce in U.S. waters and between U.S. ports. Section 27 of the statute, also known as the Jones Act, requires that all commercial shipping between U.S. ports and trade or navigation in coastal waters must be performed by U.S.-flag ships constructed in the United States, wholly owned by U.S. citizens, and crewed by U.S. citizens and U.S. permanent residents. Steep penalties result from noncompliance.

In 2012, close to 40 tankers and perhaps as many as 270 barges are used to move petroleum products and crude oil in coastal waters. But not all of these vessels are capable of or available to move product from the Gulf Coast to the Northeast due to size and other factors. At the end of 2010, MARAD listed over 140 Jones Act barges greater than 10,000 dead weight tons (DWT).* See "Additional Information on Jones Act Vessels' Potential Role in Northeast Refinery Closures".

*Numbers vary by industry sources, MARAD: U.S.-Flag Oil Pollution Act of 1990 (OPA-90) Phase-Out" (Updated 03/31/11).

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.

In terms of lost volumes, replacing ULSD is likely to stress markets more than replacing gasoline. Global distillate markets are structurally tight. This is particularly true for ULSD, which many refiners outside the United States cannot produce. Thus, ULSD is likely to be sourced mainly from the U.S. Gulf Coast, where ULSD exports have been growing, reaching over 500,000 bbl/d in recent months. However, reducing exports and redirecting products from the Gulf Coast to the Northeast will involve overcoming both of the logistical issues enumerated above.

Global availability of gasoline is greater than that of ULSD, and gasoline replacement volumes are likely to draw heavily from imports sourced in Europe and Asia, notably India. However, refinery closures in Europe and the shutdown of the HOVENSA refinery are tightening the global gasoline market. Import volumes can be shipped on foreign-flagged vessels, but they face the same terminal capacity and pipeline connectivity issues described above.

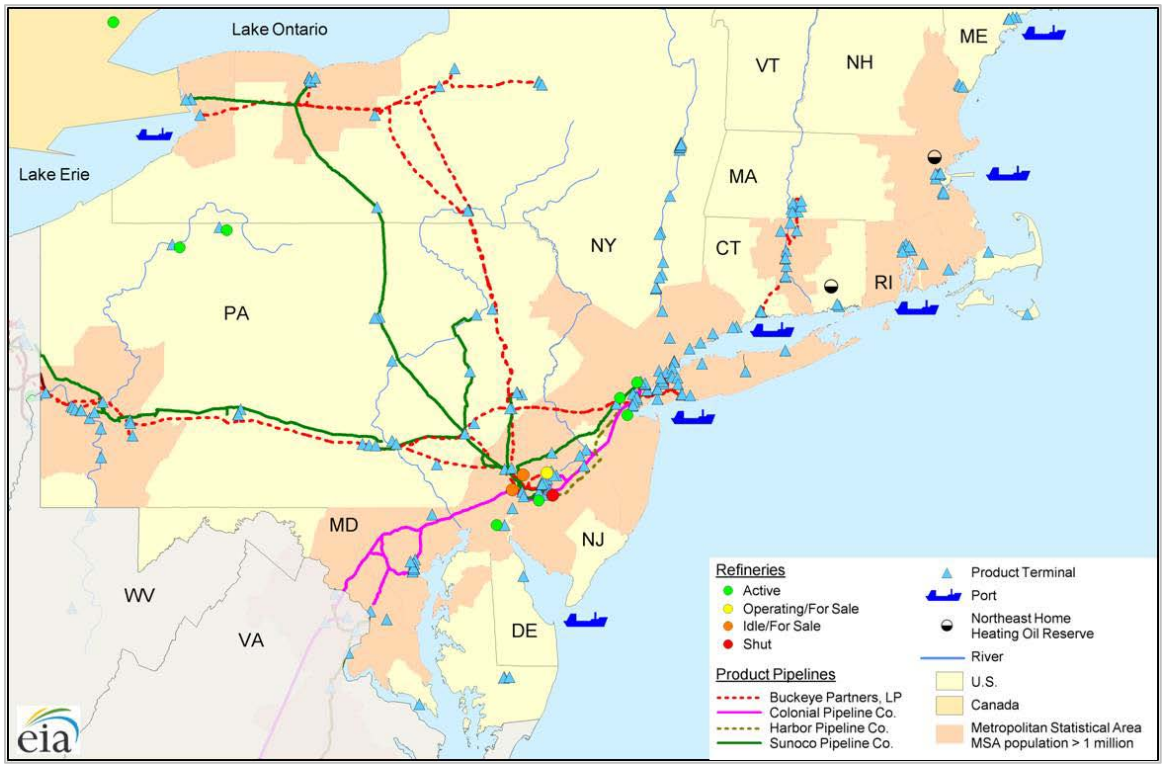
The potential loss of the Sunoco Philadelphia refinery presents a complex supply challenge, and no single solution will address the logistical hurdles that must be overcome. The industry will have a financial incentive to serve all markets in the Northeast, and companies are currently investigating options. However, companies are not likely to make significant investments in new logistical arrangements until the status of Sunoco's Philadelphia refinery is known. EIA will continue to monitor this situation as it evolves.

3. Logistical Constraints on Moving Product to the Northeast

As discussed below, ULSD replacement supplies may have limited foreign sources and may need to come from the U.S. Gulf Coast. When suppliers move product from the U.S. Gulf Coast to the Northeast, they will need to overcome both pipeline and vessel constraints. Currently, most Gulf Coast products move to the Northeast through the Colonial Pipeline, which is running near capacity. The Lower Atlantic, excluding Florida, is supplied largely from the Gulf Coast by the Colonial and Kinder Morgan Plantation pipelines. 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.

The larger logistical hurdle is the lack of terminal and pipeline connections to move products from waterborne vessels (either from foreign supply sources or from the Gulf Coast) into the product distribution system that currently supplies areas through Pennsylvania and into western New York (Figure 1). Ports serving Philadelphia-area refineries primarily handle crude oil and their docks and tanks are not equipped to offload waterborne products.

Figure 1. Petroleum Product Assets in the Northeast



Source: U.S. Energy Information Administration.

Most products from the closed or possibly idled Philadelphia-area refineries moved through the Sunoco and Buckeye pipelines west and north. In addition to those refineries, PBF's Delaware City refinery feeds into the same pipelines, and a small volume coming off the Colonial Pipeline enters this part of the distribution system. Waterborne products from New York Harbor are fed into the north-south Buckeye line as well, but there is little ability to inject more New York Harbor volumes into either the east-west or north-south pipelines. (PBF's Paulsboro, NJ refinery feeds into the pipeline system that moves product west and north. However, opportunity for additional injections at this pipeline location appear limited.) There will be some additional ability to inject volumes into the affected Buckeye and Sunoco pipelines soon. Sunoco's Eagle Point, NJ refinery, which was closed in February 2010, is being converted to a terminal that can accept waterborne products. This facility will be able to feed into the pipelines affected by the three closed or possibly idled refineries, but it is still not finished. Even when it is completed, its additional capacity, along with other incremental pipeline flow increases that may be available by July, will be inadequate to replace the lost volumes from the three Philadelphia-area refineries.

If the product volumes that can be shipped through the Sunoco and Buckeye pipelines are insufficient, prices will need to increase to balance consumption with available supply and attract additional product delivery by truck and rail; although, the current capacity of rail terminals to handle petroleum flows is limited. Trucks can come from terminals fed by Midwest refineries and from New York Harbor. A higher-price environment could persist for months, if not longer, until infrastructure changes can be made.

Eventually a number of longer-term solutions will evolve. Which changes occur will depend on the economics at the time, and because many of the infrastructure changes may not be needed if the Sunoco Philadelphia plant stays in operation, the uncertainty surrounding its future will likely cause investors to wait until a shutdown is definite.

Companies are looking at various potential solutions in the interim, along with longer-term options which are described in more detail in Section 6. Longer-term options include pipeline connectivity changes and expansion, and refinery expansion at operating refineries in the Northeast.[3] The docks and terminals at closed refineries may be changed to receive products rather than crude oil. Such conversions at the Philadelphia-area refineries could take a year or more as significant dock alterations may be required along with storage tank additions and other terminal changes. Infrastructure changes take time, and investors will likely require more clarity about the ownership and operating status of Northeast petroleum supply assets before they take action.

[3]PBF Energy announced plans for expansion of its Delaware City refinery in December 2011.

4. Product Markets and Alternative Sources of Supply

This section focuses on the markets for three major products: ULSD, heating oil (which for purposes of this report includes all distillate fuel oil with sulfur content greater than 15 parts per million [ppm]), and gasoline. It describes current demand and supply sources for the three products, and projects the surplus or gap that will result in 2012 and 2013 under the assumption that the Sunoco Philadelphia refinery actually shuts down in July 2012. A discussion of potential alternative sources of supply available to fill the gap follows that indicates the volumes needed and the major logistical hurdles.

While characteristics of demand vary between the products, the supply chains tend to be similar. In general, products are supplied in the Northeast by a combination of local refinery production, imports, and shipments from other regions of the United States. Local refinery production is a larger component of supply in the Central Atlantic than it is in New England. As described in Section 3, refinery production is especially crucial in the markets of Pennsylvania and western New York, which rely largely on the Philadelphia-area refineries for product supply. Apart from meeting local demand, production from those refineries moves in two general directions: mainly west through Pennsylvania and into western New York, with a small volume going north to New York Harbor.

Import sources tend to vary between gasoline and distillate. However, for both fuels, Canada and the U.S. Virgin Islands play a significant role in supplying the Northeast. Two major export-oriented refineries in those locations have been critical in supplying the Northeast: Irving Oil's refinery in St. John, New Brunswick; and HOVENSA's refinery on St. Croix, U.S. Virgin Islands.

The majority of products shipped from other regions, mainly the Gulf Coast, come to the Northeast through the Colonial pipeline. Receipts of products from Colonial have increased in recent years. In addition to some relatively small capacity expansions on the line, the increase probably is due to a reduction in demand on the southern end of the line, which relies more heavily on the Gulf Coast for supply. Non-pipeline shipments also are an important part of the intraregional product supply chain in the Northeast. Particularly important are the significant volumes shipped to New England via barge from New York Harbor.

4.1 Ultra-Low-Sulfur Diesel, ULSD

4.1.1 Demand

Diesel fuel used today is mostly ULSD, a clean-burning transportation fuel that is required by the U.S. Environmental Protection Agency (EPA) as part of its comprehensive national control program to reduce air emissions through regulation of both fuels and vehicles. In order to prevent damage to advanced emission control devices required on diesel engines, ULSD is restricted to a maximum of 15 ppm of sulfur content. The regulation requires ULSD for on-highway use, non-road applications (e.g., construction), locomotive use, and marine applications. ULSD fuel requirements began taking effect in 2006, but the EPA allowed for a gradual implementation of requirements over time. During 2010, all on-highway and non-road fuel use had to be ULSD. In 2012, locomotive and marine applications will all use ULSD.

In 2008, ULSD consumption in the Northeast was about 360,000 bbl/d. After a brief dip in 2009 during the recession,[4] consumption returned to earlier levels in 2010 and remained there through the first 11 months of 2011. Diesel fuel is used mainly in trucking. While diesel fuel use in trucking has generally declined following the economic slowdown, ULSD consumption has been relatively flat, mainly as a result of the ongoing phase-in of ULSD.

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. (See box.) Heating oil currently has no Federal sulfur 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,[5] 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. Currently, ULSD demand has a small seasonal variation, with a minor increase during the summer months related to increased transportation use. However, heating oil use is highly seasonal, peaking in the winter months (see Section 4.2). New York heating oil consumption has peaked in recent years between 130,000 and 170,000 bbl/d, meaning that ULSD consumption could increase from 35% to 50% over the base ULSD demand of 360,000 bbl/d during that peak winter period, with less than a 10% increase over base ULSD demand during the low-demand summer months.

Northeast States Reducing Heating Oil Sulfur Content

Effective July 2012, New York State will be the first of several Northeastern States to require ULSD be used for space heating, replacing higher-sulfur distillate fuels in order to improve air quality.

Following New York's lead, other Northeast States have announced dates to phase-in ULSD for heating oil:

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

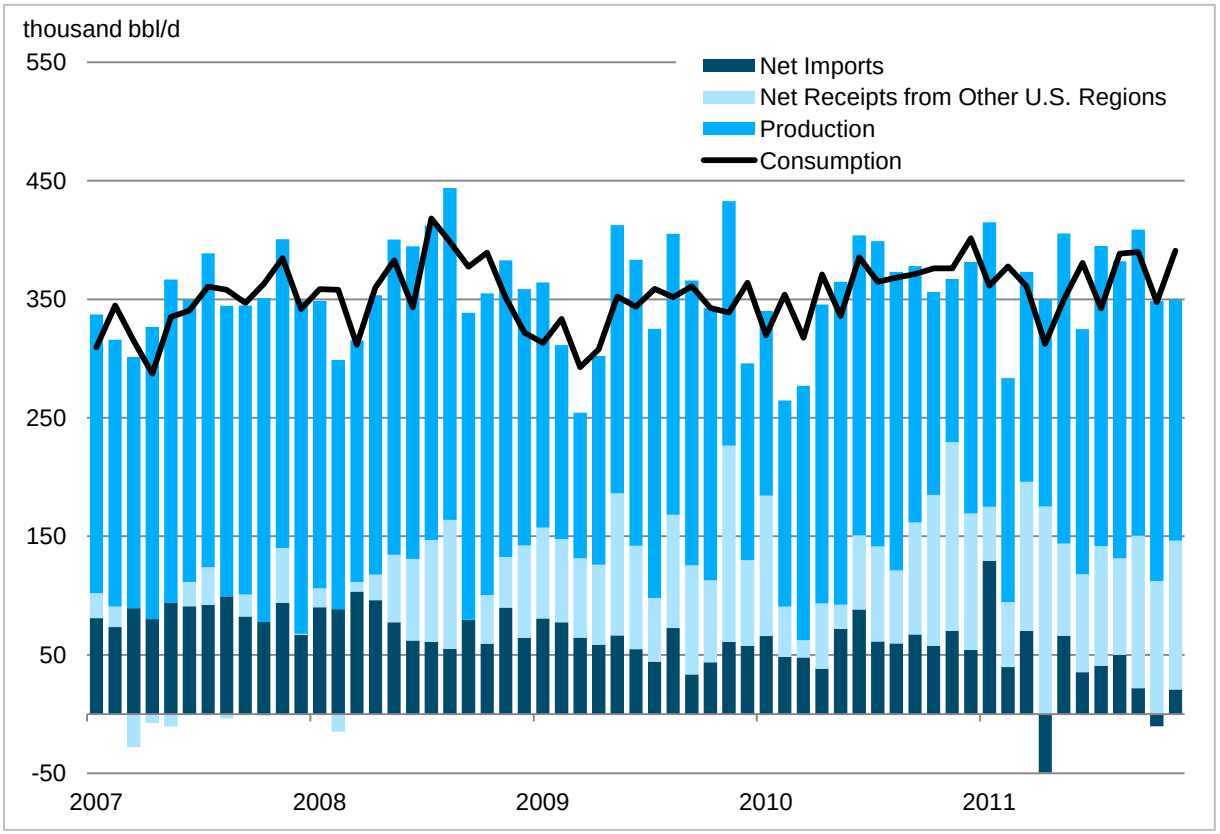
[4] Recent recession ran from December 2007 through June 2009, http://www.nber.org/cycles/cyclesmain.html.

[5] U.S. Energy Information Administration Prime Supplier sales data for Distillate No. 2 Fuel Oil is used as the estimate for New York heating oil demand.

4.1.2 Supply

In 2011, Northeast refineries supplied about 61% of Northeast ULSD consumption, net receipts from other regions supplied close to 28%, and net imports supplied about 10%. Figure 2 shows the major sources of ULSD supply to the Northeast.

Figure 2. Northeast ULSD Supply-Demand Balance, Monthly 2007-2011



*Net imports represents gross imports minus gross exports.
Source: U.S. Energy Information Administration.

In 2011, ULSD production from Northeast refineries was about 220,000 bbl/d. If the Sunoco Philadelphia refinery closes and the Sunoco Marcus Hook and ConocoPhillips Trainer refineries remain closed, Northeast production is estimated to drop to an average of 150,000 bbl/d in 2012 and 110,000 bbl/d in 2013.

Net receipts of ULSD from other regions in the United States, mainly the U.S. Gulf Coast, are the next largest source of supply (averaging about 100,000 bbl/d in 2011). Figure 2 shows a slight increase in net receipts from other U.S. regions over the past five years.

Northeast ULSD imports averaged about 70,000 bbl/d in 2011. These volumes come almost entirely from Canada and the U.S. Virgin Islands. Canada supplied 55,000 bbl/d, representing 77% of ULSD imports, and the U.S. Virgin Islands supplied nearly all of the rest. The imports from the U.S. Virgin Islands come from the HOVENSA refinery, which closed in February 2012, with the large majority going to New England. The remaining ULSD imports from the U.S. Virgin Islands went to the Lower Atlantic

region. Through November 2011, imports from the U.S. Virgin Islands were down, but Eastern Europe (including Russia) supplied ULSD volumes to the Northeast in two of the months, which is unusual by historical standards.

Exports of ULSD from the Northeast averaged about 5,000 bbl/d in 2010, but picked up in 2011 to more than 30,000 bbl/d, as regional consumption was flat, and there was surplus capacity to take advantage of ULSD markets outside the United States. Export volumes can be expected to be absorbed into the local supply pool because price differentials are not expected to support exports from the Northeast if the Sunoco Philadelphia refinery closes.

4.1.3 Supply-Demand Balance and Alternative Sources of Supply

It is unclear how the available supply sources will meet demand if the Sunoco Philadelphia refinery closes. Table 2 shows the volumes of ULSD that might need to be replaced in the event that the refinery, which has been a major producer of ULSD in recent years, is actually idled. Annual historical data are shown through 2011.[6] The projections for 2012 and 2013 (at the bottom of the table) show a gap that represents the volume of additional supply needed over and above historical levels to meet projected demand given reduced production levels within the region.

Table 2. Northeast ULSD Supply-Demand Balance and Projections: Annual Average 2007-2013

(Thousand bbl/d)
(Rounded to closest 10,000 bbl/d)

	2007	2008	2009	2010	2011*	2012 Outlook	2013 Outlook
Consumption	**340**	**360**	**340**	**360**	**360**	**380**	**430**
Supply	**340**	**360**	**340**	**360**	**360**	**290**	**250**
In-Region Production (+)	250	250	200	210	220	150	110
Net Receipts from Other Regions (+)	–	30	90	70	100	90	90
Imports (+)	90	80	60	70	70	50	50
Exports (-)	–	–	–	–	30	–	–
Stock Decrease (+) / Increase (-)	–	–	-10	10	–	–	–
Surplus (+) / Gap (-)	**–**	**–**	**–**	**–**	**–**	**-90**	**-180**

*Data through November 2011.

Notes: Projected consumption is based on data from EIA's *Short-Term Energy Outlook*. It includes a switch in consumption from heating oil to ULSD of an additional 70,000 bbl/d beginning in July 2012, based on New York's requirement that heating oil move to ULSD specifications. Projected production is based on assumed yields and the capacity of remaining refineries. Sunoco Philadelphia is assumed to close in July 2012. Projected imports are 3-year historical averages adjusted down by U.S. Virgin Islands contributions. Historical net receipts are estimated. Projected net receipts are 3-year historical averages. The Surplus/Gap indicates the under- or over-supply needed to meet consumption.

Source: U.S. Energy Information Administration.

It is estimated that if the Sunoco Philadelphia refinery closes, it will result in the need for 90,000 bbl/d of ULSD in 2012 and 180,000 bbl/d in 2013 in addition to historical levels of supply. Rising consumption – both from continued economic recovery and the addition of New York heating oil volumes switching to ULSD— and declining production widen the gap, but removing ULSD export volumes adds back supply to close the gap somewhat. Because the estimates are based on EIA consumption forecasts, any deviation

[6] Year 2011 data is through November.

in actual consumption from the forecasts will increase or decrease the need for additional products by a corresponding amount.

Increasing shipments from the Gulf Coast is the most likely source of additional supply for ULSD. From a volume standpoint, the gap could be closed completely by Gulf Coast refineries sending their current export volumes to the Northeast. Gulf Coast ULSD exports exceeded 500,000 bbl/d towards the end of 2011. As indicated earlier, moving those volumes to the Northeast will be hampered by logistical constraints. With the Colonial pipeline running near capacity, moving the needed product to the Northeast will require Jones Act vessels, which may be in short supply.

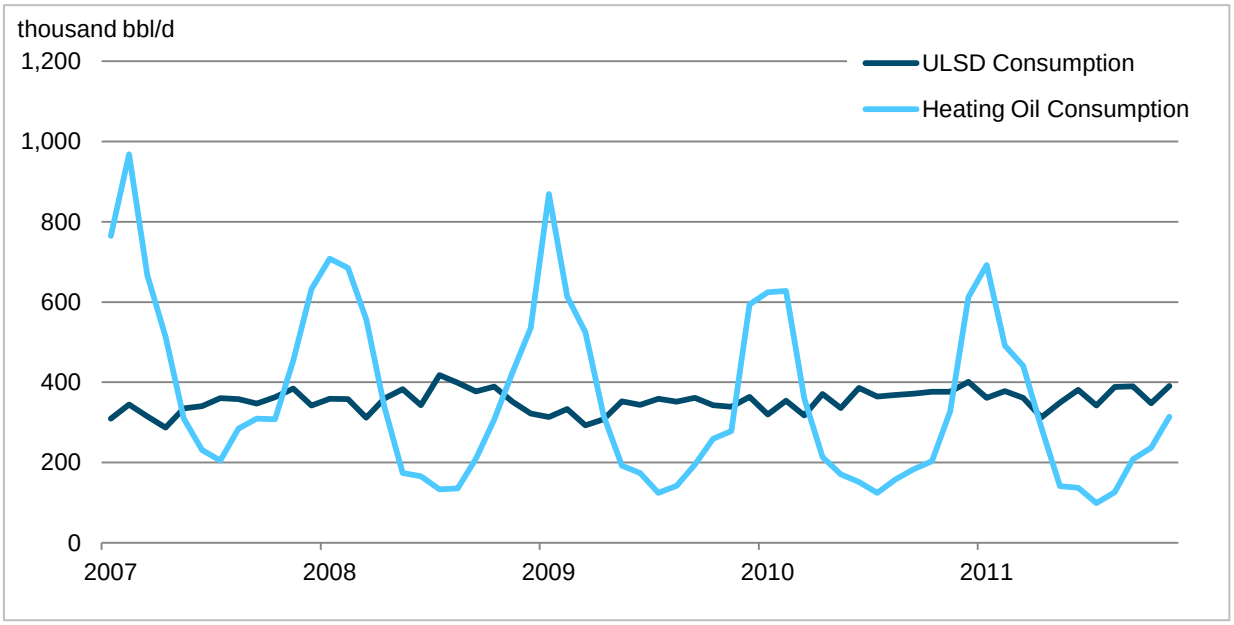
Imports of ULSD are not expected to increase. New foreign sources of ULSD are limited, because not many other countries require ULSD. Europe, however, does require very low-sulfur fuel, and is a large net importer of the product. In the absence of domestic vessel constraints, Northeast suppliers probably would find it more economic to purchase ULSD from the Gulf Coast than to bid it away from Europe.

4.2 Heating Oil

4.2.1 Demand

The Northeast is the largest regional consumer of heating oil in the United States, and is the location of over 80% of the 7.2 million U.S. homes that used the fuel for space heating in 2009. However, heating oil consumption has been declining in the Northeast as it loses market share to natural gas and as homeowners increase conservation and efficiency measures. Heating oil consumption is relatively unique in the petroleum markets because of its strong seasonality. Figure 3 shows the monthly variations for heating oil consumption in contrast to ULSD consumption. Consumption varies considerably with weather, and can almost quadruple from the summer lows to the winter peak

Figure 3. Northeast Heating Oil and ULSD Consumption, Monthly 2007-2011



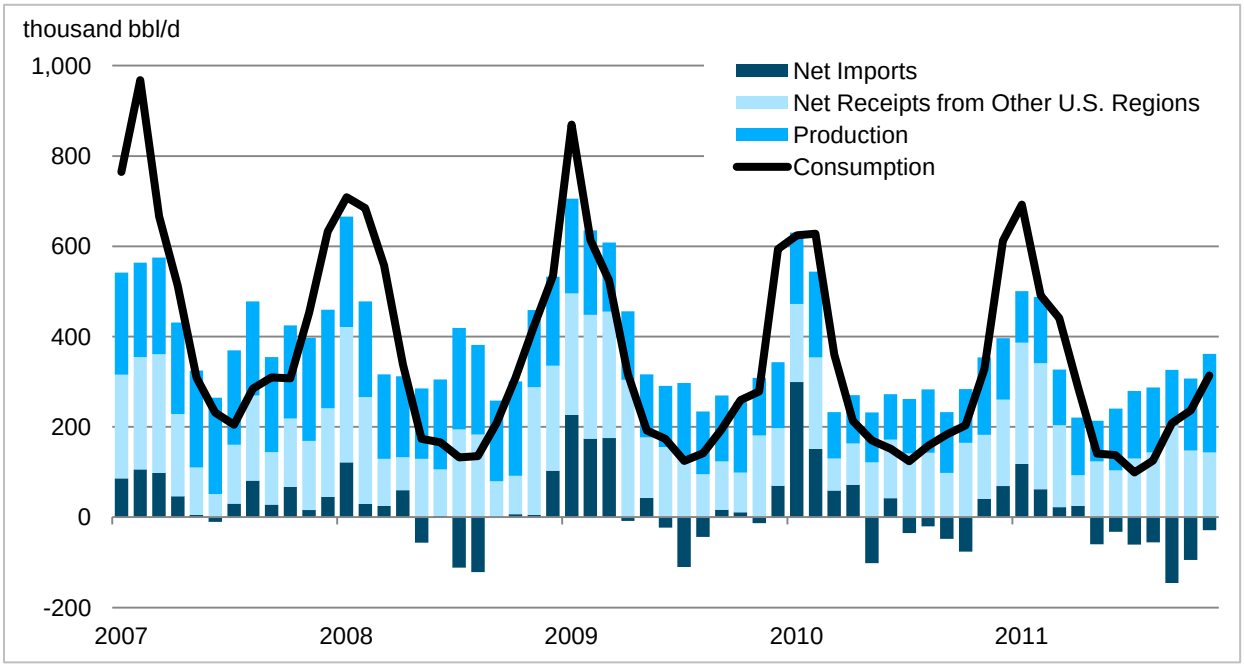
Source: U.S. Energy Information Administration.

months.

4.2.2 Supply

Figure 4 provides a monthly view of seasonal heating oil consumption and supply sources used to meet that consumption. Refinery production is relatively flat throughout the year, supplying less than half the annual demand, but supplying proportionally less in the winter than in the summer. During the peak-demand winter months, imports surge to help meet peak needs, and exports typically drop to zero. Inventories also play an important role with heating oil supply. They are built up during the low-demand summer months, as represented by the consumption line dropping below total supply, and then drawn down to help meet peak-winter needs, which is shown in Figure 4 by the consumption line being well above the supply sources listed.

Figure 4. Northeast Heating Oil Supply-Demand Balance, Monthly 2007-2011



*Net imports represents gross imports minus gross exports.
Source: U.S. Energy Information Administration.

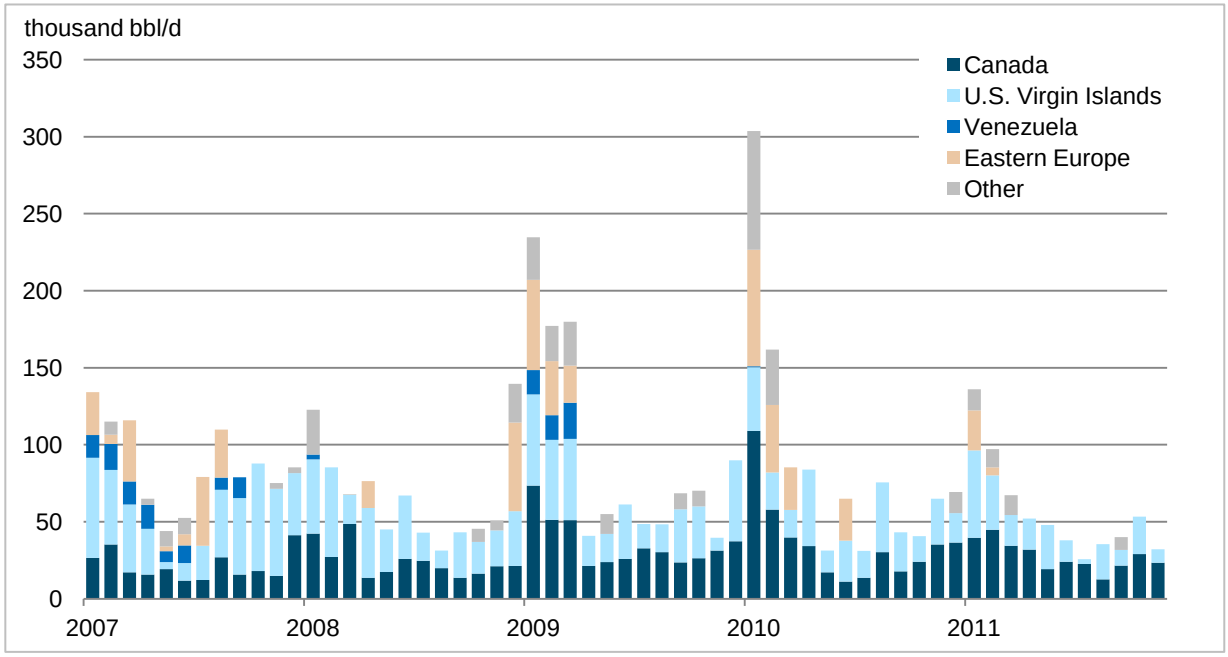
During the peak winter months of December, January, and February, Northeast refineries typically supply about 30% of heating oil consumption, imports provide about 20%, net receipts from other U.S. regions about 35%, and stock draws about 15%.

Northeast refinery production of heating oil had been declining before the recent refinery shutdowns, dropping by about 70,000 bbl/d from the 2007 total to an average of 140,000 bbl/d in 2010 and 2011. With the closure of three Philadelphia-area refineries, production may drop by another 40,000 bbl/d from 2011 to an average of 100,000 bbl/d in 2013, which is proportionally less than the decline in ULSD production between 2011 and 2013.

Net receipts during the peak winter months provide about as much supply as local production. As with other petroleum products in the Northeast, most net receipts come from Gulf Coast refineries.

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.

Figure 5. Northeast Heating Oil Imports by Origin, Monthly 2007-2011



Source: U.S. Energy Information Administration.

The announced plan to close the Sunoco Philadelphia refinery in July 2012 if no buyer is found would, if implemented, occur as heating oil stocks need to be built for winter use. However, the Sunoco Philadelphia refinery has not been a significant producer of conventional (non-ULSD) heating oil in recent years. EIA does not expect suppliers in States still using non-ULSD heating oil to have difficulty locating sources of the fuel for their winter use.

4.2.3 Supply-Demand Balance and Alternative Sources of Supply

Table 3 illustrates the basic supply-demand balance for heating oil in the Northeast. The projections for 2012 and 2013 are structured to illustrate the surplus/gap that results from changes in consumption and the loss in refining capacity. After a slight rebound in 2012, heating oil consumption is projected to decline in 2013, both due to the underlying downward trend and the phase-in of New York's new low sulfur requirement beginning in July 2012.

The projections for 2012 and 2013 indicate surplus supply for heating oil despite the loss of production due mainly to declining consumption and assuming no exports. Under these circumstances, the supply

of heating oil should be adequate even after the recent refinery shutdowns and the potential implementation of announced plans to close the Sunoco Philadelphia refinery in July 2012 if no buyer is found.

Table 3. Northeast Heating Oil Supply-Demand Balance and Projections: Annual Average 2007-2013

(Thousand bbl/d)
(Rounded to closest 10,000 bbl/d)

	2007	2008	2009	2010	2011*	2012 Outlook	2013 Outlook
Consumption	**470**	**370**	**360**	**310**	**290**	**310**	**280**
Supply	**470**	**370**	**360**	**310**	**290**	**340**	**310**
In-Region Production (+)	210	190	160	140	140	120	100
Net Receipts from Other Regions (+)	180	170	170	140	160	160	160
Imports (+)	80	70	100	80	60	60	50
Exports (-)	40	60	50	50	80	–	–
Stock Decrease (+) / Increase (-)	40	–	-20	–	10	–	–
Surplus (+) / Gap (-)	**–**	**–**	**–**	**–**	**–**	**30**	**30**

*Data through November 2011.
Notes: Projected consumption is based on data from EIA's *Short-Term Energy Outlook*. It includes a switch in consumption from heating oil to ULSD of an additional 70,000 bbl/d beginning in July 2012, based on New York's requirement that heating oil move to ULSD specifications. Projected production is based on assumed yields and the capacity of remaining refineries. Sunoco Philadelphia is assumed to close in July 2012. Projected imports are 3-year historical averages adjusted down by U.S. Virgin Islands contributions. Historical net receipts are estimated. Projected net receipts are 3-year historical averages. The Surplus/Gap indicates the under- or over-supply needed to meet consumption.
Source: U.S. Energy Information Administration.

4.3 Gasoline

4.3.1 Demand

Gasoline consumption in the Northeast peaked at more than 1,660,000 bbl/d in 2005 and stayed roughly consistent through 2007. Since 2007, consumption of finished gasoline has fallen by about 120,000 bbl/d to an average of 1,540,000 bbl/d through the first 11 months of 2011. The decline began with the recent recession, and supply has been further diminished by increased vehicle fuel efficiency, demographic trends, and generally higher prices compared with the peak-consumption years. However, the decline in finished gasoline consumption hides an even larger decline in consumption of petroleum-based gasoline due to increased ethanol blending over this period. With the blending of ethanol increasing from about 2% in 2005 to almost 10% (about 150,000 bbl/d) of the Northeast's supply of finished gasoline in 2011, consumption of petroleum-based gasoline is almost 250,000 bbl/d lower than in 2005.

Ethanol blending has changed the way the gasoline market is supplied. Because of the chemical characteristics of ethanol, finished gasoline (which contains ethanol) cannot be shipped via pipeline. Thus, ethanol generally is shipped by rail from the Midwest to blending terminals on the East Coast. Because finished gasoline containing ethanol cannot be shipped via pipeline, refiners and blenders now produce an unfinished petroleum-based gasoline component that can be shipped on a pipeline. This unfinished gasoline is called "blendstock for oxygenate blending" (BOB). Once the BOB is blended with

an oxygenate, it becomes finished gasoline. The use of BOB and ethanol as an oxygenate elevates the importance of blending terminals in the gasoline supply chain. Since the advent of ethanol blending, terminals have become more sophisticated to accommodate BOB production and ethanol blending to supply market demand.

There are important specification-related distinctions in gasoline demand to be considered in determining how the market will be supplied. One such distinction is between conventional BOB (CBOB) and reformulated BOB (RBOB). RBOB is blendstock used to make reformulated finished gasoline (RFG), which meets certain specifications to reduce pollution from emissions. RFG makes up approximately 70% of gasoline sales in the Northeast; conventional gasoline makes up the remaining 30%. The three Philadelphia-area refineries and HOVENSA were major RBOB producers. Although producing RBOB is more complex and costly than producing CBOB, the ability to obtain sufficient RBOB to meet Northeast demand is not expected to be a problem. With a large number of foreign refiners able to meet U.S. specifications and the added flexibility of RBOB production at blending terminals, RBOB supply sources probably will be able to match demand.

Another distinction is between summer and winter gasoline specifications. Gasoline demand is less seasonal than distillate demand. Accordingly, inventory and import cycles tend to be smoother, without sudden demand spikes affecting the supply chain. However, gasoline sold in the summer months has a lower Reid Vapor Pressure (RVP), which improves drivability and reduces emissions in the summer heat. Similar to RBOB, the summer-grade gasoline is slightly more complex and costly to produce than winter-grade gasoline. Each spring, the supply chain switches from winter grade to summer grade, at times causing brief market dislocations. This spring will be the first seasonal grade switch without production from Sunoco Marcus Hook, ConocoPhillips Trainer, and HOVENSA; however, lost production has been partially offset by the restart of PBF's Delaware City refinery. The bigger challenge for the seasonal switch could come in the spring of 2013 if the Sunoco Philadelphia refinery closes in July 2012.

A third distinction is that the Pittsburgh area has a different summer gasoline specification than the rest of the Northeast. Because the specification requires a fuel unique to Pittsburgh, markets for the fuel are often tight. The Pittsburgh area historically was supplied mainly by the Philadelphia-area refineries. Even when those refineries were running, the area often faced very tight markets for their summer grade gasoline. With the refineries idled, the volumes to meet Pittsburgh's requirements will have to come from further afield. The on-specification volumes may not be located in areas where supplies can easily be sent to meet Pittsburgh's demand. During the summer, supply chains for Pittsburgh's summer-grade gasoline will be stressed more than other areas in Pennsylvania, and moving requisite volumes of fuel to the Pittsburgh market could prove difficult. Some supplies currently are moving into the Pittsburgh market from the Midwest via pipeline.

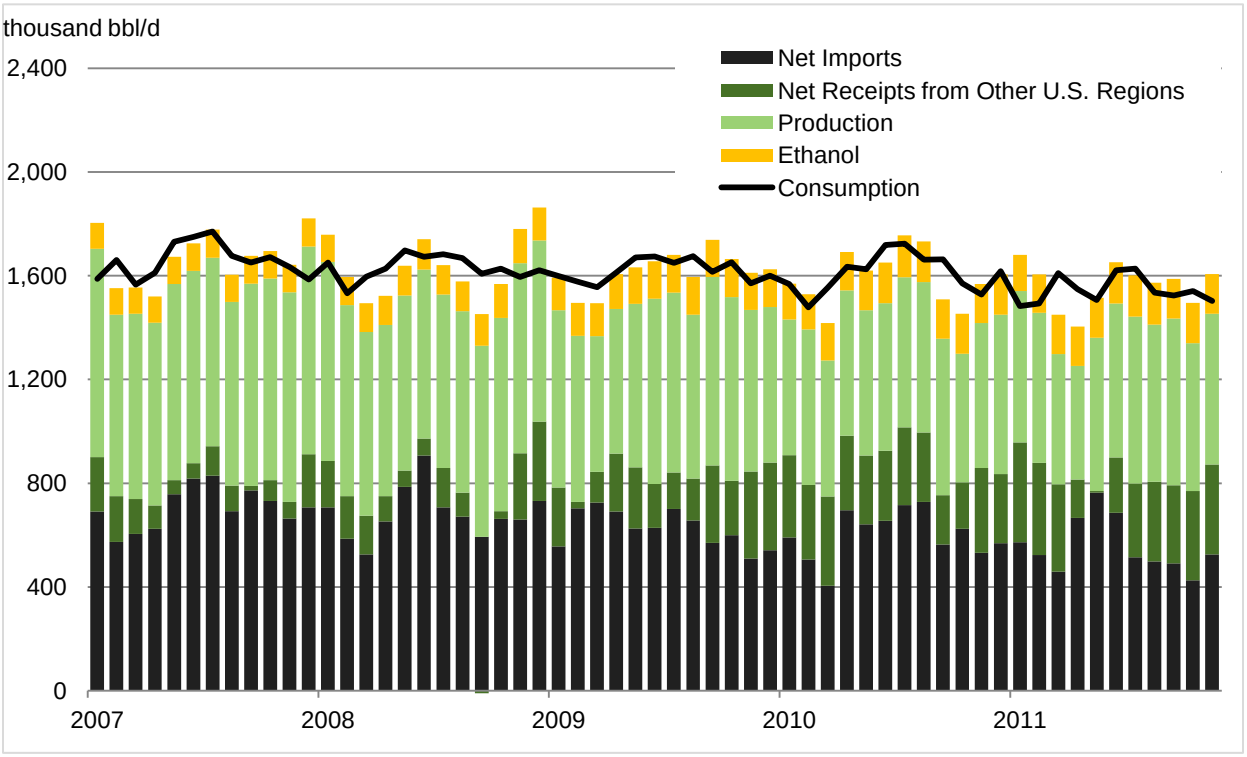
4.3.2 Supply

In 2011, in-region refinery production and imports supplied roughly equal shares of the Northeast gasoline market (about 38% and 36%, respectively), and net receipts from other regions, mainly the Gulf Coast, made up another 18% of the finished gasoline consumed. Just under 10% of the remaining

finished gasoline consumed was supplied by the blending of ethanol.[7] Figure 6 shows supply sources for gasoline in the Northeast since 2007.

In 2011, gasoline production from Northeast refineries was about 580,000 bbl/d. If the Sunoco Philadelphia refinery closes in July 2012 and the Sunoco Marcus Hook and ConocoPhillips Trainer refineries remain closed, production is estimated to drop to an average of 420,000 bbl/d in 2012 and 350,000 bbl/d in 2013. Thus, if all three refineries are closed, it would leave the Northeast gasoline market with approximately 240,000 bbl/d of incremental supply needs.

Figure 6. Northeast Gasoline Supply-Demand Balance, Monthly 2007-2011



*Net imports represents gross imports minus gross exports.
Source: U.S. Energy Information Administration.

Gasoline imports to the Northeast averaged about 560,000 bbl/d in 2011. Imports played an important role in supplying New York and New England, which is particularly reliant on imports. Most of the Northeast's gasoline imports come through New York Harbor. However, the Central Atlantic is much less reliant on imports. Imports to the Northeast come mainly from Western Europe, Canada, and the U.S. Virgin Islands. Figure 7 shows imports to the Northeast by origin. The Canadian and U.S. Virgin Islands volumes tend to move more to New England while volumes from Western Europe tend to move more to New York Harbor.

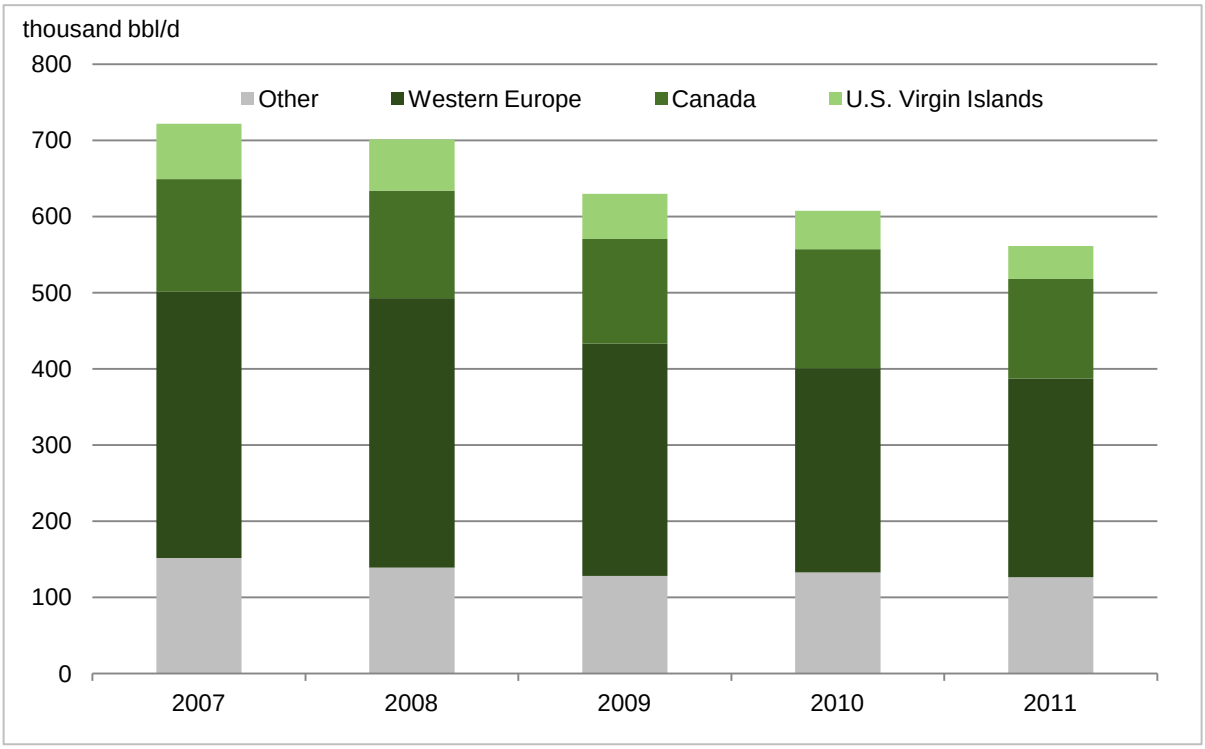
The Northeast exports only small amounts of gasoline, less than 5,000 bbl/d in 2011. While not significant, those export volumes can be expected to be absorbed into the local supply pool, because

[7] Sum of supply components does not add to 100% due to stock changes and rounding.

price differentials are not expected to support exports from the Northeast if the Sunoco Philadelphia refinery closes.

The Northeast relies on receipts from other U.S. regions to a lesser extent for gasoline than it does for distillate. Almost all receipts come via the Colonial pipeline from the Gulf Coast, but pipeline volumes making it all the way up to the Northeast have been increasing in recent years and comprised about 18%

Figure 7. Northeast Gasoline Imports by Origin, Annual Average 2007-2011



Source: U.S. Energy Information Administration.

of Northeast supply in 2011, up from just 7% in 2007.

4.3.3 Supply-Demand Balance and Alternative Sources of Supply

It is uncertain how these supply sources will meet demand if the Sunoco Philadelphia refinery closes. Table 4 captures the volumes of gasoline that might need to be replaced in the event that the the refinery is actually idled.

It is estimated that if the Sunoco Philadelphia refinery closes in July 2012, adding to the shutdowns of refineries that have already been implemented, the Northeast will be short 160,000 bbl/d of gasoline in 2012 and 240,000 bbl/d of gasoline in 2013 in addition to historical levels of supply. However, because the estimates are based on EIA consumption forecasts, any deviation in actual consumption from the forecasts will increase or decrease the need for additional products by a corresponding amount. In 2012, the majority of this supply gap would begin in July, when EIA assumes that the Sunoco Philadelphia refinery will be idled. Because the data above are annual averages, it is likely that if the Sunoco Philadelphia refinery is idled in July, the requirements in the second half of 2012 will be closer to the

240,000 bbl/d level shown for 2013. Most of this supply requirement will be needed throughout Pennsylvania and western New York, the areas which are directly supplied by the Philadelphia-area refineries. However, with some volumes from the Philadelphia-area refineries going to New York Harbor, and the loss of imports from the U.S. Virgin Islands, there will be some additional supply needs throughout the Northeast.

Table 4. Northeast Gasoline Supply-Demand Balance and Projections: Annual Average 2007-2013

(Thousand bbl/d)
(Rounded to closest 10,000 bbl/d)

	2007	2008	2009	2010	2011*	2012 Outlook	2013 Outlook
Consumption	**1,660**	**1,630**	**1,620**	**1,610**	**1,540**	**1,540**	**1,540**
Supply	**1,660**	**1,630**	**1,620**	**1,610**	**1,540**	**1,380**	**1,300**
In-Region Production (+)	750	710	640	560	580	420	350
Ethanol Inputs (+)	100	120	140	150	150	150	150
Net Receipts from Other Regions (+)	120	120	200	270	270	250	250
Imports (+)	720	700	630	610	560	560	550
Exports (-)	20	20	–	–	–	–	–
Stock Decrease (+) / Increase (-)	–	-10	–	10	–	–	–
Surplus (+) / Gap (-)	**–**	**–**	**–**	**–**	**–**	**-160**	**-240**

*Data through November 2011.

Notes: Projected consumption is based on data from EIA's *Short-Term Energy Outlook*. Projected production is based on assumed yields and the capacity of remaining refineries. Sunoco Philadelphia is assumed to close in July 2012. Projected imports are 3-year historical averages adjusted down by U.S. Virgin Islands contributions. Historical net receipts are estimated. Projected net receipts are 3-year historical averages. The Surplus/Gap indicates the under- or over-supply needed to meet consumption.

Source: U.S. Energy Information Administration.

In the short term, increasing imports is the most readily available option for replacing lost gasoline production. Finding additional volumes of gasoline generally should not pose a problem because global markets have sufficient supplies. Europe, despite recent refinery closures, should be able to ship additional volumes to the United States. Refineries in Canada also are likely to have additional supplies to send. However, less traditional sources are also likely to play an increasing role in supplying the Northeast. One of the most probable incremental suppliers is India. With significant refinery capacity additions over the past few years, India has become an increasingly large supplier in global product markets and is already exporting about 40,000 bbl/d of gasoline to the U.S. East Coast. Additional volumes could come from increased refining capacity elsewhere in Asia and the Middle East.

Some of the supply gap may also be filled by increased shipments from the Gulf Coast. However, this is less certain. Based on historical levels, EIA estimates that 250,000 bbl/d will come from the Gulf Coast in 2012 and 2013, but in 2011 that number was larger at 270,000 bbl/d. Thus, 20,000 bbl/d of the gap could be filled by pipeline shipments that already are occurring. Beyond that, additional volumes from the Gulf Coast via the Colonial pipeline will be limited by pipeline capacity issues described above. Moreover, if demand rebounds on the southern end of the line, some of the recent increases in supply

to the Northeast could be reversed. There are volumes available at Midwest refineries, particularly those in Ohio, to meet some demand, and there are existing pipeline connections from those refineries into the western Pennsylvania markets. However, there are indications that these lines could be operating at full capacity.

Increased ethanol blending does not represent a short-term option for incremental supply. The East Coast is already blending ethanol at close to 10%, and despite the EPA's having approved blends of up to 15% ethanol, increasing blending above 10% still faces some regulatory and market hurdles.

Similarly, increased production from remaining East Coast refineries will not provide substantial supplies in the short term. The ability to increase runs at remaining refineries is limited, and it appears that increasing yields of gasoline at the expense of distillate will continue to be uneconomic, as tightness in global distillate markets continues to incentivize distillate production over gasoline production. Beyond 2013, there is the possibility of expanded refinery capacity in the Northeast; e.g., PBF is exploring the expansion of its 182,000 bbl/d Delaware City facility.

5. Price Impacts

In the short term, if the Sunoco Philadelphia refinery shuts down, wholesale and retail product prices relative to crude oil are expected to increase in the Northeast, possibly spiking in some areas. Given fixed infrastructure to deliver products, markets in inland Pennsylvania and western New York may face logistical challenges in obtaining supplies given limited access for product volumes from sources other than the Philadelphia-area refineries into the product pipeline systems that run west and north from the origin points in the Philadelphia area to serve these markets. This is an evolving issue, and the industry is seeking solutions, a financial incentive will exist to resupply these inland locations if Sunoco's Philadelphia refinery closes. But the issue is complex, with no single solution, and as of the publication of this report, there appears to be the potential for shortfalls in the areas served by these pipelines.

The level of petroleum product prices is mostly a function of crude oil prices. However, the price differences between crude oil and products can grow or contract depending on the strength or weakness of supply relative to demand. When supply is tight with product inventories diminishing relative to normal levels, product prices can rise, sometimes sharply. How long and how high prices increase depends on how large the shortfall is and how quickly and effectively it is resolved.

If shortfalls occur, as measured by sustained inventory draws and potential terminal outages, wholesale and retail prices relative to crude oil would rise rapidly, which would attract new supply via more costly delivery means such as trucking, and would encourage some moderation in demand. This will create incentives for trucks to move some product from more distant terminals than usual. For example, more products might move into western Pennsylvania from neighboring Midwest locations such as Ohio. If the problem persists, prices could increase further, perhaps incentivizing even longer distance trucking. A breakeven trucking cost to move product 300 miles (e.g., roughly the distance from New York Harbor to Pittsburgh) can be around 20-30 cents per gallon, but qualified drivers and their trucks may need an additional incentive to rearrange their current work. Price spikes would typically be larger than breakeven costs of marginal transportation to provide incentives for unusual supply responses. However, it is important to emphasize that at this point in time, it is simply not clear how the logistical challenges will be overcome and to what extent, if any, very long-haul trips would be needed. Generally, very long-haul trips would be a last resort and would be undertaken only as needed to help the affected markets rebalance.

As the market rebalances from any price spikes, but before infrastructure changes can be made, a less efficient supply chain would be in place than was operating prior to the assumed idling of the Sunoco Philadelphia refinery considered in this analysis. In the analysis scenario, this situation could persist for a year or more, depending on the infrastructure projects that are ultimately needed. Prices in the Northeast would likely be higher relative to other regions than before, depending on the interim marginal sources of supply.

Prices being set from marginal sources of supply are influenced by additional costs to produce and deliver a product as well as by what is necessary to bid that product away from its current market. Predicting where the marginal price-setting supply will come from and what price will be required to obtain that supply is highly uncertain. More product volumes will be moving by higher-cost modes than

prior to the closure. The marginal supply sources and price impacts of serving the inland Pennsylvania and western New York areas, which are affected by constrained pipeline access, would be expected to be different than the price impacts of those other Northeast areas that can receive additional waterborne deliveries. However, there will be interactions among all of these areas through the links that are still functioning in our analytical scenario.

First consider the price impacts of serving the inland Pennsylvania and western New York areas for all products after the initial transition impacts of the Sunoco Philadelphia refinery closure assumed in the analysis scenario subside. Much of the replacement product volume will likely have to come from the Midwest. As Midwest supplies move east, Gulf Coast supplies can flow via pipeline and traditional routes into the Midwest. Midwest and Gulf Coast refineries have adequate supplies to replace the lost volumes in this inland area, but movement into Pennsylvania and New York will still require longer haul trucking . Even if increased Midwest supplies are able to move by pipeline into western Pennsylvania, those west-to-east pipelines stop in the Pittsburgh area, and the terminal network is not set up to deliver those supplies further east, so longer haul trucking will persist, although there should be minimal need for very long routes, such as the 300-mile example above. Some trucking from New York Harbor into inland areas that are closer to New York Harbor than Pittsburgh may also add to supply. While the marginal trucking costs in this case are likely to be less than the 20-30 cents mentioned above, trucks and drivers may be in short supply, which could keep prices above marginal transportation costs. This type of strained supply chain is also more exposed to temporary disruptions and price volatility.

For inland areas that see a significant reduction in the amount of petroleum products received through product pipelines originating in the Philadelphia refinery complex that have traditionally served as an important supply channel , price impacts will likely vary by product as well. For example, some products move into Pennsylvania through a pipeline that links to the Colonial pipeline. With most marginal supply of ULSD being on the Gulf Coast, suppliers may reduce some gasoline supply through this pipeline route in favor of ULSD. While this might help ULSD prices, it would require more gasoline from the Midwest and New York Harbor truck routes, adding more pressure to gasoline prices.

Next consider the price of delivering products to the areas outside of inland Pennsylvania and western New York that can be served by increased waterborne supplies. ULSD may be the most difficult product to bring to these other Northeast areas during the interim period, and it may see some of the highest price increases. As previously described, the most likely source of replacement ULSD is the Gulf Coast, and with constrained pipeline capacity from the Gulf Coast, most incremental volumes would arrive by water. Direct waterborne movement from the Gulf Coast would be by Jones Act vessel, and thus the price of ULSD would be influenced by Jones Act vessel rates, which seem to run two-to-three times foreign flag ship rates. But since Jones Act vessels are not readily available, actual transportation costs might have to be considerably higher than current rates to bid scarce vessels away from their current business. This vessel scarcity implies some additional ULSD may come from foreign sources, such as India, and these import volumes would then possibly set the Northeast price. To obtain such foreign supplies, buyers would bid them away from other markets such as Europe. This would require paying a price that is at least as high as European ULSD plus the additional transportation cost from Europe to New York Harbor. In 2011, European wholesale ULSD prices averaged about 5 cents per gallon higher than U.S. New York Harbor prices, but varied from near zero to about 15 cents per gallon higher.

Transportation costs from Europe were running 5 to 9 cents per gallon in 2011. These numbers imply that ULSD prices to the Northeast would have to be somewhat higher than current U.S. prices to obtain these imports, and price volatility likely would be higher as well.

The price issues for delivering gasoline to the Northeast areas outside of inland Pennsylvania and western New York via water are different than for ULSD in that the Northeast already receives significant volumes of gasoline imports, and the current price reflects associated transportation costs. Additional imports will be required in this analysis scenario not only to replace lost refinery volumes previously serving this region outside of Pennsylvania and western New York, but also to replace any gasoline volumes pushed out of pipeline deliveries by ULSD. These increased imports add to demand for available gasoline in world markets, and gasoline prices will increase to attract additional volumes. However, we would expect price impacts for incremental imports of gasoline to be less than ULSD, since supply options and availability are greater.

As needed infrastructure changes are made, Northeast prices would tend to ease, but not necessarily back to levels prior to the idling of three Philadelphia-area refineries and the HOVENSA refinery considered in the analysis scenario. In the longer term, with more product supply coming from imports and from the Gulf Coast, infrastructure changes would likely include more docks and terminal capability to handle increased waterborne arrivals and possibly increased pipeline capacity to bring product from the Gulf Coast. Regardless of the specific changes, supply lines will be longer to the Northeast, and higher prices would be expected due to increased transportation costs alone, but prices are also influenced by need and competition for products in the distant supply source regions. In addition, longer supply chains can add to the potential for higher price volatility when supply or demand disruptions occur, since it can take longer for new supply to arrive. The next chapter provides more discussion of the long-term environment and the increasing role of the midstream industry that covers the trading and logistics portion of the petroleum business so critical to making these supply chains work.

6. Long-Term Implications

6.1 Integration of East Coast Product Markets

Although Philadelphia-area refineries primarily supply the Central Atlantic region, other East Coast markets (i.e., New England and the Lower Atlantic regions) may also feel the long-term effects of refining downsizing. The three East Coast subregions may become more integrated in the future from the standpoint of logistics and more uniform from the standpoint of product specification. Supply systems will become more integrated as a result of refinery downsizing in the Northeast. Up until now, the Central Atlantic region, as the historic heartland of East Coast refining, has depended on a distinctive supply mix – including a combination of local refinery output, Gulf Coast products delivered by pipeline, and waterborne imports – which set it apart from the rest of the East Coast. Both Florida (in the Lower Atlantic) and New England depend heavily on waterborne product supply, whereas other parts of the Lower Atlantic (excluding Florida) rely primarily on pipeline deliveries from the Gulf Coast. A permanent and significant reduction in East Coast refining capacity would thus bring the Central Atlantic market in closer competition with New England and Florida for waterborne imports and with the rest of the Lower Atlantic for pipeline deliveries. Should Gulf Coast or international refined product markets grow tight, upward price pressure in the Central Atlantic could quickly spread to the rest of the East Coast.

In addition, expansions of pipeline, terminal, and storage capacity may be accompanied by increased logistical connectivity among facilities throughout the East Coast. This may translate into greater market integration and new opportunities for arbitrage between subregions along the East Coast.

At the same time as supply systems become more integrated, expected increases in the use of ULSD as heating fuel is expected to create a more uniform distillate market . The transition of heating oil from high-sulfur distillate to ULSD is scheduled to start with New York in 2012 and continue with Maine, Massachusetts, New Jersey, and Vermont through 2018. Other Northeast States are likely to follow suit. In the past, the Northeast's reliance on heating oil for space heating set it apart from the rest of the East Coast, where distillate was used primarily for transportation, and ULSD accounted for most of its demand. The widespread adoption of ULSD requirements for heating oil is likely to encourage the development of a seamless ULSD distillate market throughout the entire East Coast, causing commercial and residential consumers of heating-oil in the New England and Central Atlantic areas to compete with truckers for the same barrels.

6.2 Impact of Reduced Refining Activity on East Coast Product Distribution

Refinery closures in the U.S. Virgin Islands and the Philadelphia area are likely to affect product distribution arrangements along the entire East Coast. With the HOVENSA shutdown, both the Lower Atlantic and New York Harbor lose a major source of supply, while Philadelphia-area refinery closures most directly affect the Central Atlantic markets in Delaware, the District of Columbia, Maryland, New Jersey, New York, and Pennsylvania.

The short-term impacts of the idling of refineries serving the Northeast market are discussed in Sections 4 and 5 above. As mentioned, the most pressing near-term challenges are in the Central Atlantic, where logistics must be upgraded and expanded to efficiently and economically accommodate alternate supply sources. This will take time, capital investments, and clarity on asset ownership and corporate plans. In

the Lower Atlantic and New England, on the other hand, coping with the idling of Philadelphia-area refineries is a lesser challenge, limited as it is to finding alternative sources of supply, as those markets will continue to rely on their existing product import capacity.

While the short-term effects of the idled Philadelphia-area refineries will be concentrated in the Central Atlantic, their long-term impacts will be more evenly spread throughout the entire East Coast. Supply availability, rather than deliverability, will be the main long-term issue, as investments improve product delivery infrastructure and various segments of the market and locations compete for the same barrels. Following a period of adjustment, the logistics will evolve in the Central Atlantic to accommodate new supply sources. Product offloading capacity will be expanded in the Philadelphia area and New York Harbor, and there will be increased connectivity between marine terminals and product pipelines running through inland Pennsylvania and into western New York. Pipeline capacity from the Gulf Coast to the Central Atlantic may be increased. Finally, new logistical links may efficiently channel additional Midwest production into some markets now served by Philadelphia-area refineries or net receipts from the Gulf Coast.

In addition to incremental pipeline capacity expansions and adjustments in connectivity between pipelines, terminal, and storage facilities, some East Coast product pipelines may be reversed in response to changed market conditions. There have been reports that pipeline companies were considering reversing some of pipelines running east from the Philadelphia area to western Pennsylvania and Ohio.[8] Pipeline reversals or expansions could help bring refined product from Ohio and other Midwest refineries to Pittsburgh and other markets further east.

The result is that the entire East Coast market will more homogeneously rely on common sources of domestic and imported product supply. Segments of the East Coast market may compete with one another and with global markets for the same barrels.

6.3 Increased Role of Inventories and Midstream Services

Refinery closures in the Philadelphia area and the Caribbean mean that East Coast markets will become more reliant on product supply brought in from longer distances. Longer supply lines to East Coast markets will not only require upgraded transport links, but also significantly raise demand for storage, as higher inventory levels will be needed to manage seasonal demand peaks and disruption risks. Product storage capacity will rise significantly as inventories will become a growing part of the supply mix during peak-demand periods. As demand for logistics services increases, that industry may be incentivized to take on a new, more active role in managing the region's product supply.

The midstream sector of the oil industry[9] has been going through a period of nationwide restructuring. Midstream services, which once were ancillary segments of a vertically integrated oil industry, are being reorganized into fast-growing, independent Master Limited Partnerships (MLPs), a trend which is expected to continue. NuStar Energy LP and Sunoco Logistics are among the most prominent examples

[8]Some of these plans include potentially reversing pipelines in order to move natural gas liquids from producing areas in the Marcellus shale to East Coast ports.

[9]For the purposes of this report, "midstream" refers to the segment of the petroleum industry that transports and stores refined products and crude oil. It does not include refining.

of such large and newly independent midstream companies. Often initially launched as spinoffs by refining companies, those new MLPs have joined the ranks of more established logistics firms such as Buckeye Partners, LP. Several companies, including NuStar, Sunoco Logistics, Buckeye, and Plains All American Pipeline, have been rapidly expanding their East Coast and Caribbean footprints and have announced plans to further expand their local tank farms.

Shrinking refining capacity in the Atlantic Basin goes hand in hand with fast-rising terminal capacity, not least because some of the idled refineries are being converted into storage.

- Plains All American bought the Yorktown, VA refinery in 2011, and converted it into a 6.6 million barrel terminal for crude oil, refined products, and liquefied petroleum gas (LPG).
- Sunoco Logistics is converting Sunoco's idled Eagle Point refinery in Westville, NJ, into a marine terminal.
- HOVENSA, in announcing the closure of its St. Croix refinery, also said it would convert it into a product tank farm.
- NuStar has announced a planned expansion of its Linden NuTop tank farm in New York Harbor, including the conversion of the facility from a rack marketing terminal to a bulk storage terminal accompanied by an 850,000-barrel capacity increase.
- Buckeye in 2008 bought Northeast gasoline and distillate distributor Farm & Home Oil Company and merged it with Buckeye Energy Services, its wholesale Midwest and Northeast product distribution arm. In early February 2012, Buckeye announced its acquisition of a 4-million-barrel marine terminal from Chevron at Perth Amboy in New York Harbor, which it may integrate with its nearby Linden, NJ, tank farm at some point via a new pipeline.

Even as they have been separated from once vertically-integrated oil companies, midstream companies have been consolidating horizontally, expanding their reach beyond the United States and enhancing their assets' internal connectivity. Both NuStar and Buckeye have acquired major Caribbean tank farms:

- NuStar bought a 13.8-million-barrel terminal in St. Eustatius, in the former Netherlands Antilles, in 2005, and plans to expand it by 11.8 million barrels. NuStar's international portfolio also includes assets in Canada, Mexico, the United Kingdom, and Turkey.
- Buckeye bought Bahamas Oil Refining Company International (BORCO), a 21.6-million-barrel terminal for crude oil, fuel oil, and light products in 2011, and plans to boost its capacity by more than a third. Ultimately, Buckeye said it may double BORCO's capacity. In combination with the Perth Amboy terminal and its Linden facility, BORCO would enable seamless movement of waterborne light products, such as gasoline and diesel, onto existing pipeline networks running from Linden through inland Pennsylvania and into western New York.

Non-U.S. firms also are active in the Caribbean, China's national oil company PetroChina, India's privately-owned refiner Reliance, and Brazil's national oil company Petrobras all have been identified in trade publications as major capacity holders in the Caribbean. These large market participants reportedly use Caribbean storage to break bulk (i.e., break down large imported vessel loads into smaller parcels for distribution across multiple markets in the Americas) or build bulk (i.e., aggregate small vessel loads from various regional suppliers into large vessels for export). In the future, growth in

Caribbean clean product storage capacity and the close integration of the Caribbean with East Coast marine terminals could provide product shippers with economies of scale and facilitate long-haul product imports into the East Coast and other markets in the Western Hemisphere. While this can be seen as being conducive to greater market efficiency, it also suggests that East Coast markets will increasingly compete for supply in globalized product markets. Unlike inventory changes on the East Coast, which are subject to reporting to the EIA, stock changes in the Caribbean are not transparent. Partially shifting East Coast seasonal or market-opportunistic stock building into non-U.S. territory would thus be associated with a potentially significant loss of market transparency.

While it is too early to say how restructuring of the refining and logistics infrastructure in the Northeast will affect product markets and redefine the ways in which petroleum products are supplied to East Coast consumers, it probably is safe to expect significant changes in supply dynamics and product pricing as changing market conditions compound the impact of corporate restructuring.