Motor Gasoline Market Spring 2007 and Implications for Spring 2008

April 2008

Energy Information Administration
Office of Oil and Gas
U.S. Department of Energy
Washington, DC 20585

Preface and Contacts

The Energy Information Administration (EIA) is the independent statistical and analytical agency within the U.S. Department of Energy. EIA provides timely, high-quality energy information and prepares objective, transparent analyses for use of Congress, the Administration, and the public. EIA, however, does not take positions on policy issues. Because of EIA's statutory independence with respect to the content of its energy information program, the analysis presented herein is strictly its own and should not be construed as representing the views of the U.S. Department of Energy or the Administration.

The EIA Office of Oil and Gas prepared this report. Questions concerning the report can be directed to Joanne Shore, Joanne.shore@eia.doe.gov, 202/586-4677, Senior Analyst in the Petroleum Division.

For questions on other energy statistics available from EIA, please contact EIA's National Energy Information Center at:

National Energy Information Center, EI-30
Energy Information Administration
Forrestal Building
Washington, DC 20585

Telephone: 202/586-8800
TTY: 202/586-1181
FAX: 202/586-0727
E-mail: infoctr@eia.doe.gov
World Wide Web Site: http://www.eia.doe.gov/
FTP Site: ftp://ftp.eia.doe.gov/

Acknowledgements: EIA wishes to acknowledge the valuable assistance of EIA contractors John Hackworth and Charles Lieder, who provided critical refinery technical information, and of the National Petrochemical and Refiners Association and several petroleum companies, which provided operations details regarding imports. Editing and production assistance was provided by Laura Gehlin and Molly Sellers.

Table of Contents

Figures and Tables

Figures

Tables

Summary

Gasoline prices have risen substantially since the 1990s, driven mainly by crude oil price increases, which pushed up wholesale and retail gasoline prices. While crude oil prices, which are set in the world market, continue to be a major factor behind gasoline price increases, other factors impact the wholesale price of gasoline relative to crude oil. Changes in wholesale gasoline prices relative to crude oil are determined by the tightness between new gasoline supply (production and net imports) and demand. Demand varies seasonally and depends on economic factors. New gasoline supply is affected by refinery outages, refinery run decisions, and import variations. This report focuses on the major factors that drove the widening difference between wholesale gasoline and crude oil prices in 2007 and explores how those factors might impact gasoline prices in 2008.

In particular, and responsive to Section 804 of the Energy Independence and Security Act of 2007,[1] the Energy Information Administration (EIA) reviewed and analyzed information that was available from commercial reporting services on scheduled refinery outages for 2008, and assessed the expected effects of those outages on the prices and supplies of gasoline. Much of this report focuses on a review of 2007 in order to establish a basis for determining how planned refinery outages and other factors might impact gasoline markets in 2008. EIA's future reports on planned refinery outages under Section 804 will evolve as additional information becomes available and EIA develops new methodologies for analysis.

Toward the end of 2006, crude oil prices began to decline, and with the transition from methyl tertiary butyl ether (MTBE) to ethanol completed and the end of the summer driving season drawing near, gasoline prices dropped even faster than crude oil prices. Both crude oil and gasoline prices bottomed out toward the end of January 2007, before reversing and climbing again. From late January through the middle of May 2007, average U.S. retail gasoline prices rose $1.05 per gallon, starting from $2.17 and peaking at $3.22 per gallon. Retail prices rose with wholesale (spot) gasoline prices. Crude oil, however, only rose about 30 cents per gallon during this same time period.[2] Two primary supply factors contributed to the gasoline price increases over crude oil prices in the first half of 2007: large refinery outages in the United States and inadequate import increases to make up for the U.S. refinery production losses.

Looking ahead, expectations for U.S. gasoline supply relative to demand are for a more favorable supply situation in January through May 2008 than was the case in 2007. Demand growth is expected to slow somewhat, while at the same time, refinery capacity

[1] Energy Independence and Security Act of 2007, Section 804, Coordination of Planned Refinery Outages, http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=110_cong_bills&docid=f:h6enr.txt.pdf .

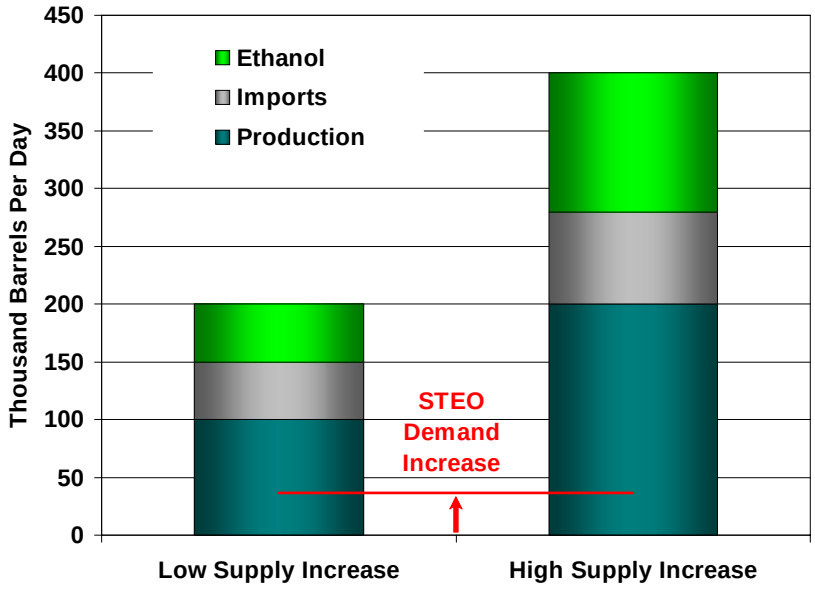
[2] For a discussion on general market factors affecting gasoline prices, see Energy Information Administration, "Inquiry into August 2003 Gasoline Price Spike," November 2003, Chapter 2 and Appendix C, http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/gasps/gasps.pdf.

availability and imports show signs of improvements. However, crude prices continue to rise, pushing gasoline prices higher.

The planned refinery outages for January through May 2008 are lower than for that period in 2007. Given lower planned outages scheduled for this spring and assuming the return of unplanned outages to more typical levels, including the return of BP's Texas City refinery to full operation, gasoline production could increase between 100 and 200 thousand barrels per day over last year's level, depending on the incentives. In addition, ethanol use, which adds to gasoline supply, is expected to continue to increase as a result of the Energy Independence and Security Act of 2007.

Import volume availability is also expected to improve. The International Energy Agency (IEA)[3] stated that gasoline exports from Europe are expected to increase 80 thousand barrels per day in 2008 over 2007. The United States, therefore, could see gasoline import availability increase as much as 80 thousand barrels per day January through May 2008 above last year's level. However, a return to recent gasoline import trend growth would indicate an average gasoline import increase closer to 50 thousand barrels per day.

Figure S1. Possible Increases in Gasoline Supply Relative to Demand, January through May 2008



Source: EIA Estimates and *Short-Term Energy Outlook*, March 2008.

Considering the uncertainty in all the gasoline supply components, there is little likelihood of events combining in 2008 to lead to the kind of tight supply downstream from crude oil markets seen in spring 2007. If all of the low-range estimates for supply occurred, total gasoline supply would increase about 200 thousand barrels per day (Figure S1).

[3] International Energy Agency, *Oil Market Report*, December 2007, p. 46, http://www.oilmarketreport.org.

The adequacy of gasoline supplies through February 2008 also is evident from gasoline inventory levels, which climbed well above the typical seasonal range. Total gasoline inventories may have peaked on March 7, 2008, when they reached 236 million barrels per day, which is 16 million barrels per day higher than the high end of the typical seasonal inventory range.

Because all gasoline supply components are responsive to margin incentives, some gasoline margin increases would be expected during the spring. However, the increases are not likely to be of the magnitude of those seen in 2007. Although the refinery outage and import impacts may contribute less to gasoline price increases in 2008 than in 2007, record crude oil prices are nonetheless pushing gasoline prices to record levels.

1. Introduction

Gasoline prices have risen substantially since the 1990s, driven mainly by crude oil price increases, which pushed up wholesale and retail gasoline prices. While crude oil prices, which are set in the world market, continue to be a major factor behind gasoline price increases, other factors impact the wholesale price of gasoline relative to crude oil. Changes in wholesale gasoline prices relative to crude oil are determined by the tightness between new gasoline supply (production and net imports) and demand. Demand varies seasonally and depends on economic factors. New gasoline supply is affected by refinery outages, refinery run decisions, and import variations. This report focuses on the major factors that drove the widening difference between wholesale gasoline prices and crude oil in 2007 and explores how those factors might impact gasoline prices in 2008.

The retail and wholesale price increases in spring 2007 followed on the heels of a large gasoline price swing relative to crude oil in the fall of 2005, when Hurricanes Rita and Katrina hit the United States, and another large price swing in the spring of 2006, as shown in Figure 1. The 2006 price surge was mainly due to continued refinery outages from the hurricanes on top of the loss of BP's large Texas City refinery.[4] Additional pressure occurred in the marketplace during 2006 when the industry switched to using ethanol in place of methyl tertiary butyl ether (MTBE).[5]

Toward the end of 2006, crude oil prices began to decline, and with the transition from MTBE to ethanol completed and the end of the summer driving season drawing near, gasoline prices dropped even faster than crude oil prices. Both crude oil and gasoline prices bottomed out toward the end of January 2007, before reversing and climbing again. From late January through the middle of May 2007, average U.S. retail gasoline prices rose $1.05 per gallon, starting from $2.17 and peaking at $3.22 per gallon. Retail prices rose with rising wholesale (spot) gasoline prices. Crude oil, however, only rose about 30 cents per gallon during this same time period.[6]

Two primary supply factors contributed to the gasoline price increases over crude oil prices in the first half of 2007: large refinery outages in the United States and inadequate import increases to make up for the U.S. refinery production losses.

[4] The Texas City refinery experienced an explosion and fire in March 2005, which resulted in a partial shutdown. After the hurricanes in the fall of 2005, the Texas City refinery inspections revealed damage, and BP determined that extensive maintenance and repair were needed http://www.bp.com/sectiongenericarticle.do?categoryId=9005029&contentId=7010402.

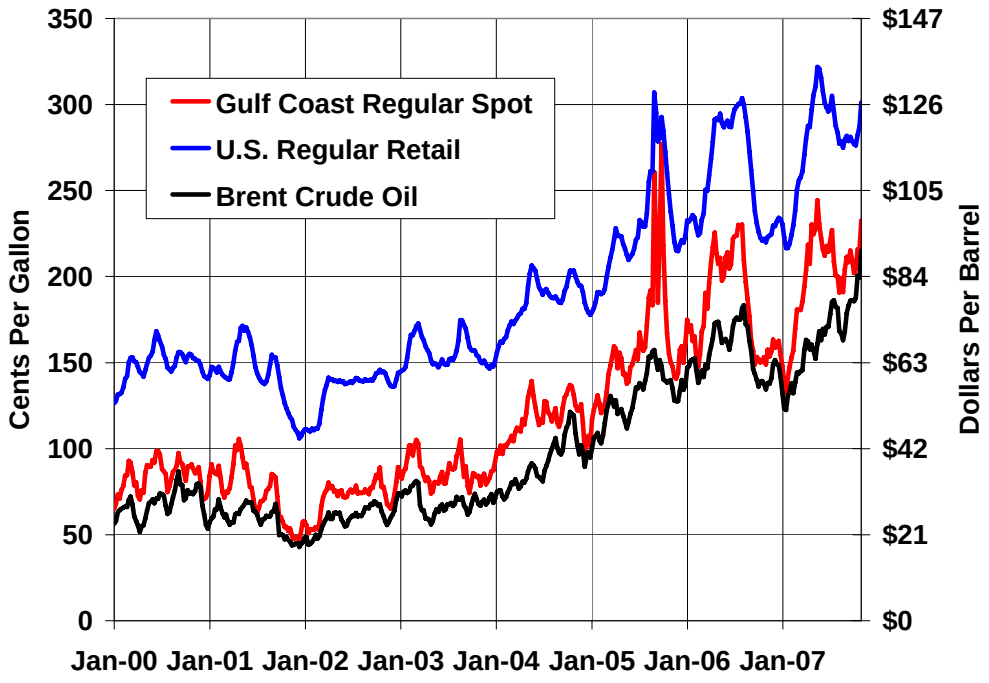
[5] Energy Information Administration, "Eliminating MTBE in Gasoline in 2006," February 22, 2006, http://www.eia.doe.gov/pub/oil_gas/petroleum/feature_articles/2006/mtbe2006/mtbe2006.pdf.

[6] For a discussion on general market factors affecting gasoline prices, see Energy Information Administration, "Inquiry into August 2003 Gasoline Price Spike," November 2003, Chapter 2 and Appendix C, http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/gasps/gasps.pdf.

The remainder of this report looks at these two factors to better understand their relative level of importance and to explore whether they were one-time events or indicators of what the future may hold.

In particular, and responsive to Section 804 of the Energy Independence and Security Act of 2007, the Energy Information Administration (EIA) reviewed and analyzed information on refinery outages scheduled for 2008 that was available from commercial reporting services. EIA used this analysis to determine the expected effects of those upcoming refinery outages on the prices and supplies of refined petroleum products (see section 5 of this report). EIA's future reports on planned refinery outages will evolve as additional information becomes available and EIA develops new methodologies for analysis.

Figure 1. Gasoline and Crude Oil Prices



Sources: Reuters Weekly Average Brent crude oil and Gulf Coast regular spot gasoline prices; EIA U.S. regular retail gasoline price.

2. Overview of Spring 2007 Gasoline Markets

The increases in gasoline prices relative to crude oil in early 2007 were consistent with a tightening market, as shown by declining gasoline inventories.[7] Figure 2 shows the large swing in total gasoline inventories from very high levels at the beginning of February down to very low levels, bottoming out by the end of April. A drop like that seen in the spring of 2007 indicates demand is outstripping new supply, resulting in inventories being used to meet the difference.

Late winter and early spring are generally the time for planned refinery maintenance turnarounds. Analysts would have expected at least part of the inventory build from mid-December 2006 to the very high levels at the beginning of February 2007 to cover lost production during turnarounds. The initial drop in inventories through March resulted in gasoline crack spreads, the difference between the price of wholesale gasoline and the price of crude oil, rising from about 14 cents to 36 cents per gallon by the beginning of March, where they hovered for most of that month, as shown in Figure 2. However, as the surplus inventory level disappeared and inventories continued to drop rapidly, reaching very low levels by the end of April, gasoline crack spreads shot up to 83 cents per gallon in mid-May. Inventories in May finally reversed and began to increase. At about this same time, gasoline crack spreads fell back as the new supply/demand balance eased.

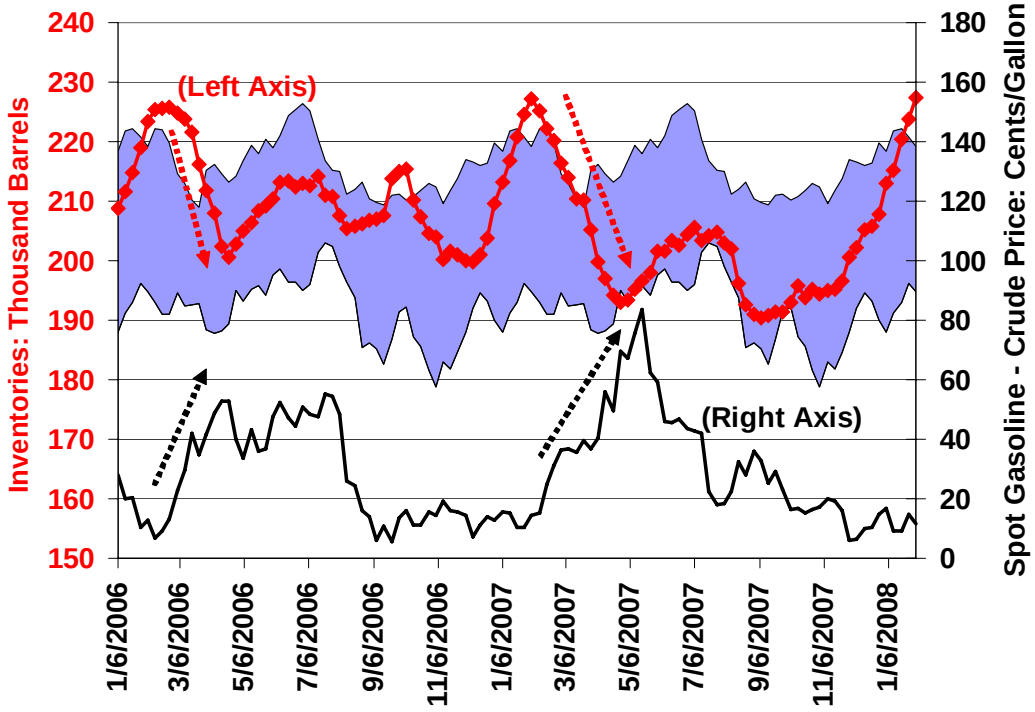
Table 1 takes a closer look at the January through May supply components relative to demand. While demand increased 96 thousand barrels per day during the first 5 months of 2007 compared to the same period in 2006, new supply from refinery production, oxygenate use, and net imports fell 30 thousand barrels per day, with drawdown of inventories being used to meet demand. This is in contrast to 2006 where supply was large enough for inventories to build during the January through May period.

Figures 3 through 6 show gasoline demand (as measured by product supplied) and the new supply components of refinery production of petroleum-based gasoline, oxygenate inputs to gasoline, and net imports by month, compared to the prior 2 years. Gasoline demand was generally stronger in 2007 up until the peak summer months when year-over-year volumes were closer to those in 2006. Production from refineries was lower than volumes in 2005 or 2006 in most months up until July. Imports were particularly low for the first few months of 2007, compared to the high imports seen following Hurricanes Rita and Katrina, but picked up and surpassed 2006 level imports in May. In 2007, ethanol's substitution for MTBE added little volume in the early part of 2007 relative to oxygenate use in 2006, but oxygenate use can be seen picking up in the summer months.

[7] Inventories represent the balance between new supply (production and net imports) and demand. For example, when demand is exceeding new supply, inventories are drawn down to meet the demand that exceeds new supply. When gasoline inventories indicate a tightening gasoline balance, it is frequently accompanied with an increase in gasoline price relative to crude oil price.

The next two sections explore imports and refinery production in more detail to determine what was behind the response of these supply components.

Figure 2. Weekly Total Motor Gasoline Inventories and Gasoline-Crude Oil Price Spread



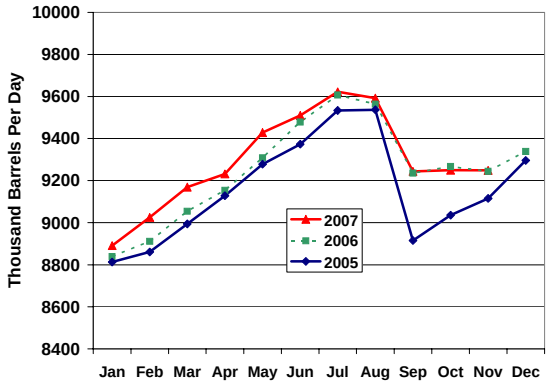
Note: Colored band represents a two standard deviation variation above and below the 5-year weekly average for gasoline inventories for 2000 through 2004. Arrows illustrate the inverse relationship between spot gasoline-crude oil spread and inventory movements during spring 2006 and spring 2007.
Sources: Inventories: EIA Weekly Petroleum Status Report; Prices: Reuters Gulf Coast spot regular gasoline price minus Brent spot price.

Table 1. Gasoline Volumes, January through May 2005–2007 (Thousand Barrels Per Day)

Jan–May Year	Gasoline Demand	Gasoline Refinery Production*	Oxygenate Use**	Total Gasoline Imports	Total Exports	Stock Change
2005	9,017	7,754	369	1075	177	4
2006	9,055	7,636	372	1229	146	39
2007	9,151	7,616	420	1171	147	-82
Change 2005–2006	38	-119	3	154	-32	34
Change 2006–2007	96	-19	48	-58	1	-121

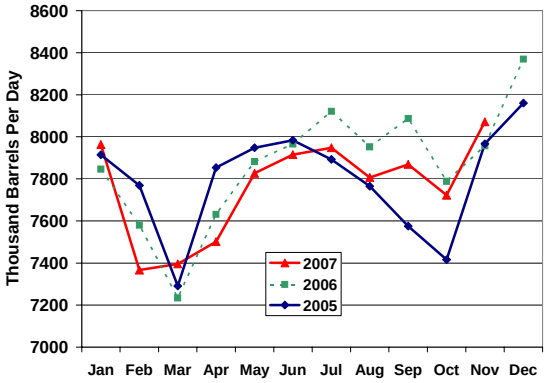
Notes: *Gasoline refinery production excludes oxygenate inputs.
**Oxygenate use is oxygenate inputs to refineries and blenders plus the fuel ethanol adjustment published in Table B1, *Petroleum Supply Monthly*.
Source: Energy Information Administration, *Petroleum Supply Monthly*, various issues

Figure 3. Gasoline Product Supplied



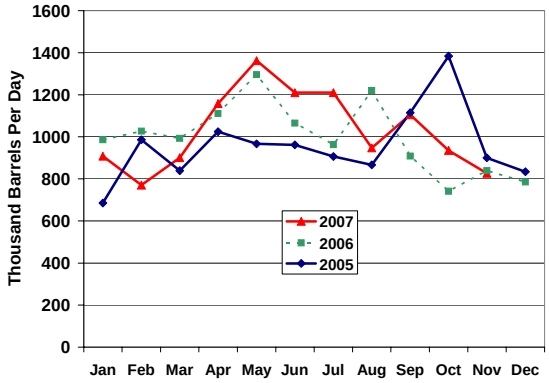
Source: Energy Information Administration, *Petroleum Supply Monthly*, various issues.

Figure 4. Refinery Production Finished Gasoline and Blending Components, Excluding Oxygenates



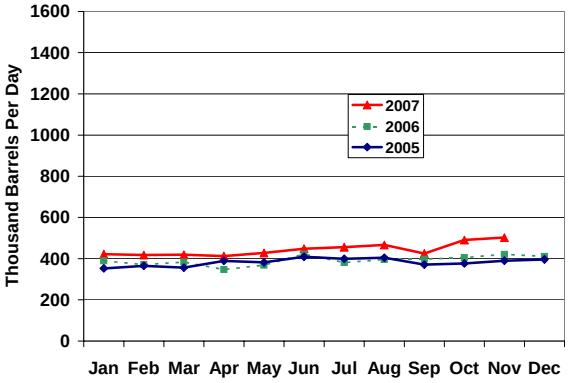
Source: Energy Information Administration, *Petroleum Supply Monthly*, various issues.

Figure 5. Total Gasoline Net Imports



Source: Energy Information Administration, *Petroleum Supply Monthly*, various issues.

Figure 6. Total Oxygenate Inputs



Source: Energy Information Administration, *Petroleum Supply Monthly*, various issues.

3. Imports

Imports have been a growing source of gasoline supply in the United States for many years. For first time since 1998, imports in the period from January through May 2007 fell compared to the same period in the prior year, in spite of the relatively high price differences between crude oil and gasoline. The question is why more gasoline imports did not come into the United States when prices rose significantly this spring. Imports might have been hindered because fewer volumes were available from world markets or the available imports went to other regions. As described below, the answer seems to be that both factors came into play.

Import Background

From 1991 through 1995, total U.S. motor gasoline imports averaged 326 thousand barrels per day. Imports increased steadily from 1995 until 2006, when they averaged 1,144 thousand barrels per day, more than 3.5 times the volume in the first part of the 1990s. Imports went from supplying 4 percent of U.S. gasoline demand during the first part of the 1990s to 12 percent in 2006.

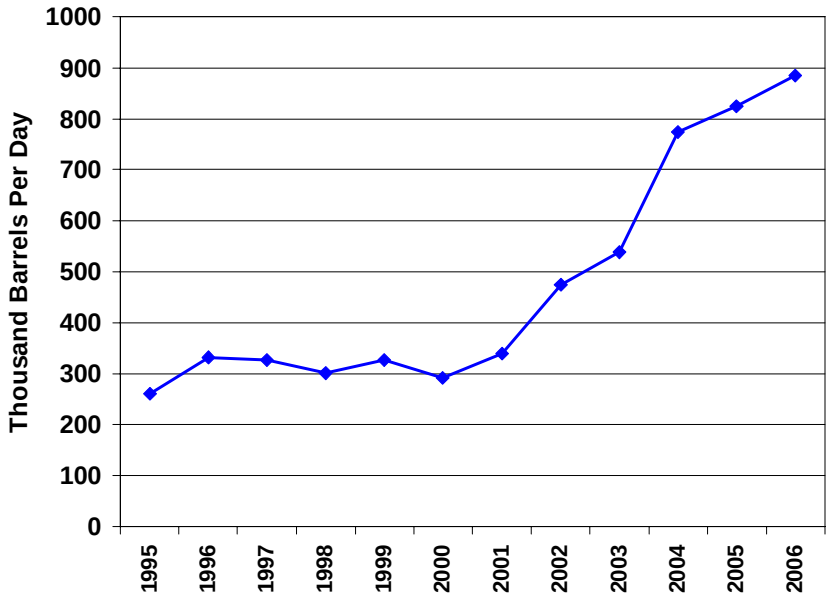
The largest part of this growth came from Western Europe, where refineries were producing more gasoline than the region could use. Europe has been encouraging the use of more efficient diesel-fueled light-duty vehicles in place of gasoline-fueled vehicles for many years in order to help reduce energy consumption. The switch has resulted in European Organization of Economic Cooperation and Development (OECD)[8] gasoline demand declining an average of 92 thousand barrels per day each year from 2002 through 2006.[9] Diesel demand has increased annually by about the same amount during that period.

Because of the characteristics of the processing units in place, European refineries have not been able to shift their production to accommodate the market shift from gasoline to diesel fuel. European refineries have been maximizing their diesel output, but they continue to produce gasoline in excess of demand. Furthermore, the gasoline surplus has been growing. As gasoline demand declined, European gasoline production did not change much, resulting in an increasing surplus in that region. The excess gasoline volumes have found a growing market in the United States. In 2006, 25 percent of the gasoline volume produced in OECD Europe was exported, and about two-thirds of those gasoline exports flowed to the United States.[10]

[8] The 23 European OECD countries are Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Poland, Portugal, Slovak Republic, Spain, Sweden, Switzerland, Turkey, and the United Kingdom.
[9] Based on data from the International Energy Agency.
[10] Based on monthly data for 2006 from the International Energy Agency for total gasoline exports and U.S. gasoline imports.

Figure 7 shows the rising gasoline exports from Europe over the 1995–2006 period, reflecting the growing surplus created by decreasing local demand. We have seen no indication that gasoline production in Europe will change significantly over the next 5 to 10 years. Europe's total petroleum demand is not growing, so refinery investments are not being directed to expand crude oil processing. Many current refinery investments are directed toward processes that will convert residual fuel oil to gasoline and distillate fuels, which leaves gasoline production near current levels. The International Energy Agency (IEA) is projecting gasoline demand will fall 46 thousand barrels per day per year from 2007 to 2012. Hence, assuming that gasoline production is not reduced, then gasoline exports will similarly increase 46 thousand barrels per day.[11]

Figure 7. Total Motor Gasoline Exports from OECD Europe



Source: Data from IEA, Monthly Oil Data Service database (2/16/2008). 2007 value reflects January – November.

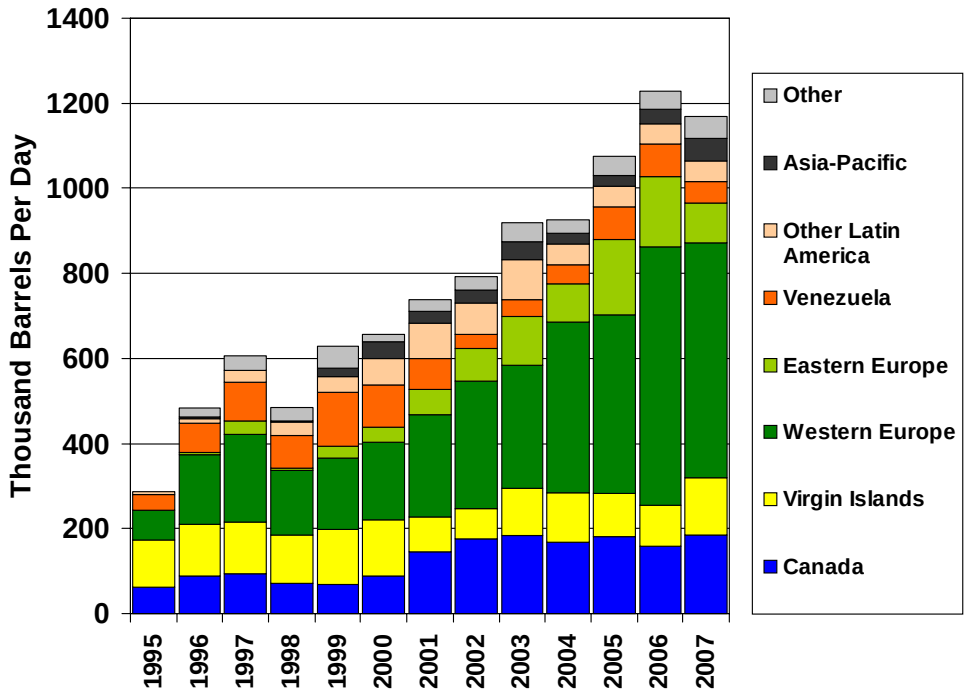
Focus on Spring 2007

In order to explore the U.S. gasoline import situation in spring 2007, the focus will shift to the January through May time period. Figure 8 illustrates the growing gasoline volumes being imported from Europe during the January through May timeframe from 1995 though 2007, as well as changes in imports from other countries. In the decade from 1995 through 2005, total U.S. motor gasoline imports increased 787 thousand barrels per day. About 45 percent of the increase came from Western Europe, and 22 percent came from Eastern Europe. In 2006, imports surged as U.S. refinery capacity was

[11] International Energy Agency, *Medium-Term Oil Market Report*, July 2007, http://omrpublic.iea.org/mtomr.htm.

recovering from damage inflicted during Hurricanes Rita and Katrina, and Europe had allowed purchases from its strategic product reserves to help meet U.S. demand, making it an unusual year.[12]

Figure 8. Total U.S. Motor Gasoline Imports by Area, January through May



Source: EIA Petroleum Supply Monthly and Petroleum Supply Annual Data.

Had price incentives returned to more typical levels in 2007, the decline in imports from 2006 shown in Figure 8 might have been expected. But unusually strong price incentives occurred in 2007. Table 2 shows that the Gulf Coast gasoline crack spread began the year relatively strong and then expanded further to reach record levels in March through May. Given the strong price incentives that occurred, the question remains why imports fell back to the extent they did in 2007.

The 59-thousand-barrel-per-day fall in U.S. imports in January through May 2007 from the same period in 2006 derived from Eastern Europe (down 74 thousand barrels per day), Western Europe (down 54 thousand barrels per day), and Venezuela (down 28 thousand barrels per day). These were partially offset by increases from Virgin Islands

[12] A large impact of Europe opening its strategic reserves was likely psychological. Knowing those reserves could be used, companies might have been less reticent to ship product to the United States, knowing they could draw on the reserves if the market tightened more than expected. The European gasoline inventory declines in January and February were not out of the ordinary and would not appear to have created a need for quick restocking.

(up 39 thousand barrels per day), Canada (up 26 thousand barrels per day), and from the Asia Pacific and other regions (up 31 thousand barrels per day).

Table 2. Average Gulf Coast Crack Spreads (Cents per Gallon)

	Jan-Feb	March-May
2001	21.8	27.0
2002	6.7	14.5
2003	17.4	20.6
2004	26.0	35.5
2005	17.3	25.1
2006	15.4	39.6
2007	17.2	53.1

Source: Reuters Gulf Coast Regular Gasoline minus Brent Crude Oil

The total U.S. import decline is somewhat misleading in that it understates the gasoline supply impact on the region that receives the largest volume of imports, the East Coast. EIA collects regional petroleum data for the 5 Petroleum Administration for Defense Districts (PADDs), with the East Coast identified as PADD 1.[13] As shown in Figure 9, East Coast (PADD 1) imports fell 120 thousand barrels per day (more than twice the U.S. total import decline), and imports serving the total area east of the Rocky Mountains were down about 147 thousand barrels per day relative to 2006.

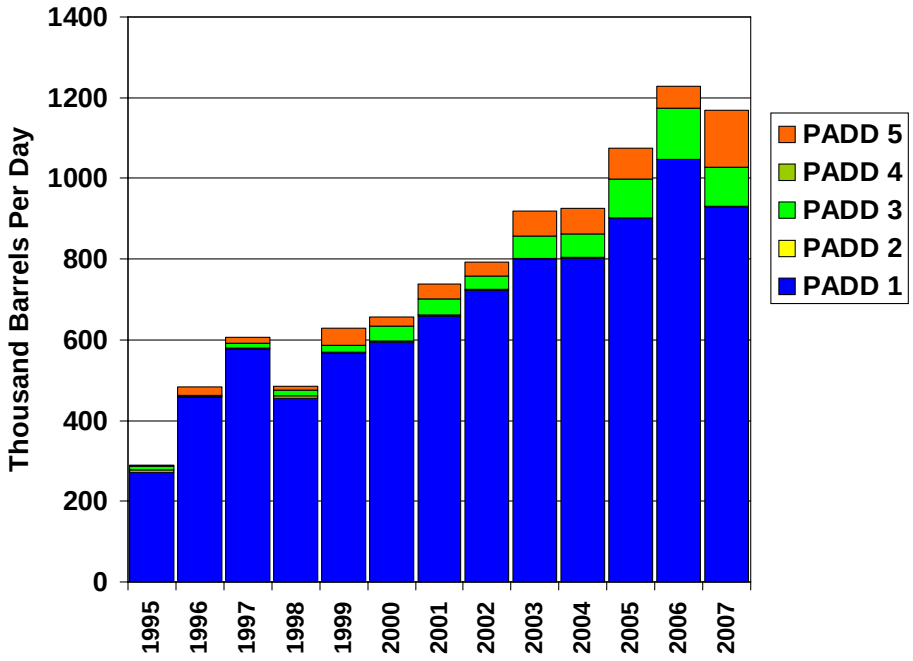
The total U.S. import decline was moderated by increases in imports into the Gulf Coast and California. The increased volumes into the Gulf Coast (PADD 3) during the first part of 2006 were expected; these volumes helped to fill the gap left by the slow return of refineries to normal operation after the hurricanes of fall 2005. As expected, Gulf Coast imports fell back in 2007, dropping about 27 thousand barrels per day. In contrast, West Coast imports in January through May 2007 increased an unusual 85 thousand barrels per day over the same period in 2006.

Sources of California Gasoline Import Increases in 2007

Because California requires a very clean gasoline, not many refineries outside of the West Coast can produce the product. As a result, the West Coast sometimes attracts import volumes from very distant sources. Of the 85-thousand-barrels-per-day increase in PADD 5 imports January through May, notable were increases in volumes from United Kingdom (up 20 thousand barrels per day), Saudi Arabia (up 11 thousand barrels per day), Taiwan (up 8 thousand barrels per day), Finland (up 7 thousand barrels per day) and Singapore (up 5 thousand barrels per day).

[13] For definitions and a map of the PADDs, see http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_monthly/current/pdf/append.pdf

Figure 9. Total Motor Gasoline Imports by PADD, January through May



Source: EIA Petroleum Supply Monthly and Petroleum Supply Annual Data.

Gasoline Exports from Europe in Spring 2007

Again, the question remains why U.S. import volumes from Europe were not stronger in spring 2007 as a result of the higher-than-normal gasoline crack spreads during that time. Either fewer exports were produced, or they went to other areas of the world. International data are limited, but European OECD volume data are available, and volumes from Europe were a key element to understanding the falloff in imports. After 6 years of substantial increases in total gasoline exports, the first half of 2007 saw European OECD gasoline exports dipping slightly in total, with more significant decreases to the United States (Table 3) offset by increases to other countries.

In order to get an indication of where the European gasoline export volumes might have gone, the analysis looked at the Netherlands, Italy, and Spain, which are large gasoline exporters, representing over 50 percent of European gasoline exports, and which typically send a significant share of their exports to multiple countries. Countries with these characteristics are most likely to shift volumes opportunistically. Furthermore, the trade press and several traders with whom we spoke mentioned extra volumes going to Mexico and Nigeria. As shown in Table 4, exports from the Netherlands, Italy, and Spain to the United States experienced a 50-thousand-barrel-per-day decrease, with Nigeria and Mexico experiencing an even larger increase from those countries. Gasoline imports to the United States were low in January and February, helping to pull down the January

through May average year-over-year. However, in the critical months of March through May, when U.S. gasoline margins were very high, the relative share of exports from Netherlands, Italy, and Spain to Mexico and Nigeria were higher than in the full January-through-May period.

Table 3. OECD European Gasoline Export Volumes

Jan–May	European Total Gasoline Net Exports	European Gasoline Exports to the United States
2005	788	423
2006	884	606
2007	869	552
Change 2005–2006	96	183
Change 2006–2007	-15	-54

*Note: OECD European gasoline exports to the United States as reported by IEA are different than OECD European import volumes reported by EIA. This is partially due to uncertain export destinations reported to IEA. It was assumed that EIA import volumes would be more accurate for the purposes of this report
Sources: European Total Net Exports: International Energy Administration; European Exports to the United States Form EIA-814 Data showing gasoline imports from Europe.

Table 4. Gasoline Exports from Selected* OECD European Countries (Thousand Barrels Per Day)

January–May	Exports to U.S.	Exports to Mexico	Exports to Nigeria
Netherlands			
2006	89	14	40
2007	67	20	54
Spain			
2006	44	12	0
2007	34	29	2
Italy			
2006	44	6	0
2007	26	31	0
Total 3 Countries			
2006	177	32	40
2007	127	80	56
Change	-50	+48	+16

*Note: Selected Countries are those European countries among the higher exporters and sending significant share of exports to multiple countries.
Source: International Energy Administration

The United States could have used imports of either conventional gasoline or reformulated gasoline components, and the volumes that were drawn away from the United States do not seem to have been low-quality product that the United States could

not use. Several traders also confirmed that volumes moving out of Europe to other destinations included product that the United States could have used.

In looking ahead to the future, European exports are generally expected to increase as that region's gasoline demand is expected to continue to fall, while European gasoline production is projected to stay relatively flat for the next 5 years or so. This year illustrates that, in any given year, variation around a general trend may move in the opposite direction from time to time. Similarly, gasoline importing countries in South America, Asia, the Middle East, and Africa have growing demand and may need more import volumes in the near term. But their need for imports will vary year to year. IEA, for example, sees Iran and Iraq (two major gasoline importers) needing less import volume in 2008 than in 2007. Finally, when other regions need gasoline import volumes, they may from time to time bid them away from the United States. Note that countries with centrally planned economies do not always respond to price signals in the same way as market economies and may have reasons to purchase volumes regardless of the price. The implications of imports to the United States in 2008 will be revisited in the last section.

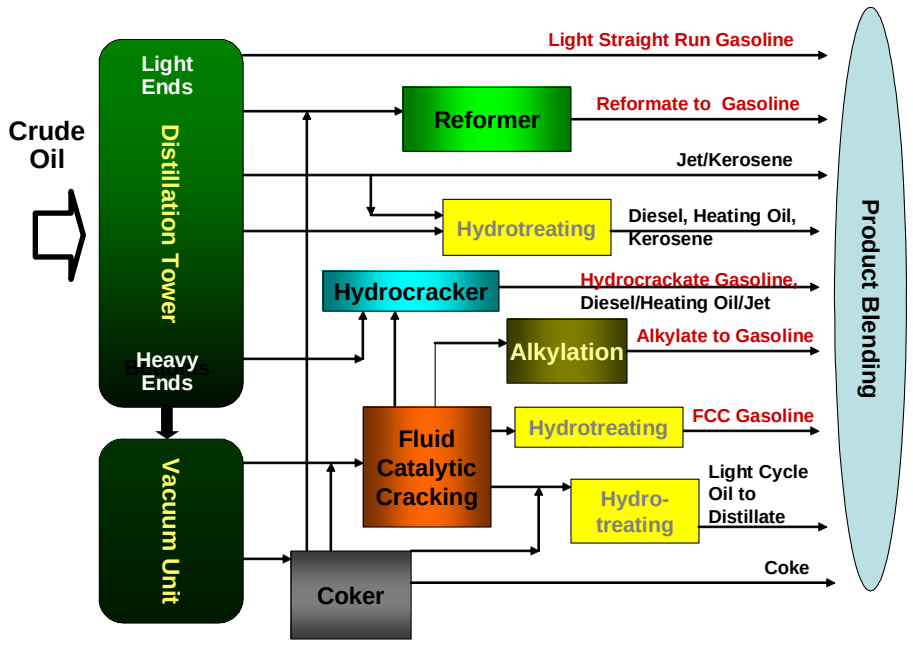
4. U.S. Refinery Gasoline Production

Refinery crude distillation unit capacity in the United States in 2007 increased slightly over 2006, and yet gasoline production declined. An unusual level of outages was behind the weak gasoline production in spring 2007.

Refinery Background

Figure 10 is a simplified refinery diagram that illustrates the different units in a refinery that produce gasoline streams: straight run gasoline from the crude distillation unit; reformate; fluid catalytic cracking (FCC) gasoline; and alkylate (using olefin feedstock from the FCC unit). Each stream has different properties, which when combined, produce either a blendstock for ethanol blending or a finished gasoline that meets both emission and performance requirements.

Figure 10. Simplified Refinery Diagram



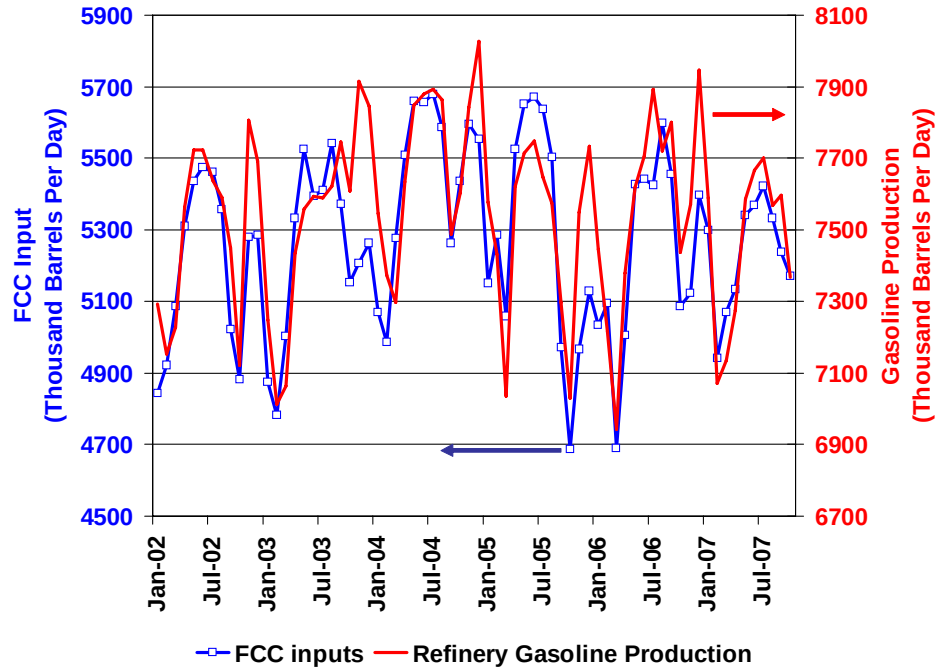
Source: EIA

The FCC unit and the alkylation unit, which the FCC feeds, together affect about half of the gasoline volume produced at a refinery.[14] As such, refinery production of gasoline is

[14] Energy Information Administration, "Refinery Outages: Description and Potential Impact on Petroleum Product Prices," March 2007, SR/OOG2007-01, Chapter 2, http://www.eia.doe.gov/oiaf/servicerpt/refinery_outages/SROOG200701.pdf.

highly correlated with operation of the FCC unit (Figure 11). However, the FCC unit's operation is sometimes affected by the operation of the crude distillation unit and vice versa. The feedstock for the FCC unit comes from the crude distillation unit, but in some cases can be purchased or brought in from another refinery. Similarly, if the FCC unit is offline, the refinery may not have the room to store the FCC unit feedstock that the crude distillation unit generates and may not be able to sell the FCC feedstock at an economically attractive price, making it preferable to reduce operation of the crude distillation unit. As a result of the importance of the FCC unit to gasoline production, the remaining discussion in this section will focus on both FCC unit and crude distillation unit outages.

Figure 11. Input to FCC Units and Refinery Gasoline Production



Source: Form EIA-810.

Approach and Data Used for Outage Analysis

Two sets of data were used in this report. The first is refinery unit input data reported monthly on the refinery Form EIA-810. While outages are not explicitly identified in the unit input that EIA collects, they can be inferred from the changes in unit input levels. As described in more detail in an earlier EIA report,[15] significant outages are identified in the EIA data as a drop in unit inputs to levels below 85 percent of capacity. While this

[15] Energy Information Administration, "Refinery Outages: Description and Potential Impact on Petroleum Product Prices," March 2007, SR/OOG2007-01, http://www.eia.doe.gov/oiaf/servicerpt/refinery_outages/SROOG200701.pdf.

dataset is complete in that it covers all refineries, it lacks information on whether an outage was planned or unplanned.

The second data source used was from Industrial Information Resources, Inc. (IIR). IIR collects information on refinery maintenance and classifies the outage periods as planned or unplanned. These categories are not precise. For example, a planned outage can extend longer than anticipated, but the extra outage period is not reclassified as unplanned. However, the designation still separates those outages that were planned in advance from those that happened unexpectedly. Unplanned outages can be quite short (2 to 7 days) when a unit is brought down as a result of an electrical outage or problem in other refinery operations and experiences no damage in the shutdown process. But when units are brought down due to a fire or as a result of some other damage, an unplanned outage can last much longer.

Refinery Operations in Spring 2007

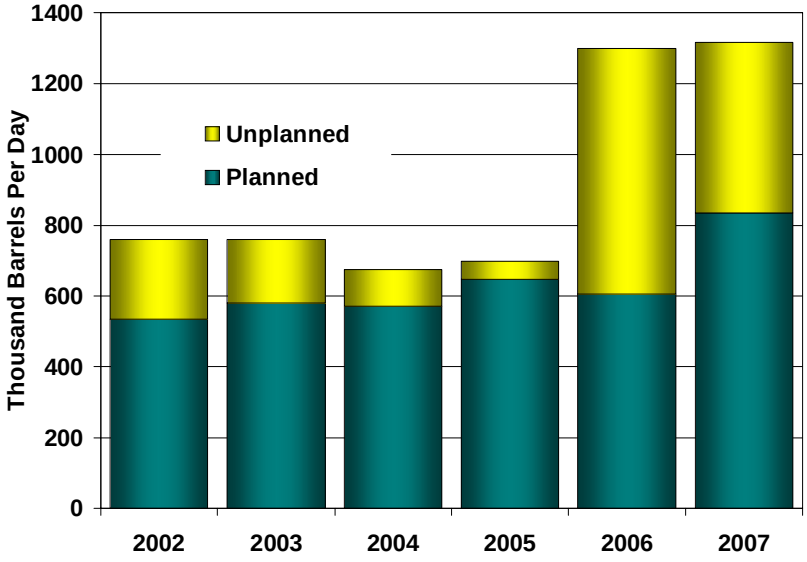
In January through May 2006, unplanned distillation unit outages were very high, mainly as result of the refineries still recovering from the hurricanes in the fall of 2005 (Figure 12). Although the hurricane-damaged refineries returned to operation (with the exception of BP's Texas City), both planned and unplanned outages were still high in January through May 2007. Unplanned outages were exceptionally high relative to the more typical years of 2002 to 2005.

Table 5 highlights major unplanned outages in 2007 as well as the outages for the period January through May. Total U.S. unplanned outages January through May 2007 shown in Figure 12 were 467 thousand barrels per day. The selected outages in the last column of Table 5 illustrate that during January through May, two major refinery outages accounted for 267 thousand barrels per day of the outages, or 57 percent of the U.S. total unplanned outage capacity. Table 5 also illustrates that outages during the rest of the year were significant as well. The average daily distillation capacity loss for the entire year for the five refineries in Table 5 was 334 thousand barrels per day.

Figure 13 shows both FCC and distillation unit the outages, including both planned and unplanned, for PADDs 1 through 3 combined. Based on earlier EIA analysis,[16] the higher FCC and distillation outages in PADDs 1 through 3 would be expected to reduce gasoline production by about 120 to 150 thousand barrels per day during January through May 2007 compared to 2005. In fact, FCC capacity lost to outages for 2007 was estimated to be 116 thousand barrels per day over 2005 and FCC capacity also increased 60 thousand barrels per day over this period.

[16] Energy Information Administration, "Refinery Outages: Description and Potential Impact on Petroleum Product Prices," March 2007, SR/OOG/2007-01, Figures 24-26, http://www.eia.doe.gov/oiaf/servicerpt/refinery_outages/SROOG200701.pdf.

Figure 12. U.S. Planned and Unplanned Distillation Unit Capacity Outages, January through May



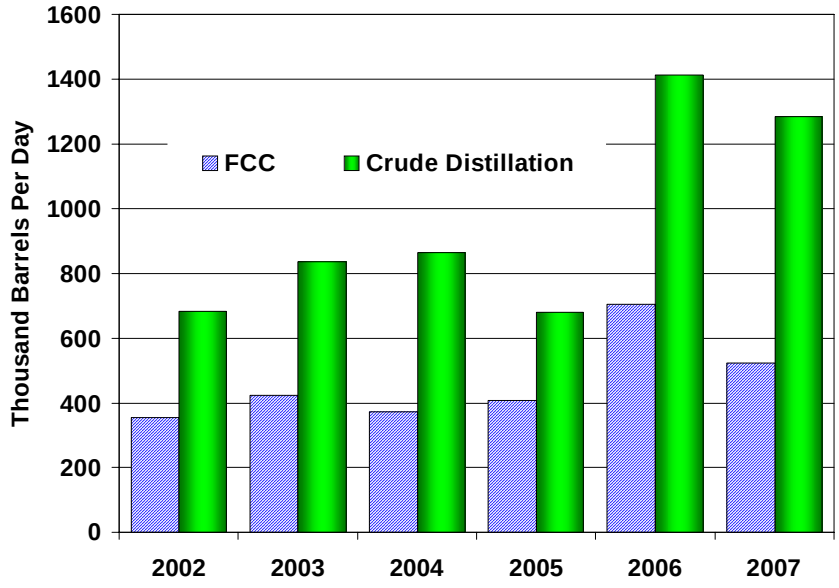
Source: Industrial Information Resources, Inc. Historical Database.

Table 5. Major Unplanned Distillation Outages in 2007

Refinery	Distillation Capacity Affected (KB/D)	Start Date	End Date	Days in 2007	Average for Year (KB/D)	Average for Jan–May (KB/D)
BP's Texas City	218.5	9/22/2005	2/2008	365	218.5	218.5
Valero's McKee	60	2/16/2007	6/16/2007	121	19.9	48.1
Coffeyville's Coffeyville	100	7/1/2007	9/1/2007	63	17.3	0
Chevron's Pascagoula	162.5	8/16/2007	2/15/2008	138	61.4	0
Valero's Port Arthur	75	9/25/2007	12/15/2007	82	16.8	0
Total					333.9	266.6

Note: KB/D represents thousand barrels per day. Also, some large refinery outages mentioned in the trade press, such as the BP Whiting outage, were classified as planned since they occurred in conjunction with a planned outage, and therefore are not shown on this table.
Source: Industrial Information Resources, Inc. Database.

Figure 13. PADDs 1 through 3 Estimated Capacity Lost to Outages, January through May

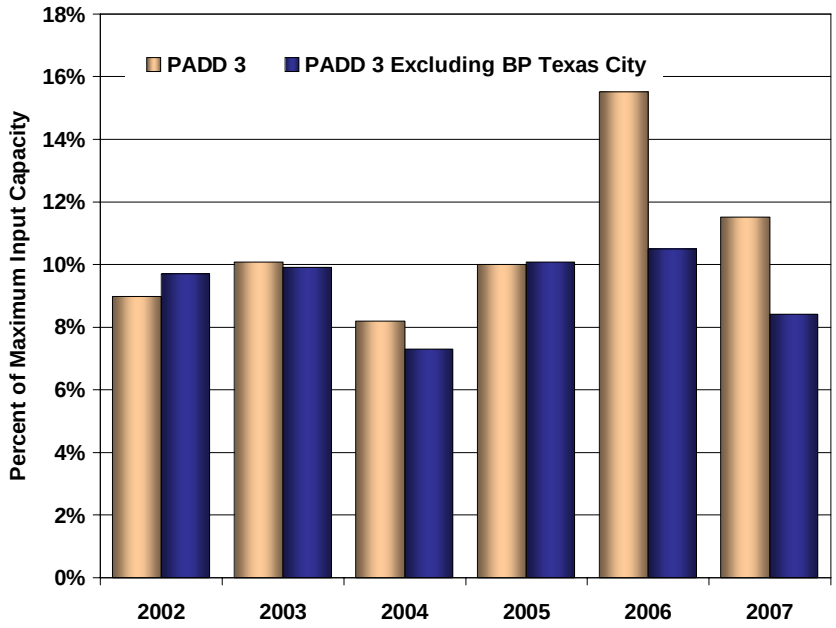


Source: Form EIA-810 Data, Estimated Outages based on inputs less than 85 percent of capacity.

Within PADD 3, BP's Texas City refinery continued to represent a large part of the 2007 outages. Figure 14 shows that the 2007 January-through-May FCC outages would have been more typical in PADD 3, if Texas City had been operating. BP indicated that the second train, which represents about half of capacity of the 417-thousand-barrel-per-day refinery, would not be returning to service until early 2008.

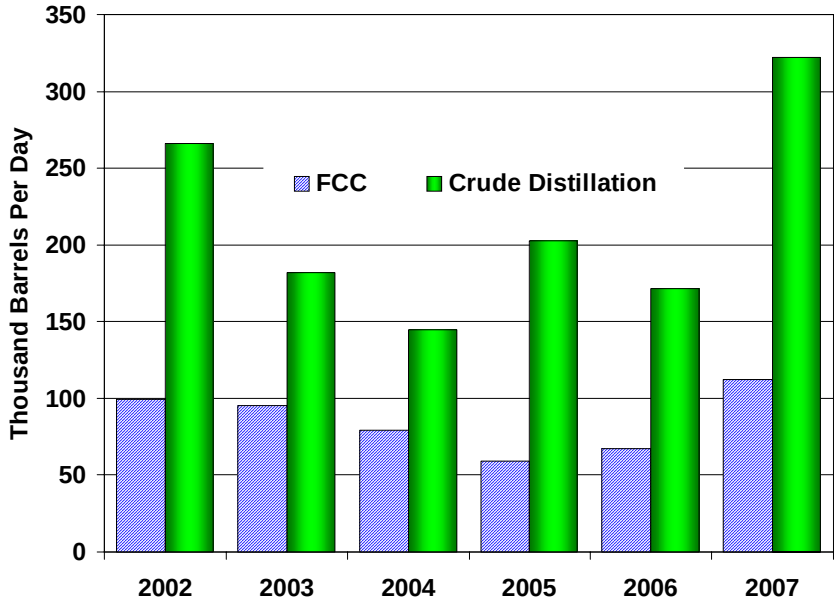
In PADD 5, distillation outages were much higher in 2007 than outages seen since 2002. However, FCC outages were not exceptionally high (Figure 15). Much of the distillation outage volume can be attributed to a fire that preceded a planned outage at the Chevron Richmond refinery's 240-thousand-barrel-per-day distillation unit. Based on a commercial outage report, the duration of the actual outage was more than double the planned outage period and accounted for about half of the total capacity offline January through May 2007 in the West Coast region. The loss of capacity in PADD 5 helps to explain the larger-than-typical import levels into this region in spring 2007.

Figure 14. PADD 3 FCC Outages, January through May



Source: Form EIA-810 Data, Estimated Outages based on inputs less than 85 percent of capacity.

Figure 15. West Coast (PADD 5) Estimated Capacity Lost to Outages, January through May



Source: Form EIA-810 Data, Estimated Outages based on inputs less than 85 percent of capacity.

5. Implications for Gasoline Market, January through May 2008

Looking ahead, expectations for U.S. gasoline supply relative to demand are for a more favorable supply situation in January through May 2008 than was the case in 2007. Demand growth is expected to slow somewhat, while at the same time, refinery capacity availability and imports show signs of improvements. However, crude prices continue to rise, pushing gasoline prices higher.

Availability of refinery capacity in 2008 for gasoline production may be significantly improved over 2007. The planned outages for January through May 2008 reported by IIR are lower than for that period in 2007. Given lower planned outages scheduled for this spring season and assuming the return of unplanned outages to more typical levels, including the return of BP's Texas City refinery to full operation, gasoline production could increase from 100 to 200 thousand barrels per day over last year's level. The gasoline production range for January through May 2008 is estimated from FCC input levels. The high end of the range (200 thousand barrels per day) assumes FCC outages similar to those experienced from 2002 through 2005, both planned and unplanned. The low end of the range assumes higher unplanned outages and a slower return to operation by BP's Texas City refinery. However, unplanned outages can reverse this situation. The uncertainty behind the timing of the return of BP's Texas City refinery and the potential for higher unplanned outages could still impact these results. Nevertheless, the likelihood of improved production availability over 2007 levels seems relatively high to EIA.

Import volume availability is also expected to improve. Average imports in December 2007 were 91 thousand barrels per day higher than December 2006, and January 2008 gasoline imports averaged over 80 thousand barrels higher than the prior January. The IEA[17] stated that gasoline exports from Europe are expected to increase 80 thousand barrels per day in 2008 over 2007. IEA also indicated that Nigeria and Iran are expected to import less from Europe. The United States could, therefore, see gasoline import availability increase 50 to 80 thousand barrels per day January through May 2008 above last year's level. The range reflects the items mentioned by IEA, higher import levels in January and February than occurred last year, and a return to trend growth after the unusual upward growth in January through May 2006 and the decline in 2007.

Recalling that the 2006 switch from MTBE to ethanol put additional pressures on the gasoline markets and that ethanol is a growing source of gasoline volume, EIA also looks at projections of ethanol use in 2008. While the new renewable fuel standard that was included in the energy bill signed in December 2007 will require increased ethanol use, the speed of penetration into new regions may vary through the year, with slower increases expected for the first half of 2008 than in the second half. The year-over-year increase for January to May might vary between 50 and 120 thousand barrels per day.

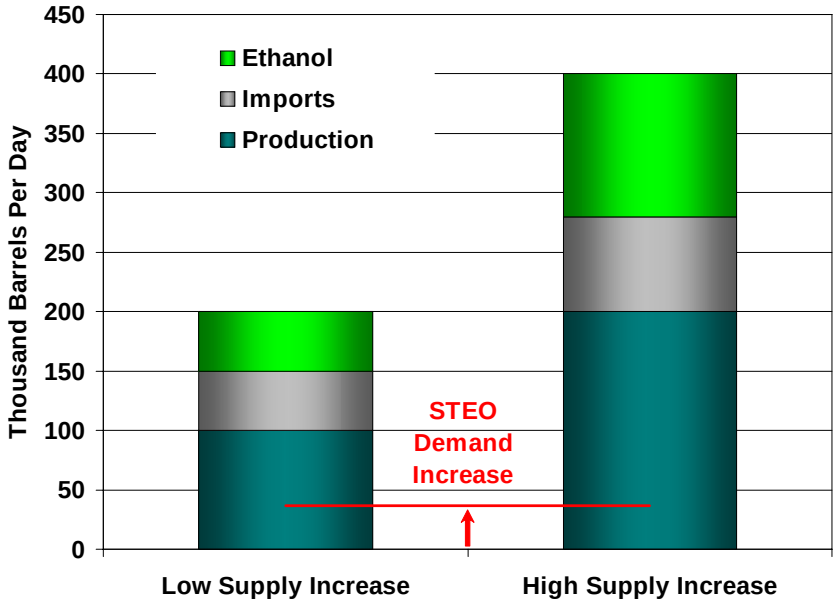
[17] International Energy Agency, *Oil Market Report*, December 2007, p. 46, http://www.oilmarketreport.org.

The lower volume (50 thousand barrels per day) is based on the average ethanol use increase seen in late 2006 through early 2007. This low estimate assumes that work on terminals and service stations and arrangements for transportation slow penetration in the early months. This slow penetration would be followed by an accelerated increase in ethanol use for the remainder of the year. The higher volume (120 thousand barrels per day) reflects faster penetration during the first half of the year.

Gasoline stocks at the end of 2007 were not as high as the unusually high level at the end of 2006, but higher imports in January in the face of weak demand growth have resulted in stocks building to levels above those seen in early 2007. Stocks may have peaked at 236 million barrels on March 7, which is about 16 thousand barrels per day over the high end of the typical range seen during end of February or early March, as shown in EIA's Weekly Petroleum Supply Report.[18]

Considering the uncertainty in all the supply components, there is little likelihood of supply events combining to lead to the kind of tight supply downstream from crude oil markets seen in spring 2007. If all of the low-range estimates occurred, total gasoline supply would increase about 200 thousand barrels per day (Figure 16).

Figure 16. Possible Increases in Gasoline Supply Relative to Demand, January through May 2008



Source: EIA Estimates and *Short-Term Energy Outlook*, March 2008.

[18] EIA's weekly gasoline inventories can be found various places, including: http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/weekly_petroleum_status_report/current/pdf/figure04.pdf

EIA's March 2008 *Short Term Energy Outlook*[19] shows gasoline demand increasing about 37 thousand barrels per day January through May 2008, significantly less than supply availability. Even if demand were to increase about 1 percent, or 92 thousand barrels per day, ample supply should be available. Thus a large stock draw or large gasoline margin increase seems very unlikely. Because all the supply components are responsive to margin incentives, some margin increases would be expected during the spring. However, the increases are not likely to be of the magnitude of those seen in 2007. Although the refinery outage and import impacts may contribute less to gasoline price increases in 2008 than in 2007, record crude oil prices are pushing gasoline prices to record levels.

[19] Energy Information Administration, *Short Term Energy Outlook (STEO)*, February 2008, http://www.eia.doe.gov/emeu/steo/pub/contents.html.