Independent Statistics & Analysis
U.S. Energy Information Administration

Refinery Outages: Fourth-Quarter 2015

October 2015

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1. Preface

This report examines U.S. refinery outages planned for the fourth quarter of 2015 and the implications for available refinery capacity, petroleum product markets, and supply of gasoline, diesel fuel, and heating oil. Dissemination of such analyses can be beneficial to market participants who may otherwise be unable to access such information.

Refinery outages result from the planned shutdown of refinery units for maintenance and upgrades, and from unplanned shutdowns from a variety of causes such as mechanical failure, bad weather, power failures, fire, and flooding. Planned maintenance is typically scheduled when refined petroleum product consumption is relatively low, in the fall and in the first quarter when there is less demand for transportation fuels.

This report analyzes the availability of refinery capacity to produce diesel fuel and heating oil (distillate) and gasoline, focusing on two refinery units—the atmospheric crude distillation unit (ACDU) and the fluid catalytic cracking unit (FCCU)—that are strongly correlated with distillate and gasoline production, respectively. In addition, data for planned maintenance on catalytic reforming units (CRU) and hydrocracking units (HU) are provided in Chapters 6-10.

This issue of the refinery outage report uses the same methodology as the First-Half 2015 issue and focuses on how planned refinery outages may affect the adequacy of regional distillate fuel and gasoline supplies, as defined by Petroleum Administration for Defense District (PADD) areas. Therefore, this report does not include a discussion of national-level balances.

National supply/demand balances have very limited implications for the regional adequacy of distillate fuel and gasoline supply because pipeline infrastructure, geography, and marine shipping regulations constrain the amount of product that can flow among the different regions of the United States. In most regions of the country, most distillate fuel and gasoline is supplied by in-region refinery production.

Unplanned outages are by definition unexpected and vary widely, thus making an estimate of future unplanned outages based on historical averages problematic. Because of this uncertainty, this report does not attempt to estimate future unplanned outages. In lieu of estimating unplanned outages, this report provides data on the historical level and frequency of unplanned outages and considers how unplanned outages could prove disruptive based on expectations for overall supply in each region, taking planned outages into account.

EIA plans to continue work to improve the analysis of the impact of refinery outages on the availability of supply, including a more granular analysis of sub-PADD supply patterns, interregional product flows, and unplanned outages.

2. Executive Summary

Planned refinery maintenance during the fourth quarter of 2015 is not expected to adversely affect the supply of gasoline and distillate. The effect of refinery outages on product supplies depends on many factors, including petroleum product demand, the availability of product supplies from available refinery capacity, inventories, imports and redirected exports, as well as actual levels of both planned and unplanned refinery outages. Barring unusually high unplanned outages, planned outages that extend beyond the planned period, or higher-than-expected demand, supply of gasoline and distillate should be adequate in all regions during the fourth quarter.

Demand for distillate (diesel fuel and heating oil) in the United States through the first half of 2015 averaged 4.1 million barrels per day (b/d), an increase of 4,000 b/d (0.1%) year-over-year. EIA's October *Short-Term Energy Outlook* (STEO) expects distillate demand to average 4.1 million b/d in the fourth quarter of 2015, and to remain at that level through 2016. However, colder-than-expected winter temperatures could cause distillate demand to be higher than expected in New England (PADD 1A) and in the Central Atlantic (PADD 1B) states.

U.S. gasoline demand is typically lower in the winter; it increases in the spring as the driving season begins. Through the first half of 2015, U.S. motor gasoline demand averaged 9.0 million b/d, a year-over-year increase of 266,000 b/d (3%). EIA's October STEO expects gasoline consumption to average 9.3 million b/d and 9.1 million b/d in the third and fourth quarters of 2015, respectively.

Like the First Half 2015 issue, this edition of the report considers the supply of distillate fuel and gasoline supply on regional (both PADD and sub-PADD) levels, rather than at a national level. National balances have very limited meaning for the adequacy of distillate fuel and gasoline supply because pipeline infrastructure, geography, and marine shipping regulations constrain the amount of product that can flow among the different regions of the United States.

Across the country, fourth-quarter 2015 planned refinery maintenance on atmospheric crude distillation units (ACDU) and fluid catalytic cracking units (FCCU), two refinery units that are strongly associated with distillate and gasoline production, during the fourth quarter of 2015 is concentrated in October. Table 1 provides a monthly summary by PADD of the percentage of available refining capacity expected to be out of service for maintenance during the fourth quarter of 2015.

Table 1. Planned outages, percent of available capacity, 4th quarter 2015

Region	Capacity (million b/d)	Atmospheric Crude Distillation Unit (ACDU) October	November	December
East Coast (PADD 1)	1.3	3%	0%	0%
Midwest (PADD 2)	4.0	13%	3%	0%
Gulf Coast (PADD 3)	9.1	2%	1%	0%
Rocky Mountains (PADD 4)	0.6	3%	2%	0%
West Coast (PADD 5)	2.8	0%	0%	0%
		Fluid Catalytic Cracking Unit (FCCU)		
Region	**Capacity (million b/d)**	**October**	**November**	**December**
East Coast (PADD 1)	0.5	0%	0%	0%
Midwest (PADD 2)	1.3	4%	1%	0%
Gulf Coast (PADD 3)	3.0	3%	1%	0%
Rocky Mountains (PADD 4)	0.2	8%	1%	0%
West Coast (PADD 5)	0.9	14%	17%	4%

Source: Industrial Info Resources (IIR), September 1, 2015 database.

Planned maintenance in PADD 1 (East Coast) is light, with no FCCU work scheduled as of the start of September and ACDU maintenance planned only for October. East Coast gasoline inventories have been above the five-year range in all but one week since mid-December 2014, and given the availability of gasoline supply to the region from the global market, gasoline supply should be adequate to meet demand. PADD 1 distillate inventories have been above the five-year average since July.

Planned maintenance in PADD 2 (Midwest) is concentrated in October, when an average of 535,645 b/d of ACDU capacity is expected to be offline. This level of planned maintenance is significantly higher than the 10-year average and exceeds the 10-year maximum. November ACDU planned maintenance, at 110,400 b/d, is lower than the 10-year average and the 2014 level. There is no planned ACDU maintenance in December as of the writing of this report. Supplemental supply of gasoline and distillate from the Gulf Coast should be available, if needed. However, the time required for resupply to reach the Midwest from the Gulf Coast does vary considerably across the region because of its size. Resupply can reach Oklahoma, Kansas, and Missouri from the Gulf Coast within 7-10 days, but it may take close to 30 days to reach the northernmost states at the end of the supply line. Fourth-quarter planned FCCU maintenance in PADD 2 is minimal, with 8,533 b/d offline in November.

In PADD 3 (Gulf Coast), very little FCCU and ACDU maintenance is planned for fourth quarter 2015. Last year, both FCCU and ACDU maintenance levels were elevated in October, setting 10-year highs. In 2015, planned maintenance is below average in October and November, and no planned maintenance is scheduled for December as of the writing of this report. As Gulf Coast gasoline inventories are above the five-year average (76.9 million barrels as of October 2), supply of gasoline should be adequate. Distillate inventories are also ample, near the five-year average and above both 2014 and 2013 levels. In addition, substantial volumes of gasoline and distillate are exported from the Gulf Coast. Exports generally act as a stabilizer in U.S. product markets, similar to inventories, as they can be diverted to domestic markets if product balances tighten.

There is little maintenance planned for PADD 4 (Rocky Mountain), and inventories of gasoline and distillate are above the five-year average. As a result, supply is expected to be adequate.

PADD 5 (West Coast) planned ACDU maintenance is minimal over the period, but planned FCCU maintenance in October and November is more than 50,000 b/d higher than the 10-year average and more than 25,000 b/d higher than the 10-year maximum. The ongoing unplanned FCCU outage following the February 18 explosion at the ExxonMobil refinery in Torrance, California, has continued to put upward pressure on gasoline prices in the region. Imports of total motor gasoline to California ranged between 28,000-68,000 b/d in March through July, compared with an average of 5,000 b/d in 2013-14. Further outages, either planned or unplanned, would exacerbate the supply situation. PADD 5 gasoline inventories declined steadily during the summer driving season, reaching a multiyear low of 25.7 million barrels on August 21. Since then, gasoline inventories have rebuilt and are now in the five-year range and have been above the five-year average since September 11. Distillate inventories have been above the five-year average for much of the year.

Summary findings for each region (PADD) of the country are provided in the next section. Current market conditions, more detailed discussions of refinery maintenance in each region, and a discussion of other factors that affect the market are provided in subsequent sections. Additional data for planned maintenance on catalytic reforming units (CRU) and hydrocracking units (HB) are provided in Chapters 5-9.

3. Background

This report examines refinery outages planned for the fourth quarter of 2015 and the potential implications for available refinery capacity, petroleum product markets, and supply of gasoline and distillate (diesel fuel and heating oil). Such analyses can be beneficial to market participants who may otherwise be unable to access such information.

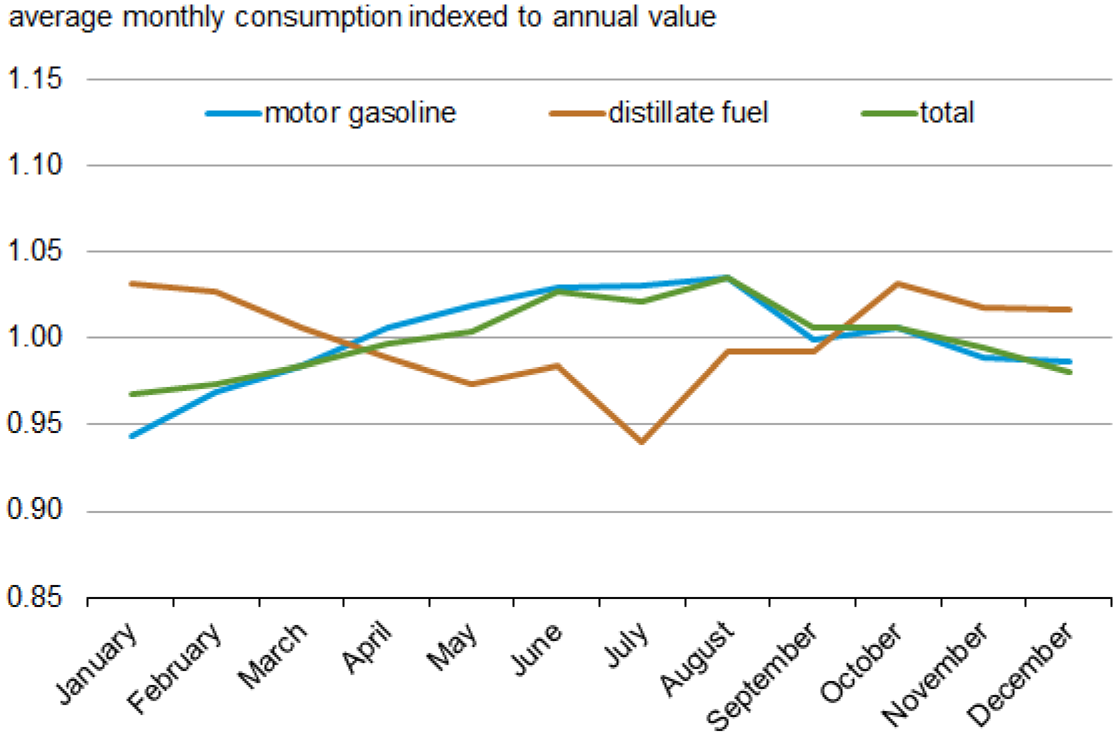
The report looks at planned maintenance levels for atmospheric crude distillation units (ACDU) and fluid catalytic cracker units (FCCU) in relation to historical maintenance levels at the Petroleum Administration for Defense District (PADD) level and in the context of current market conditions. Distillate (diesel fuel and heating oil) production is mainly affected by outages of the ACDU, while gasoline production impacts are most strongly correlated with FCCU outages. In addition, data for planned maintenance on catalytic reforming units (CRU) and hydrocracking units (HU) are provided in chapters 5-9.

Since 2008, there have been significant changes in the structure of U.S. petroleum product markets and their relationship to global markets. U.S. refinery capacity and utilization rates have increased while U.S. demand for gasoline and distillate fuels has generally declined. The United States, which until recently was a net importer of petroleum products, is now a significant net exporter of these products, primarily from the Gulf Coast. The East Coast, which lacks sufficient refining capacity to supply in-region demand, continues to rely on significant imports of petroleum products.

Refinery outages result from the planned shutdown of refinery units for maintenance and upgrades and from unplanned shutdowns that result from a variety of causes such as mechanical failure, bad weather, power failures, fire, and flooding. Planned maintenance at U.S. refineries is typically scheduled when refined petroleum product consumption is low in the fall and in the first quarter when there is less demand for transportation fuels.

Figure 1 illustrates the seasonal variation in petroleum consumption. The seasonality of gasoline consumption is the primary driver of the seasonality of total U.S. petroleum consumption because gasoline accounts for nearly half of petroleum use. Distillate consumption, which has a seasonal pattern because of the winter heating season in the Northeast, moderates the winter decline in total petroleum consumption.

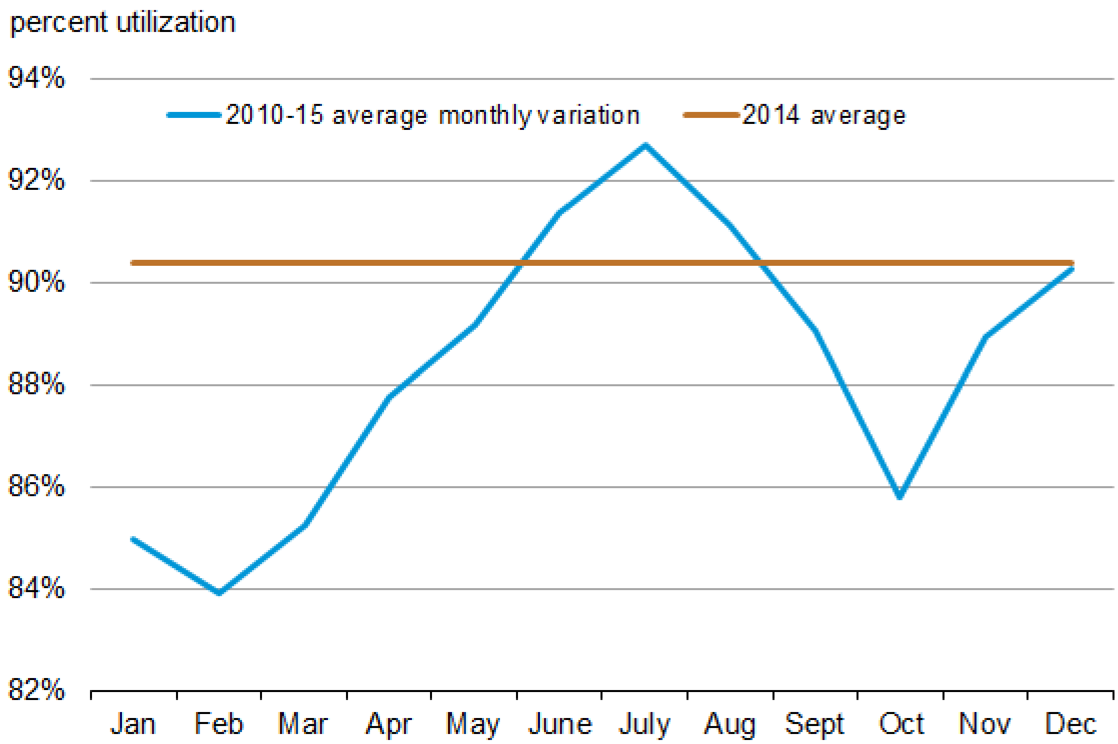
Figure 1. Seasonal variation in U.S. petroleum consumption (January 2010–December 2014)



Note: Consumption is represented by product supplied.
Source: U.S. Energy Information Administration, *Petroleum Supply Monthly.*

Figure 2 illustrates the seasonal variation in refinery utilization rates. Refinery utilization rates reflect crude oil input levels and take into account discretionary changes in crude oil inputs based on market conditions, including consumption, planned maintenance, and unplanned outages. Utilization generally follows the seasonal consumption patterns, falling to the lowest levels during the first quarter when petroleum product demand is low and then declining again in the fall.

Figure 2. Seasonal variation in monthly U.S. refinery utilization (January 2010–July 2015)



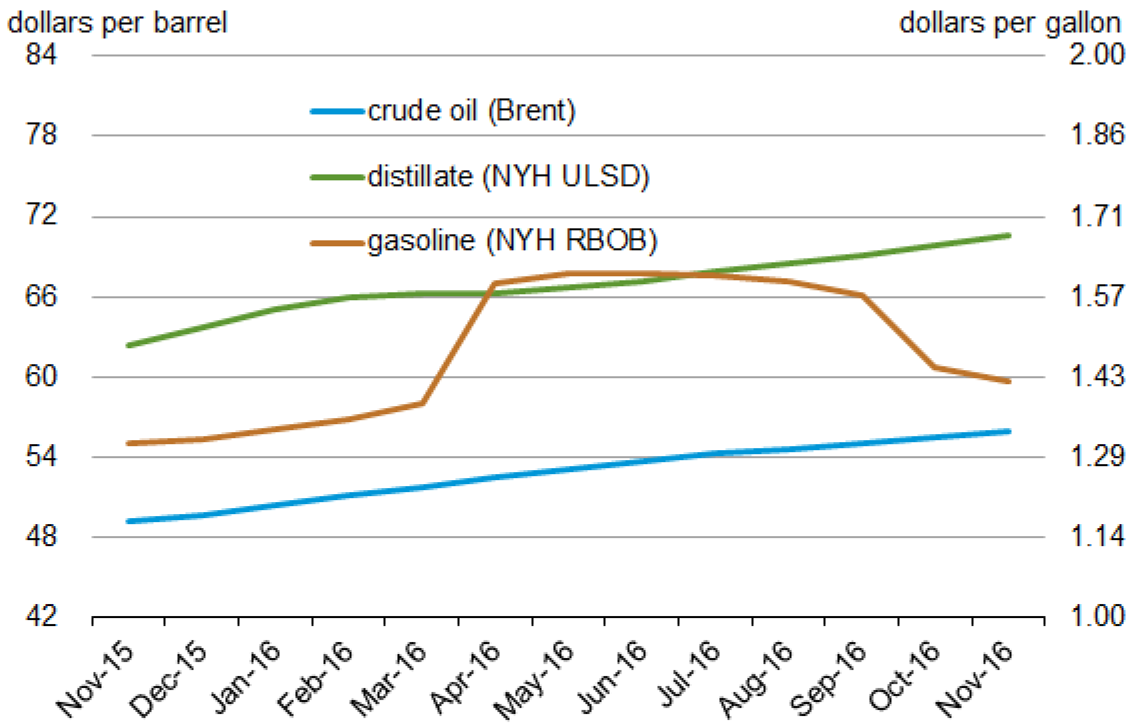
Note: Utilization represents gross inputs as percentage of operable distillation capacity. July 2015 data are the latest available.
Source: U.S. Energy Information Administration, *Petroleum Supply Monthly.*

Refiners typically arrange for adequate product supplies in advance of planned maintenance. They do this by operating refineries at high utilization rates during periods prior to planned maintenance to build inventories; by purchasing product from other sources, including other domestic and international refiners; or by curtailing exports to the global market. Other market participants that could be affected by refinery outages often build inventory as well, and planned product exports may be redirected to the domestic market. Product inventory is used to supplement supply during outages, as is product that might otherwise be exported. Storage capacity can limit maximum total product inventory, while minimum inventory operating levels can limit the extent to which inventories can be drawn down.

Refineries with available capacity can increase unit throughputs, and thus gasoline and distillate production, making up for offline capacity. However, the dynamics of this process are influenced by market conditions. Often, higher product prices caused by tight supply conditions signal refiners to increase production or pull back exports.

The perception of future prices can also influence decisions about building inventory. If the market believes that prices will be lower in the future, storing product for future sale may result in a loss on those future sales versus selling the product now. This market condition, called backwardation, penalizes adding products to inventory. If perceptions are that future prices will increase, called contango, then those who store product for future sales may realize higher returns. Perceptions of petroleum prices are reflected in several worldwide markets in which participants can enter into contracts to buy or sell either financial instruments or physical products for future delivery of petroleum products. The main petroleum product futures market in the United States is the New York Mercantile Exchange (Nymex). Current futures prices from Nymex are shown in Figure 3.

Figure 3. Nymex and ICE futures prices of crude oil, distillate fuel and gasoline



Note: Nymex RBOB and ULSD futures prices and ICE Brent futures prices are as of October 14, 2015. RBOB is reformulated blendstock for oxygenate blending. ULSD is ultra-low sulfur distillate. Nymex denotes New York Mercantile Exchange. ICE denotes Intercontinental Exchange.
Source: Bloomberg, L.P.

As illustrated in Figure 3, futures prices for crude oil are in contango, when near-term prices are lower than longer-dated prices. As discussed in Chapter 4 of this report, the near-term crude oil market is significantly oversupplied, driving down near-term prices. However, market expectations are that crude supply will decline and demand growth will eventually result in a more balanced global supply/demand outlook, which has encouraged inventory builds and higher longer-dated prices.

Gasoline prices are expected to be flat through March 2016 and to then increase, reflecting both the change from winter specification gasoline to the more costly-to-manufacture spring/summer gasoline, and expectations for increasing demand as the driving season begins. Gasoline sold in the winter months is different chemically from gasoline sold in summer months. The change from winter-grade to summer-grade generally occurs between March and June. This change in gasoline specifications limits the amount of inventory that can be built in the current period, because some storage is needed for winter-grade for immediate sales and because separate storage facilities are needed for summer-grade that will be sold in the future. The futures curve for gasoline flattens out from April through August before moving into backwardation (when near-term prices are higher than longer-dated prices) in September as gasoline specifications shift to less-costly-to-produce winter grades and as the driving season ends and demand is expected to decline.

Distillate markets are in slight contango through October 2016, tracking crude oil prices. Space-heating requirements increase demand in winter months for distillate in the U.S. Northeast and also in Europe.

4. Recent Market Conditions

As of October 6, the price of North Sea Brent crude oil has averaged $55 per barrel (b) year to date. In the October *Short-Term Energy Outlook* (STEO), EIA forecasts that Brent will average $54/b for all of 2015, $45/b lower than the 2014 average. The lower price reflects the global oversupply of crude oil and has been characterized by elevated volatility.

Global crude oil supplies have risen sharply over the past few years, primarily because of rapid and sustained growth in production in North America and, more recently, from the Organization of the Petroleum Exporting Countries. Although lower crude prices have led to recent monthly declines in U.S. oil production, the October STEO estimates U.S. crude production for 2015 will average 9.2 million barrels per day (b/d), which is 4.2 million b/d above 2008 levels. U.S. crude oil production is forecast to decrease through mid-2016 before growth resumes late in 2016, averaging 8.9 million b/d for the year.

While global oil supply growth has been strong, economic growth outside of the United States has been slow, particularly in Russia and non-Organization for Economic Cooperation and Development (OECD) Asia, the largest source of global petroleum demand growth since 2009. Economic growth in the United States has been relatively strong. EIA estimates global consumption of petroleum and other liquids grew by 1.2 million b/d in 2014, averaging 92.4 million b/d for the year. EIA expects global consumption of petroleum and other liquids to grow by 1.3 million b/d in 2015 and by 1.4 million b/d in 2016. China continues to be the main driver of non-OECD oil consumption growth, despite the slowdown in the country's economic growth beginning in the second half of 2014 and with continuing signs of weakening in its economy. China's consumption growth is expected to average 0.3 million b/d in 2015 and in 2016, below the 0.4 million b/d growth in 2014.

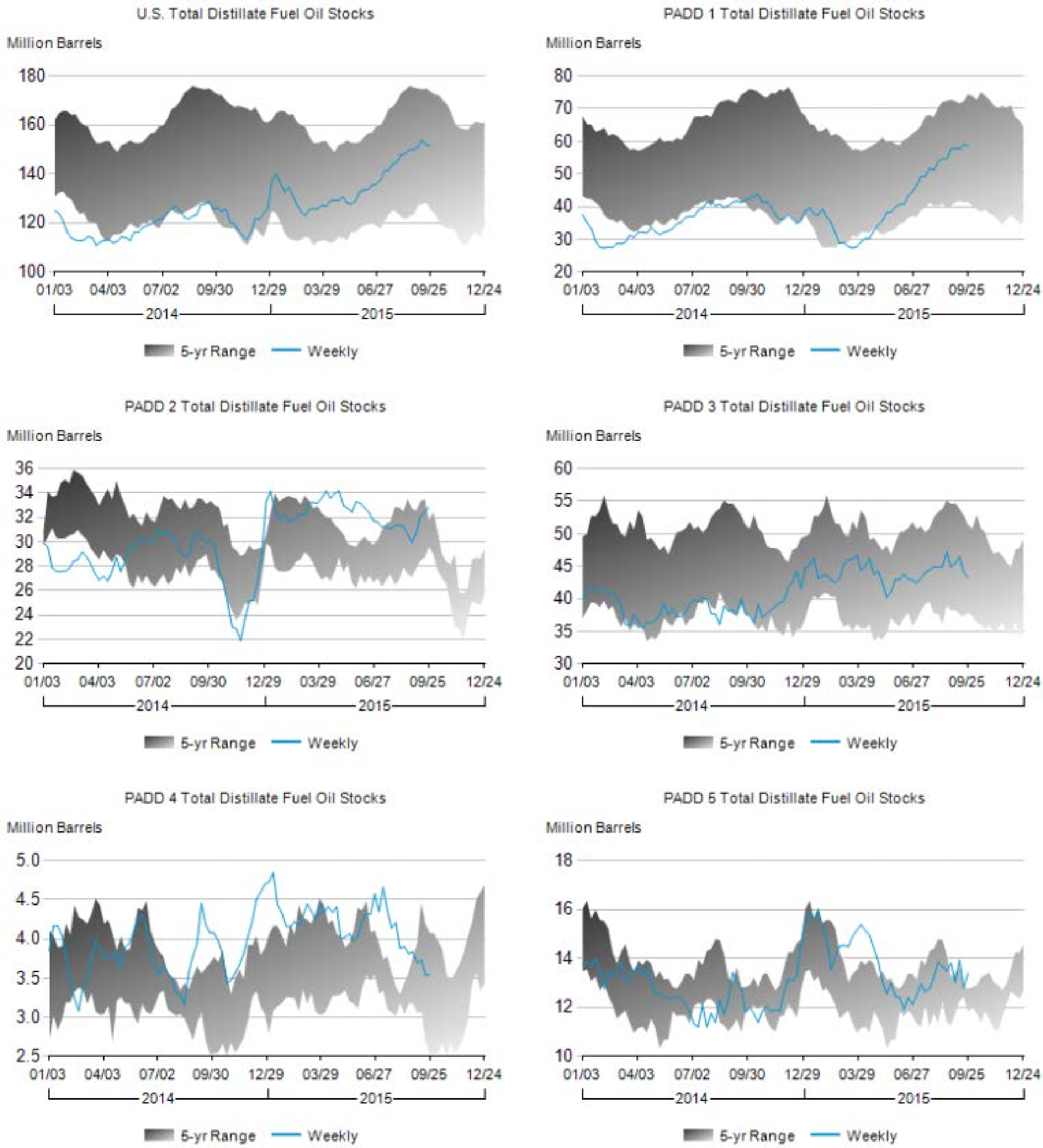
With continued access to price-advantaged crude oil and natural gas, sophisticated upgrading equipment, and a strategic location compared with demand centers in Latin America, U.S. refineries have been running at record high levels. Through July 2015, gross throughputs averaged 16.4 million b/d, the highest annual average since EIA began collecting data in 1985. Gross inputs to U.S. refineries exceeded 17 million b/d for six consecutive weeks in July and August, a level not previously reached or exceeded in any week since EIA began publishing the data in 1990. Refinery production of gasoline and distillate has increased to supply growing demand in global markets, contributing to a widening U.S. petroleum product trade surplus. Monthly domestic demand for gasoline has averaged 3% higher than last year, and gasoline crack spreads exceeded those for distillate for much of the summer. For the week ending September 25, 2015, gross U.S. refinery inputs were 16.2 million b/d, an increase of 177,000 b/d compared to the same week in 2014. Record-high U.S. refinery runs contributed to high U.S. gasoline and distillate (diesel fuel and heating oil) inventories. Heading into this winter heating season, propane inventories are at a record high.

Falling crude oil prices, coupled with increased refinery production of gasoline and distillate (diesel fuel and heating oil), have led to declines in gasoline and distillate prices. After averaging $3.36 per gallon (gal) in 2014, the U.S. average retail price for regular gasoline averaged $2.52/gal from January through September of this year, a drop of 84 cents/gal. The U.S. average retail price for ULSD has fallen $1.03/gal, from $3.91 to $2.80.

EIA expects U.S. gasoline consumption to increase by 190,000 b/d (2.1%) in 2015, following growth of 80,000 b/d (0.9%) in 2014. Forecast gasoline consumption averages 9.1 million b/d in 2015, the highest level since the peak of 9.3 million b/d in 2007. Although total nonfarm employment and total vehicle miles traveled have increased by 2.9% and 3.4%, respectively, over the past eight years, improving vehicle fuel economy has steadily contributed to lower gasoline consumption. Gasoline consumption is forecast to remain flat in 2016, as the effect of continued economic growth on highway travel offsets a long-term trend toward vehicles that are more fuel-efficient. Over the same period, U.S. consumption of distillate fuel is forecast to fall by 30,000 b/d (0.7%) in 2015 and then increase by 50,000 b/d (1.3%) in 2016. The 2016 growth is driven by increasing manufacturing output, foreign trade, and marine fuel use.

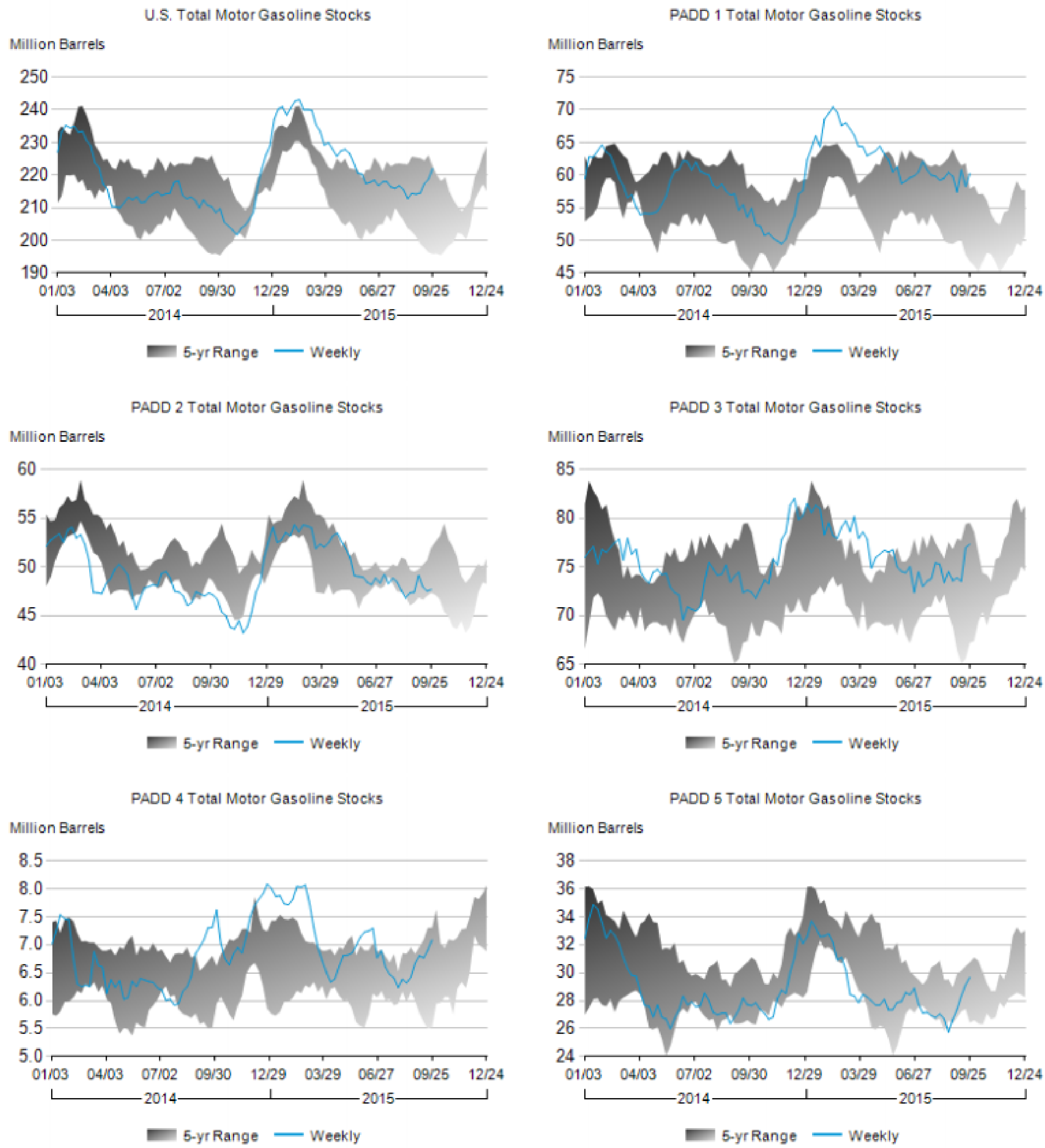
U.S. participation in the global petroleum products markets has increased steadily in the past several years. Total U.S. product exports averaged 4.2 million b/d in the first seven months of 2015, up 2.3 million b/d from 2009. Exports generally act as a stabilizer in U.S. product markets, similar to inventories, as they create a source of supply that can be diverted to domestic markets if product balances tighten, depending on the structure of sales contracts,. Supplying overseas markets with product from economically efficient U.S. refineries also helps balance global product supply and demand, which in turn helps U.S. regions that rely on imports. Through July 2015, the U.S. East Coast imported an average of 0.9 million b/d of gasoline and distillate.

Figure 4. Regional distillate inventories as of September 25, 2015



Source: U.S. Energy Information Administration, *Weekly Petroleum Status Report*.

Figure 5. Regional motor gasoline inventories as of September 25, 2015



Source: U.S. Energy Information Administration, *Weekly Petroleum Status Report*.

5. PADD 1 Regional Outage Review

5.1. Summary

Generally, planned refinery maintenance on the East Coast, which includes all states in New England, the Central Atlantic, and the Lower Atlantic, is expected to be very light in the fourth quarter of 2015.

As there are relatively few refineries on the East Coast, the region relies on transfers of petroleum products from other regions, primarily from the Gulf Coast, and on imports from the actively traded Atlantic Basin market. As a result, refinery outages in other parts of the country and in the countries from which gasoline and distillate are imported can affect supply. Planned maintenance at refineries on the Gulf Coast is not expected to adversely affect supply of gasoline and distillate to the East Coast, as the substantial volumes of gasoline and distillate typically exported from the Gulf Coast can be diverted to domestic markets if product balances tighten.

East Coast gasoline inventories have been above the five-year range in all but one week since mid-December 2014, and given the availability of gasoline supply to the region from the global market, gasoline supply should be adequate to meet demand. Since July, PADD 1 distillate inventories have been above the five-year average, which has not happened since September 2011.

5.2. Refinery capacity overview

As of September 1, 2015, the region has 1.3 million b/d of atmospheric crude distillation unit (ACDU) capacity on a stream day basis, 0.5 million b/d of fluid catalytic cracking unit (FCCU) capacity, 0.3 million b/d of catalytic reforming unit (CRU) capacity, and 46,000 b/d of hydrocracking unit (HU) capacity. As the region is structurally short refining capacity, meaning that in-region demand exceeds local refinery production, it relies on transfers of petroleum products from other PADDs, primarily PADD 3, and on imports from the actively-traded Atlantic Basin market to meet gasoline and distillate demand.

5.3. ACDU planned maintenance

Planned ACDU maintenance in PADD 1 is light throughout fourth-quarter 2015. PADD 1 refineries currently have planned ACDU maintenance scheduled only for October 2015. Last year, planned maintenance was concentrated in December, with an average of 5,484 barrels per day (b/d).

Table 2. PADD 1 planned ACDU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	39,516	0	99,274	4/10	5,161	230,000
November	0	0	106,583	4/10	36,667	175,000
December	0	5,484	36,613	2/10	5,484	67,742

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

5.4. FCCU planned maintenance

PADD 1 refineries have no planned FCCU maintenance throughout fourth-quarter 2015. Since 2005, refineries in PADD 1 have undergone planned FCCU maintenance less than half the time in October through December. During December, planned FCCU maintenance has occurred only rarely during the past 10 years. Planned maintenance in 2014 was concentrated in December, averaging 14,194 b/d.

Table 3. PADD 1 planned FCCU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	0	0	46,032	4/10	11,290	140,323
November	0	0	44,025	4/10	2,800	123,333
December	0	14,194	16,855	2/10	14,194	19,516

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

5.5. CRU planned maintenance

PADD 1 refineries currently have planned CRU maintenance scheduled only for October 2015. Since 2005, refineries in PADD 1 have undergone planned CRU maintenance only 2 out of 10 years between October and December.

Table 4. PADD 1 planned CRU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	19,429	4,161	14,197	2/10	13,135	15,258
November	0	43,120	43,527	2/10	43,120	43,933
December	0	13,135	14,197	2/10	13,135	15,258

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

5.6. HU planned maintenance

PADD 1 refineries have no planned HU maintenance scheduled for fourth-quarter 2015. Since 2005, refineries in PADD 1 have undergone planned HU maintenance only 3 out of 10 years in October and November. In the past 10 years there was no planned HU maintenance in December.

Table 5. PADD 1 planned HU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	0	0	17,161	3/10	13,935	22,452
November	0	0	5,467	3/10	800	11,400
December	0	0	0	0/10	0	0

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

5.7. Unplanned outages

Because PADD 1 relies on a variety of sources for product supply, including the actively traded Atlantic Basin market, the region is often less affected by supply disruptions from unplanned refinery outages, although extreme situations can put stress on the supply chain.

In October 2012, Hurricane Sandy resulted in a number of unplanned outages at PADD 1 refineries, initially because the refineries shut down in advance of the storm, but also because of storm-related damage. The hurricane damaged much of the petroleum supply infrastructure in the New York Harbor (NYH) area and significantly disrupted the supply chain. Immediately following the storm, the lack of commercial or generator power kept many terminals from delivering product from storage. Recent winter storms have not significantly affected petroleum supply infrastructure.

Tables 6-9 provide details on levels of historical unplanned outages in each category. As of September 1, 2015, there was no carryover of unplanned maintenance in PADD 1.

Table 6. PADD 1 unplanned ACDU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	66,754	4/10	7,419	103,226
November	0	93,056	3/10	17,500	191,667
December	0	27,419	3/10	4,839	70,000

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 7. PADD 1 unplanned FCCU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	15,581	5/10	3,548	35,645
November	0	30,328	6/10	6,500	127,750
December	0	26,442	5/10	2,710	51,452

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 8. PADD 1 unplanned CRU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	12,912	5/10	839	27,742
November	0	17,725	5/10	3,690	43,000
December	0	20,226	3/10	1,032	43,000

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 9. PADD 1 unplanned HU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	4,258	2/10	2,710	5,806
November	0	1,800	1/10	1,800	1,800
December	0	0	0/10	0	0

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

6. PADD 2 Regional Outage Review

6.1. Summary

Planned maintenance for the atmospheric crude distillation units in the Midwest region is expected to be above the 10-year maximum during October 2015. November planned maintenance is below the 10-year average, while December has no scheduled maintenance. For the FCCU and CRU units there is planned maintenance in October and November. For the hydrocracking units, planned maintenance levels in October are expected to be above the 10-year average. No planned maintenance is scheduled for November and December 2015.

Midwest refineries produce most of the gasoline and distillate fuel consumed in the region, particularly during the winter months when gasoline demand is seasonally lower. The Midwest also receives supplies from other regions, primarily from the Gulf Coast. Planned Gulf Coast refinery maintenance is not expected to affect the supply of gasoline and distillate available to the Midwest.

Inventories can act as a source of supplemental supply during outages. Supplemental supply from the Gulf Coast should also be available if needed. However, the time required for resupply to reach the Midwest from the Gulf Coast does vary considerably across the region because of its size. Resupply can reach Oklahoma, Kansas, and Missouri from the Gulf Coast within 7-10 days but may take close to 30 days to reach the northernmost states at the end of the supply line. As a result, unplanned outages in the northernmost states could lead to supply disruptions.

6.2. Refinery capacity overview

PADD 2 includes North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, Missouri, Iowa, Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Kentucky, and Tennessee. PADD 2 has 27 operable refineries, of which 26 are operating. These 26 operating refineries have combined atmospheric crude distillation unit (ACDU) capacity of 4.0 million b/d on a stream day basis, fluid catalytic cracking unit (FCCU) capacity of 1.3 million b/d, catalytic reforming unit (CRU) capacity of 0.9 million b/d, and hydrocracking unit (HU) capacity of 0.3 million b/d.

While PADD 2 refineries supply most of the gasoline and distillate consumed in the region, PADD 2 also receives supplies from PADD 3, especially gasoline during the peak summer driving season.

6.3. ACDU planned maintenance

Planned ACDU maintenance in PADD 2 starts with above 10-year maximum outages in October, but moderates in November to below 10-year average, and there is no planned maintenance in December. Given the intensity of planned maintenance in the ACDU, the region is at risk in case of major unplanned maintenance, creating short-term challenges in supplying transportation fuels to the market.

Table 10. PADD 2 planned ACDU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	535,645	178,032	195,396	10/10	89,742	454,323
November	110,400	190,000	153,026	9/10	6,667	470,333
December	0	0	93,561	5/10	8,387	347,581

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

6.4. FCCU planned maintenance

Planned FCCU maintenance is light in PADD 2 during fourth-quarter 2015, but operations may be impacted because of high ACDU outages in October 2015.

Table 11. PADD 2 planned FCCU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	48,774	230,097	127,447	10/10	32,887	251,152
November	8,533	82,733	62,918	10/10	4,000	186,383
December	0	0	26,844	3/10	3,387	38,952

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

6.5. CRU planned maintenance

CRU planned maintenance in PADD 2 for October is higher than the 10-year average and is moderate in November 2015. There is no planned CRU maintenance for PADD 2 in December.

Table 12. PADD 2 planned CRU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	80,161	56,613	62,264	10/10	30,693	108,033
November	21,667	42,917	33,859	8/10	2,567	72,733
December	0	0	16,677	2/10	6,774	26,581

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

6.6. HU planned maintenance

HU planned maintenance in PADD 2 for October 2015 is higher than the 10-year average, and no maintenance is planned for November or December.

Table 13. PADD 2 planned HU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	32,323	22,710	28,710	8/10	1,677	88,968
November	0	26,667	17,379	8/10	2,333	33,767
December	0	0	3,387	1/10	3,387	3,387

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

6.7. Unplanned outages

The large geographic area of PADD 2 is an important factor in understanding the significance to distillate fuel and gasoline supply of both planned and unplanned refinery outages. For example, the closeness of southern PADD 2 to the main U.S. refining center in PADD 3 typically makes it possible for emergency supply to reach the region fairly quickly. But an unplanned refinery outage in the northernmost part of PADD 2 is more problematic because it can take several weeks for product from alternate sources of supply to reach the area. In addition, supply disruptions that are concentrated in one part of PADD 2 can have a greater impact than disruptions of similar magnitude that are dispersed across the PADD.

Tables 14-17 provide details on historical unplanned outages. Because a carryover of unplanned outages is expected to last throughout fourth-quarter 2015, the unplanned HU outage will remain 26,000 b/d, significantly higher than the 10-year maximum.

Table 14. PADD 2 unplanned ACDU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	41,361	5/10	1,774	153,539
November	0	30,492	5/10	3,800	99,933
December	0	21,964	8/10	10,968	34,839

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 15. PADD 2 unplanned FCCU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	9,075	6/10	3,016	16,565
November	0	19,553	5/10	4,333	41,067
December	0	16,819	8/10	2,065	38,129

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 16. PADD 2 unplanned CRU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	24,988	2/10	18,645	31,331
November	0	7,700	2/10	3,850	11,550
December	0	4,608	3/10	1,887	8,710

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 17. PADD 2 unplanned HU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	26,000	2,258	1/10	2,258	2,258
November	26,000	5,222	3/10	2,533	8,800
December	26,000	11,043	3/10	1,935	18,774

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

7. PADD 3 Regional Outage Review

7.1. Summary

Planned maintenance in the Gulf Coast region, which includes Alabama, Mississippi, Louisiana, Arkansas, Texas, and New Mexico, is generally light compared with the second half of 2014, when maintenance did not result in supply disruptions, and distillate and gasoline supply should be adequate to meet demand during the fourth quarter of 2015. As Gulf Coast gasoline inventories are above the five-year average (76.4 million barrels as of October 2), supply of gasoline should be adequate. Distillate inventories are also ample, near the five-year average and above both 2014 and 2013 levels. In addition, substantial volumes of gasoline and distillate are exported from the U.S. Gulf Coast and exports, like inventories, generally act as a stabilizer in U.S. product markets as can possibly be diverted to domestic markets if product balances tighten.

The Gulf Coast region, which has substantially more refining capacity than is needed to meet in-region gasoline and distillate demand, supplies substantial volumes of distillate and gasoline to other regions, notably the East Coast and the Midwest. Gulf Coast refinery maintenance is not expected to adversely affect supply to other regions of the country.

7.2. Refinery capacity overview

PADD 3 comprises the southern central states of Alabama, Mississippi, Louisiana, Arkansas, Texas, and New Mexico. As of September 1, 2015, the region had 51 operable refineries, all of which are operating, with atmospheric crude distillation unit (ACDU) capacity totaling 9.1 million b/d on a stream day basis, fluid catalytic cracking unit (FCCU) capacity of 3.0 million b/d, catalytic reforming unit (CRU) capacity of 1.9 million b/d, and hydrocracking unit (HU) capacity of 1.2 million b/d. There are an additional five facilities in the region that are considered refineries but do not have ACDUs or FCCUs, so are not included in this report’s analysis.

The Gulf Coast region is the largest refining center in the United States and is home to slightly more than half of the country’s capacity. Data on refinery capacity within PADD 3 are grouped into five refining districts: New Mexico, Texas Inland, Texas Gulf Coast, Louisiana Gulf Coast (which includes coastal portions of Mississippi and Alabama), and North Louisiana-Arkansas (which includes northern Mississippi and Alabama). Regional capacity is concentrated primarily in the Texas Gulf Coast and Louisiana Gulf Coast districts. These two districts have 16 refineries each, with 49% and 39% of regional crude distillation capacity, respectively.

7.3. ACDU planned maintenance

CDU maintenance in PADD 3 is planned for October and November 2015. Maintenance is concentrated in October and expected to be significantly lower than the 10-year historical average and 2014 levels.

Table 18. PADD 3 planned ACDU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	207,710	653,890	390,317	10/10	74,677	653,890
November	52,167	247,483	203,265	10/10	7,200	330,200
December	0	12,803	67,169	10/10	9,258	226,581

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

7.4. FCCU planned maintenance

FCCU maintenance in PADD 3 is planned for October and November 2015. Maintenance is concentrated in October and is expected to be significantly lower than the 10-year historical average and 2014 levels.

Table 19. PADD 3 planned FCCU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	86,452	418,916	198,386	10/10	31,935	418,916
November	19,917	93,560	130,655	10/10	38,700	301,267
December	0	7,742	37,902	9/10	4,758	141,194

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

7.5. CRU planned maintenance

CRU maintenance in PADD 3 is planned for October and November 2015. Maintenance is concentrated in October and is expected to be significantly lower than the 10-year historical average and 2014 levels.

Table 20. PADD 3 planned CRU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	44,516	201,291	108,980	9/10	33,774	201,291
November	11,433	92,400	53,430	9/10	7,333	127,174
December	0	33,871	25,590	8/10	6,194	61,458

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

7.6. HU planned maintenance

HU maintenance in PADD 3 is planned for October and November 2015. Maintenance is concentrated in October and expected to be significantly lower than the 10-year historical average and 2014 levels.

Table 21. PADD 3 planned HU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	36,032	209,323	63,987	9/10	8,710	209,323
November	6,467	135,533	50,905	7/10	15,000	135,533
December	0	34,355	21,598	4/10	968	34,355

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

7.7. Unplanned outages

Unplanned outages can result in supply issues even in a region with substantial refining capacity such as PADD 3. When significant amounts of PADD 3 capacity are offline unexpectedly, regions dependent on Gulf Coast supply as well as the Gulf Coast itself are impacted.

Tables 22-25 provide details on historical unplanned refinery outages in PADD 3. There is no carryover of unplanned outages in fourth-quarter 2015.

Table 22. PADD 3 unplanned ACDU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	443,833	9/10	40,974	2,103,452
November	0	253,494	9/10	38,423	857,267
December	0	249,846	10/10	4,000	845,613

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 23. PADD 3 unplanned FCCU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	180,860	10/10	69,942	850,334
November	0	96,746	10/10	10,400	486,267
December	0	90,217	10/10	24,242	387,581

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 24. PADD 3 unplanned CRU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	104,508	9/10	652	507,974
November	0	98,451	6/10	3,256	215,900
December	0	76,668	9/10	9,290	206,597

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 25. PADD 3 unplanned HU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	72,931	8/10	2,323	303,097
November	0	54,611	8/10	2,080	181,133
December	0	55,046	9/10	6,812	185,419

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.

Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

8. PADD 4 Regional Outage Review

8.1. Summary

Although there are moderate levels of maintenance planned for the Rocky Mountain region, which includes Idaho, Montana, Wyoming, Utah, and Colorado, supply should be sufficient as inventories of gasoline and distillate are above the five-year average.

Although refineries in the Rocky Mountain region supply most of the in-region gasoline and distillate demand, the region does receive small volumes of product from refineries in the Midwest and the Gulf Coast, which can be possible sources of supplemental supply during a shortage.

8.2. Refinery capacity overview

At the start of 2015, PADD 4 had 17 refineries, all of which were operating. PADD 4 has the least refining capacity of any region in the United States, with combined atmospheric crude distillation unit (ACDU) capacity of 611,000 b/d on a stream day basis, fluid catalytic cracking unit (FCCU) capacity of 200,000 b/d, catalytic reforming unit (CRU) capacity of 131,000 b/d, and hydrocracking unit (HU) capacity of 40,000 b/d.

8.3. ACDU planned maintenance

ACDU maintenance in PADD 4 is planned for October and November. Maintenance is concentrated in October and is expected to be significantly lower than the 10-year historical average.

Table 26. PADD 4 planned ACDU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	17,323	30,161	31,656	9/10	2,581	58,710
November	9,600	0	17,654	6/10	4,800	28,000
December	0	0	18,613	4/10	2,419	40,000

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

8.4. FCCU planned maintenance

FCCU maintenance in PADD 4 is planned for October and November. The level of maintenance is expected to be close to the 10-year historical average but significantly lower than the 2014 level.

Table 27. PADD 4 planned FCCU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	15,919	25,903	13,621	8/10	1,806	35,097
November	2,933	3,467	4,297	5/10	1,467	7,367
December	0	0	0	0/10	0	0

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

8.5. CRU planned maintenance

FCCU maintenance in PADD 4 is planned for October and November, and is expected to be significantly lower than the 10-year historical average and the 2014 level.

Table 28. PADD 4 planned CRU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	4,239	12,500	7,761	8/10	258	16,181
November	1,707	10,283	6,346	7/10	1,867	11,600
December	0	0	2,461	2/10	890	4,032

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

8.6. HU planned maintenance

FCCU maintenance in PADD 4 is planned for October, and is expected to be significantly lower than the 10-year historical average.

Table 29. PADD 4 planned HU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	1,581	0	6,000	2/10	2,500	9,500
November	0	3,000	4,272	3/10	3,000	5,167
December	0	0	0	0/10	0	0

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

8.7. Unplanned outages

PADD 4 is relatively isolated from other refining regions and relies primarily on in-region production. As a result, unplanned outages in PADD 4 can disrupt gasoline and distillate supply. However, PADD 4's reliance on in-region supply insulates the region from disruptions in other parts of the country. Infrastructure connections between PADD 4 and PADDs 2 and 3, as well as Canada, provide sources of supply from outside the region during supply disruptions.

Tables 30-33 provide details on historical unplanned refinery outages in PADD 4. There is no carryover of unplanned outages into the fourth-quarter 2015.

Table 30. PADD 4 unplanned ACDU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	11,985	7/10	1,871	32,125
November	0	15,213	3/10	4,125	31,163
December	0	21,303	5/10	4,125	64,970

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 31. PADD 4 unplanned FCCU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	4,369	4/10	2,516	7,226
November	0	516	3/10	283	730
December	0	11,970	3/10	4,968	18,452

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 32. PADD 4 unplanned CRU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	1,602	4/10	516	2,200
November	0	1,962	3/10	1,687	2,200
December	0	4,717	4/10	1,161	12,684

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 33. PADD 4 unplanned HU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	2,699	5/10	158	5,000
November	0	4,113	5/10	3,000	5,000
December	0	7,415	4/10	3,161	18,000

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

9. PADD 5 Regional Outage Review

9.1. Summary

On February 18, the ExxonMobil refinery in Torrance, California, experienced an explosion that significantly reduced in-region production of gasoline and distillate; however, with relatively light planned maintenance in the West Coast region, which includes California, Nevada, Oregon, Washington, Arizona, Alaska, and Hawaii, supplies of gasoline and distillate fuel are expected to be adequate to meet demand in PADD 5 during the fourth quarter of 2015. Imports of total motor gasoline to California ranged from 28,000–68,00 barrels per day (b/d) for March through July (the latest data available), compared with an average of 5,000 b/d in 2013-14. Further outages, either planned or unplanned, would exacerbate the supply situation. Gasoline inventories declined steadily during the summer driving season, reaching a multiyear low of 25.7 million barrels on August 21. Since then gasoline inventories have been rebuilt. Inventories are now in the five-year range and close to the five-year average since September 11. Distillate inventories have been above the five-year average for much of 2015.

9.2. Refinery capacity overview

PADD 5 comprises the western states of California, Nevada, Oregon, Washington, Arizona, Alaska, and Hawaii. As of September 1, the region had 32 operable refineries, of which 31 are currently in operation, with atmospheric crude distillation unit (ACDU) capacity totaling 2.8 million b/d on a stream day basis, fluid catalytic cracking unit (FCCU)capacity of 0.9 million b/d, catalytic reforming unit (CRU) capacity of 0.6 million b/d, and hydrocracking unit (HU) capacity of 0.5 million b/d. California has 17 operating refineries (67% of PADD 5 ACDU capacity) mostly clustered in two refining centers within the state. About 40% of California refinery capacity is in the San Francisco area and the remaining 60% is in the southern part of the state, primarily near Los Angeles. Washington has 22% of PADD 5 ACDU capacity, and all five of its refineries are near Puget Sound. Alaska has five refineries, making up 6% of PADD 5 ACDU capacity, and Hawaii, with two operating refineries, has 5% of regional capacity.

9.3. ACDU planned maintenance

Some insignificant ACDU maintenance in PADD 5 is planned for October and November.

Table 34. PADD 5 planned ACDU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	323	54,387	130,719	7/10	20,129	329,806
November	833	46,633	102,283	6/10	3,600	225,600
December	0	0	18,892	3/10	4,645	26,226

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.

Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

9.4. FCCU planned maintenance

FCCU maintenance in PADD 5 is planned for each month of fourth-quarter 2015. Maintenance is expected to be significantly higher than the 10-year historical average in October and November and moderately lower than the 10-year historical average in December.

Table 35. PADD 5 planned FCCU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	121,548	0	69,441	3/10	20,903	93,871
November	147,067	0	77,365	6/10	39,200	121,933
December	38,710	0	43,597	8/10	2,710	106,613

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

9.5. CRU planned maintenance

CRU maintenance in PADD 5 is planned for October, and is significantly lower than the 10-year historical average and close to the 2014 level.

Table 36. PADD 5 planned CRU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	9,032	8,555	32,769	9/10	8,555	85,323
November	0	11,960	24,624	10/10	10,667	49,000
December	0	0	4,652	6/10	1,290	8,052

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

9.6. HU planned maintenance

HU maintenance in PADD 5 is planned for October, and is expected to be moderately higher than the 10-year historical average.

Table 37. PADD 5 planned HU outages

(barrels per day)

Month	2015 planned outages	2014 planned outages	2005-14 average of realized planned outages	2005-14 count of realized planned outages	2005-14 minimum realized planned outages	2005-14 maximum realized planned outages
October	40,645	0	34,206	5/10	10,323	54,613
November	0	0	27,273	5/10	17,067	53,100
December	0	0	3,194	2/10	1,161	5,226

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* planned outages are the average of actual outages and exclude months where no outages occurred.

9.7. Unplanned outages

Because PADD 5 is relatively isolated from other U.S. markets and located far from international sources of supply, the region is highly dependent on in-region production to meet demand. As a result, when significant capacity is unexpectedly out of service, the market effect can be pronounced.

Tables 38-41 provide detail on historical unplanned outages. There is a carryover of sustained, high-volume unplanned FCCU outage.

Table 38. PADD 5 unplanned ACDU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	74,124	7/10	7,742	250,000
November	0	100,017	4/10	19,167	240,000
December	0	72,935	5/10	7,742	240,000

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 39. PADD 5 unplanned FCCU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	100,000	16,152	9/10	1,355	66,548
November	100,000	31,183	5/10	6,933	70,083
December	100,000	31,981	6/10	2,323	73,548

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 40. PADD 5 unplanned CRU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	7,891	6/10	784	34,461
November	0	9,347	3/10	2,000	14,340
December	0	6,468	2/10	5,806	7,129

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.

Table 41. PADD 5 unplanned HU outages

(barrels per day)

Month	2015 on-going unplanned outages	2005-14 average of realized unplanned outages	2005-14 count of realized unplanned outages	2005-14 minimum realized unplanned outages	2005-14 maximum realized unplanned outages
October	0	6,560	6/10	1,161	13,887
November	0	8,775	4/10	1,500	14,000
December	0	2,258	3/10	774	3,097

Source: U.S. Energy Information Administration, based on IIR data as of September 1, 2015.
Note: *Realized* unplanned outages are the average of actual outages and exclude months where no outages occurred.