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Market Assessment of Refinery Outages Planned for October 2010 through January 2011

November 2010

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Preface and Contacts

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. EIA is the nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The EIA Office of Petroleum, Gas, and Biofuels Analysis prepared this report. Questions concerning the report can be directed to Joanne Shore (Joanne.Shore@eia.doe.gov, 202/586-4677), Team Leader in the Office of Petroleum, Gas, and Biofuels Analysis. Specific questions on statistics relating production to outages can be directed to John Zyren (John.Zyren@eia.doe.gov, 202/586-6405), Senior Industry Economist in the Office of Petroleum, Gas, and Biofuels Analysis.

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Summary

Section 804 of the Energy Independence and Security Act of 2007 (Pub. L. 110-140) requires the U.S. Energy Information Administration (EIA) to review and analyze planned refinery outages "not less frequently than twice each year." This report reviews the supply implications of refinery outages planned for October 2010 through January 2011, which covers the seasonal increase in middle distillate supply (diesel fuel, heating oil, jet fuel and kerosene) over the winter. Refinery outages are the result of both planned maintenance and unplanned unit shutdowns. Maintenance is usually scheduled during the times when demand is lowest, i.e., in the first quarter and again in the fall. Unplanned outages can occur at any time and for any reasons such as mechanical failure, fire, or flood.

EIA's analysis of current data for planned refinery outages, combined with the typical level of unplanned outages, indicate that available refinery capacity during October 2010 through January 2011 is adequate to meet forecasts of U.S. gasoline and middle distillate consumption based on EIA's September 2010 *Short-Term Energy Outlook (STEO).* However, Petroleum Administration for Defense District (PADD) 1 (see Appendix B) and some areas in the Midwest and upper PADD 4 may experience tight markets and temporary price pressure in the fall.

EIA relies on commercial data, mainly that supplied by Industrial Info Resources, Inc. (IIR), to identify planned and unplanned outages. The production loss from these outages must be estimated to assess the potential impacts on markets. EIA estimates refinery production impacts of the outages using relationships between EIA historical refinery production and unit input data. This report focuses on crude distillation and fluid catalytic cracking (FCC) unit capacities, since these are the refining units that have the most impact on production of distillate and gasoline, respectively.

Petroleum consumption in the United States has declined in recent years, bottoming out in 2009 at more than 1.9 million barrels per day less than in it was 2007, before the economic downturn affected consumption. Facing weak demand for petroleum products and expectations for a slow recovery, a number of refineries have been idled or shut down. Since January 2009, the United States has idled or shut down about 500,000 barrels per day of crude distillation capacity. But with the startup of the 180,000 barrel-per-day expansion of Marathon's Garyville refinery in 2010, the net loss is only about 320,000 barrels per day, much less than the decline of consumption since 2007. This still leaves the United States with surplus capacity to meet consumption before outages are considered.

Table S-1 shows that, in aggregate and after outages are taken into consideration, crude distillation unit capacity that remains operating should be more than adequate to meet EIA's *STEO* forecast for refining inputs needed to meet consumption. Table S-2 shows similar findings for FCC capacity that remains after outage volumes are removed.

Even though aggregate U.S. capacity after outages appears adequate this fall, PADDs 1 and 2 and some northern areas of PADD 4 are experiencing tighter than usual supply-demand balances. PADD 1 is affected by factors on both sides of the Atlantic. This

region's refineries have been undergoing a high level of planned crude distillation unit outages in September and October. The middle distillate market remains well supplied with inventories above the typical range for this time of year, but PADD 1's gasoline supply is affected by a tight import market as well as by domestic refinery outages. PADD 1 relies on gasoline imports more than on distillate imports. Gasoline imports to the East Coast are being affected by Canadian refinery maintenance at Irving's 300,000-barrel-per-day facility in New Brunswick, which supplies the Northeast, and by the French strikes that began in September. The French strikes cut off some crude supplies moving into Europe and resulted in the temporary shutdown of a number of European refineries. Europe is a major source of gasoline to the U.S. East Coast, and current PADD 1 stock levels of gasoline have declined since early September from well above typical ranges to more normal levels.

In response to the PADD 1 supply situation, gasoline spot prices in New York Harbor are showing more market pressure than on the Gulf Coast. Typically, New York Harbor conventional gasoline prices would be 2 to 4 cents per gallon higher than Gulf Coast prices. By mid October, the spread was varying around 9 to 12 cents per gallon, indicating modest additional price pressure on East Coast gasoline of about 5 to 10 cents per gallon.

While the PADD 1 supply-demand balance has tightened, Irving's New Brunswick refinery and the PADD 1 refineries should be returning to operation in early-to-mid November, relieving the supply-demand balance to a large degree, and the French strikes have ended as of early November. PADD 3 refineries should be able to supply additional product volumes to PADD 1 during this period, in the event that supplies do not recover as expected.

PADD 2 refiners have scheduled high levels of planned outages for FCC units in September through November 2010, but gasoline supplies remain ample. Although crude distillation unit outages in aggregate are not large, certain areas in the Midwest and northern areas of PADD 4 are experiencing tight distillate markets, with some temporary terminal outages. These areas have few alternative supplies. Some unplanned outages have added to tightness in this part of the country. In addition, refineries supplying the Magellan pipeline are undergoing a large outage cycle that may be contributing to some local tightness, but most of this maintenance should be finished in early November. (The Magellan pipeline serves areas of PADDs 2 and 4.) The terminal outages of which EIA is aware, while indicative of local price pressure, should be easing by the time this report is published, barring additional unexpected supply disruptions. However, PADD 2 distillate inventories have been falling recently from above average levels into the normal range.

PADD 3 refineries have scheduled moderate levels of planned outages for crude and FCC units during this timeframe, potentially being able to fill in for the decline in PADD 2 and PADD 1 capacity availability, should maintenance schedules prove longer than expected.

Inventories reflect the regional markets' supply-demand balances. Notwithstanding the situations noted above, most regions are seeing above average inventories of gasoline and distillate fuels.

In summary, most of the United States should not see product prices affected much by refinery outages, as a result of low demand, high inventories and adequate capacity.

However, PADD 1 and some areas of PADDs 2 and 4 are experiencing tightening markets as a result of local large refinery outages and a tightening gasoline import market stemming from a large outage in Canada on top of strikes in Europe. With many U.S. and Canadian refineries returning to operation in early-to-mid November, and with the French strikes ending in early November, the regional situation should ease soon. In addition, extra capacity in PADD 3 should be available to help meet consumption needs if refineries take longer than expected to return to full operation.

Table S-1. U.S. Comparison of Maximum Crude Inputs from Crude Distillation Capacity Available After Outages with *STEO*-Forecast Crude Input Needs
(Thousand Barrels Per Stream Day)

Month	Actual and Forecast STEO Crude Inputs	Operable Distillation Capacity	Estimated Total Distillation Outages	Distillation Capacity Net of Outages	Potential Crude Inputs (Net Capacity * 0.907)	Surplus: Potential Crude Inputs minus *STEO* Inputs
August 2010	14,990	18,393	385	18,008	16,333	1,343
September 2010	14,470	18,393	1,023	17,370	15,755	1,285
October 2010	14,020	18,393	1,281	17,112	15,521	1,501
November 2010	14,240	18,393	383	18,010	16,335	2,095
December 2010	14,200	18,393	259	18,134	16,448	2,248
January 2011	13,930	18,393	622	17,771	16,118	2,188

Note: Operable Distillation Capacity reflects the refinery closures highlighted in Chapter 2. July and August crude inputs are based on weekly data through September 1. September through January 2011 data are STEO-forecast crude inputs. Potential crude inputs are estimated by applying a factor (0.907) that represents the average of the 10 highest utilization months from January 2002 through June 2010, where utilization is estimated as crude inputs over distillation capacity net of outages. Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table S-2. U.S. Comparison of Maximum FCC Inputs from FCC Capacity Available After Outages with Estimated *STEO*-Forecast FCC Input Needs
(Thousand Barrels Per Stream Day)

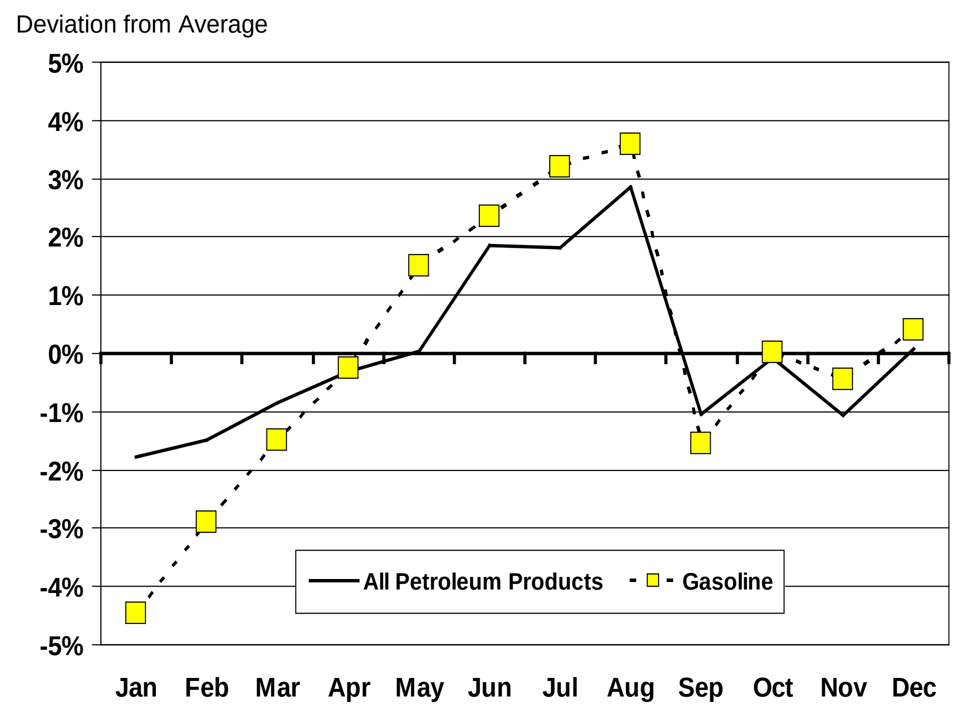
Month	Actual and STEO-Forecast Crude Inputs	Actual and Projected FCC Inputs (FCC Pct Crude = .356)	Operable FCC Capacity	Estimated Total Outages	Capacity Net of Outages	Potential FCC Inputs (Net Capacity * 0.942)	Surplus: Potential Inputs minus *STEO* Inputs
August 2010	14,990	5,157	6,119	182	5,937	5,592	436
September 2010	14,470	4,978	6,119	378	5,741	5,408	431
October 2010	14,020	4,823	6,119	510	5,609	5,284	461
November 2010	14,240	4,899	6,119	274	5,845	5,506	607
December 2010	14,200	4,885	6,119	122	5,997	5,649	764
January 2011	13,930	4,792	6,119	495	5,624	5,298	506

Note: Operable FCC Capacity reflects the refinery closures highlighted in Chapter 2. FCC input volumes are estimated by multiplying crude inputs by a factor (0.344) that represents the average observed ratio between FCC and crude inputs for facilities experiencing no major outages. Potential FCC inputs are estimated by applying a factor (0.942) that represents the average observed difference between FCC input volumes and capacity in the United States for facilities experiencing no major outages and running at high input levels.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

1. Introduction

As required under Section 804 of the Energy Independence and Security Act of 2007 (Pub. L. 110-140), this periodic report reviews the supply implications of planned refinery outages -- in this case for March 2010 through June 2010, which covers the seasonal increase in driving consumption. Refinery outages are the result of both planned maintenance and unplanned outages, the latter of which occur for many reasons, including mechanical failures, fires, and flooding.[1] Maintenance is usually scheduled during the times when consumption is lowest, i.e., in the first quarter and again in the fall. Figure 1 demonstrates these seasonal variations in consumption. Total petroleum consumption is driven mainly by gasoline consumption. Distillate consumption (diesel and heating oil) moderates the petroleum consumption dip in the winter, but because distillate consumption is about half that of gasoline, it does not substantially affect the total seasonal consumption variations.

Figure 1. Seasonal Variation in Petroleum Consumption around Annual Average (2002-2009)



Source: EIA, *Petroleum Supply Monthly*

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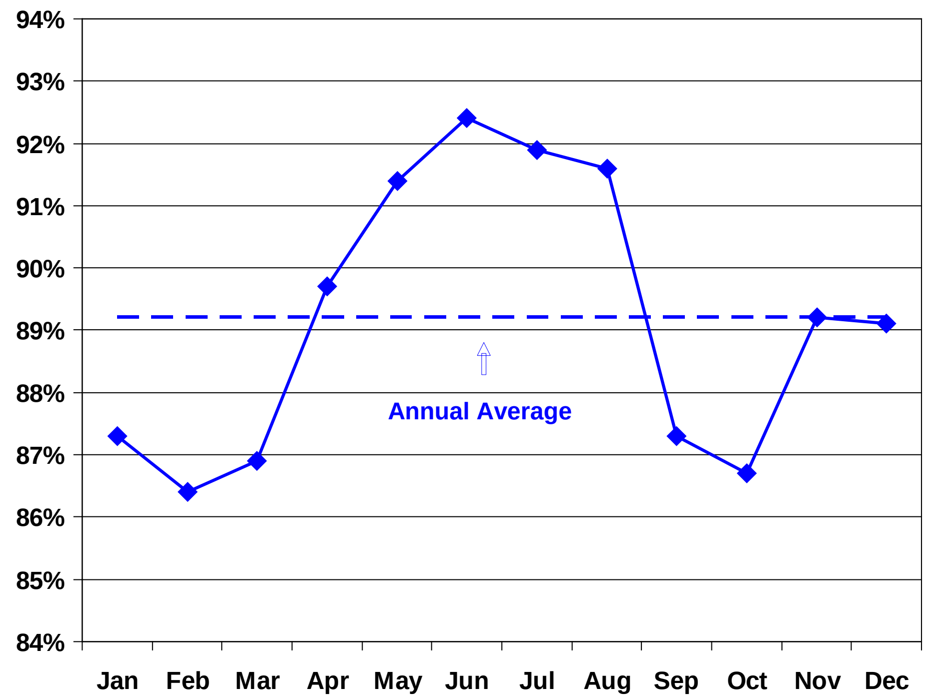
[1] For more detail on refinery outages, see EIA, *Refinery Outages: Description and Potential Impact on Petroleum Product Prices*, March 2007, SR/OOG/2007-1. http://www.eia.doe.gov/oiaf/servicerpt/refinery_outages/SROOG200701.pdf.

Refinery utilization reflects discretionary crude oil throughput changes that follow consumption, as well as maintenance and unplanned outages. While utilization generally follows the seasonal consumption pattern, falling to its lowest during the first quarter and dipping again in the fall (Figure 2), it does not distinguish between discretionary run decisions based on consumption and impacts due to outages.

Figure 2. Seasonal Variation in Refinery Utilization (Average 2002-2009)



Source: EIA, *Petroleum Supply Monthly*

Ultimately, changes in production impact prices, so the impact of outages on production must be determined. The relationship is not simple and can only be estimated. Outages may involve a number of different units and associated refinery equipment that each affect product output differently. Even refiners analyzing their own facilities do not have a definitive production impact number but estimate the potential impact. For this report, the Energy Information Administration (EIA) uses statistical techniques based on historical data to estimate aggregate outage impacts on production (see Appendix A).

Middle distillate production (diesel, heating oil, jet fuel and kerosene) is mainly affected by outages of the crude distillation unit, while gasoline production is most strongly correlated with fluid catalytic cracking (FCC) unit outages.[2] As a result, this report focuses primarily on planned outages of crude distillation and FCC units. Outages of

[2] Ibid. Chapter 2.

alkylation units, reformers, hydrotreaters (sulfur removing units), hydrocrackers, and coking units can also affect volumes, but these units have not had the same degree of impact on gasoline and middle distillate production as FCC and crude distillation units; therefore they are not included in the estimates.

Crude distillation unit outages affect all product production, although refiners sometimes can use intermediate feedstocks to keep some downstream units, e.g., the FCC units, functioning. Conversely, if an FCC unit is offline, a refinery may not be able to store or move its FCC-unit feedstock to another refinery; as a consequence, the crude oil distillation unit may need to run at lower rates to slow production of this feedstock.

The remainder of this report reviews the projected October 2010 through January 2011 outage situation. Chapter 2 begins with a review of the current market situation to provide the underlying market conditions in which the outages are occurring. Chapter 3 looks at projected outages and compares them with historical outages for that time of year. Very large deviations from typical levels are noted for each Petroleum Administration for Defense District or PADD. Chapter 4 compares the ability of capacity remaining after outages to EIA's *Short Term Energy Outlook* (*STEO*) forecast. Maximum potential inputs to available capacity are compared to *STEO* capacity inputs forecast to meet projected demand. Chapter 5 uses an EIA model to estimate the potential gasoline and middle distillate volumes (diesel, heating oil, jet fuel and kerosene) that could be produced from available refinery capacity net of outages. Chapter 6 ends the report with a concluding summary of the impacts of outages on the market.

2. Recent Market Conditions and Outlook

The impact refinery outages may have on product prices depends both on the magnitude of the affected product output and on the market conditions in which the outages occur. For example, if consumption is low relative to available supply, even larger-than-normal refinery outages may not have much impact on prices.

Table 1 shows petroleum consumption in the United States bottoming out in 2009 at more than 1.9 million barrels per day less than in 2007. While 2010 is expected to close with higher consumption than in 2009, petroleum consumed is still projected to be almost 1.8 million barrels per day less than it was in 2007.

Table 1. U.S. Consumption

	Consumption (Million Barrels Per Day)			Projected Consumption	Growth
	2007	2008	2009	2010	2009-2010
Gasoline	9.29	8.99	9.00	9.03	0.3%
Distillate and Jet Fuel	5.82	5.49	5.02	5.10	1.6%
Total Petroleum Consumption	20.68	19.50	18.77	18.93	0.9%

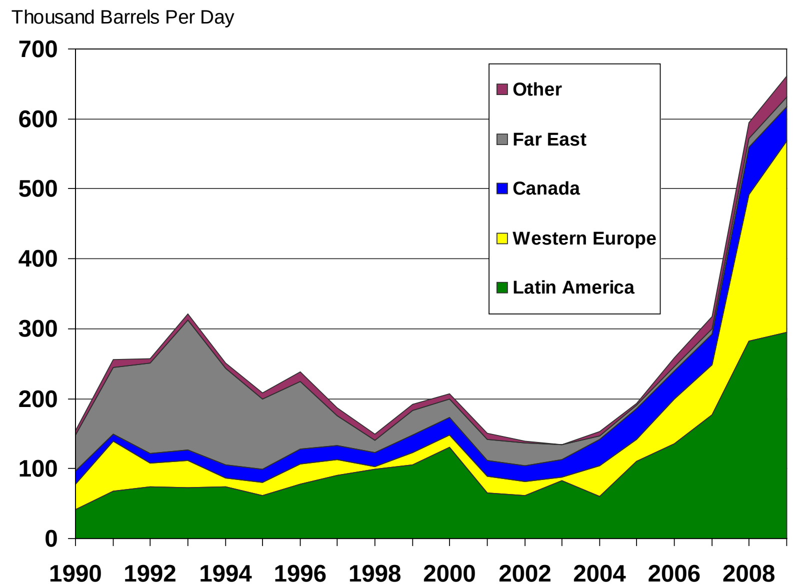
Note: Gasoline consumption includes ethanol.
Source: EIA September 2010 *Short Term Energy Outlook*

Middle distillates consumption fell much more than gasoline, dropping 0.8 million barrels per day (14 percent), as the falling economy affected heavy duty trucking consumption and air travel. In 2010, middle distillate fuel use has been climbing, and distillate and jet fuel combined are expected to grow 1.6%.

Gasoline consumption is more sensitive to changes in personal income, which fared relatively better than overall economic activity during the downturn. Gasoline consumption fell 0.3 million barrels per day (3 percent) from 2007 to 2009, and it is expected to grow only 0.03 million barrels per day (0.3 percent) in 2010.

On the supply side, U.S. refiners have been cushioned somewhat from the recession-related consumption decline by increased exports of middle distillate fuels and falling gasoline imports. Most gasoline imports come into PADD 1, while most middle distillate exports leave from PADD 3. With distillate margins rising in international markets in 2008, the United States became a net exporter of middle distillate products that year. Exports increased almost 300,000 barrels per day over 2007 (Figure 3). Although international distillate margins fell in 2009 from 2008 levels, U.S. distillate exports increased again-- by about 60,000 barrels per day--as refiners looked for product outlets. Through July 2010, distillate exports fell slightly from the export volumes seen over the same 7 months in 2009, as did distillate imports. Both declined by about 15,000 barrels per day, continuing to support refinery runs at levels higher than they would have been in response to U.S. consumption alone.

Figure 3. Annual Middle Distillate Exports



Source: EIA Petroleum Supply Monthly

Gasoline imports declined 19 percent (over 220,000 barrels per day) from 2007 to 2009, compared to the U.S. consumption decline of 3 percent. In 2010, total gasoline imports have continued to decline, and U.S. refiners found some increased export opportunities. Gasoline exports through July 2010 averaged about 100,000 barrels per day more than in 2009.

Even with the export opportunities and the decline in gasoline imports, refinery runs have been relatively low. Through August of 2010, gross inputs to refineries were still 1.8 percent lower than for the comparable period in 2007, even though they were almost 3 percent higher than last year over the same time period.

Weak demand and low profitability since 2008 have resulted in a number of companies shutting or idling refinery capacity. Table 2 summarizes major refinery capacity changes during the past few years. While about 500,000 barrels per day of capacity has closed, the startup of Marathon's Garyville expansion countered some of that loss. If the market situation improves, some of the capacity listed in Table 2 may return, such as the Delaware City refinery which was purchased from Valero by PBF Energy.

Table 2. Recent and Planned Refinery Closures and Capacity Shutdowns					
Company	Refinery	State	Type of Change	Date of Change	Capacity Change (KB/D)
Flying J /Alon	Big West, Bakersfield	CA	Purchased in 2nd Quarter by Alon; might restart only as intermediate processing facility	Idled Jan 2009	-66
Valero / PBF Energy	Delaware City	DE	Purchased in 2nd Quarter 2010 by PBF Energy	Idled Nov 20, 2009; restart mid 2011	-182 until restart
Sunoco	Eagle Point	NJ	Idled indefinitely	Oct 6, 2009	-145
			Permanently closed	Feb 1, 2010	N/A
Holly	Tulsa	OK	Combined 2 refineries	Jun 1, 2009	0
			Planned integration	3rd Quarter 2010	-30
Western	Gallup & Bloomfield	NM	Integrated 2 refineries	Nov 9, 2009	-17
Marathon	Garyville	LA	Expansion	Jan, 2010	180
Western	Yorktown	VA	Idled indefinitely	Aug 2010	-70
Sources: Various news releases and information on company websites.					

PADDs 1 and 2 and some northern areas of PADD 4 are experiencing tighter than usual supply-demand balances. PADD 1 is affected by factors on both sides of the Atlantic. The middle distillate market remains well supplied, with inventories at the high end of the typical range for this time of year (Figure 4), but PADD 1's gasoline market is under pressure from a tight import market as well as from domestic refinery outages, which will be discussed in later chapters. PADD 1 relies on gasoline imports more than on distillate imports. Gasoline imports to the East Coast are affected by Canadian refinery maintenance at Irving's 300,000-barrel-per-day New Brunswick facility, and by the French strikes that began in September. The French strikes cut off some crude supplies into Europe and resulted in a temporary shutdown of a number of European refineries. Europe is a major source of gasoline to the U.S. East Coast, and current PADD 1 stock levels of gasoline have declined since early September from well above typical ranges to more normal levels. (Figure 5) By the end of October, the strikes were beginning to end, but inventories will have to be rebuilt, keeping some pressure in the market even after facilities reopen.

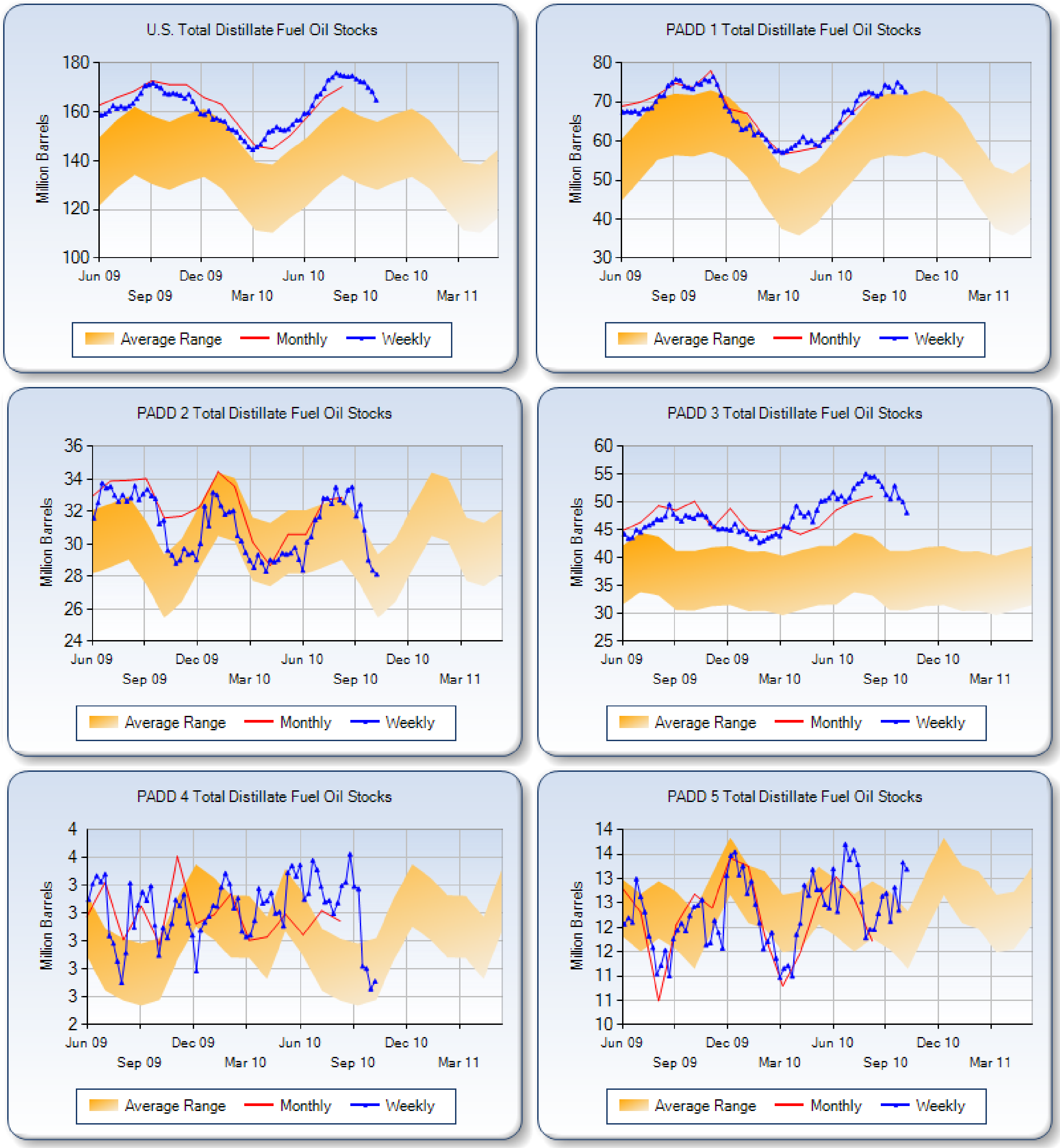
In response to the PADD 1 supply situation, gasoline spot prices in New York Harbor are showing more market pressure than on the Gulf Coast. Typically New York Harbor conventional gasoline prices would be 2 to 4 cents per gallon higher than Gulf Coast. By mid October, the spread was varying around 9 to 12 cents per gallon, indicating modest price pressure on East Coast gasoline of about 5 to 10 cents per gallon.

While the PADD 1 supply-demand balance has tightened, Irving and PADD 1 refineries should be returning to operation in early to mid- November, largely relieving the supply-demand balance, even if the French strike market impacts continue for some time.

Gasoline supplies in PADD 2 remain ample, but certain areas in the Midwest and northern areas of PADD 4 are experiencing tight distillate markets, with some terminals temporarily running out of product. Areas in the upper Midwest and upper PADD 4 regions have few alternative supplies. Unplanned outages on top of planned outages have added to tightness in this part of the country, which is discussed further in Chapter 4. The terminal outages of which EIA is aware, while indicative of local price pressure, should be easing by the time this report is published, barring additional unexpected supply disruptions.

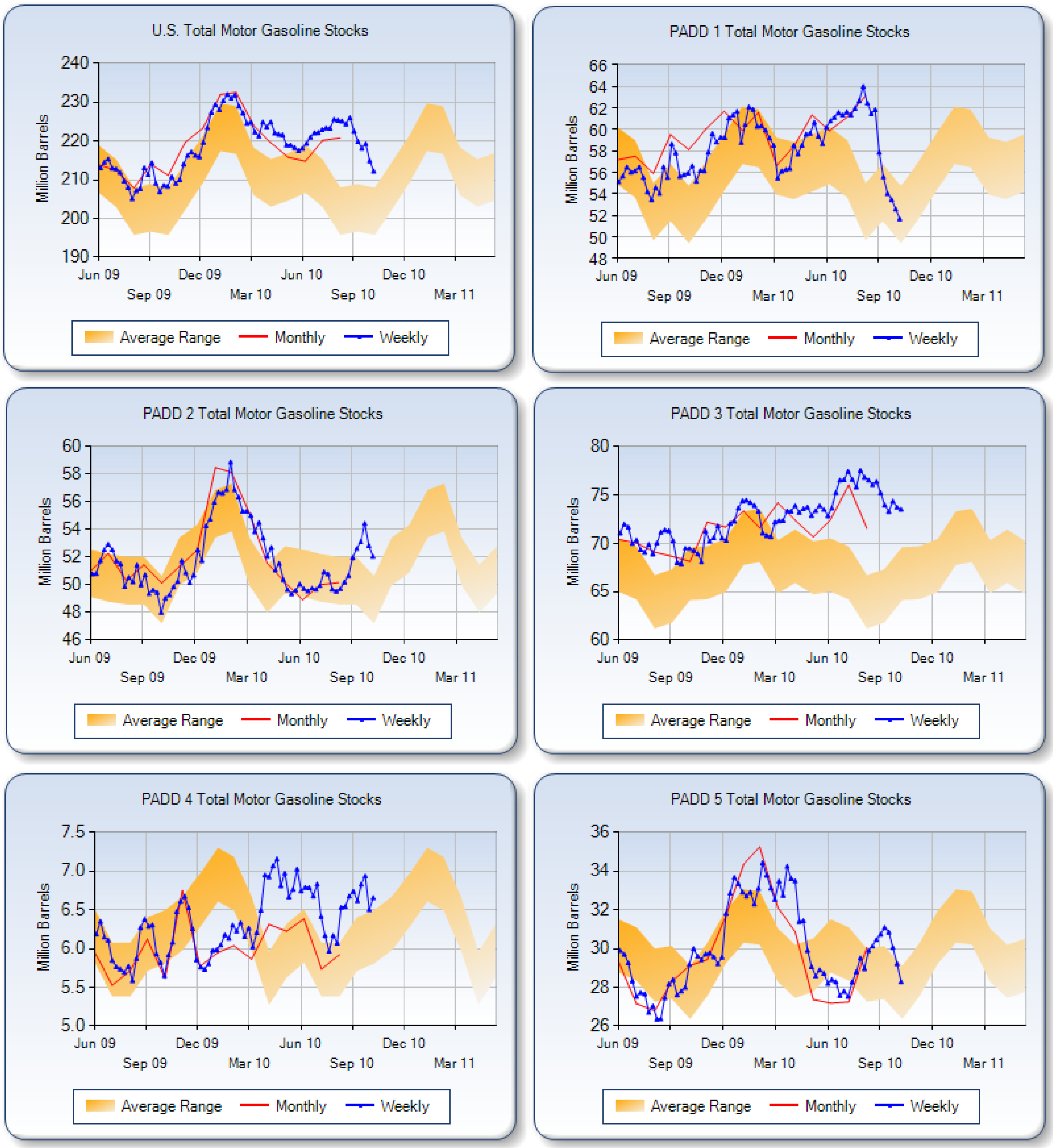
In summary, most of the United States should not see product prices affected much by refinery outages, as a result of low demand, high inventories, and adequate capacity. However, PADD 1 and some areas of PADDs 2 and 4 are experiencing tightening markets as a result of local large refinery outages and a tightening gasoline import market stemming from a turnaround at Canada's Irving refinery on top of strikes in Europe. Domestic refineries in PADDs 1 and 2 and the Irving refinery are expecting to be finished with maintenance in early to mid-November, which should help to ease markets in PADDs 1 and 2.

Figure 4 Distillate Inventories Week Ending October 29



Source: EIA ***Weekly Petroleum Status Report***

Figure 5 Gasoline Inventories Week Ending October 29



Source: EIA *Weekly Petroleum Status Report*

3. Capacity Outage Review

This chapter looks at projected outages for October 2010 through January 2011 and compares them with historical outage patterns. The chapter describes past planned and unplanned outages for both crude distillation units and FCC units, which are the units that have the most impact on distillate and gasoline production respectively. For the second half of 2010, moderate consumption of liquid fuels should diminish the potential for outage-related price impacts in the second half of 2010, even with consideration of the recent Enbridge pipeline disruptions of crude deliveries in some parts of PADD 2 (Chicago / Michigan / Ohio vicinity) and the closure of the PADD 1 Yorktown refinery.

Section 3.1 describes the data used in this report. Sections 3.2, 3.3, and 3.4 address outages at the U.S. level, outages in each PADD, and other outages of special interest. Over the October 2010 through January 2011 period, the most significant areas of concern for planned outages are in the October-November timeframe in PADDs 1 and 2. The low level of outages in PADD 3 should help to balance supply. However, in January 2011, PADDs 3 and 5 will experience above-average crude outages.

3.1 Data

EIA does not collect outage data directly.[3] However, commercial data are available with enough detail to analyze potential impacts of planned outages on supply and thus on price. The main commercial data source used in this report is a database assembled by Industrial Info Resources (IIR), a firm that provides market intelligence in a range of areas including planned and unplanned refinery outages. Because outages are likely to be the primary cause of any substantial drops in inputs to refinery units, EIA compares total planned and unplanned IIR outages to the unit input data collected on Form EIA-810 (Monthly Refinery Report). In addition to IIR planned outage data, EIA gathers planned outage information from trade press and other public sources to compare with IIR's information.

3.2 United States Outages

3.2.1 Crude Distillation Unit Outages

While crude distillation unit outages impact production of all products, these outages have a particularly strong correlation with distillate production.

Planned Crude Distillation Unit Outages

The quarterly crude unit outages shown in Figure 6 indicate that, for the United States in total, planned outages for the first and second quarters in 2010 were above average. In the second half of 2010, planned outages are estimated to be slightly above typical levels. Figure 7 shows planned U.S. outages by month, since quarterly averages can mask potential high-outage months that could impact prices. U.S. outages were above average for each of the first 6 months of 2010. In the second half of 2010, the months of

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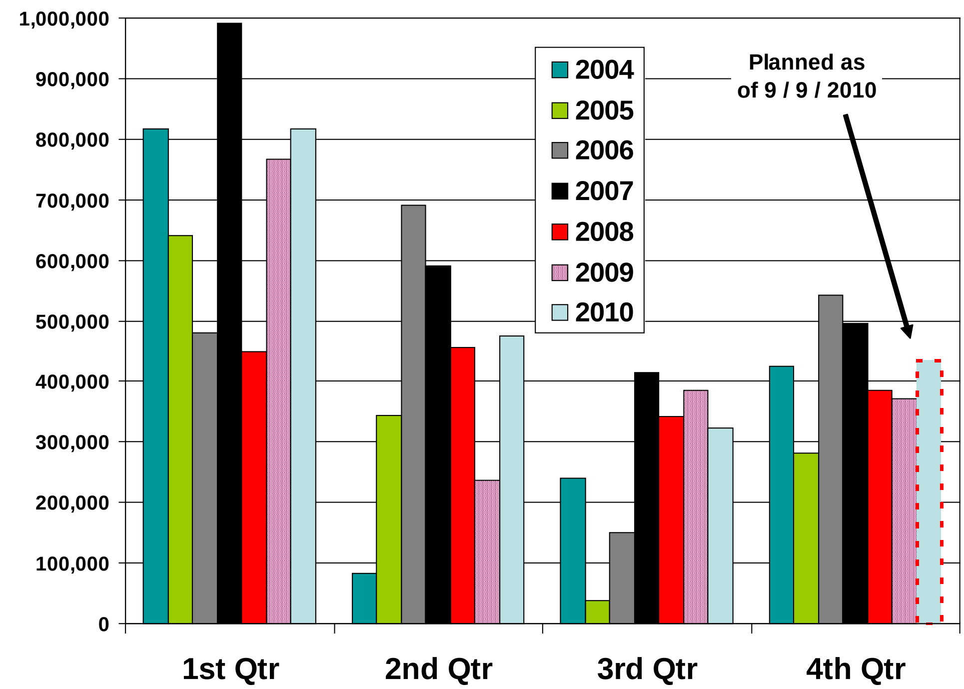
[3] EIA is proposing to collect refinery outage data, as outlined in an informational Federal Register Notice, 74 FR 69334, and Thursday, December 31, 2009.

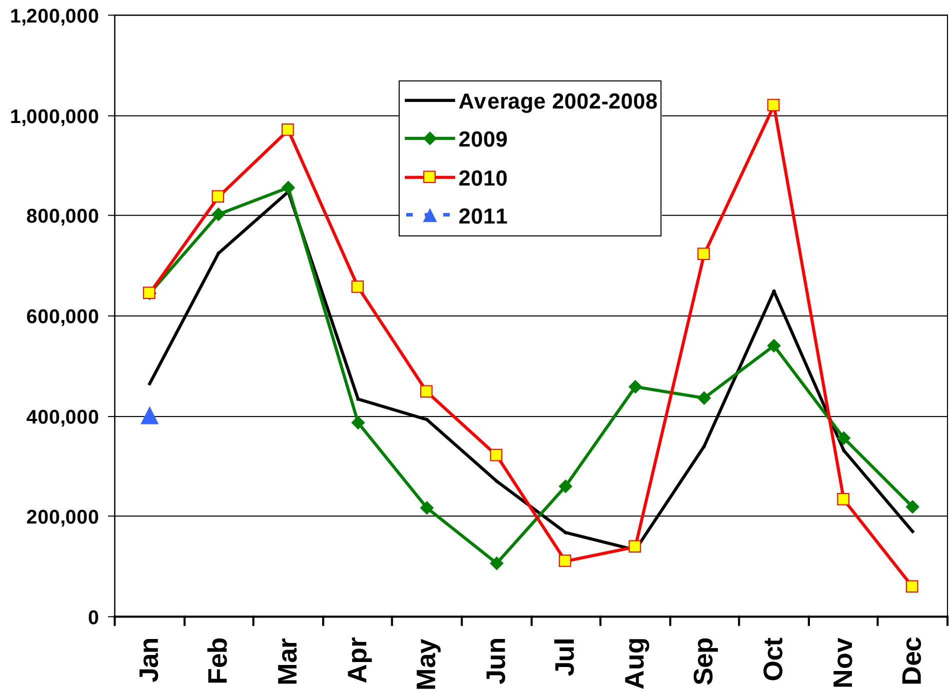
September and October are forecast to be significantly higher than average, with November and December below average. January 2011 is currently projected to be lower than average for that time of year.

Figure 6. Quarterly U.S. Planned Crude Distillation Unit Outages, 2004-2010 (Barrels per Stream Day)



Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes PADD 1 and PADD 5 asphalt refineries.

Figure 7. Monthly U.S. Planned Crude Distillation Unit Outages
(Barrels per Stream Day)



Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes PADD 1 and PADD 5 asphalt refineries.

Unplanned Crude Distillation Unit Outages

In addition to planned outages, unplanned outages also occur. While unplanned outages are often of short duration (e.g., a shutdown caused by loss of electricity), they can continue over longer periods if significant equipment damage occurs or severe weather keeps staff from returning a refinery to operation.

Unplanned outage estimates are based on average historical unplanned outages since 2002, excluding the 2005, 2006, and 2008 hurricane impacts. Historical unplanned outages for January through June averaged about 260,000 barrels per day, but actual unplanned outages during the first half of 2010 averaged almost 350,000 barrels per day, or almost 100,000 barrels per day over the historical average. As high stock levels during 2009 and 2010 have illustrated, these deviations from historical unplanned outage levels have not reduced supply relative to consumption, and thus unplanned outages should not have had an unusual impact on product prices when compared to impacts of crude oil price fluctuations on product prices in the first half of 2010.

Total Planned and Unplanned Crude Distillation Unit Outage Assessment

Actual total U.S. crude distillation unit refinery outages for November 2009 through August 2010 and expected outages for September 2010 through January 2011 are summarized in Table 3. Total expected outage levels for September 2010 through January 2011 represent planned outages plus typical unplanned outages.

As shown in Table 3, total outages for the United States were consistently above average in the first half of 2010; as noted above. The crude unit outage projection for second half of 2010 is above average in September and October and then below average for November through January 2011. However, as detailed in Section 3.3, individual PADDs may have crude distillation outage levels which deviate above or below their average levels.

Table 3. U.S. Crude Distillation Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	355,534	159,600	515,134	510,000
December 2009 Actual	218,967	286,936	505,903	380,000
January 2010 Actual	644,129	351,524	995,653	700,000
February Actual	837,471	455,160	1,292,631	1,000,000
March Actual	971,454	422,274	1,393,728	1,100,000
April Actual	656,701	143,066	799,767	730,000
May Actual	449,006	287,550	736,556	610,000
June Actual	321,500	359,800	681,300	430,000
July Actual	109,968	160,936	270,904	460,000
August Actual	139,855	245,548	385,403	400,000
September	722,600	300,000	1,022,600	640,000
October	1,020,736	260,000	1,280,736	890,000
November	232,566	150,000	382,566	490,000
December	59,032	200,000	259,032	380,000
January 2011	401,838	220,000	621,838	700,000

Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes & refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts & refinery closures. Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes PADD 1 and PADD 5 asphalt refineries.

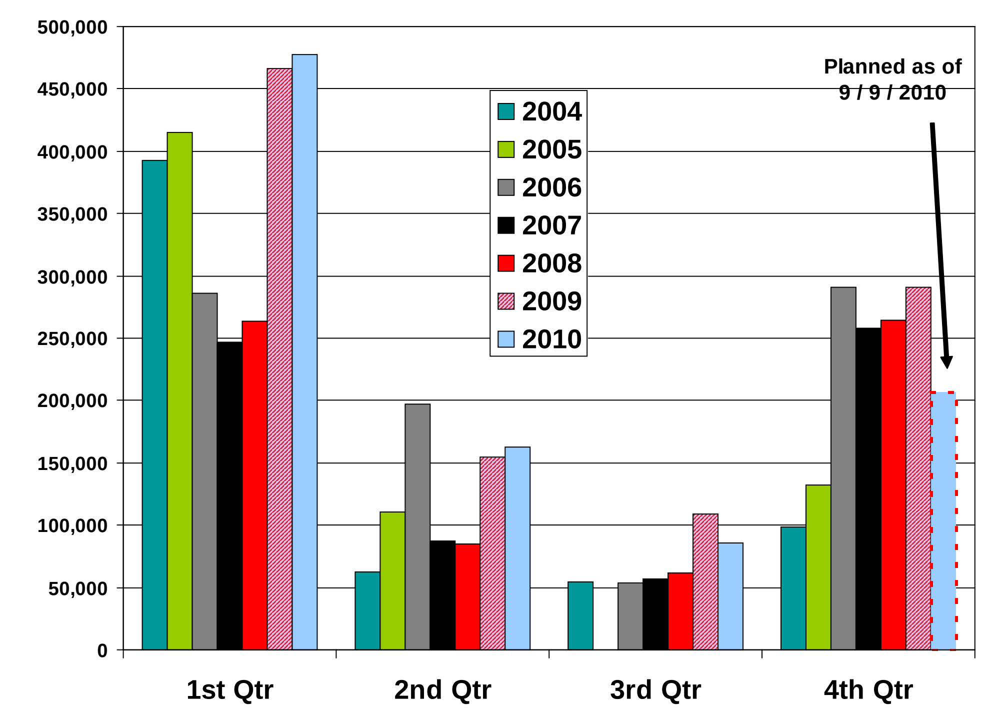
3.2.2 FCC Outages

FCC unit outages usually have a significant impact on gasoline production, although they can affect crude throughput as well. The large volume of material that goes from the crude unit to the FCC unit may require more storage than is available while an FCC unit is down. If a refinery does not have a means of moving that FCC feed volume to another facility, the refinery may have to reduce its crude runs to reduce the generation of FCC feedstock. Also, in periods when consumption is low and margins are weak, refiners may reduce refinery inputs when there is a planned or unplanned outage on a key downstream unit such as the FCC unit.

Planned FCC Unit Outages

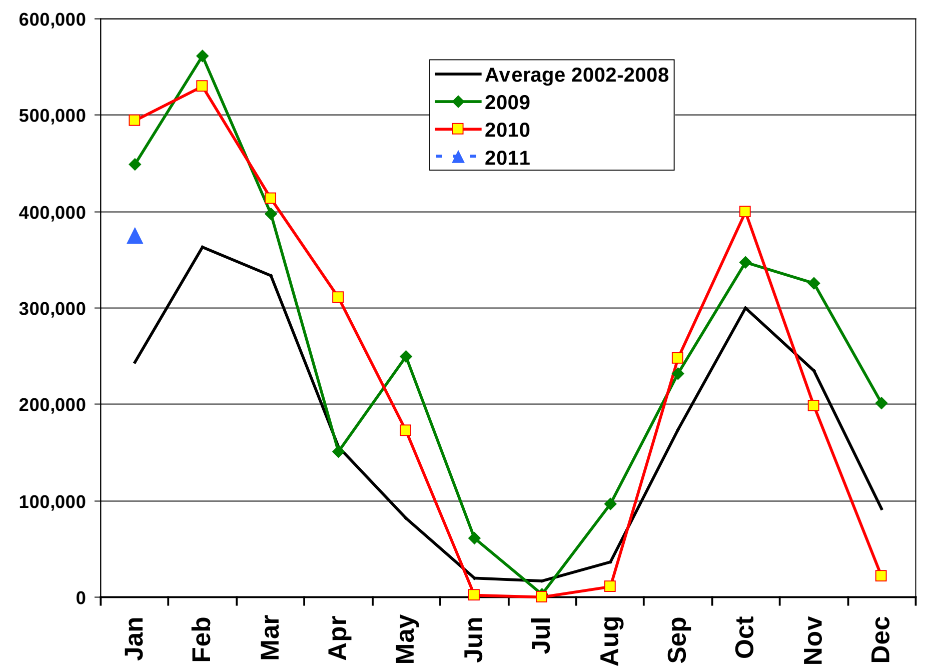
Total U.S. FCC planned outages follow a pattern similar to crude distillation unit outages. The quarterly FCC unit outages shown in Figure 8 indicate that, planned outages for the first and second quarters of 2010 were above average. In the second half of 2010, planned outages are slightly above typical levels. Figure 9 shows planned U.S. outages by month, since quarterly averages can mask potential high-outage months that could impact prices. U.S. outages for FCC units were above average for each of the first 5 months of 2010. In the second half of 2010, the months of September and October are forecast to be significantly higher than average, with November and December below average. While January 2011 is projected to have higher FCC outages than average, they are projected at lower volumes than seen in 2009 or 2010.

Figure 8. Quarterly U.S. Planned Fluid Catalytic Cracking Unit Outages, 2004-2010 (Barrels per Stream Day)



Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes PADD 1 and PADD 5 asphalt refineries.

Figure 9. Monthly U.S. Planned FCC Unit Outages, 2002-2010 (Barrels per Stream Day)



Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes PADD 1 and PADD 5 asphalt refineries.

Unplanned FCC Unit Outages

For the first half of 2010, unplanned outages were slightly below average.

Total Planned and Unplanned FCC Unit Outage Assessment

Table 4 summarizes both planned and unplanned U.S. outages by month. Total FCC outage levels were above average in the first and second quarters of 2010, a situation which continues in the second half of 2010. As discussed in Section 3.3, individual PADDs have FCC outage levels which deviate above or below their typical levels.

Table 4. U.S. FCC Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
Nov 2009 Actual	325,721	41,797	367,518	320,000
December Actual	201,210	71,355	272,565	210,000
January 2010 Actual	494,534	97,581	592,115	390,000
February Actual	530,424	9,536	539,960	520,000
March Actual	413,347	19,532	432,879	470,000
April Actual	311,333	60,666	371,998	320,000
May Actual	172,952	135,549	308,501	210,000
June Actual	2,167	141,200	143,367	160,000
July Actual	-	81,225	81,225	150,000
August Actual	11,226	171,097	182,323	190,000
September	247,680	130,000	377,680	310,000
October	399,630	110,000	509,630	420,000
November	198,449	76,000	274,449	320,000
December	22,162	100,000	122,162	210,000
January 2011	374,741	120,000	494,741	390,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes & refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts & refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

3.3 Regional Outages of Interest for Potential Price Impacts

3.3.1 PADD 1 Outages

Outages in PADD 1 during 2010 do not include the now-closed or idled Yorktown, Delaware City, and Eagle Point refineries. Historical averages are also calculated without these refinery histories. Implications of the capacity lost from the closed refineries are covered in Chapter 4.

As shown in Table 5, PADD 1 had some large planned crude unit outages in March 2010, but outages in surrounding months were below average through May. Then a mixture of planned and unplanned outages caused significantly above-average outages in June, August and September. After large scheduled outages in October 2010, no outages are planned for November through January 2011.

Table 6 shows that after a high level of PADD 1 FCC outages in March 2010, FCC outages remained and are projected to remain near average levels through early January 2011.

Table 5. PADD 1 Crude Distillation Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	-	-	-	52,000
December Actual	-	4,766	4,766	680
January 2010 Actual	-	-	-	3,200
February Actual	23,571	21,107	44,679	25,000
March Actual	143,794	-	143,794	56,000
April Actual	9,333	-	9,333	62,000
May Actual	10,323	-	10,323	50,000
June Actual	33,000	-	33,000	9,700
July Actual	-	-	0	20,000
August Actual	-	31,613	31,613	11,000
September	153,333	1,100	154,433	25,000
October	185,484	15,000	200,484	54,000
November	-	-	-	24,000
December	-	680	680	680
January 2011	-	3,200	3,200	3,200

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes and refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts and refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes asphalt refineries.

Table 6. PADD 1 FCC Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	47,167	-	47,167	23,000
December Actual	19,516	-	19,516	12,000
January 2010 Actual	77,419	57,097	134,516	12,000
February Actual	11,250	-	11,250	27,000
March Actual	105,000	-	105,000	68,000
April Actual	58,167	5,667	63,833	42,000
May Actual	39,839	-	39,839	30,000
June Actual	-	-	-	10,000
July Actual	-	12,903	12,903	6,000
August Actual	-	9,484	9,484	29,000
September	-	8,800	8,800	40,000
October	19,645	5,000	24,645	20,000
November	700	1,800	2,500	19,000
December	-	10,000	10,000	13,000
January 2011	-	12,000	12,000	12,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes and refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts and refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

3.3.2 PADD 2 Outages

Table 7 shows that after a high level of planned outages in March through May 2010, PADD 2 crude distillation unit outages are projected to be slightly above average in October and then below average through early 2011.

As shown in Table 8, PADD 2 FCC units had a high level of outages in April 2010 but typical outage levels for the first half of 2010 as a whole. After low outage activity in the summer, FCC planned outage levels are expected to be very high for September through November, then below average in December and January 2011. This period of planned FCC outages is at the highest level since a similarly high level of planned outages in September to November 2007, when consumption was higher.

Table 7. PADD 2 Crude Distillation Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	143,667	27,667	171,334	99,000
December Actual	-	42,097	42,097	72,000
January 2010 Actual	-	18,387	18,387	72,000
February Actual	19,929	23,750	43,679	120,000
March Actual	431,887	15,000	446,887	350,000
April Actual	466,834	17,833	484,667	180,000
May Actual	143,693	-	143,693	110,000
June Actual	75,000	-	75,000	54,000
July Actual	-	1,129	1,129	120,000
August Actual	-	19,742	19,742	80,000
September	43,667	44,000	87,667	160,000
October	253,516	28,000	281,516	240,000
November	64,233	9,300	73,533	99,000
December	-	13,000	13,000	72,000
January 2011	-	46,000	46,000	72,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes and refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts and refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table 8. PADD 2 FCC Unit Outages (Barrels Per Stream Day)				
Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	44,587	-	44,587	59,000
December Actual	-	15,290	15,290	45,000
January 2010 Actual	-	5,419	5,419	24,000
February Actual	5,143	5,250	10,393	50,000
March Actual	89,129	-	89,129	100,000
April Actual	104,133	19,566	123,699	52,000
May Actual	32,226	3,033	35,259	49,000
June Actual	-	5,033	5,033	17,000
July Actual	-	6,032	6,032	32,000
August Actual	-	30,581	30,581	45,000
September	102,680	11,000	113,680	77,000
October	244,968	3,800	248,768	100,000
November	163,416	7,300	170,716	59,000
December	14,710	18,000	32,710	45,000
January 2011	-	12,000	12,000	24,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes & refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts & refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

3.3.3 PADD 3 Outages

As shown in Table 9, after experiencing above-average first quarter and below-average second quarter outage levels, PADD 3 crude distillation units have a high level of planned outages (about twice the average) in September and October, followed by about average expected outage levels in the November through January 2011 period.

Table 9. PADD 3 Crude Distillation Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	145,200	41,700	186,900	290,000
December 2009 Actual	193,161	100,974	294,135	250,000
January 2010 Actual	516,387	233,432	749,819	520,000
February Actual	707,464	321,500	1,028,964	670,000
March Actual	302,999	312,258	615,257	520,000
April Actual	138,000	10,333	148,333	350,000
May Actual	136,661	84,017	220,678	320,000
June Actual	171,167	144,250	315,417	300,000
July Actual	55,000	45,097	100,097	260,000
August Actual	100,210	28,903	129,113	250,000
September	486,967	230,000	716,967	380,000
October	522,655	190,000	712,655	460,000
November	168,333	130,000	298,333	290,000
December	55,000	160,000	215,000	250,000
January 2011	252,032	150,000	402,032	520,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes and refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts and refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

For PADD 3 FCC outages, Table 10 shows that after average outage levels in the first and second quarters of 2010, below-average outage levels are planned for the third and fourth quarters. However, well-above-average outage levels are planned for January 2011.

Table 10 PADD 3 FCC Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	188,967	41,067	230,034	180,000
December 2009 Actual	75,081	38,452	113,533	100,000
January 2010 Actual	296,696	18,258	314,954	260,000
February Actual	412,745	4,286	417,031	340,000
March Actual	97,057	9,032	106,089	220,000
April Actual	32,500	21,733	54,233	190,000
May Actual	30,403	9,032	39,435	120,000
June Actual	-	32,033	32,033	120,000
July Actual	-	19,516	19,516	110,000
August Actual	7,742	83,613	91,355	110,000
September	120,000	94,000	214,000	170,000
October	50,323	95,000	145,323	260,000
November	-	61,000	61,000	180,000
December	-	57,000	57,000	100,000
January 2011	297,741	86,000	383,741	260,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes & refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts & refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

3.3.4 PADD 5 Outages

PADD 5 crude distillation units experienced average outage levels in first and second quarters of 2010 but, as shown in Table 11, unplanned outage levels were above average for the second and third quarters. Currently, planned outages are at average levels for the third and fourth quarters 2010, but a well-above-average outage level is projected for January 2011.

Table 11. PADD 5 Crude Distillation Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	66,667	80,000	146,667	66,000
December Actual	25,806	80,000	105,806	37,000
January 2010 Actual	127,742	80,000	207,742	100,000
February Actual	79,257	80,000	159,257	220,000
March Actual	4,613	89,532	94,145	160,000
April Actual	5,334	112,400	117,734	95,000
May Actual	126,613	200,710	327,323	100,000
June Actual	28,000	188,000	216,000	55,000
July Actual	45,968	108,000	153,968	54,000
August Actual	30,645	125,032	155,677	54,000
September	27,300	108,000	135,300	62,000
October	20,129	24,000	44,129	120,000
November	-	13,000	13,000	66,000
December	-	21,000	21,000	37,000
January 2011	149,806	12,000	161,806	100,000

Note: Unplanned-outage values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes & refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts & refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database; excludes asphalt refineries.

As shown in Table 12, PADD 5 FCC planned outages were at average levels in the first quarter of 2010, but planned and unplanned outages combined to be well above average in the second quarter. After a high level of planned outages (about 3 times average) in October, outage levels are expected to be below average in November and December, and about average in January 2011.

Table 12. PADD 5 FCC Unit Outages (Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Planned	Estimated Unplanned	Estimated Total Outage Level	Typical Historical Total Outage Level
November 2009 Actual	45,000	-	45,000	58,000
December Actual	106,613	-	106,613	37,000
January 2010 Actual	120,419	9,355	129,774	96,000
February Actual	101,286	-	101,286	100,000
March Actual	112,096	10,500	122,596	66,000
April Actual	100,000	12,600	112,600	17,000
May Actual	41,935	123,484	165,419	5,900
June Actual	-	100,467	100,467	18,000
July Actual	-	42,000	42,000	12,000
August Actual	-	42,000	42,000	8,800
September	25,000	42,000	67,000	13,000
October	80,968	7,500	88,468	32,000
November	21,333	5,700	27,033	56,000
December	7,452	13,000	20,452	45,000
January 2011	77,000	14,000	91,000	96,000

Note: Unplanned-average values for September through January 2011 are historical average values for 2002-2009 excluding months in 2005, 2006, and 2008 affected by hurricanes and refinery closures. Similarly, typical historical values are average planned outages 2002-2009 plus average unplanned outages 2002-2009 excluding 2005, 2006 and 2008 hurricane impacts and refinery closures.
Source: Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

3.4 Other Outages

Because PADD 4 includes sparsely populated areas, some of which are served by only one refinery, outages can create temporary price increases. Planned crude distillation unit outages are projected at average levels in second half of 2010, but of some note is that, in the first half of 2010, these refineries had higher than average levels of unplanned crude outages. During this same period, FCC planned and unplanned outage levels were about average. For fourth quarter 2010 and January 2011, planned FCC outages are forecast to be slightly below average levels. However, refineries supplying areas in northern PADD 4 are undergoing some moderate-level crude unit shutdowns in October 2010. After that, very low levels of outages are planned for November through January 2011.

EIA has also reviewed the planned outages that affect the northern areas of PADD 2 and PADD 4, which sometimes experience supply problems as a result of limited supply alternatives. The primary refineries supplying the Magellan Pipeline, which moves product from the Gulf Coast and lower Midwest into the upper Midwest, planned significant crude and FCC outages (one-sixth of total system distillation and FCC capacity) in October 2010. After that month, November 2010 through January 2011 are forecast to have average levels of outages.

During the third quarter 2010, the Enbridge Pipeline system had several major pipeline leaks and extended outages of their Line 6A and Line 6B. In each instance, a number of Midwest refineries experienced reduced crude supplies. However, alternative supply sources and high inventories helped to cushion the loss. Some local areas saw price run-ups for brief periods as the market adjusted, but little impact on overall Midwest product supply was seen.

4. Adequacy of Available Capacity after Outage Considerations

This chapter compares the maximum available capacity (i.e., total capacity minus capacity lost from outages) to the projected need for capacity to meet consumption for the period October 2010 through January 2011. The *STEO* is used as the benchmark to estimate the need for refining capacity to meet consumption.

Chapter 3 indicated that, based on typical historical outage patterns, total U.S. crude distillation and FCC unit outages are projected to be at typical to above typical levels in the second half of 2010, with some months significantly above average in certain PADDs. As the fall heating season begins, these regional variations in outages are being monitored relative to supply (both current stocks and production) and consumption. PADDs 1 and 2 and some northern areas of PADD 4 are where supply is of most concern in early fall.

Specifically, PADD 1 is experiencing a high level of planned crude distillation unit outages in September and October 2010, but distillate supplies seem ample and inventories remain above typical ranges for this time of year. The gasoline market, however, is being affected both by the PADD 1 refinery outages and by tight import supplies resulting from maintenance at a large Canadian refinery and the French strikes, as discussed in Chapter 2. Current PADD 1 stock levels of gasoline have declined from well above typical ranges to more normal levels since early September. While the PADD 1 supply-demand balance has tightened, Canadian and PADD 1 refineries should be returning to operation in early November, relieving the supply-demand balance to a large degree. PADD 3 refineries should be able to supply additional product volumes to PADD 1 during this period should supplies not recover as expected.

For FCC units, PADD 2 refiners have scheduled high levels of planned outages in September through November 2010, but PADD 3 refineries have scheduled moderate levels of planned outages for crude and FCC units during this timeframe, thus potentially being able to fill in for the decline in PADD 2 capacity availability. Currently, PADD 2 gasoline stock levels are slightly above average, but distillate inventories have been dropping as this region experiences its high-demand distillate season when crops are being harvested. Certain areas in the Midwest and northern areas of PADD 4 are experiencing tight distillate markets, with some temporary terminal outages. These areas have few alternative supplies. Some unplanned outages have added to tightness in this part of the country. In addition, the refineries supplying the Magellan pipeline are undergoing a significant outage cycle that may be contributing to some local tightness, but most of this maintenance should be finished in early November. (The Magellan pipeline serves areas of PADDs 2 and 4.) The terminal outages of which EIA is aware, while indicative of local price pressure, should be easing by the time this report is published, barring additional unexpected supply disruptions.

4.1 Adequacy of U.S. Capacity

This section compares the availability of refining capacity after outages to meet *STEO*'s projections of refining operations needed to meet consumption. Looking at historical refinery crude distillation unit inputs for those refineries not experiencing outages and running at fairly high input levels, a maximum utilization factor was developed to estimate the potential or maximum crude inputs that could be achieved with available capacity, net of outages. These potential crude inputs are then compared to *STEO*'s projected crude inputs. The difference, when positive, represents surplus capability to meet forecast consumption.

FCC unit information is handled differently. The *STEO* does not forecast FCC inputs. This outage report uses a historical relationship between distillation unit inputs (which *STEO* forecasts) and FCC inputs. To provide a comparison of maximum FCC inputs after capacity is reduced for outages with that needed to meet forecast consumption, the maximum available FCC input is compared with *STEO* crude distillation unit input times the historical ratio of FCC-to-distillation unit inputs.

Table 13 compares the *STEO* forecast of refinery crude inputs needed to meet total U.S. petroleum consumption with an estimate of potential inputs that could be run in available refinery capacity after outages (i.e., total capacity minus capacity lost to outages). While Chapter 3 showed higher than average planned outages in September and October, as the last column in Table 13 shows, available crude distillation capacity exceeds that needed to meet consumption in all months. The predicted surplus input capabilities of 1.3 to 2.2 million barrels per day represent a range of 9 to 16 percent over inputs needed to meet consumption for fall 2010 and early 2011.

Table 13. U.S. Comparison of Maximum Crude Inputs from Crude Distillation Capacity Available After Outages with *STEO*-Forecast Crude Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Forecast *STEO* Crude Inputs	Operable Distillation Capacity	Estimated Total Distillation Outages	Distillation Capacity Net of Outages	Potential Crude Inputs (Net Capacity x 0.907)	Surplus: Potential Crude Inputs minus *STEO* Inputs
November 2009 Actual	13,900	18,613	515	18,098	16,415	2,515
December Actual	13,980	18,271	506	17,765	16,113	2,133
January 2010 Actual	13,670	18,464	996	17,468	15,844	2,174
February Actual	13,970	18,464	1,293	17,171	15,574	1,604
March Actual	14,300	18,464	1,394	17,070	15,483	1,183
April Actual	15,120	18,464	800	17,664	16,021	901
May Actual	15,220	18,464	737	17,727	16,079	859
June Actual	15,390	18,464	681	17,783	16,129	739
July Actual	15,470	18,464	271	18,193	16,501	1,031
August Actual	14,990	18,393	385	18,008	16,333	1,343
September	14,470	18,393	1,023	17,370	15,755	1,285
October	14,020	18,393	1,281	17,112	15,521	1,501
November	14,240	18,393	383	18,010	16,335	2,095
December	14,200	18,393	259	18,134	16,448	2,248
January 2011	13,930	18,393	622	17,771	16,118	2,188

Note: Operable Distillation Capacity reflects the refinery closures highlighted in Chapter 2. July and August crude inputs are based on weekly data through September 1. September through January 2011 data are *STEO*-forecast crude inputs. The potential crude inputs are estimated by applying a factor (0.907) that represents the average of the 10 highest utilization months from January 2002 through June 2010, where utilization was estimated as crude inputs over distillation capacity net of outages.
Sources: *September 2010 Short-Term Energy Outlook;* Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table 14 illustrates that the available FCC capacity at the U.S. level should also be able to meet the total forecast gasoline consumption. Here again, the estimated surplus input capability of 0.4 to 0.8 million barrels per day represents a range of 10 to 16 percent surplus input capability for FCC units in fall 2010 and early 2011.

Table 14. U.S. Comparison of Maximum FCC Inputs from FCC Capacity Available After Outages with Estimated *STEO*-Based FCC Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and *STEO*-Forecast Crude Inputs	Actual and Projected FCC Inputs (FCC Pct Crude = .344)	Operable FCC Capacity	Estimated Total FCC Outages	Capacity Net of Outages	Potential FCC Inputs (Net Capacity x 0.942)	Surplus: Potential Inputs minus Projected Inputs
November 2009 Actual	13,900	4,820	6,292	368	5,924	5,581	761
December Actual	13,980	4,759	6,147	273	5,874	5,534	775
January 2010 Actual	13,670	4,443	6,147	592	5,555	5,233	790
February Actual	13,970	4,621	6,147	540	5,607	5,282	661
March Actual	14,300	4,742	6,147	433	5,714	5,383	641
April Actual	15,120	5,201	6,147	372	5,775	5,440	239
May Actual	15,220	5,236	6,147	309	5,838	5,500	264
June Actual	15,390	5,294	6,147	143	6,004	5,655	361
July Actual	15,470	5,322	6,147	81	6,066	5,714	392
August Actual	14,990	5,157	6,119	182	5,937	5,592	436
September	14,470	4,978	6,119	378	5,741	5,408	431
October	14,020	4,823	6,119	510	5,609	5,284	461
November	14,240	4,899	6,119	274	5,845	5,506	607
December	14,200	4,885	6,119	122	5,997	5,649	764
January 2011	13,930	4,792	6,119	495	5,624	5,298	506

Note: Operable FCC Capacity reflects the refinery closures highlighted in Chapter 2. The FCC input volumes are estimated by multiplying crude inputs by a factor (0.344) that represents the average observed ratio between FCC and crude inputs for facilities experiencing no major outages. The potential FCC inputs are estimated by applying a factor (0.942) that represents the average observed difference between FCC input volumes and capacity in the United States for facilities experiencing no major outages and running at high input levels.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

4.2 Adequacy of Regional Capacity

While U.S. capacity in the aggregate shows adequate capacity to meet expected demand, PADD 1 and some areas in PADDs 2 and 4 have been experiencing market tightness due to refinery outages and other issues as described in the following sections.

4.2.1 Adequacy of PADD 1 Capacity

As indicated in Table 15, even with the closure of Western Refining's Yorktown, Virginia refinery, PADD 1 refineries should have adequate crude unit distillation capacity to meet forecast regional consumption. With a high level of outages planned for September and October 2010, surplus input capability to crude distillation units is only about 5 percent in PADD 1; with well-below-average outage levels in November 2010 through early 2011, surplus input capability jumps to over 20 percent.

For FCC units (Table 16), moderate consumption forecasts and below-average planned outage levels in the second half of 2010 result in estimated surplus input capability to FCC units of about 20 percent (even with consideration for the loss of Virginia's Yorktown Refinery).

Although PADD 1 middle distillate markets are well supplied, the region's gasoline markets have tightened both from PADD 1 refinery outages and from events outside the United States affecting availability of gasoline imports, as described in Chapter 2. PADD 1 relies on gasoline imports more than on distillate imports. PADD 1 stock levels of gasoline have declined since early September from well above typical ranges to more normal levels.

While the PADD 1 supply-demand balance has tightened, Irving and PADD 1 refineries should be returning to operation in early-to-mid November, relieving the supply-demand balance to a large degree. As described in Section 4.2.3, PADD 3 refineries should be able to supply additional product volumes to PADD 1 during this period in the event that supplies do not recover as expected.

Table 15. PADD 1 Comparison of Maximum Crude Inputs from Crude Distillation Capacity Available After Outages with *STEO*-Based Crude Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs (Regional = 0.076 U.S.)	Operable Distillation Capacity	Estimated Total Distillation Outages	Distillation Capacity Net of Outages	Potential Crude Inputs (Net Capacity x 0.927)	Surplus: Potential Crude Inputs minus Projected Inputs
November 2009 Actual	1,348	1,818	-	1,818	1,685	337
December Actual	1,104	1,476	5	1,471	1,364	259
January 2010 Actual	1,080	1,476	-	1,476	1,368	288
February Actual	1,104	1,476	45	1,431	1,327	223
March Actual	1,130	1,476	144	1,332	1,235	105
April Actual	1,194	1,476	9	1,467	1,360	165
May Actual	1,202	1,476	10	1,466	1,359	156
June Actual	1,216	1,476	33	1,443	1,338	122
July Actual	1,222	1,476	-	1,476	1,368	146
August Actual	1,139	1,405	32	1,373	1,273	134
September	1,100	1,405	154	1,251	1,159	60
October	1,066	1,405	200	1,205	1,117	51
November	1,082	1,405	-	1,405	1,302	220
December	1,079	1,405	1	1,404	1,302	223
January 2011	1,059	1,405	3	1,402	1,299	241

Note: Operable Distillation Capacity reflects the refinery closures highlighted in Chapter 2. July and August crude inputs are based on weekly data through September 1. September through January 2011 data are projected regional crude inputs based on the U.S. *STEO* forecast. The potential crude inputs are estimated by applying a factor (0.927) that represents the average of the 10 highest PADD 1 utilization months from January 2002 through June 2010, where utilization was estimated as crude inputs over distillation capacity net of outages.
Sources: *September 2010 Short-Term Energy Outlook;* Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table 16. PADD 1 Comparison of Maximum FCC Inputs from FCC Capacity Available After Outages with Estimated *STEO*-Based FCC Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs	Actual and Projected FCC Inputs (FCC Pct Crude = 0.421)	Operable FCC Capacity	Estimated Total FCC Outages	Capacity Net of Outages	Potential FCC Inputs (Net Capacity x 0.947)	Surplus: Potential Inputs minus Projected Inputs
November 2009 Actual	1,348	511	762	47	715	677	166
December Actual	1,104	499	617	20	597	566	67
January 2010 Actual	1,080	400	617	135	482	458	58
February Actual	1,104	512	617	11	606	575	63
March Actual	1,130	484	617	105	512	486	2
April Actual	1,194	503	617	64	553	525	22
May Actual	1,202	506	617	40	577	548	42
June Actual	1,216	512	617	-	617	586	74
July Actual	1,222	515	617	13	604	573	59
August Actual	1,139	480	589	9	580	550	70
September	1,100	463	589	9	580	551	88
October	1,066	449	589	25	564	536	87
November	1,082	456	589	3	587	557	101
December	1,079	454	589	10	579	549	95
January 2011	1,059	446	589	12	577	548	102

Note: Operable FCC Capacity reflects the refinery closures highlighted in Chapter 2. The FCC input volumes are estimated by multiplying PADD 1 crude inputs by a factor (0.421) that represents the average observed ratio between FCC and crude inputs for facilities experiencing no major outages. The potential FCC inputs are estimated by applying a factor (0.949) that represents the average observed difference between FCC input volumes and capacity in PADD 1 facilities experiencing no major outages and running at high input levels.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

4.2.2 Adequacy of PADD 2 Capacity

PADD 2 is forecast to experience a dramatic difference between planned crude distillation unit and FCC outages. For crude units (Table 17), a below-average level of planned outages in second-half 2010 results in a projected surplus input capability in the range of 8 to 15 percent (0.3 to 0.5 million barrels per day) over that needed to meet consumption. In Table 18 (for FCC units), September through November FCC planned outages are at 2 to 3 times the average level for the fall, resulting in almost no surplus FCC input capability in PADD 2 for this period. As described in Chapter 3, these outage levels assume average unplanned outages on top of planned outages. Total projected outages are at the highest level since the fall of 2007. With so little surplus input capability, large unplanned shutdowns could cause PADD 2 fuel providers to look for other supplies unexpectedly.

While PADD 2 refiners are experiencing high levels of planned FCC outages for September through November 2010, gasoline supplies remain ample. However, certain areas in the Midwest and northern areas of PADD 4 are experiencing tight distillate markets, with some temporary terminal outages. These areas have few alternative supplies. Some unplanned outages have added to tightness in this part of the country. In addition, refineries supplying the Magellan pipeline are undergoing a significant outage cycle that may be contributing to some local tightness; most of this maintenance should be finished in early November. (The Magellan pipeline serves areas of PADDs 2 and 4.) The terminal outages of which EIA is aware, while indicative of local price pressure, should be easing by the time this report is published, barring additional unexpected supply disruptions. PADD 2 distillate inventories have been falling recently from above average levels into the normal range, reflecting some of this tightness.

PADD 3 refineries have scheduled moderate levels of planned outages for crude and FCC units during this timeframe, potentially being able to fill in for the decline in PADD 2 and PADD 1 capacity availability, should maintenance schedules prove to be longer than expected.

Table 17. PADD 2 Comparison of Maximum Crude Inputs from Crude Distillation Capacity Available After Outages with *STEO*-Based Crude Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs (Regional = 0.226 U.S.)	Operable Distillation Capacity	Estimated Total Distillation Outages	Distillation Capacity Net of Outages	Potential Crude Inputs (Net Capacity x 0.932)	Surplus: Potential Crude Inputs minus Projected Inputs
November 2009 Actual	3,016	3,953	171	3,782	3,525	508
December Actual	3,146	3,953	42	3,911	3,645	499
January 2010 Actual	3,076	3,953	18	3,935	3,667	591
February Actual	3,143	3,953	44	3,909	3,643	500
March Actual	3,218	3,953	447	3,506	3,268	50
April Actual	3,402	3,953	485	3,468	3,232	(170)
May Actual	3,425	3,953	144	3,809	3,550	126
June Actual	3,463	3,953	75	3,878	3,614	152
July Actual	3,481	3,953	1	3,952	3,683	202
August Actual	3,388	3,953	20	3,933	3,666	278
September	3,270	3,953	88	3,865	3,602	332
October	3,169	3,953	282	3,671	3,422	253
November	3,218	3,953	74	3,879	3,616	397
December	3,209	3,953	13	3,940	3,672	463
January 2011	3,148	3,953	46	3,907	3,641	493

Note: July and August crude inputs are based on weekly data through September 1. September through January 2011 data are projected regional crude inputs based on the U.S. *STEO*-forecast. The potential crude inputs are estimated by applying a factor (0.932) that represents the average of the 10 highest PADD 2 utilization months from January 2002 through June 2010, where utilization was estimated as crude inputs over distillation capacity net of outages.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table 18. PADD 2 Comparison of Maximum FCC Inputs from FCC Capacity Available After Outages with Estimated *STEO*-Based FCC Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs	Actual and Projected FCC Inputs (FCC Pct Crude = 0.327)	Operable FCC Capacity	Estimated Total FCC Outages	Capacity Net of Outages	Potential FCC Inputs (Net Capacity x 0.950)	Surplus: Potential Inputs minus Projected Inputs
November 2009 Actual	3,016	990	1,296	45	1,251	1,189	199
December Actual	3,157	1,027	1,296	15	1,281	1,217	190
January 2010 Actual	3,076	996	1,296	5	1,291	1,226	230
February Actual	3,143	989	1,296	10	1,286	1,221	232
March Actual	3,218	980	1,296	89	1,207	1,147	167
April Actual	3,402	1,112	1,296	124	1,172	1,114	1
May Actual	3,425	1,120	1,296	35	1,261	1,198	78
June Actual	3,463	1,132	1,296	5	1,291	1,226	94
July Actual	3,481	1,138	1,296	6	1,290	1,225	87
August Actual	3,388	1,108	1,296	31	1,265	1,202	94
September	3,270	1,069	1,296	114	1,182	1,123	54
October	3,169	1,036	1,296	249	1,047	995	(41)
November	3,218	1,052	1,296	171	1,125	1,069	17
December	3,209	1,049	1,296	33	1,263	1,200	151
January 2011	3,148	1,029	1,296	12	1,284	1,220	190

Note: FCC input volumes are estimated by multiplying PADD 2 crude inputs by a factor (0.327) that represents the average observed ratio between FCC and crude inputs for facilities experiencing no major outages. The potential FCC inputs are estimated by applying a factor (0.950) that represents the average observed difference between FCC input volumes and capacity in PADD 2 facilities experiencing no major outages and running at high input levels.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

4.2.3 Adequacy of PADD 3 Capacity

PADD 3 crude distillation units will experience above average outage levels in September and October 2010, with surplus input capability to crude units of about 10 percent (Table 19). With planned crude outages at average levels in fourth quarter 2010 and in early 2011, surplus input capability should be greater than 15 percent (i.e., greater than 1 million barrels per day). For FCC units, average planned outage levels in fall 2010 will produce surplus input capability to FCC units in the 10- to-14-percent range (about 0.3 million barrels per day) as displayed in Table 20. However, early 2011 planned FCC outages will reduce the surplus capability to less than 3 percent (less than 0.1 million barrels/day).

Table 19. PADD 3 Comparison of Maximum Crude Inputs from Crude Distillation Capacity Available After Outages with *STEO*-Based Crude Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs (Regional = 0.501 U.S.)	Operable Distillation Capacity	Estimated Total Distillation Outages	Distillation Capacity Net of Outages	Potential Crude Inputs (Net Capacity x 0.934)	Surplus: Potential Crude Inputs minus Projected Inputs
November 2009 Actual	6,658	8,882	187	8,695	8,121	1,463
December Actual	6,962	8,882	294	8,588	8,021	1,059
January 2010 Actual	6,808	9,075	750	8,325	7,776	968
February Actual	6,957	9,075	1,029	8,046	7,515	558
March Actual	7,121	9,075	615	8,460	7,901	780
April Actual	7,530	9,075	148	8,927	8,338	808
May Actual	7,580	9,075	221	8,854	8,270	690
June Actual	7,664	9,075	315	8,760	8,181	517
July Actual	7,704	9,075	100	8,975	8,383	678
August Actual	7,510	9,075	129	8,946	8,355	845
September	7,249	9,075	717	8,358	7,806	557
October	7,024	9,075	713	8,362	7,810	786
November	7,134	9,075	298	8,777	8,197	1,063
December	7,114	9,075	215	8,860	8,275	1,161
January 2011	6,979	9,075	402	8,673	8,101	1,122

Note: July and August crude inputs are based on weekly data through September 1. September through January 2011 data are projected regional crude inputs based on the U.S. *STEO*-forecast. The potential crude inputs are estimated by applying a factor (0.934) that represents the average of the 10 highest PADD 3 utilization months from January 2002 through June 2010, where utilization was estimated as crude inputs over distillation capacity net of outages.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table 20. PADD 3 Comparison of Maximum FCC Inputs from FCC Capacity Available After Outages with Estimated *STEO*-Based FCC Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs	Actual and Projected FCC Inputs (FCC Pct Crude = 0.365)	Operable FCC Capacity	Estimated Total FCC Outages	Capacity Net of Outages	Potential FCC Inputs (Net Capacity x 0.961)	Surplus: Potential Inputs minus Projected Inputs
November 2009 Actual	6,658	2,526	3,128	230	2,898	2,785	259
December 2009 Actual	6,856	2,499	3,128	114	3,014	2,897	398
January 2010 Actual	6,808	2,322	3,128	315	2,813	2,703	381
February Actual	6,957	2,353	3,128	417	2,711	2,605	252
March Actual	7,121	2,556	3,128	106	3,022	2,904	348
April Actual	7,530	2,748	3,128	54	3,074	2,954	206
May Actual	7,580	2,767	3,128	39	3,089	2,968	202
June Actual	7,664	2,761	3,128	32	3,096	2,975	214
July Actual	7,704	2,812	3,128	20	3,108	2,987	175
August Actual	7,510	2,719	3,128	89	3,039	2,920	201
September	7,249	2,617	3,128	94	3,034	2,916	299
October	7,024	2,584	3,128	134	2,994	2,878	294
November	7,134	2,589	3,128	181	2,947	2,832	243
December	7,114	2,567	3,128	72	3,056	2,936	369
January 2011	6,979	2,564	3,128	384	2,744	2,637	73

Note: FCC input volumes are estimated by multiplying PADD 3 crude inputs by a factor (0.365) that represents the average observed ratio between FCC and crude inputs for facilities experiencing no major outages. The potential FCC inputs are estimated by applying a factor (0.961) that represents the average observed difference between FCC input volumes and capacity in PADD 3 facilities experiencing no major outages and running at high input levels.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

4.2.4 Adequacy of PADD 5 Capacity

During the first half of 2010, PADD 5 crude units experienced a much higher than average level of unplanned outages. (Table 21) This situation produced a number of second quarter months with surplus input capability to crude units in the 0 to 5 percent range. Projected planned and typical unplanned outages in Table 21 for fall 2010 and January 2011 leave PADD 5 crude-unit surplus-input capability at greater than 15 percent (about 0.4 million barrels per day). But if PADD 5 crude units continue to experience a high level of unplanned outages as seen earlier in the year, the projected excess capacity would fall. For FCC units (Table 22), although large planned outages occur in October 2010 and January 2011, the surplus input capability at FCC units is predicted to remain greater than 20 percent (greater than 0.1 million barrels per day) throughout fall and early 2011.

Table 21. PADD 5 Comparison of Maximum Crude Inputs from Crude Distillation Capacity Available After Outages with *STEO*-Based Crude Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs (Regional = 0.162 U.S.)	Operable Distillation Capacity	Estimated Total Distillation Outages	Distillation Capacity Net of Outages	Potential Crude Inputs (Net Capacity x 0.829)	Surplus: Potential Crude Inputs minus Projected Inputs
November 2009 Actual	2,377	3,300	147	3,153	2,614	237
December 2009 Actual	2,265	3,300	106	3,194	2,648	383
January 2010 Actual	2,215	3,300	208	3,092	2,563	349
February Actual	2,263	3,300	159	3,141	2,604	341
March Actual	2,317	3,300	94	3,206	2,658	341
April Actual	2,449	3,300	118	3,182	2,638	189
May Actual	2,466	3,300	327	2,973	2,464	(1)
June Actual	2,493	3,300	216	3,084	2,557	63
July Actual	2,506	3,300	154	3,146	2,608	102
August Actual	2,428	3,300	156	3,144	2,607	178
September	2,344	3,300	135	3,165	2,624	279
October	2,271	3,300	44	3,256	2,699	428
November	2,307	3,300	13	3,287	2,725	418
December	2,300	3,300	21	3,279	2,718	418
January 2011	2,257	3,300	162	3,138	2,602	345

Note: July and August crude inputs are based on weekly data through September 1. September through January 2011 data are projected regional crude inputs based on the U.S. *STEO*-forecast. Potential crude inputs are estimated by applying a factor (0.829) that represents the average of the 10 highest PADD 5 utilization months from January 2002 through June 2010, where utilization was estimated as crude inputs over distillation capacity net of outages.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

Table 22. PADD 5 Comparison of Maximum FCC Inputs from FCC Capacity Available After Outages with Estimated *STEO*-Based FCC Input Needs
(Thousand Barrels Per Stream Day)

Month (November 2009 Through January 2011)	Actual and Projected Crude Inputs	Actual and Projected FCC Inputs (FCC Pct Crude = 0.282)	Operable FCC Capacity	Estimated Total FCC Outages	Capacity Net of Outages	Potential FCC Inputs (Net Capacity x 0.946)	Surplus: Potential Inputs minus Projected Inputs
November 2009 Actual	2,377	627	904	45	859	813	186
December 2009 Actual	2,400	587	904	107	797	754	167
January 2010 Actual	2,215	576	904	130	774	732	156
February Actual	2,263	616	904	101	803	759	143
March Actual	2,317	582	904	123	781	739	157
April Actual	2,449	691	904	113	791	749	58
May Actual	2,466	695	904	165	739	699	3
June Actual	2,493	703	904	100	804	760	57
July Actual	2,506	707	904	42	862	815	109
August Actual	2,428	685	904	42	862	815	131
September	2,344	661	904	67	837	792	131
October	2,271	640	904	88	816	771	131
November	2,307	651	904	27	877	830	179
December	2,300	649	904	20	884	836	187
January 2011	2,257	636	904	91	813	769	133

Note: FCC input volumes are estimated by multiplying PADD 5 crude inputs by a factor (0.282) that represents the average observed ratio between FCC and crude inputs for facilities experiencing no major outages. The potential FCC inputs are estimated by applying a factor (0.946) that represents the average observed difference between FCC input volumes and capacity in PADD 5 facilities experiencing no major outages and running at high input levels.
Sources: *September 2010 Short-Term Energy Outlook*; Industrial Info Resource (IIR), www.iirenergy.com, September 9, 2010 database.

5. Outage Impacts on Production

Chapter 4 showed that, at the U.S. level, neither crude distillation nor FCC capacity outages should prevent refiners from meeting EIA's *STEO*-forecast refining requirements to meet consumption through June 2010. Because the mix of supply from imports, stocks, and production may vary, this chapter explores the gasoline and distillate production that available capacity (net of outages) might produce.

Unit outages have varying impacts on production, but adequate statistical relationships exist to estimate production impacts. In particular, FCC unit outages better explain gasoline production than outages of crude distillation units. Crude distillation units, on the other hand, are a better indicator of distillation production. Distillate and gasoline wholesale margins, refinery capacity utilization, and time of year also help explain some of the production variations historically and are helpful in estimating future gasoline and distillate fuel production impacts consistent with prices seen in EIA's *STEO*. Models developed to capture these relationships are summarized in Appendix A.

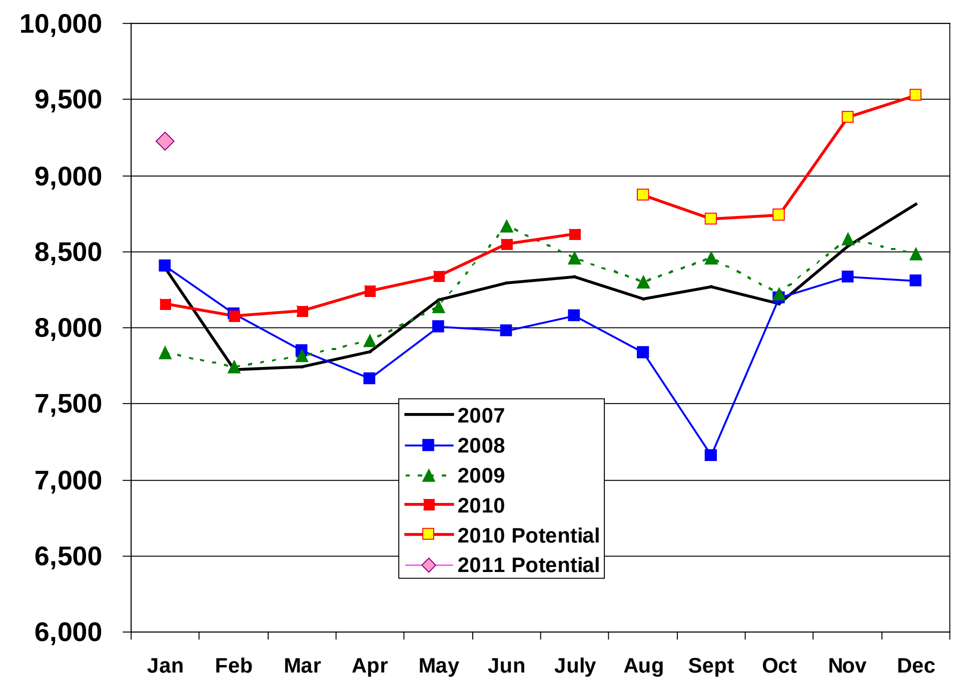
In any given region, the underlying assumption is that refiners with available capacity can increase their throughputs, and thus production, to help fill in for offline capacity. The dynamics of this process, however, are influenced by current market conditions. The price response is the signal to refiners to produce more supply. In weak markets, such as currently being experienced, refiners are unlikely to produce supply in advance of a potential supply problem. This means some price increase could occur before refiners increase production from available capacity.

As was the case in 2009, low petroleum consumption projected in 2010 means less refinery capacity is needed than before the recession-related reduction in consumption. In addition, more ethanol is being used to meet gasoline consumption than in prior years, further reducing the need for refinery capacity to produce that fuel. As a result, planned outages are not expected to create significant supply constraints.

Looking ahead to the winter heating season, Figures 10 and 11 show U.S. actual gasoline and middle distillate production from 2007 through mid-year 2010, and potential production from August 2010 through January 2011. Potential production is derived using the model in Appendix A, assuming maximum inputs of crude and unfinished oils to available capacity (net of outages).

Estimated potential middle distillate fuel production in October 2010 is about 640,000 barrels per day higher than actual production in October 2009. Potential middle distillate production for November 2010 through January 2011 is about 1 million barrels per day over last year's actual production during those months. Estimated gasoline potential production in October 2010 is only about 300,000 barrels per day over the prior year's actual October production, but, like distillate fuel, potential gasoline production in November 2010 through January 2011 is about 1 million barrels per day over the prior year's actual production during those months.

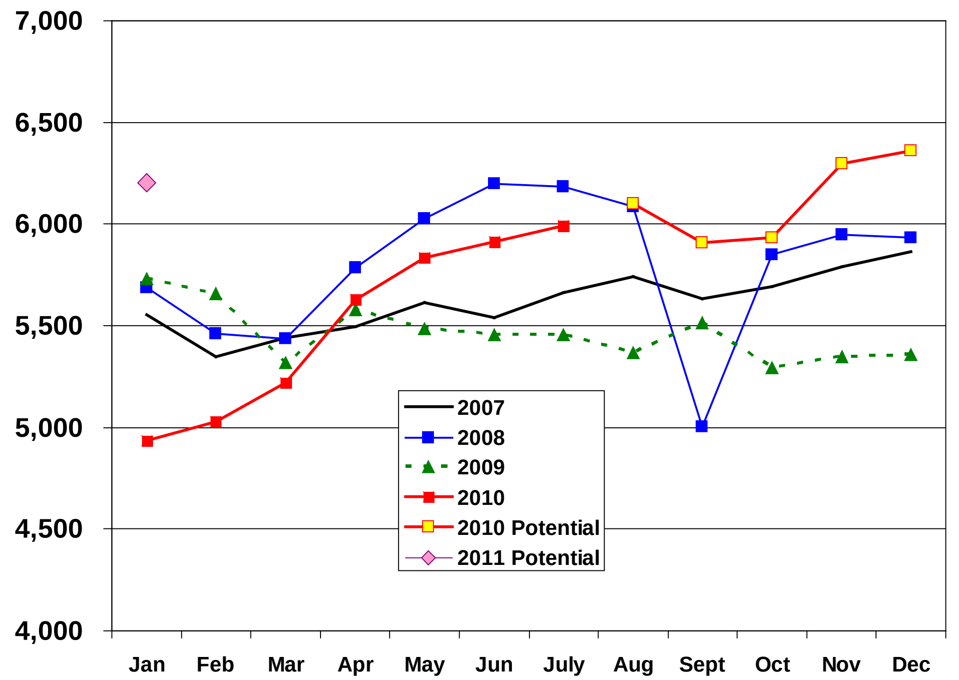
Figure 10. U.S. Monthly Gasoline Actual and Potential Production, 2007-January 2011 (Thousand Barrels per Day)



Note: Refinery gasoline production represents finished gasoline (including oxygenates added at terminals).
Sources: Actual: 2007 – July 2010, EIA Petroleum Supply Monthly. Potential: August 2010 – January 2011, EIA projections based on available capacity.

Refiners have some ability to move between gasoline and distillate, as exemplified in the 2008 when distillate production was very high and gasoline production was correspondingly low. More typical distillate-to-gasoline production ratios are expected this fall and winter. Stock levels are healthy and additional gasoline imports should be available if needed. However, the heating fuel market is concentrated in the Northeast, and if Northeast inventories are depleted during a cold snap, it takes some time to move additional product into that region from either the U.S. Gulf Coast or Europe.

Figure 11. U.S. Monthly Middle Distillate Actual and Potential Production, 2007-January 2011 (Thousand Barrels per Day)



Sources: Actual: 2007 – July 2010, EIA Petroleum Supply Monthly. Potential: August 2010 – January 2011, EIA projections based on available capacity.

6. Conclusion

At the U.S. level, after considering the outlook for planned outages, the typical level of unplanned outages, and ample U.S. inventories of distillate fuel and gasoline, current planned refinery outages do not appear to threaten suppliers' ability to meet forecast demand for petroleum products through January 2011. Even though aggregate U.S. refinery capacity after outages appears adequate this fall, PADDs 1 and 2 and some northern areas of PADD 4 are experiencing tighter than usual supply-demand balances in October. In November, these markets should relax as much of the heavy maintenance is finished and refinery operations resume.

PADD 1 has a high level of planned crude distillation unit outages in October 2010, but distillate inventories are high and the middle distillate market remains well supplied. The gasoline market in PADD 1, however, is affected by tighter import supplies than normal due to Canadian refinery maintenance and the French strikes reducing gasoline exports to world markets. With much of the U.S. and Canadian refinery maintenance scheduled for completion in early-to-mid November, and with French strikes ending in early November, PADD 1 gasoline markets should relax.

Areas of PADD 2 and the upper parts of PADD 4 have been experiencing some temporary shortages of diesel fuel at some terminals. Outages in some areas along with high diesel demand for harvesting are contributing to this problem but, as with the East Coast, refinery maintenance is scheduled to be finished in November in many cases, helping to ease the situation soon.

Stock levels for gasoline and distillate remain relatively high in most areas. In PADD 2, refinery outages are combining with harvest-season demand to draw inventories down from unusually high levels to more typical levels. Gasoline inventories in PADD 1 dropped steeply in September and early October, but also remain in the typical range.

Appendix A. Forecast Models Used to Estimate Gasoline & Distillate Production from Available Capacity

As part of the outage study, an econometric analysis was made of refinery light product yields in order to explore whether forecasting models could be created for refinery output of finished gasoline and light oil products (LOP) given easily obtained unit input variables. This would allow EIA to explore the impact of outages, which reduce unit inputs, on production. In addition, market variables were explored that would also potentially impact production. To help meet this goal, an effort was made to model LOP yield and gasoline yield as a percentage of LOP yield for the United States, the estimation results for which are shown below.

Model estimates show that the refinery yields of LOP and finished gasoline vary seasonally and that they depend on FCC inputs, with product margins having small effects. Distillate output also varies seasonally and depends mainly on distillation capacity utilization with product margins. Both models include 0 / 1 indicator variables for onetime events: d_dec02 refers to market effects the Venezuelan strike on imports, and dh_sep05 refers to hurricanes Katrina / Rita. The data used in this study came from various sources, including EIA's *Petroleum Supply Monthly* and *Petroleum Marketing Monthly*. The data used include:

- Refinery Light Oil Product production and production yields;
- Refinery gasoline production and production yield;
- Available refinery distillation capacity;
- Gasoline and distillate wholesale product margins using the same prices forecast in the EIA *Short-Term Energy Outlook,* in cents per gallon.

$$y_{L,t} = c + \beta_0 x_{G,t} + \alpha z_t + \sum_{i=1}^{11} \gamma_i m_i + \tau T + \varphi\, y_{L,t-1} + \delta_i D_i + \varepsilon_t \qquad \text{Eqn. 1.}$$

$$y_{G,t} = c' + \sum_{j=0}^{1} \beta'_j x_{G,t-j} + \beta'_2 x_{D,t} + \alpha' z_t + \sum_{i=1}^{11} \gamma'_i m_i + \tau' T + \varphi' y_{G,t-1} + \delta'_i D_i + \varepsilon'_t$$

Eqn. 2.

Where

$y_{L,t}$ refers to light oil product yield at time t;

$y_{G,t}$ refers to gasoline percent of LOP yield at time t;

$x_{G,t}$ refers to gasoline margin (cents per gallon) at time t;

$x_{D,t}$ refers to distillate margin (cents per gallon) at time t;

z_t refers to distillation capacity utilization at time t;

m_i refers to monthly 0 / 1 indicator variables, Feb, Mar, …, Dec ;

T refers to a linear time trend;

D_i refers to onetime event indicator variables;

ε_t refers to error term at time t.

c, α, β, γ, τ, δ, φ and c', α', β', γ', τ', δ', φ' are estimated parameters.

The LOP yield variable was calculated as a percent of crude oil and unfinished refinery inputs. The distillation capacity variable was calculated as total distillation capacity minus the capacity lost to outages. Gasoline production is total gasoline production less butanes, pentanes and oxygenates.

Both equations were estimated using data from January 2002 through May 2010. For the gasoline output yield model, one would expect the coefficient sign on the gasoline margin to be positive (more profit leading to higher yields), and a negative coefficient on distillate margins. The positive coefficient on the lagged dependent variable for both models indicates that the level of current yield depends on the previous month's output, the large (approximately 0.4) estimated coefficients indicating a large degree of inter-temporal inertia. The models are summarized in Tables A-1 and A-2.

The models fit historical data well, as demonstrated by the high R-square and the small regression error relative to the size of the dependent variable and providing good out-of-sample forecasts. A comparison of the goodness-of-fit to historical data can be seen in Figures A-1 and A-2.

Table A-1. Light Oil Product (LOP) Yield Model

Independent Variable: LOP Yield

Parameter	*Estimated Coefficient*	
C	48.8587	***
FEB	-0.54876	***
MAR	-1.35766	***
APR	-1.19327	***
MAY	-1.06213	***
JUN	-1.07847	***
JUL	-1.06866	***
AUG	-0.99563	***
SEP	0.16227	
OCT	0.58460	**
NOV	0.89639	***
DEC	0.92806	***
Trend	0.01095	***
margin_distillate	0.00678	*
Distillation Capacity	-0.05690	***
LOP Yield (-1)	0.47323	***
DH_SEP05 variable	1.39710	***
adj. R Squared	0.945	
std. error of reg.	0.412	
mean of dep. variable	82.86	

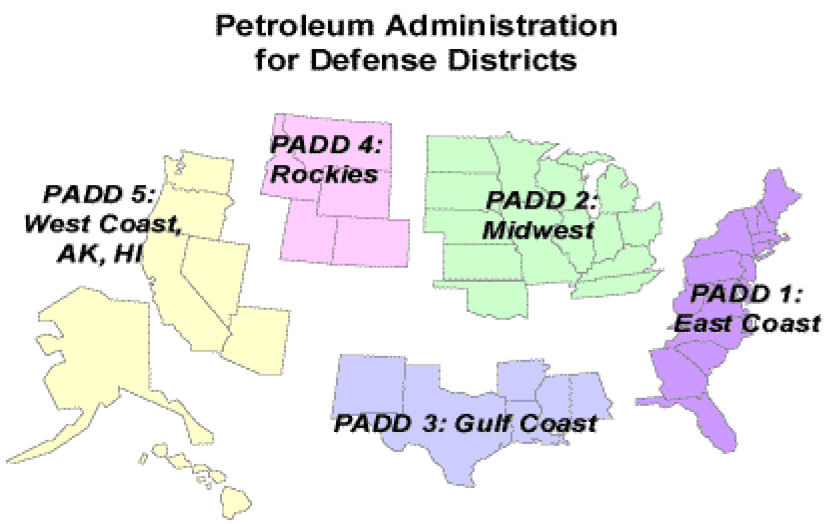
Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.

Table A-2. Model for Gasoline Percent of LOP Yield

Independent Variable: Gasoline Pct. of LOP

Parameter	*Estimated Coefficient*	
C	41.4866	***
FEB	-0.53592	**
MAR	-0.78930	***
APR	-0.90009	***
MAY	-0.86708	***
JUN	-0.71854	**
JUL	-0.76833	***
AUG	-1.08622	***
SEP	-0.33712	
OCT	-0.58938	**
NOV	-0.10283	
DEC	0.04132	
Trend	-0.01507	***
margin_gasoline	0.01811	***
margin_gasoline (-1)	0.01166	*
margin_distillate	-0.04122	***
Distillation Capacity	-0.06360	***
GASPctLOP (-1)	0.41274	***
D_DEC02 variable	-1.63018	**
DH_SEP05 variable	1.97807	***
adj. R Squared	0.877	
std. error of reg.	0.502	
mean of dep. variable	57.64	
Note: *** indicates significance at the 1% level, ** indicates significance at the 5% level, and * indicates significance at the 10% level.		

APPENDIX B. Petroleum Administration for Defense Districts (PADDs)



PADDs were delineated during World War II to facilitate oil allocation.

PADD 1 (East Coast) is composed of these three subdistricts:

Subdistrict 1A (New England): Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont.

Subdistrict 1B (Central Atlantic): Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania.

Subdistrict 1C (Lower Atlantic): Florida, Georgia, North Carolina, South Carolina, Virginia, West Virginia.

PADD 2 (Midwest): Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, North Dakota, South Dakota, Ohio, Oklahoma, Tennessee, Wisconsin.

PADD 3 (Gulf Coast): Alabama, Arkansas, Louisiana, Mississippi, New Mexico, Texas.

PADD 4 (Rocky Mountain): Colorado, Idaho, Montana, Utah, Wyoming.

PADD 5 (West Coast): Alaska, Arizona, California, Hawaii, Nevada, Oregon, Washington