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June 20, 2019

Sent via eFile

<b>BCUC INQUIRY INTO GASOLINE AND DIESEL PRICES IN BC EXHIBIT A2-6</b>
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**Re: British Columbia Utilities Commission – An Inquiry into Gasoline and Diesel Prices in British Columbia – Project No. 1599007 – U.S. Energy Information Administration Research Paper dated September 2015**

British Columbia Utilities Commission staff submit the following research paper for the record in this proceeding:

U.S. Energy Information Administration  
West Coast Transportation  
Fuels Markets

We invite participants to provide any comments on this exhibit by **Thursday, June 27, 2019**.

Sincerely,

*Original signed by Ian Jarvis for:*

Patrick Wruck  
Commission Secretary

/aci  
Enclosure



*Independent Statistics & Analysis*  
U.S. Energy Information  
Administration

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# West Coast Transportation Fuels Markets

September 2015



This report was prepared by the U.S. Energy Information Administration (EIA), the statistical and analytical agency within the U.S. Department of Energy. By law, EIA's data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views in this report therefore should not be construed as representing those of the U.S. Department of Energy or other federal agencies.

## Table of Contents

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Introduction .....	1
Executive Summary.....	3
Southern California and Southern Nevada .....	6
Northern California and Northern Nevada.....	7
Pacific Northwest.....	8
Arizona .....	9
Hawaii .....	10
Alaska.....	11
PADD 5 Overview .....	13
Transportation fuels supply.....	13
Product specifications.....	15
Market structure.....	18
Southern California and Southern Nevada .....	21
Supply and logistics.....	22
Motor gasoline supply/demand .....	24
Distillate fuel supply/demand.....	25
Jet fuel supply/demand .....	26
Renewable fuels and biofuels supply/demand .....	26
Retail markets .....	27
Northern California and Northern Nevada .....	28
Supply and logistics.....	28
Motor gasoline supply/demand .....	31
Distillate fuel supply/demand.....	32
Jet fuel supply/demand .....	33
Renewable fuels and biofuels supply/demand .....	33
Retail markets .....	34
Pacific Northwest.....	35
Supply and logistics.....	35
Motor gasoline supply/demand .....	38
Distillate fuel supply/demand.....	39

Jet fuel supply/demand .....	40
Renewable fuels and biofuels supply/demand .....	40
Retail markets .....	41
Arizona .....	42
Supply and logistics.....	42
Motor gasoline supply/demand .....	43
Distillate fuel supply/demand.....	45
Jet fuel supply/demand .....	46
Renewable fuels and biofuels supply/demand .....	46
Retail market .....	47
Hawaii .....	48
Supply and logistics.....	48
Motor gasoline supply/demand .....	51
Distillate fuel supply/demand.....	52
Jet fuel supply/demand .....	53
Renewable fuels and biofuels supply/demand .....	53
Retail market .....	54
Alaska .....	55
Supply and logistics.....	55
Motor gasoline supply/demand .....	58
Distillate fuel supply/demand.....	59
Jet fuel supply/demand .....	60
Renewable fuels and biofuels supply/demand .....	60
Retail market .....	61

## Tables

---

Table 1. Transportation fuels consumption within PADD 5: regional market breakdown.....	13
Table 2. PADD 5 gasoline specifications .....	16
Table 3. Ethanol producers and production by state .....	17
Table 4. Biodiesel producers and capacity by state.....	18
Table 6. Northern California and Northern Nevada refineries .....	29
Table 7. Pacific Northwest refineries.....	36
Table 8. Hawaii refineries .....	49
Table 9. Alaska refineries .....	56

## Figures

---

Figure 1. Petroleum Administration for Defense Districts (PADDs) .....	1
Figure 2. Petroleum product supply and refining capacity by PADD .....	4
Figure 3. PADD 5 marine movements .....	5
Figure 4. PADD 5 2013 average regional transportation fuel demand by product .....	6
Figure 5. PADD 5 mainland refineries and product flows .....	14
Figure 6. PADD 5 2013 supply/demand balance .....	15
Figure 7. Gasoline market structure .....	19
Figure 8. Southern California and Southern Nevada 2013 supply/demand balances .....	21
Figure 9. Southern California and Southern Nevada refineries and petroleum product flows .....	23
Figure 10. Southern California and Southern Nevada motor gasoline supply/demand balance .....	24
Figure 11. Southern California and Southern Nevada distillate supply/demand balance .....	25
Figure 12. Southern California and Southern Nevada jet fuel supply/demand balance .....	26
Figure 13. Southern California and Southern Nevada retail market structure .....	27
Figure 14. Northern California and Northern Nevada 2013 supply/demand balance .....	28
Figure 15. Northern California and Northern Nevada refineries and petroleum product flows .....	30
Figure 16. Northern California and Northern Nevada motor gasoline supply/demand balance .....	31
Figure 17. Northern California and Northern Nevada distillate supply/demand balance .....	32
Figure 18. Northern California and Northern Nevada jet fuel supply/demand balance .....	33
Figure 19. Northern California and Northern Nevada retail market structure .....	34
Figure 20. Pacific Northwest 2013 supply/demand balance .....	35
Figure 21. Pacific Northwest refineries and petroleum product flows .....	37
Figure 22. Pacific Northwest motor gasoline supply/demand balance .....	38
Figure 23. Pacific Northwest distillate supply/demand balance .....	39
Figure 24. Pacific Northwest jet fuel supply/demand balance .....	40
Figure 25. Pacific Northwest retail market structure .....	41
Figure 26. Arizona 2013 supply/demand balance .....	42
Figure 27. Arizona petroleum product flows .....	43
Figure 28. Arizona motor gasoline supply/demand balance .....	44
Figure 29. Arizona distillate supply/demand balance .....	45
Figure 30. Arizona jet fuel supply/demand balance .....	46
Figure 31. Arizona retail market structure .....	47
Figure 32. Hawaii 2013 supply/demand balance .....	48
Figure 33. Hawaii refineries and petroleum product flows .....	50
Figure 34. Hawaii gasoline supply/demand balance .....	51
Figure 35. Hawaii distillate fuel supply/demand balance .....	52
Figure 36. Hawaii jet fuel supply/demand balance .....	53
Figure 37. Hawaii retail market structure .....	54
Figure 38. Alaska 2013 supply/demand balance .....	55
Figure 39. Alaska refineries and petroleum product flows .....	57
Figure 40. Alaska motor gasoline supply/demand balance .....	58

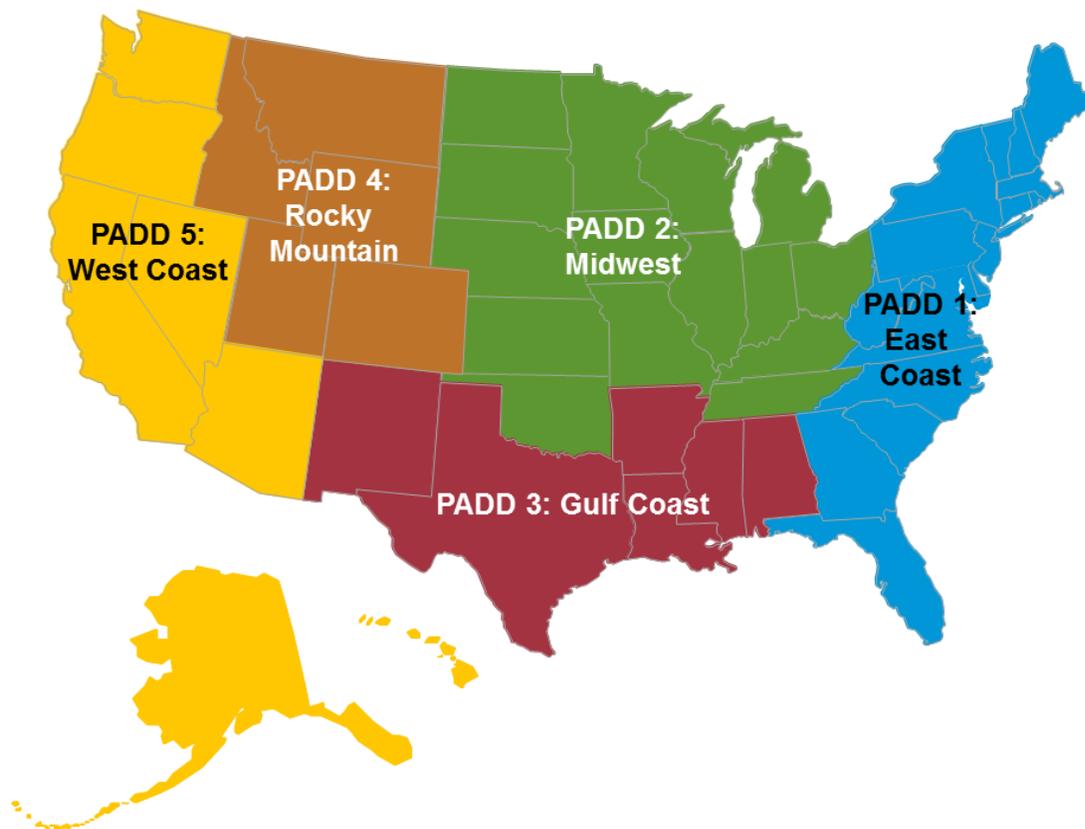
Figure 41. Alaska distillate fuel supply/demand balance .....	59
Figure 42. Alaska jet fuel supply/demand balance .....	60
Figure 43. Alaska retail market structure .....	61

## Introduction

This study examines supply, demand, and distribution of transportation fuels in Petroleum Administration for Defense District (PADD) 5, a region that includes the western states of California, Arizona, Nevada, Oregon, Washington, Alaska, and Hawaii. For this study, transportation fuels include gasoline, diesel fuel, and jet fuel.

This study is the first in a series of studies that the U.S. Energy Information Administration (EIA) plans to conduct to inform its analyses of petroleum product markets, especially during periods of supply disruption and market change.

**Figure 1. Petroleum Administration for Defense Districts (PADDs)**



Source: U.S. Energy Information Administration

This study examines transportation fuels supply, demand, and distribution at both the PADD level and for specific areas within the PADD, which are referred to as sub-PADD regions in this analysis. PADD 5 covers a large and diverse geography, and supply/demand balances and supply patterns vary within the region. The study identified six distinct regional markets within PADD 5: Southern California and Southern Nevada; Northern California and Northern Nevada; Pacific Northwest, which includes Washington and Oregon; Arizona; Hawaii; and Alaska.

For each of these regional markets as well as for PADD 5 as a whole, the study considers demand, supply, supply patterns, and distribution infrastructure, using 2013 as a base year and taking into account expected changes in balances and infrastructure in subsequent years. Demand includes in-region consumption, transfers of fuels to other parts of the United States (other PADDs) and to other regional markets within PADD 5, and exports to the global market. Supply includes in-region refinery production, receipts of fuels produced in other U.S. regions and other PADD 5 regional markets, and imports. Distribution infrastructure includes storage terminals, pipelines, rail facilities, marine loading and unloading facilities, and marine vessel availability.

EIA retained Stillwater Associates, an Irvine, California-based transportation fuels consultant, to conduct the research and analysis for the PADD 5 study. Stillwater analyzed data and information from EIA, the California Energy Commission (CEC), the Army Corps of Engineers Waterborne Commerce Statistics Center, and publicly available data from various sources.

Additional studies are planned to analyze PADD 5 crude supply, PADD 1 (East Coast), and PADD 3 (Gulf Coast) transportation fuels markets, and PADD 2 (Midwest) and PADD 4 (Rocky Mountains) transportation fuels markets.

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## Executive Summary

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In 2013, PADD 5 accounted for 17%, or 1.5 million barrels/day (b/d), of total U.S. gasoline consumption, 13%, or 494,000 b/d, of distillate (including diesel fuel) consumption, and about 30%, or 430,000 b/d, of jet fuel consumption. Consumption varies across PADD 5 and is concentrated in California.

PADD 5 transportation fuels markets have features that often result in significant and persistent increases in prices in the wake of supply disruptions. The region is geographically isolated from other U.S. refining centers, notably the Gulf Coast, where 52% of U.S. refining capacity is located, and from global refining centers that can efficiently supply product to the U.S. East Coast (PADD 1). In addition, although pipelines can move products from the Gulf Coast as far north as New York Harbor on the East Coast, there are no pipelines that cross the Rocky Mountains to move product to the mainland states of PADD 5 from the Midwest, and only limited pipelines that deliver from the Gulf Coast to the southern regions of PADD 5 and from the small refineries in PADD 4 to the eastern regions of PADD 5. The West Coast is 10 days travel by tanker from the U.S. Gulf Coast, three weeks from Asia, and more than four weeks from Europe. Pipeline and marine infrastructure, as well as vessel availability to move product within PADD 5, are also limited.

Across PADD 5, specifications for motor gasoline and diesel fuel vary state-to-state and even within some states, making it difficult to cover product shortfall in one area with supply from another. In addition, some product specifications, like those for the California Air Resources Board (CARB) gasoline and diesel fuel, are difficult and costly to manufacture, and not all refineries in PADD 5, much less elsewhere in the United States or the rest of the world, can make such products. Even when refineries outside PADD 5 can manufacture product to meet these specifications, supplies generally are not kept on hand, further limiting resupply options when disruptions occur.

Because PADD 5 is isolated, in-region refineries are the primary source of transportation fuels for PADD 5. In 2013, PADD 5 refinery production was sufficient to cover about 91% of in-region motor gasoline demand, 96% of jet demand, and 113% of distillate demand. Heavy reliance on in-region production further complicates the supply chain when disruptions occur. When disruptions occur, all of these factors noted above combine to limit short-term supply options, lengthen the duration of supply disruptions, and cause prices to increase and remain higher for a longer period than would be typical in markets outside PADD 5.

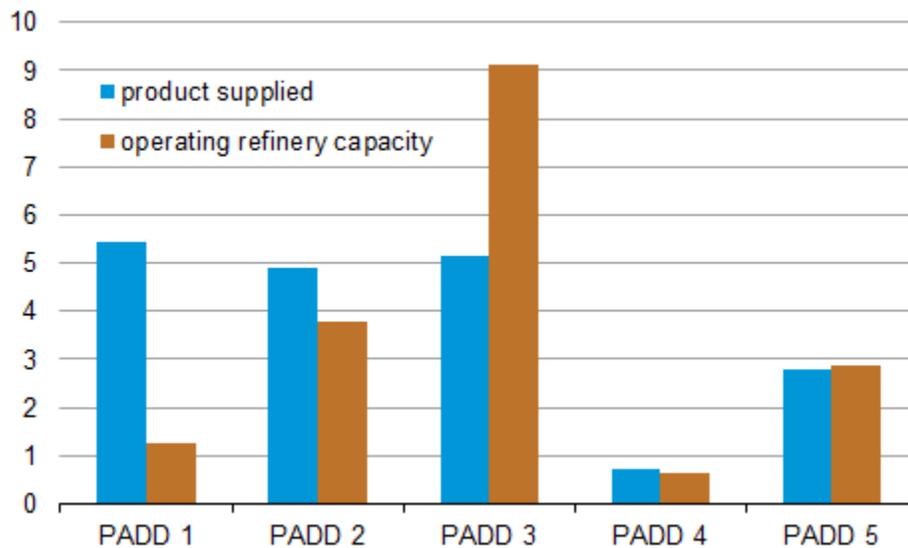
The recent increase in gasoline prices on the West Coast following a series of [supply disruptions](#) that started with an unplanned refinery outage in February at a Southern California refinery provides a case in point. On February 18, an explosion and fire occurred at the third-largest refinery in Southern California. West Coast product markets reacted immediately to the potential loss of supply from the refinery, and spot gasoline prices quickly increased. The rapid price response is not unusual and is similar to what happened following past unplanned outages in that region. In the five weeks following the outage, West Coast total motor gasoline inventories decreased by 3.0 million barrels (10%), and remained below the five-year average for most weeks through August. Inventories provide an immediate, although limited, source of alternative supply but typically are insufficient to offset a prolonged market disruption. With limited resupply options from within the region and from within the

United States, imports increased to replace in-region production. Because the refinery outage has not yet been resolved as of the writing of this report, PADD 5 has continued to rely on imports, which has lengthened the supply chain, making the region more susceptible to shipping delays and other supply chain disruptions. Gasoline prices on the West Coast increased sharply again in early July when, according to trade press, shipping delays caused gasoline cargoes destined for the West Coast to arrive later than anticipated. In addition, PADD 5 gasoline demand was up 4% in the first six months of 2015 compared with the same time last year, putting additional pressure on the supply chain.

There are 22 operating refineries in Washington, Oregon, California, Nevada, and Arizona, the mainland states of PADD 5. These refineries, which have total atmospheric distillation unit (ADU) capacity of 2.5 million barrels per calendar day (b/cd), are located primarily in and around Los Angeles and San Francisco, California, and Puget Sound in Washington. There are two operating refineries in Hawaii with combined crude distillation processing capacity of 147,500 b/cd and five operating refineries in Alaska with combined crude distillation capacity of 165,200 b/cd.

**Figure 2. Petroleum product supply and refining capacity by PADD**

million barrels per day



Note: Refinery capacity is in barrels per calendar day.

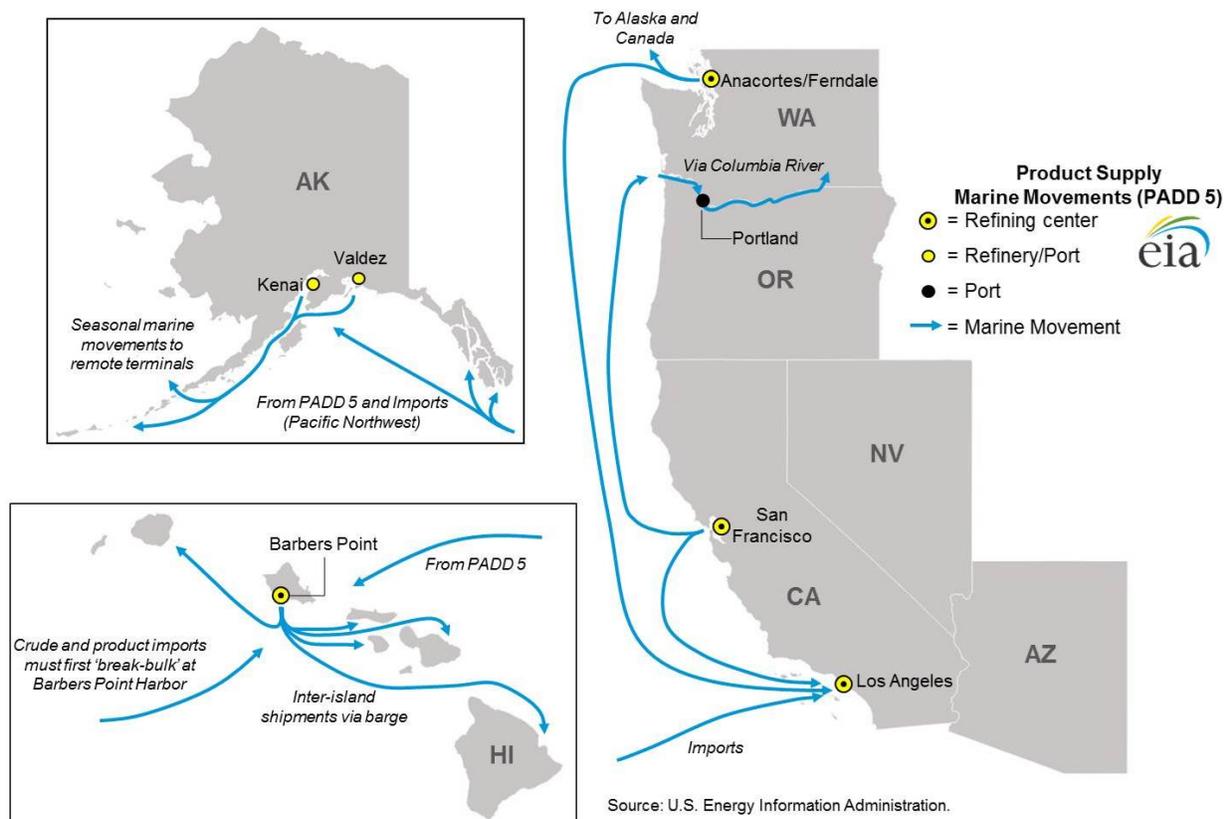
Source: U.S. Energy Information Administration

This study identified six distinct sub-PADD regional markets within PADD 5, each of which is characterized by different supply patterns for transportation fuels and each of which interacts differently with the other regions within PADD 5 and the global markets. The six regions are:

- Southern California and Southern Nevada
- Northern California and Northern Nevada
- Arizona
- Pacific Northwest, which includes Washington and Oregon
- Alaska
- Hawaii

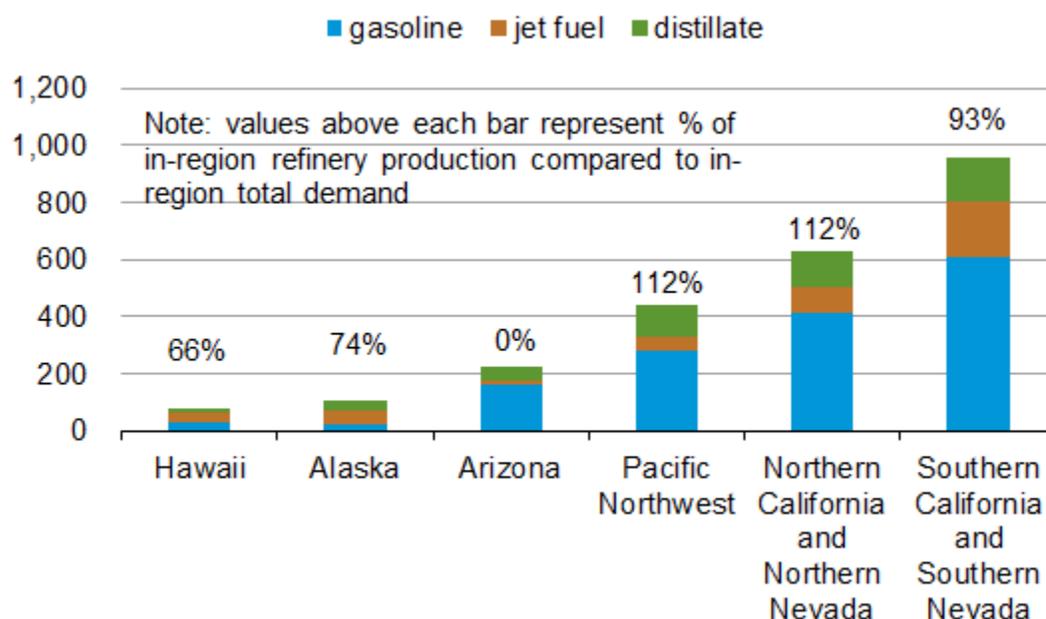
PADD 5 is just not one market for transportation fuels, but rather six distinct regional markets. These six regional markets vary significantly in demand, how transportation fuels are supplied, especially the share of supply provided by in-region refineries, and product distribution patterns. Because there is limited pipeline infrastructure connecting the six regional markets, marine movements within PADD 5 play a key role in moving transportation fuels from regions with excess supply to regions with supply shortfalls. As a result, marine vessels are generally highly utilized, and there is minimal capacity to increase intraregional shipments to manage supply disruptions.

**Figure 3. PADD 5 marine movements**



**Figure 4. PADD 5 2013 average regional transportation fuel demand by product**

thousand barrels per day



Source: Stillwater Associates analysis of EIA data

### Southern California and Southern Nevada

The Southern California and Southern Nevada (SCSN) region includes the southernmost counties of California<sup>1</sup> as well as the Las Vegas metropolitan area of Southern Nevada. The region accounts for more than 40% of total PADD 5 motor gasoline demand, and about 7% of total U.S. demand. Because of the many military air bases and large commercial aviation hubs, jet fuel demand in the SCSN region accounts for about 45% of total PADD 5 jet fuel demand and 14% of U.S. demand. SCSN accounts for 32% of total PADD 5 distillate fuel demand, which is about 4% of U.S. demand.

A combination of in-region refinery production, marine-delivered fuels produced at refineries in Northern California and Washington, receipts of fuels produced at refineries in other PADDs, and imports from the global market supply the SCSN region with transportation fuels. The regional refineries do not produce sufficient gasoline or jet fuel to meet in-region demand but produce more distillate than is consumed in the region. In-region refinery production is supplemented with marine deliveries of product from refineries in Northern California and Washington as well as imports from the global market. Transportation fuels produced at SCSN refineries also supply Arizona, and some are exported into the global market. Exports are primarily distillate fuel, which might not meet region specifications.

There are eight operating refineries in the Southern California and Southern Nevada region. In 2013, SCSN refineries produced a total of 526,800 b/d of gasoline, 182,500 b/d of distillate, and 178,100 b/d of

<sup>1</sup> The southernmost counties of California are Imperial, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura.

jet fuel, production sufficient to supply 87% of regional motor gasoline demand, 117% of total distillate fuel demand, and 92% of jet fuel demand.

Production from the refineries moves primarily by pipeline from the Los Angeles area to bulk storage and distribution terminals throughout the SCSN region. From terminals, product moves by tank truck to retail outlets. Product from the Los Angeles area is also shipped by pipeline to Arizona, reducing the product available to supply SCSN demand, which is particularly important for gasoline. Transportation fuels produced at refineries in Salt Lake City, Utah, in PADD 4, also supply SCSN.

Refineries, pipelines, ports, and storage facilities are all critical to the effective functioning of the petroleum supply chain. However, in the SCSN region, Watson Station, a pipeline hub in Carson, California, is particularly important. Product from many of the region's refineries must move through Watson Station to reach bulk storage and distribution facilities. Power outages and earthquakes can affect the region's infrastructure.

There are about 27 distinct branded companies participating in the retail market for gasoline and distillate fuel in the Southern California and Southern Nevada region. About 76% of retail outlets are branded, meaning that they are associated with and display a major oil company brand, like Chevron, Shell, 76, Valero, and ARCO. The remaining 24% of retail outlets are referred to as unbranded because they are not affiliated with a major oil company brand. Unbranded retailers include small independent retailers as well as big box retailers. In California as a whole, 79% of retail outlets are associated with a major brand, while 21% are unbranded.

## Northern California and Northern Nevada

The Northern California and Northern Nevada region (NCNN) includes counties in California north of San Luis Obispo, Kern, and San Bernardino counties, and in Nevada north of Las Vegas. In 2013, with average motor gasoline demand of 412,000 b/d, the region accounted for 27% of total PADD 5 motor gasoline demand and 5% of U.S. motor gasoline demand. NCNN distillate demand of 125,000 b/d in 2013 accounted for 25% of PADD 5 demand and 3% of U.S. demand. NCNN jet fuel demand averaged 88,000 b/d in 2013, 21% of PADD 5 demand and 6% of U.S. demand.

The region is supplied by in-region refinery production, and refineries in the region produce more motor gasoline, jet fuel, and diesel fuel than is consumed in the region. As a result, NCNN supplies other regional markets in PADD 5, primarily Southern California and Southern Nevada, with motor gasoline, jet fuel, and diesel fuel, and also exports these products. In 2013, the region exported 22,100 b/d of gasoline, 2,300 b/d of jet fuel, and 52,400 b/d of distillate fuel, primarily to Central America and South America.

There are nine operating refineries in two primary refining centers in the Northern California and Northern Nevada region. Only one of the refineries is located outside California, and it primarily produces asphalt. Most of the California refining capacity in the NCNN region is in the San Francisco Bay area. Several smaller refineries are located in California's Central Valley.

In 2013, NCNN refineries produced an average of 421,000 b/d of motor gasoline and motor gasoline blending components, 185,000 b/d of distillate, and 96,000 b/d of jet fuel. This production was more

than sufficient to meet in-region demand. NCNN refineries produced product sufficient to meet 102% of regional demand for finished motor gasoline,<sup>2</sup> 108% of jet fuel demand, and 147% of diesel fuel demand. Production from refineries in Northern California regularly supplies parts of Southern California and Oregon by marine vessel.

Product is shipped by pipeline from the refineries in San Francisco to storage and distribution terminals in the San Francisco area and further inland to Fresno and Chico, California, and to Nevada. No pipelines connect the NCNN region to other PADDs or other PADD 5 regional markets, and, as a result, supply from NCNN to those areas moves by marine vessel. The major port facilities through which products are exported into the global market and from which products are shipped to other PADD 5 regional markets are located on the San Francisco Bay.

Critical supply chain infrastructure includes the refineries, pipelines, ports, and storage facilities of the San Francisco Bay area. In particular, the Concord pipeline junction is the gathering and entry point for the main pipeline distribution artery for the region. Power outages and earthquakes can affect the region's infrastructure, and heavy fog can disrupt the port facilities on the San Francisco Bay.

In the Northern California/Northern Nevada region, 80% of retail outlets are branded and 20% are unbranded. In Northern California, about 21 companies participate in the retail market for gasoline and diesel fuel as compared with about 12 in the Reno/Carson City market. In Northern California, major oil company branded outlets dominate the retail sector, and the top five brands have 76% of the number of retail outlets. A mix of branded and unbranded retail outlets characterizes the Reno/Carson City market.

## Pacific Northwest

The Pacific Northwest region (PNW) includes the states of Oregon and Washington. In 2013, with 277,300 b/d of motor gasoline demand, the region accounted for 18% of total PADD 5 motor gasoline demand and 3% of total U.S. demand. At 111,400 b/d, PNW demand for distillate fuel was 23% of PADD 5 demand and 3% of U.S. demand. Jet fuel demand in the Pacific Northwest averaged 51,400 b/d in 2013, 12% of PADD 5 demand and 4% of U.S. demand.

The region is supplied by a combination of in-region refinery production, imports, and receipts of product manufactured at refineries outside PADD 5. Refineries in the PNW produce about as much gasoline as is consumed in the region, but considerably more than enough distillate and jet fuel than is needed to meet in-region demand. The region supplies distillate fuel and jet fuel to the global market and to other regions within PADD 5 and exports motor gasoline. The PNW also imports motor gasoline and a small amount of distillate. The combination of imports and exports is used to manage distribution system inefficiencies and gasoline grade imbalances. The PNW typically does not receive product from other regions within PADD 5. In 2013, the region exported 26,000 b/d of motor gasoline, 26,800 b/d of jet fuel, and 43,200 b/d of distillate fuel, primarily to Canada, Mexico, Central America, and South America.

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<sup>2</sup> Finished motor gasoline includes gasoline blendstock produced by refineries and 10% ethanol.

There are five operating refineries in the Pacific Northwest region, located in and around Puget Sound, Washington. There are no refineries in Oregon or eastern Washington.

In 2013, PNW refineries produced an average of 253,400 b/d of motor gasoline and motor gasoline blending components, 154,100 b/d of distillate fuel, and 83,600 b/d of jet fuel. This production was sufficient to meet 102% of regional demand for motor gasoline, 163% of jet fuel demand, and 140% of diesel fuel demand. Production from refineries in Washington regularly supplies Alaska and California.

Product is shipped from the refineries by pipeline north and south to supply Portland, Oregon, and Seattle, Washington, and product is shipped by marine vessel to supply the global markets and other regions within PADD 5. Many of the Portland storage and distribution terminals have access to the Columbia River and can ship and receive product by marine vessel. Each of the five refineries also has associated dock infrastructure for loading and discharging marine vessels, which supports imports and exports of petroleum products.

Product moves from storage and distribution terminals in Portland south to Eugene, Oregon by pipeline. Distribution infrastructure to move product from the western portions of Washington and Oregon eastward is limited. The only connection between the western and eastern portions of the region is marine transport along the Columbia River. There is no pipeline infrastructure to move product across the Cascade Range of mountains. As a result, eastern Washington is supplied with product from refineries in PADD 4. Product moves by pipeline from Salt Lake City, Utah, into eastern Washington and Oregon, and from refineries in Billings, Montana, into eastern Washington.

Critical infrastructure in the region includes the refinery complexes, pipelines, storage and distribution terminals, and the marine facilities at refineries and terminals, notably those along the Columbia River. Weather can disrupt the region's marine facilities. The Olympic pipeline, which runs from Puget Sound, Washington, to Portland, Oregon, is the main north-south corridor for petroleum product transportation in the region. Disruptions to flows on the Olympic pipeline can have a major effect on regional supply. Many of the storage and distribution terminals connected to the pipeline lack other supply options. As a result, during supply disruptions product typically supplied from these terminals may need to be sourced from other terminals, which can increase supply costs and therefore prices.

The Pacific Northwest has a slightly higher percentage of branded outlets compared to PADD 5 overall. The region has about 25 branded retailers, with 77% of retail stations selling branded fuels compared to the PADD 5 average of 72%. Brands in the Pacific Northwest include Chevron, Shell, 76, Conoco, and ARCO along with Pilot, Costco, and Sam's Club.

## Arizona

Arizona accounts for 11% of PADD 5 demand for motor gasoline, 3% of demand for jet fuel, and 10% of distillate fuel demand. There are no petroleum refineries in Arizona, and the region is supplied with product by pipelines that originate in Southern California and West Texas. In 2013, the region consumed 161,500 b/d of motor gasoline, 14,600 b/d of jet fuel, and 50,600 b/d of distillate fuel.

The Kinder Morgan East Line originates in El Paso, Texas, and consists of two parallel pipelines that end in Phoenix, Arizona. Refineries in West Texas and New Mexico supply product into the East Line for

delivery to four storage and distribution terminals in Phoenix and two in Tucson, Arizona. The Kinder Morgan West Line runs from Watson in the Los Angeles Basin to Phoenix, Arizona, and delivers product into storage and distribution terminals in Phoenix.

The two pipelines of the East Line operate at very close to full capacity, while the West Line operates well below its capacity, and as a result, is a source of incremental supply for Phoenix should supply from the East Line be reduced. However, as the transportation time for fuels delivered into Phoenix from Los Angeles is about a week to 10 days, incremental supply to Phoenix will not be immediately available. Fuels cannot be delivered from Phoenix to Tucson by pipeline; thus, there is no backup pipeline capacity for fuels supply into Tucson. Incremental supply to Tucson is via long-haul trucking.

The Kinder Morgan East and West Lines are critical to fuels supply to Arizona. Train derailments, as well as washouts and pipeline ruptures, have affected the pipeline, sections of which lie in the Union Pacific Railroad right of way. Most disruptions have been of short duration.

There are about 23 distinct fuels retailers operating in Arizona, and most (56%) of the retail outlets are unbranded. Major retail brands in Arizona include Chevron, Circle K, Fry's, QuikTrip, Shell, and Valero.

## Hawaii

Hawaii is remote and isolated from other PADD 5 regional markets and other PADDs, and relies primarily on in-region refinery production and imports. In 2013, refineries in Hawaii produced 21,500 b/d of motor gasoline, 20,300 b/d of jet fuel, and 11,800 b/d of diesel fuel sufficient to meet 72% of motor gasoline demand, 55% of jet fuel demand, and 81% of distillate fuel demand. Refinery production was supplemented with motor gasoline imports of 5,400 b/d, jet fuel imports of 19,700 b/d, and distillate imports of 2,200 barrels per day. Hawaii was also supplied with small volumes of motor gasoline and diesel fuel from other PADDs and a small volume of diesel fuel from other PADD 5 regional markets.

The state's island geography supports air travel, and as a result Hawaii's jet fuel demand, which averaged 37,000 b/d in 2013, is higher than demand for both motor gasoline and diesel fuel. Hawaii's jet fuel demand accounted for 8% of PADD 5 demand in 2013, compared with 2% of motor gasoline and 3% of distillate fuel demand. The state's distillate demand is boosted by demand from the electric power sector and U.S. Navy demand for marine fuels.

There are two operating refineries in Hawaii, both on the island of Oahu. One of the two refineries was closed for part of 2013 and changed ownership. As a result, 2013 data on refinery transportation fuels supply are atypical for Hawaiian petroleum product markets.

In 2013, refineries in Hawaii produced 21,500 b/d of motor gasoline, 20,300 b/d of jet fuel, and 11,800 b/d of distillate fuel, sufficient to meet 72% of motor gasoline demand, 55% of jet fuel demand, and 81% of distillate fuel demand. Refinery production was supplemented with motor gasoline imports of 5,400 b/d, jet fuel imports of 19,700 b/d, and diesel imports of 2,200 b/d. Hawaii was also supplied with small volumes of motor gasoline and diesel fuel from other PADDs and a small volume of diesel fuel from other PADD 5 regional markets. In addition to transportation fuels, Hawaiian refineries produce significant quantities of heavy fuels used in electric power generation.

The two refineries on Oahu and the Barbers Point port facilities and associated barge fleet are critical to Hawaii. Product from the refineries on Oahu moves by pipeline to supply storage and distribution terminals on Oahu and moves by marine vessel from the Barbers Point Harbor to terminals on the islands of Maui, Kauai, and Hawaii. Product that arrives in Hawaii by marine vessel from imports and other U.S. regions is also processed through the Barbers Point Harbor, where large seagoing marine vessels can be accommodated. Product is also shipped to the Honolulu International Airport by pipeline across Pearl Harbor, and jet fuel is delivered by truck from Honolulu area terminals. Large cargoes are offloaded, and smaller volumes are shipped by barge to the storage and distribution terminals on the other islands. There are 14 storage and distribution terminals outside the Honolulu area, many of which are very small.

There are about nine distinct retailers of transportation fuels in Hawaii, and 76% of retail outlets sell branded fuels. Chevron, 76, Aloha, Tesoro, and Shell are among the major retail brands in Hawaii.

## Alaska

Alaska has the lowest population of all PADD 5 regions, and as a result, Alaska's demand for motor gasoline accounts for a small percentage of total PADD 5 demand. However, the region's remoteness and wide geographic expanse make air travel essential and make Alaska demand for jet fuel higher than for motor gasoline. PADD 5 diesel fuel demand is supported by resource extraction activities and oil production in the north. In 2013, Alaska demand for motor gasoline was 20,800 b/d, less than 2% of total PADD 5 demand; jet fuel demand was 48,400 b/d, 11% of PADD 5 demand; and diesel fuel demand was 33,400 b/d, 7% of PADD 5 demand.

The region is supplied primarily by in-region refinery production, production from refineries in other regions of PADD 5 that is delivered by marine vessel from Washington and California, and imports.

There are five operating refineries in Alaska. A sixth refinery, Flint Hills Resources North Pole refinery, closed in 2014 and is being dismantled and converted to a storage and distribution terminal. Tesoro operates the largest and most complex refinery in Alaska at Kenai. The Tesoro refinery produces a wider range of transportation fuels, including motor gasoline, jet fuel, and diesel fuel. The refinery also produces asphalt. The other operating refineries are dispersed across the state. On the North Slope, two of the three major crude oil producers operate small distillation-only refineries that produce arctic diesel fuel for production operations. The refineries inject unsold distillation products back into the Trans-Alaska Pipeline System (TAPS). Two other distillation-only refineries, one in North Pole in central Alaska and the other in Valdez in southern Alaska, also blend unsold distillation products back into TAPS.

On an annual average basis, the refineries in Alaska supply 83% of motor gasoline demand, 76% of jet fuel demand, and 66% of diesel fuel demand. However, Alaska's seasonal weather patterns result in seasonal differences in consumption, and supply/demand balances and supply patterns vary over the year. In-region refinery supply is supplemented with receipts from other PADD 5 regions and imports. Product is regularly supplied to southeastern Alaska by marine vessel from Washington and California. Alaska also exports a small amount of fuel to Canada and Asia.

Product is moved within Alaska by pipeline between Kenai and Anchorage, by rail between Anchorage and Fairbanks, and by marine vessel. The Anchorage-to-Fairbanks rail line and the pipeline to Anchorage

are critical to the supply chain. Jet fuel is delivered to the Ted Stevens International Airport via both pipeline and trucks from Anchorage-area terminals.

There are 42 small storage/distribution terminals outside the Anchorage area that serve isolated areas. Deliveries to some locations are seasonal, occurring only during the summer and fall when barge movements are possible. In southeast Alaska, where there are few roads, fuels are supplied by barge from the U.S. West Coast and from Canada.

There are 9 distinct retailers with approximately 170 retail outlets in Alaska. Most of the retail locations (57%) are branded. Major retail brands include Holiday, Tesoro, Chevron, and Shell.

## PADD 5 Overview

PADD 5 accounts for 17%, or 1.5 million barrels/day (b/d), of total U.S. gasoline consumption, 13%, or 494,000 b/d, of distillate (including diesel fuel) consumption, and about 30%, or 430,000 b/d, of jet fuel consumption. Consumption varies across the PADD and is concentrated in California (Table 1).

**Table 1. Transportation fuels consumption within PADD 5: regional market breakdown**

thousand barrels per day

Demand by region	Gasoline <sup>1</sup>			Jet fuel			Diesel fuel		
	2013	% of PADD 5	% of U.S.	2013	% of PADD 5	% of U.S.	2013	% of PADD 5	% of U.S.
Southern California/ Southern Nevada	606.6	40.2%	6.9%	194.1	44.8%	13.5%	155.5	31.7%	4.1%
Northern California/ Northern Nevada	412.0	27.3%	4.7%	88.2	20.3%	6.1%	125.6	25.6%	3.3%
Pacific Northwest	277.3	18.4%	3.1%	51.4	11.9%	3.6%	111.4	22.7%	2.9%
Arizona	161.5	10.7%	1.8%	14.6	3.4%	1.0%	50.6	10.3%	1.3%
Hawaii	29.6	2.0%	0.3%	36.7	8.5%	2.6%	14.6	3.0%	0.4%
Alaska	20.8	1.4%	0.2%	48.4	11.2%	3.4%	33.4	6.8%	0.9%
<b>Total</b>	<b>1,507.7</b>	<b>100%</b>	<b>17.0%</b>	<b>433.3</b>	<b>100.0%</b>	<b>30.2%</b>	<b>491.1</b>	<b>100.0%</b>	<b>12.8%</b>

<sup>1</sup>Finished motor gasoline, i.e., petroleum-based gasoline blendstock plus ethanol.

Source: U.S. Energy Information Administration

## Transportation fuels supply

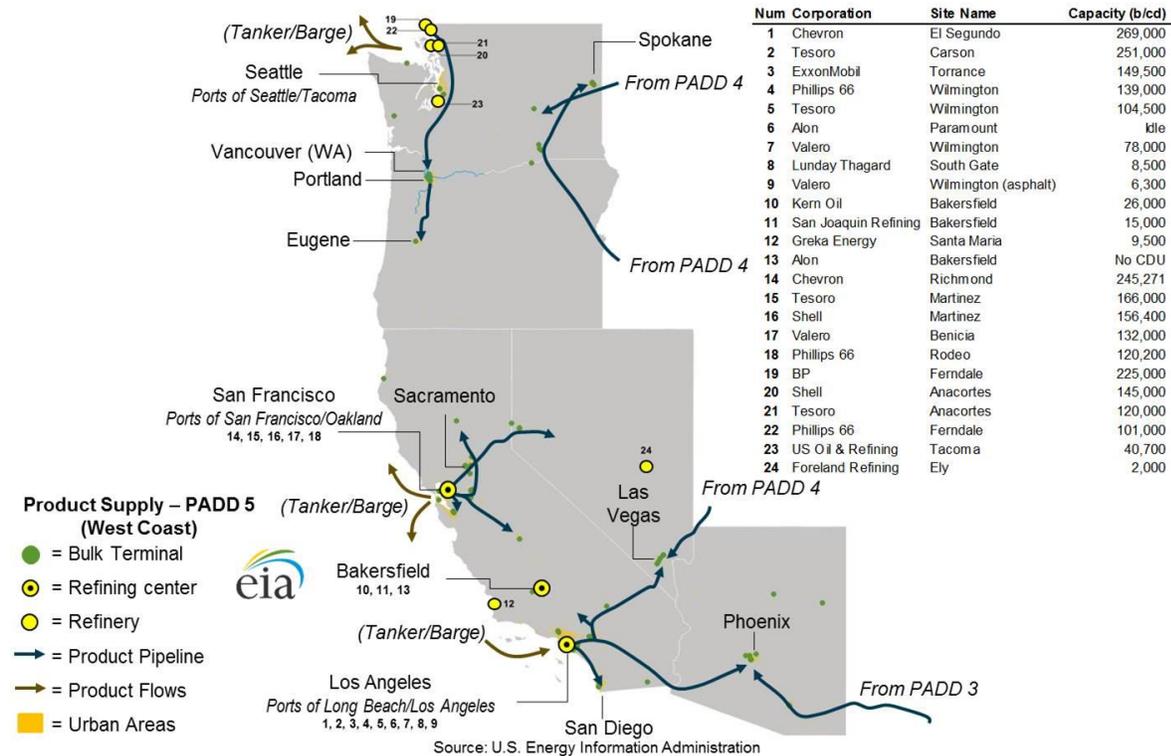
PADD 5 refineries are the primary source of transportation fuels for the region. There are 22 operating refineries in Washington, Oregon, California, Nevada, and Arizona, the mainland states of PADD 5. These refineries, which have total atmospheric crude distillation unit (ACDU) capacity of 2.5 million barrels per calendar day (b/cd), are located primarily in and around Los Angeles and San Francisco, California and Puget Sound in Washington State.

There are two operating refineries in Hawaii with combined crude distillation processing capacity of 147,500 b/cd and five operating refineries in Alaska with combined atmospheric crude distillation capacity of 165,200 b/cd.

PADD 5 depends largely on in-region refinery production of motor gasoline, jet fuel, and diesel fuel because of the relative geographic isolation of the region from other U.S. refining centers, like the Gulf Coast, and global refining centers, like Asia and Europe. There are no pipelines that cross the Rocky Mountains from PADD 4 (Rocky Mountains) and only limited pipelines that deliver to PADD 5 from PADD 3 (Gulf Coast). The West Coast is 10 days travel by tanker from the Gulf Coast and three weeks from Asia. In addition, much of PADD 5 requires the use of unique transportation fuels that are difficult and expensive to manufacture, notably California Air Resources Board (CARB) gasoline, and only a limited number of refineries outside PADD 5, both inside and outside the United States, can manufacture product that meets these unique specifications.

The interior markets of mainland PADD 5, which include Arizona, Las Vegas, Nevada, and eastern Washington, are less reliant on PADD 5 refineries as these markets can be supplied with transportation fuels produced at refineries in PADD 3 and PADD 4.

Figure 5. PADD 5 mainland refineries and product flows

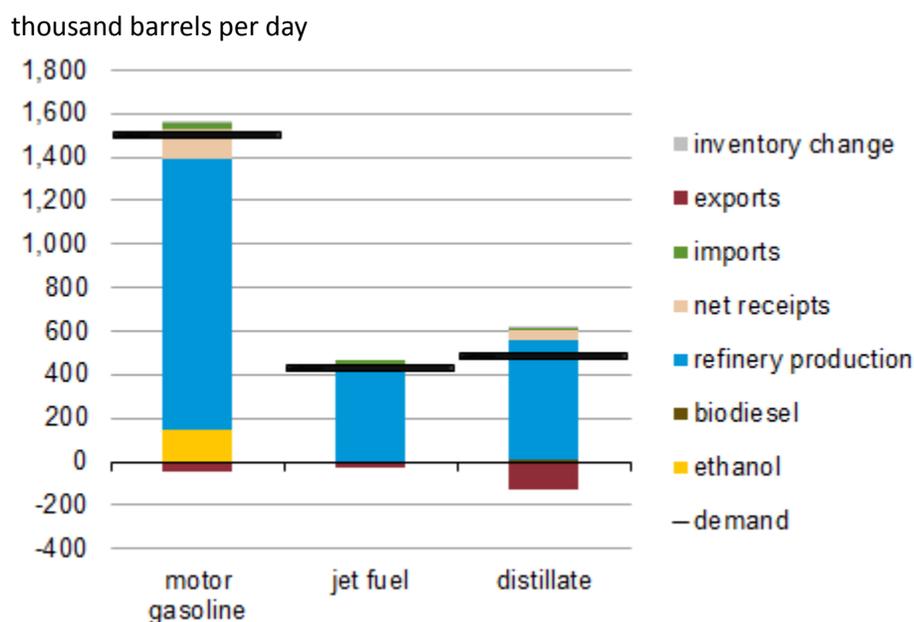


As a whole, PADD 5 refineries do not produce sufficient gasoline or jet fuel to meet total PADD 5 demand, but they produce more distillate than is consumed in the region. For 2013, PADD 5 refinery production of gasoline was sufficient to supply 91%<sup>3</sup> of PADD 5 demand, 96% of jet demand, and 113% of distillate demand. However, refinery production in two PADD 5 regional markets, Northern California/Northern Nevada and the Pacific Northwest, typically is sufficient to meet local demand under normal refinery operating conditions.

PADD 5 refinery production is supplemented by receipts of fuels produced at refineries in other PADDs and imports of petroleum products from the global market. Diesel fuel is exported to balance overall supply and demand, and other transportation fuels produced at PADD 5 refineries are also exported, to balance any mismatch between the quality of product that refineries can produce and the quality of product demanded, but also to manage distribution system inefficiencies. Distillate fuel makes up most exports, but some gasoline and jet fuel is also exported. Some exported product does not meet PADD 5 product specifications.

<sup>3</sup> 2013 PADD 5 demand for gasoline was 1,507.7 b/d of which about 90%, or 1,359.03.9 b/d, was petroleum-based gasoline blendstock (BOB). An additional 10% was ethanol. PADD 5 refineries produced 1,240.4 b/d petroleum-based gasoline, 90% of petroleum-based gasoline demand.

Figure 6. PADD 5 2013 supply/demand balance



Note: Net receipts are movements of product to and from other PADDs.

Source: Stillwater Associates analysis of EIA data

## Product specifications

Gasoline and diesel specifications vary across PADD 5, complicating the supply chain and sometimes making it difficult to cover product shortfall in one region with oversupply from another. For example, California requires reformulated gasoline that meets specifications defined by the California Air Resources Board (CARB), so-called CARB gasoline, while other areas of PADD 5 require reformulated gasoline that meets the specifications defined by the U.S. Environmental Protection Agency<sup>4</sup> (EPA). Arizona requires cleaner-burning gasoline for ozone and carbon monoxide nonattainment areas in the state, the latter to comply with the EPA Oxygenated Fuel specification.<sup>5</sup>

Table 2 provides information on gasoline specifications for different areas of PADD 5.

<sup>4</sup> Reformulated gasoline (RFG) is gasoline blended to burn more cleanly than conventional gasoline and to reduce smog-forming and toxic pollutants in the air. The RFG program was mandated by Congress in the 1990 Clean Air Act amendments, and RFG is required in cities with high smog levels and is optional elsewhere. RFG is currently used in 17 states and the District of Columbia. About 30% of gasoline sold in the United States is reformulated.

<sup>5</sup> Federal EPA [Winter Oxygenated Fuel](#) programs increase fuel oxygen and are mandated in certain areas for carbon monoxide control. The winter oxygenated fuel season is generally October through February or March.

Table 2. PADD 5 gasoline specifications

Specifications	California Summer CARBOB Regular Grade	Nevada Summer CBOB Regular Grade	Arizona Summer AZBOB Regular Grade	Sub-Octane Conventional Regular Grade	Federal Reformulated RBOB Regular Grade <sup>6</sup>	Conventional Regular Grade <sup>6</sup>
Summer Reid Vapor Pressure (psi max) <sup>1</sup>	5.99	9.0/7.8	5.7	8.0 <sup>2</sup>	Varies <sup>3</sup>	9
Distillation T50 (deg. F) <sup>1</sup>	232	170 min	E200 (25- 65%)	170 min	E200 (30- 70%)	250
Distillation T90 (deg. F, max) <sup>1</sup>	335		E300 (65- 100%)		E300 (70- 100%)	374
Benzene (vol % max) <sup>4</sup>	1.22					3.8
Aromatics (vol % max) <sup>1</sup>	38.7	25	55		50	-
Olefins (vol % max) <sup>1</sup>	11.1		27.5			
Sulfur (PPM wt% max) <sup>1,4</sup>	21	80	89	80	80	80
Road Octane (R+M/2) <sup>5</sup>	87	87	87	87	87	87

<sup>1</sup> These values are caps. These properties as well as others are inputs into the CARB and Federal Complex models.

<sup>2</sup> If RVP waiver applies, this is 9 psi max.

<sup>3</sup> Varies by state or local requirements and whether RVP waiver applies.

<sup>4</sup> Benzene and sulfur are subject to annual averaging requirements. Annual averages are 1.0% and 30 ppm maximum for benzene and sulfur respectively.

<sup>5</sup> Octane after blending with 10% ethanol (EtOH).

<sup>6</sup> Specifications generally used for exports.

Source: Kinder Morgan Pacific Operations Specification Manual, Colonial Pipeline Company Product Codes and Specifications

Diesel fuel sold in California must meet the unique CARB diesel specifications.<sup>6</sup> These stringent requirements limit out-of-state sources of diesel supply to California; however this is typically not a concern because California produces more diesel fuel than is consumed in the state.

Most transportation fuels consumed in PADD 5 must also comply with the federal Renewable Fuels Standard (RFS). Some PADD 5 state programs also encourage the use of renewable fuels. California's Low Carbon Fuel Standard (LCFS) is designed to reduce by 10% the average lifecycle carbon intensity of the motor gasoline and diesel transportation fuel pool, including all petroleum and nonpetroleum components, sold for consumption in California from 2012 to 2020. The lifecycle carbon intensity of a fuel is a measure of greenhouse gas emissions associated with producing and consuming the fuel. The Oregon Renewable Fuel Standard that was adopted in 2005 set a requirement for B5 biodiesel, which requires a minimum 5% biodiesel blending level in diesel fuel.

<sup>6</sup> CARB diesel requires lower aromatic hydrocarbon content and a higher cetane number. Aromatic [hydrocarbons](#) are a class of chemical substances characterized by having molecular structures called [benzene](#) rings. Cetane number is an indicator of the combustion speed of diesel fuel.

The three renewable fuels used in transportation fuels are ethanol, biodiesel, and renewable diesel.<sup>7</sup> PADD 5 ethanol plants had a total nameplate production capacity of 510 million gallons per year (gal/y) in 2015. Ethanol is also supplied to mainland PADD 5 states from the Midwest by rail and to Hawaii from the West Coast by tanker. Sugarcane ethanol, which has lower carbon intensity than corn ethanol, is imported into PADD 5 from Brazil and the Caribbean, when economic. Use of sugarcane ethanol is driven by California's LCFS.

Biodiesel production capacity is concentrated in Washington with 107 million gal/y. Total PADD 5 biodiesel production capacity was 191 million gal/y in 2015. Imports are the principal source of renewable diesel, primarily from Asia.

**Table 3. Ethanol producers and production by state**

<b>State</b>	<b>Number of producers</b>	<b>Nameplate production capacity (million gallons per year)</b>
Alaska	—	—
Arizona	1	275
California	5	200
Hawaii	—	—
Nevada	—	—
Oregon	1	35
Washington	—	—
<b>Total PADD 5</b>	<b>7</b>	<b>510</b>

— = No data reported.

Nameplate capacity: volume of denatured fuel ethanol that can be produced during a period of 12 months under normal operating conditions.

Number of producers is a count of plants with operable capacity as of January 1, 2015.

Source: U.S. Energy Information Administration, Form EIA-819 Monthly Oxygenate Report

<sup>7</sup> Biodiesel refers to fatty acid methyl esters produced by a chemical reaction between vegetable oils or animal fats and alcohol (transesterification), and is most commonly blended with petroleum diesel in up to 5% by volume or 20% by volume (B5 and B20). Renewable diesel refers to a diesel-like fuel that is compatible with existing infrastructure and in existing engines in any blending proportion. It is produced by refining vegetable oils or animal fats using a hydrotreating process.

**Table 4. Biodiesel producers and capacity by state**

State	Number of producers	Annual production capacity (million gallons per year)
Alaska	1	0
Arizona	1	2
California	7	59
Hawaii	1	6
Nevada	—	—
Oregon	1	17
Washington	3	107
<b>Total PADD 5</b>	<b>14</b>	<b>191</b>

—= No data reported.

Number of producers is a count of plants with operable capacity as of June 2015.

Source: U.S. Energy Information Administration, Form EIA-22M Monthly Biodiesel Production Survey

## Market structure

The PADD 5 market for gasoline is both large and complex. The number of different gasoline specifications, the uniqueness of the specifications, the close balance between in-region supply and demand, and the relative price inelasticity of gasoline demand combine to create a volatile market.<sup>8</sup>

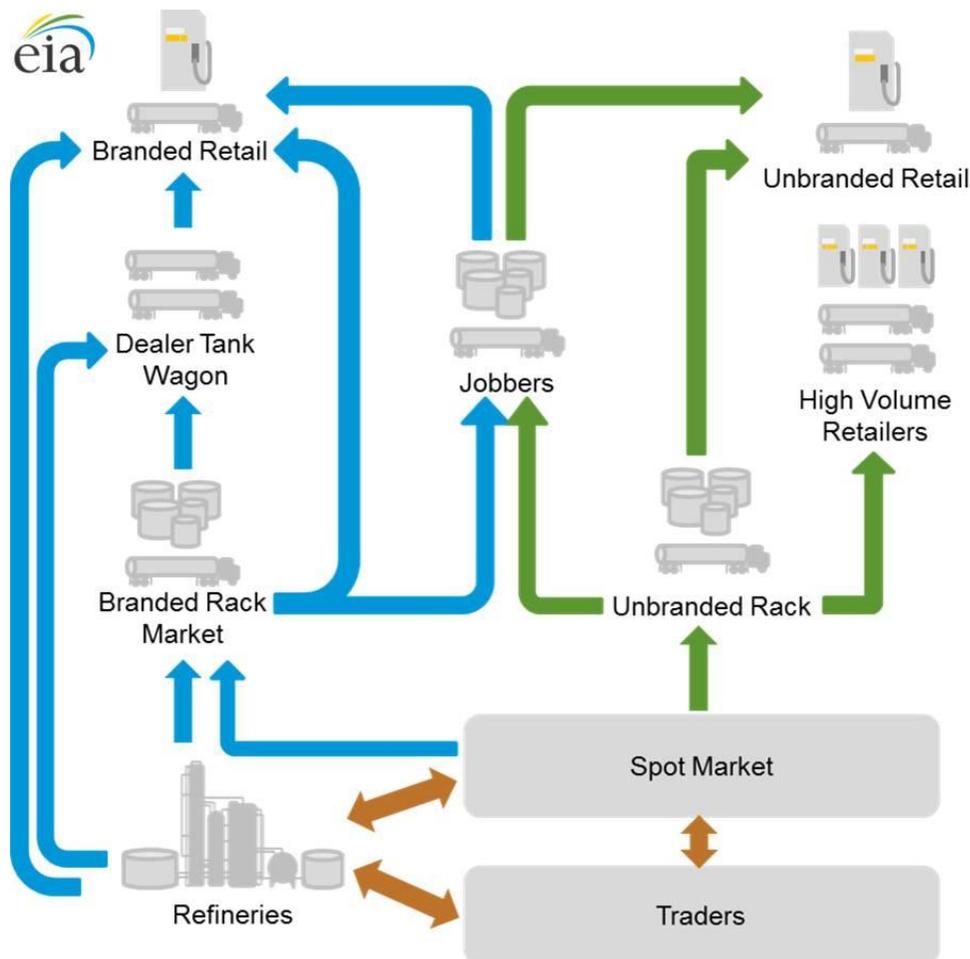
The gasoline market includes four separate but interrelated markets:

- **The spot market**, where sizeable volumes, typically parcels of at least 1 million gallons, are sold at the refinery gate or from imported cargoes, and delivered into a specified pipeline or storage facility, as agreed by the buyer and seller. There are about 15 to 20 participants in the West Coast spot market, including refiners that buy and sell products to balance refinery production and sales commitments, trading companies that are in the business of buying and selling gasoline but that typically have no presence in wholesale or retail gasoline markets, brokers with market knowledge and understanding that identify buyers and sellers and arrange deals, and independent retail marketers that move large volumes of gasoline through their own retail outlets. Prices in the spot market move with perceived changes in refinery supply and demand. There are three major spot markets for gasoline in PADD 5, located in the major refining centers of Los Angeles, San Francisco, and the Pacific Northwest. Prices in these markets reflect regional supply/demand balances as well as the cost to move product between the markets and product quality differences.
- **The rack market**, where wholesale buyers such as independent retailers or distributors that operate their own trucks purchase product delivered into a tank truck at a truck loading rack located at a storage and distribution terminal or refinery. Rack market participants may buy branded products that will be sold at a retail outlet under the name of a major oil company or may alternatively purchase unbranded products destined for sale at independent service stations or for use by commercial/industrial consumers. Branded and unbranded rack pricing varies.

<sup>8</sup> Updated from Stillwater Associates. *California Strategic Fuels Reserve – Consultant Report to the California Energy Commission*. July 2002. [http://www.energy.ca.gov/reports/2002-03-11\\_600-02-004CR.PDF](http://www.energy.ca.gov/reports/2002-03-11_600-02-004CR.PDF)

- **The dealer tank wagon (DTW) market**, where branded retail outlets (dealers) purchase branded gasoline that is delivered by tank truck (tank wagon) to their retail outlets. The price of the gasoline reflects the cost of the product and the cost of delivery.
- **The retail market**, where gasoline is sold to the end consumer at the pump at a gas station or other retail outlet. Retailers typically set prices by comparison to prices at other retail outlets. However, high volume retailers (HVRs), such as large chain stores, or *big box* store, that are focused on selling large volumes of gasoline at low margins, tend to price gasoline based on cost plus the desired margin, rather than based on prices at other retail outlets.

Figure 7. Gasoline market structure



Source: U.S. Energy Information Administration, California Strategic Reserve Study<sup>9</sup>

Over the past 10 years, the PADD 5 gasoline market has changed. The number of spot market participants has decreased as refinery ownership consolidation and as increased reliance on in-region refinery production of gasoline has reduced opportunities for trading companies and brokers to

<sup>9</sup> Stillwater Associates. *California Strategic Reserve Study – Consultant Report*. March 10, 2002. [http://www.energy.ca.gov/reports/2002-03-11\\_600-02-004CR.PDF](http://www.energy.ca.gov/reports/2002-03-11_600-02-004CR.PDF).

participate in the market. Most integrated refiner-marketers have divested their retail chains, and many of the new retail operators, including hypermarkets and big box retailers, now purchase gasoline at an unbranded rack price.

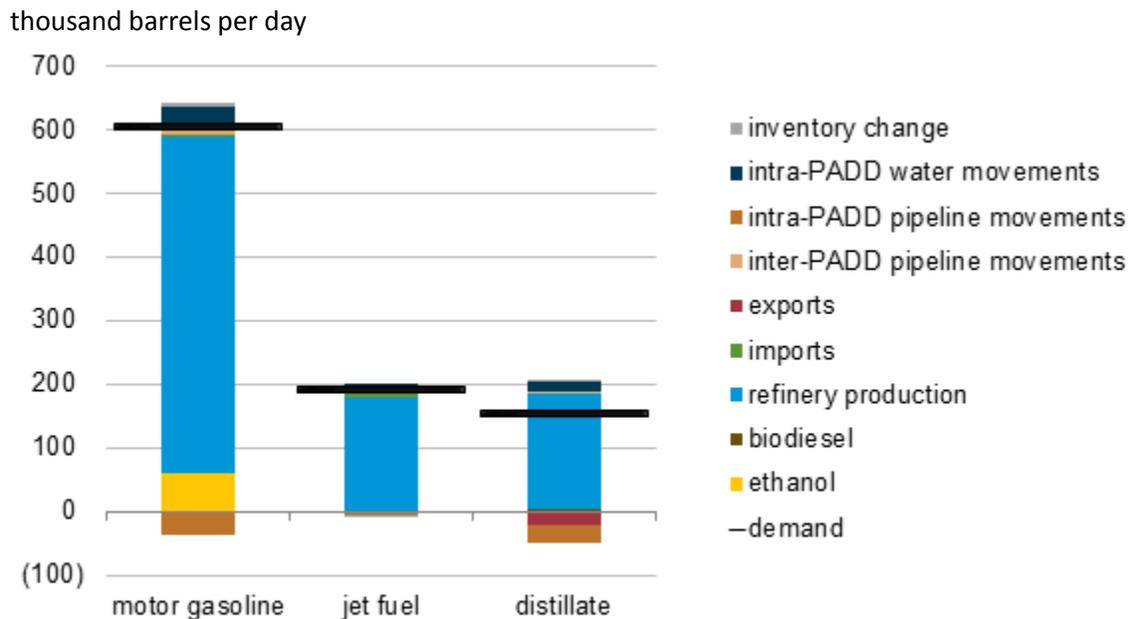
The PADD 5 market structure, notably the region's geographic isolation, unique product specifications that have increased reliance on in-region refinery production, and infrastructure limitations, can restrict both short-term and long-term responses to supply shortfalls, such as those resulting from supply chain disruptions, like refinery outages. Short-term measures to increase product supply typically include withdrawals from inventory, when available, and waterborne shipment of increased production from refineries in the region that have spare processing capacity. However, the range of product specifications across PADD 5 can make it difficult to translate inventory to other regions, and not all product specifications can be produced at all refineries. In addition, the availability of the coastwise-compliant marine vessels that are required to move fuels within the region can make it difficult to move product to where it is needed. Longer-term solutions to supply disruptions include imports from Asia and Canada as well as transfers from other U.S. refining centers like the Gulf Coast; however, only a limited number of refineries outside PADD 5, both inside and outside the United States, can manufacture product to meet all PADD 5 specifications, notably the CARB gasoline and CARB diesel specifications. As a result, when PADD 5 transportation fuel supply is disrupted, wholesale and retail prices often increase more than would be expected in other regions, like the Gulf Coast and East Coast, where alternative sources of supply are closer and more readily available, and thus lower cost.

## Southern California and Southern Nevada

The Southern California and Southern Nevada (SCSN) region includes the southernmost counties of California<sup>10</sup> as well as the Las Vegas, Nevada metropolitan area of Southern Nevada. The region accounts for more than 40% of total PADD 5 motor gasoline demand, the largest share of motor gasoline demand of the six regional PADD 5 markets, and about 7% of total U.S. demand. Because of the many military air bases and large commercial aviation hubs, jet fuel demand in the SCSN region accounts for about 45% of total PADD 5 jet fuel demand and 14% of U.S. demand. SCSN accounts for 32% of total PADD 5 distillate fuel demand, which is about 4% of U.S. demand.

A combination of in-region refinery production, marine-delivered fuels produced at refineries in Northern California and Washington State, receipts of fuels produced at refineries in other PADDs, and imports from the global market supply the SCSN region with transportation fuels. The regional refineries do not produce sufficient gasoline or jet fuel to meet in-region demand, but they do produce more distillate than is consumed in the region. In-region refinery production is supplemented with marine deliveries of product from refineries in Northern California and Washington State as well as imports from the global market. Transportation fuels produced at SCSN refineries also supply Arizona and some are exported into the global market. Exports are primarily distillate fuel, which may not meet in-region specifications.

**Figure 8. Southern California and Southern Nevada 2013 supply/demand balances**



Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

<sup>10</sup> The southernmost counties of California are Imperial, Kern, Los Angeles, Orange, Riverside, San Bernardino, San Diego, San Luis Obispo, Santa Barbara, and Ventura.

## Supply and logistics

There are eight operating refineries in the Southern California and Southern Nevada region, and these refineries supply most of the motor gasoline, jet fuel, and distillate consumed in the region. The refineries have combined atmospheric crude distillation unit capacity of 1,019,100 barrels per calendar day.<sup>11</sup> All eight refineries are located in the Los Angeles metropolitan area.

**Table 5. Southern California and Southern Nevada refineries**

Company	Location	Atmospheric Crude Distillation Unit (ACDU) operating capacity b/cd	Markets served
Valero Asphalt	Wilmington	6,300	
Lunday Thagard	Southgate	8,500	local
Valero	Wilmington	85,000	Southern California (S. CA), Las Vegas, Phoenix
Tesoro	Wilmington	104,500	S. CA, Las Vegas
Phillips 66	Wilmington	139,000	S. CA, Las Vegas
ExxonMobil	Torrance	149,500	S. CA
Tesoro	Carson	257,300	S. CA, Las Vegas
Chevron	El Segundo	269,000	S. CA, Las Vegas, Phoenix

Source: Stillwater Associates analysis of EIA data

In 2013, SCSN refineries produced a total of 526,800 b/d of gasoline, 182,500 b/d of distillate, and 178,100 b/d of jet fuel. This production was sufficient to supply 87% of regional motor gasoline demand (96% when blended with ethanol), 117% of distillate fuel demand, and 92% of jet fuel demand.

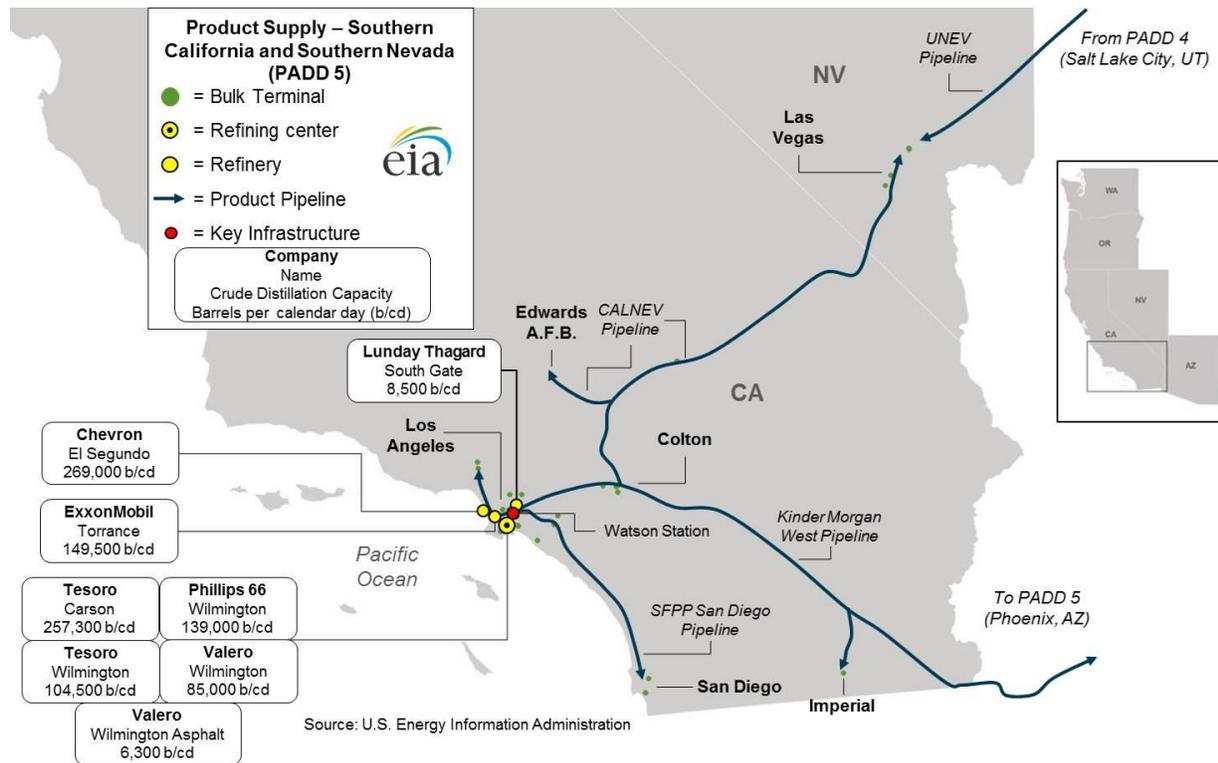
Production from the refineries moves primarily by pipeline from the Los Angeles area to bulk storage and distribution terminals throughout the SCSN region (Figure 9). From terminals, product moves by tank truck to retail outlets. Product from the Los Angeles area also supplies the Arizona Region (Arizona) by pipeline. The Kinder Morgan West Line, which is owned and operated by Kinder Morgan, Inc., originates in the Los Angeles Basin, and in 2013, it moved 35,000 b/d of gasoline, 6,000 b/d of jet, and 28,000 b/d of distillate to Phoenix, Arizona. This supply reduces the availability of product to supply the SCSN region, which is especially important for motor gasoline.

Transportation fuels produced at refineries in Salt Lake City, Utah, in PADD 4, also supply SCSN. The UNEV Pipeline<sup>12</sup> runs from Salt Lake City, Utah to North Las Vegas, Nevada and in 2013 moved 9,000 b/d of gasoline and 1,000 b/d of distillate to Las Vegas.

<sup>11</sup> Barrels per calendar day is a measure of the amount of input that a distillation unit can process in a 24-hour period under usual operating conditions. It takes into account both planned and unplanned maintenance. Barrels per stream day, another measure of refinery capacity, is the maximum number of barrels of input that a distillation facility can process within a 24-hour period when running at full capacity under optimal crude and product slate conditions with no allowance for downtime. Stream day capacity is typically about 6% higher than calendar day capacity.

<sup>12</sup> UNEV Pipeline, LLC is a joint venture between a subsidiary of Holly Energy Partners, L.P. and Sinclair Transportation Company.

Figure 9. Southern California and Southern Nevada refineries and petroleum product flows



Most of the major product distribution pipelines in the SCSN region can move product to and from more than one refinery and more than one terminal, which provides flexibility in sourcing product and ensuring that product is available for distribution to retail outlets. However, in the Los Angeles metropolitan area, there are large bulk storage and distribution terminals that are part of closed systems supplied by a single refinery. Disruptions to these closed systems can require changes to the pattern of product distribution from the terminal to the retail outlet, which can lengthen supply times and increase supply costs.

Refineries, pipelines, ports, and storage facilities are all critical to the effective functioning of the petroleum supply chain. However, in the SCSN region, Watson Station, a pipeline hub in Carson, California, is particularly important. Product from many of the region's refineries must move through Watson Station to reach bulk storage and distribution facilities. Power outages and earthquakes can affect the region's infrastructure.

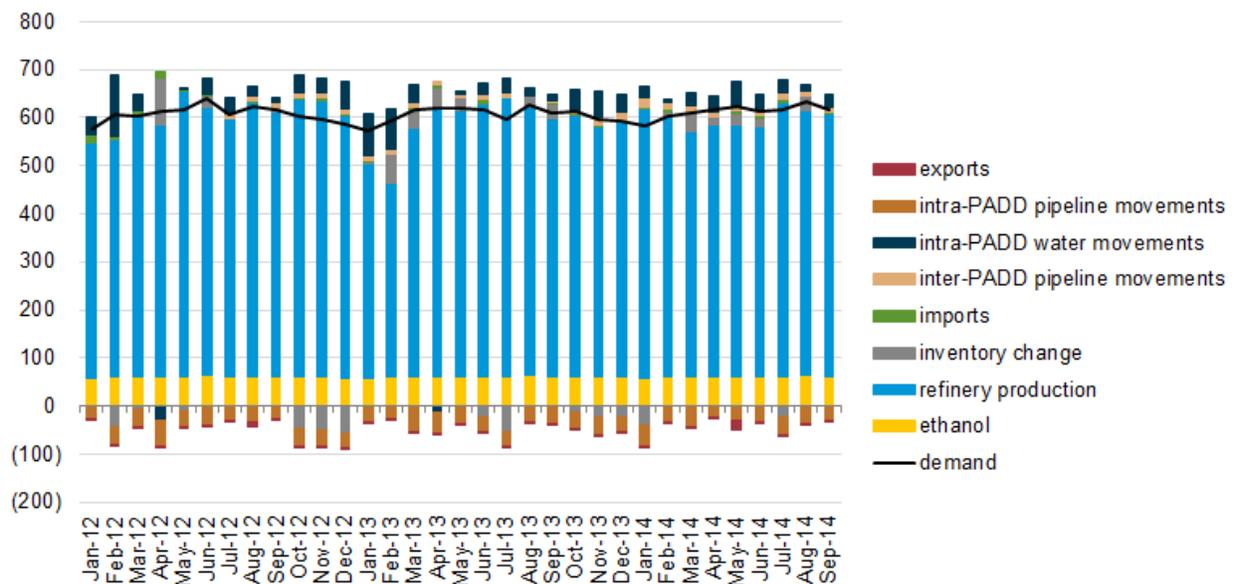
### Motor gasoline supply/demand

SCSN refineries produced sufficient gasoline to supply about 87% of in-region motor gasoline demand (96% when blended with ethanol) in 2013, although a portion of that gasoline was used to supply the Arizona region. Gasoline supplied from refineries in Northern California and Washington State and shipped by marine vessel and imports from the global market provided additional supply. Historically, the SCSN region has imported small quantities of gasoline, including gasoline-blending components, primarily from Canada and Asia. However, since March 2015, because of the continuing outage of gasoline-producing units at the Torrance refinery, gasoline imports have increased substantially. Several weeks after the Torrance, California, outage, West Coast gasoline imports more than tripled, and averaged 81,000 b/d from March 27 through June 26. Monthly data through April 2015 show California total gasoline imports coming from South Korea, Singapore, and Taiwan in Asia as well as Sweden, the United Kingdom, Italy, and the Netherlands in Europe. During periods of unplanned refinery outages and other in-region supply disruptions, waterborne supply of gasoline from other PADD 5 regions like Northern California and the Pacific Northwest, other PADDs, and the global market is critical. The availability of product from other PADD 5 regions and other PADDs depends on the availability of coastwise-compliant marine vessels.

The SCSN region exported small volumes of gasoline to Central and South America in 2013, some of which likely did not meet CARB gasoline specifications, and the region continues to supply Arizona via intra-PADD pipeline, about 36,000 b/d.

**Figure 10. Southern California and Southern Nevada motor gasoline supply/demand balance**

thousand barrels per day



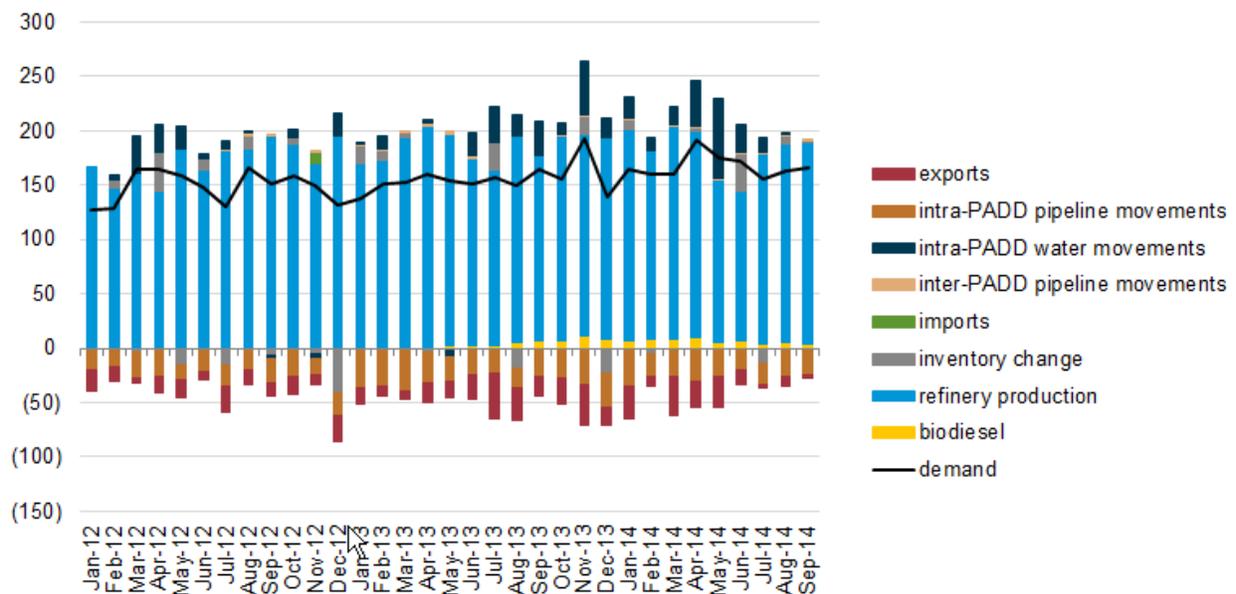
Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Distillate fuel supply/demand

Refineries in the SCSN region produce substantially more distillate fuel than is consumed in the region, 17% more in 2013. The region also receives distillate fuel by marine vessel from other sub-PADD 5 regions, 16,000 b/d in 2013, and by pipeline into Las Vegas from PADD 4, 1,200 b/d in 2013. Some of the receipts from within PADD 5 are likely to balance supply/demand of CARB specification diesel, especially during periods of SCSN refinery maintenance. The region also supplies distillate fuel to Arizona, 28,200 b/d in 2013, and exports distillate fuel to Mexico as well as to Central America and South America, about 21,500 b/d in 2013. In Arizona, diesel fuel is required to meet the standard ultra-low sulfur diesel specification, which is less stringent than the CARB diesel specification. As a result, Arizona is an outlet for Southern California diesel production that does not meet CARB specifications. Exports of distillate fuel may also include product that does not meet CARB diesel specifications.

**Figure 11. Southern California and Southern Nevada distillate supply/demand balance**

thousand barrels per day



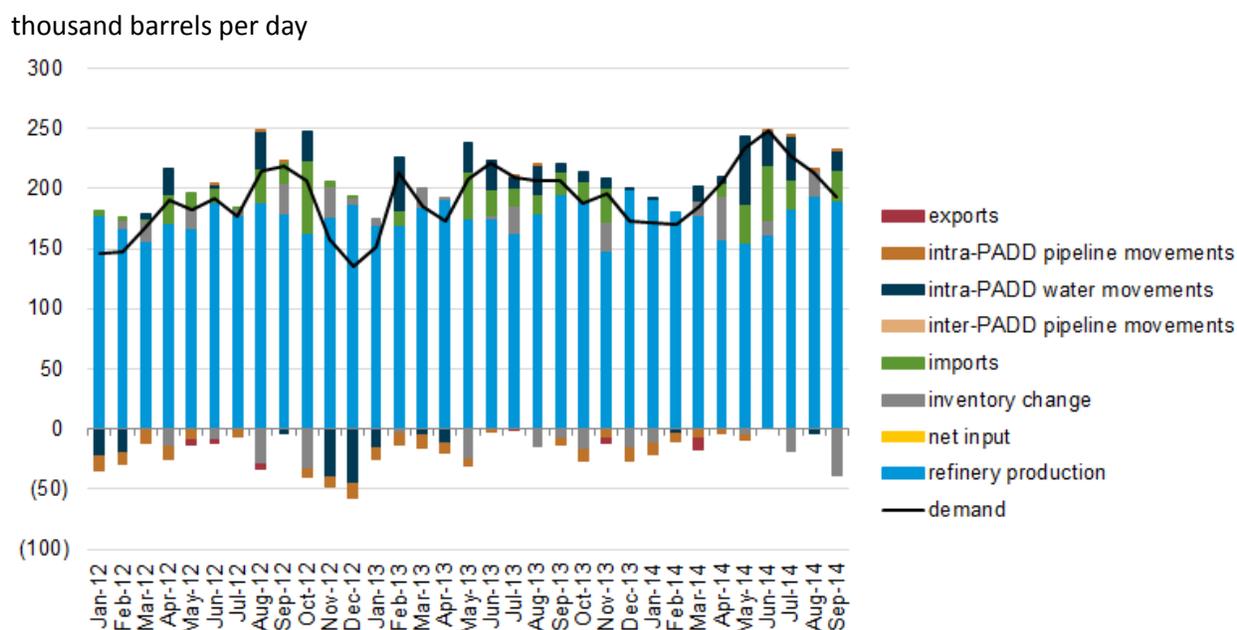
Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

## Jet fuel supply/demand

Refineries in the Southern California/Southern Nevada region do not produce sufficient jet fuel to meet in-region demand. In-region refinery production is supplemented with imports and transfers from other regions within PADD 5. The SCSN region also supplies jet fuel to Arizona by pipeline. In 2013, in-region refineries produced jet fuel sufficient to supply 92% of in-region demand. Imports and receipts from other regions of PADD 5 supplied the balance. The region typically imports more jet fuel than either motor gasoline or distillate, and imports are principally from refineries in Asia. Demand patterns for jet fuel are more variable than for gasoline and distillate, and as a result, the region can be caught short if demand rises unexpectedly or if in-region supplies are disrupted. Pipeline flows of jet fuel to Arizona have declined to an average of 6,000 b/d in 2013 as PADD 3 refineries supply increasing volumes to Arizona.

**Figure 12. Southern California and Southern Nevada jet fuel supply/demand balance**



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

## Renewable fuels and biofuels supply/demand

The region's demand for biofuels is driven by California's Low Carbon Fuel Standard (LCFS), which creates demand for fuels with lower carbon intensity, including low carbon-intensity corn-based ethanol and sugar-based ethanol, biodiesel, and renewable diesel.

Ethanol blending is limited to 10% by the CARB specification for motor gasoline, which is reflected in ethanol's 10% share of gasoline demand. Ethanol supply is from a combination of imported sugar-based ethanol and receipts from PADD 2 (Midwest) delivered by rail and truck to blending terminals.

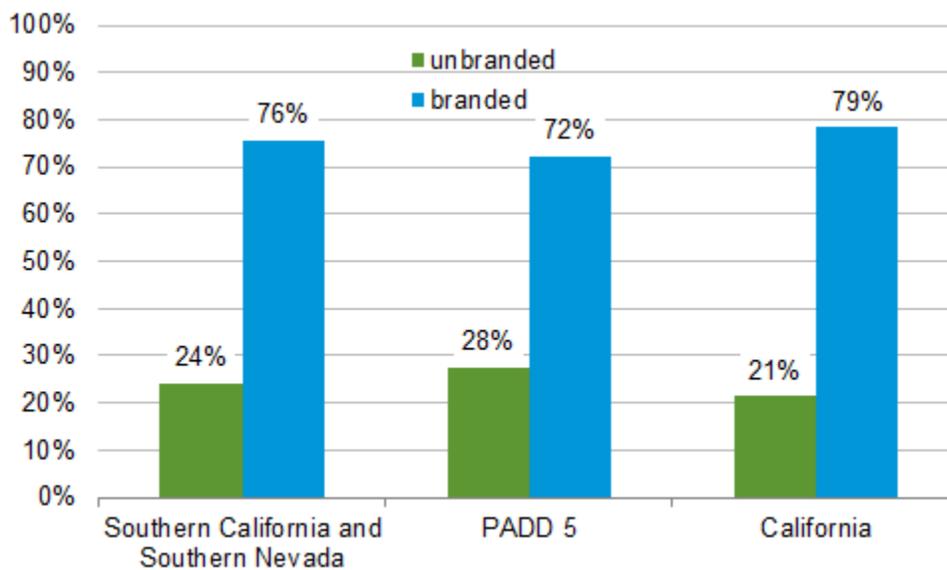
Biodiesel and renewable diesel supplied 2% of the region's distillate demand in 2013 and 4% in the first nine months of 2014. Biodiesel and renewable diesel supply is from a combination of PADD 5 production, receipts from other PADDs, and imports.

## Retail markets

There are about 27 distinct branded and unbranded companies participating in the retail market for gasoline and distillate fuel in the Southern California and Southern Nevada region. About 76% of retail outlets are branded, meaning that they are associated with and display a major oil company brand, like Chevron, Shell, 76, Valero, and ARCO. The remaining 24% of retailers are referred to as unbranded because they are not affiliated with a major oil company brand. Unbranded retailers include small independent retailers as well as big box retailers. In California as a whole, 79% of retail outlets are associated with a major brand, while 21% are unbranded. The sale of BP's Southern California business to Tesoro in 2012 resulted in the most recent large-scale shift in the region's retail market structure.

**Figure 13. Southern California and Southern Nevada retail market structure**

percent of retail outlets



Source: Stillwater Associates analysis of Oil Price Information Service (OPIS) data for the week of December 31, 2014

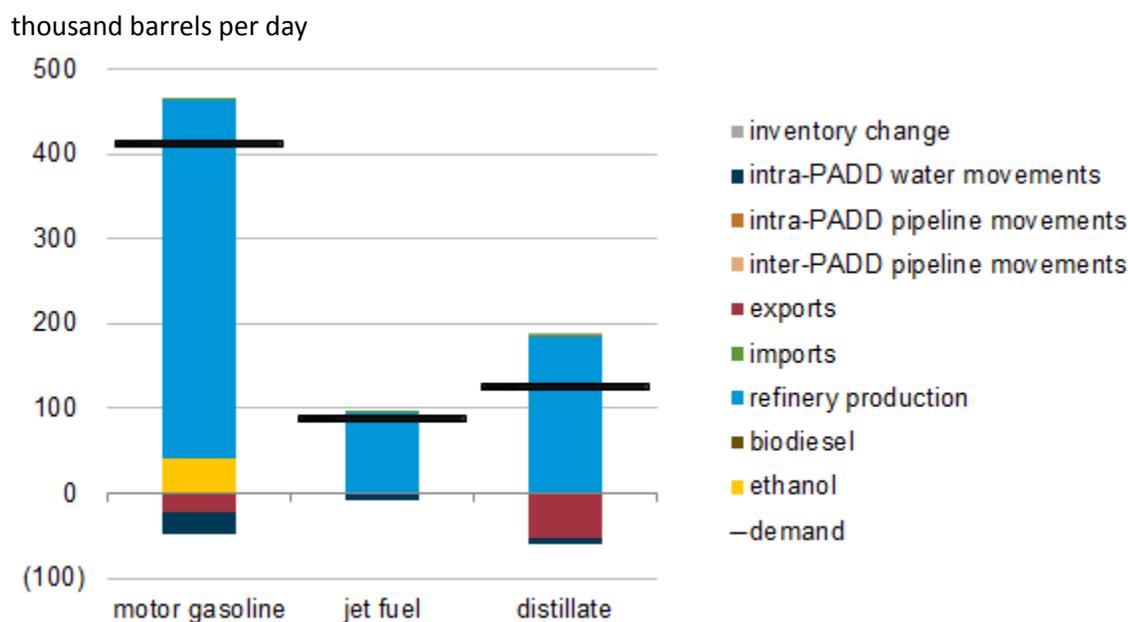
Note: OPIS data are survey rather than census data, and survey data include transactions from large commercial trucking fleet customers using company credit cards and not from cash or credit card sales to the general public.

## Northern California and Northern Nevada

The Northern California and Northern Nevada region (NCNN) includes counties in California north of San Luis Obispo, Kern, and San Bernardino counties, and in Nevada north of Las Vegas. In 2013, with average motor gasoline demand of 412,000 b/d, the region accounted for 27% of total PADD 5 motor gasoline demand and 4.7% of U.S. motor gasoline demand. NCNN distillate demand of 125,000 b/d in 2013 accounted for 25% of PADD demand and 3% of U.S. demand. NCNN jet fuel demand averaged 88,000 b/d in 2013, 21% of PADD demand and 6% of U.S. demand.

The region is supplied by in-region refinery production and refineries in the region produce more motor gasoline, jet fuel, and distillate fuel than is consumed in the region. As a result, NCNN supplies other regional markets in PADD 5, primarily Southern California and Southern Nevada, with motor gasoline, jet fuel, and diesel fuel, and also exports these products. In 2013, the region exported 22,100 b/d of gasoline, 2,300 b/d of jet fuel, and 52,400 b/d of distillate fuel, primarily to Central and South America.

**Figure 14. Northern California and Northern Nevada 2013 supply/demand balance**



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

### Supply and logistics

There are nine operating refineries in two primary refining centers in the Northern California and Northern Nevada region with combined atmospheric crude distillation unit capacity of about 885,000 barrels per calendar day. Only one of the refineries is located outside California, in Nevada. The sole refinery in Nevada, Foreland Refining in Ely, produces asphalt and fuel oil rather than motor gasoline, distillate fuel, and jet fuel. Most of the California refining capacity in the NCNN region is in the San Francisco Bay area. Several smaller refineries are located in California's Central Valley.

**Table 5. Northern California and Northern Nevada refineries**

<b>Company</b>	<b>Location</b>	<b>Atmospheric Crude Distillation Unit (ACDU) operating capacity b/cd</b>	<b>Markets served</b>
Chevron	Richmond	245,271	Northern California (N. CA), Reno, Oregon
Tesoro	Martinez	166,000	N. CA, Reno
Shell	Martinez	156,400	N.CA, Los Angeles, Reno, Nevada, exports
Valero	Benicia	145,000	N.CA, Reno, Nevada, exports
Phillips 66 <sup>1</sup>	Rodeo	120,200	S. CA, Las Vegas
Kern Oil & Refining	Bakersfield	26,000	Central California
San Joaquin Refining	Bakersfield	15,000	Central California
Santa Maria Refinery	Santa Maria	9,500	local
Foreland Refining	Ely, Nevada	2,000	local

<sup>1</sup>A portion of this facility is actually located in San Luis Obispo County but is operated as part of the Rodeo refinery.

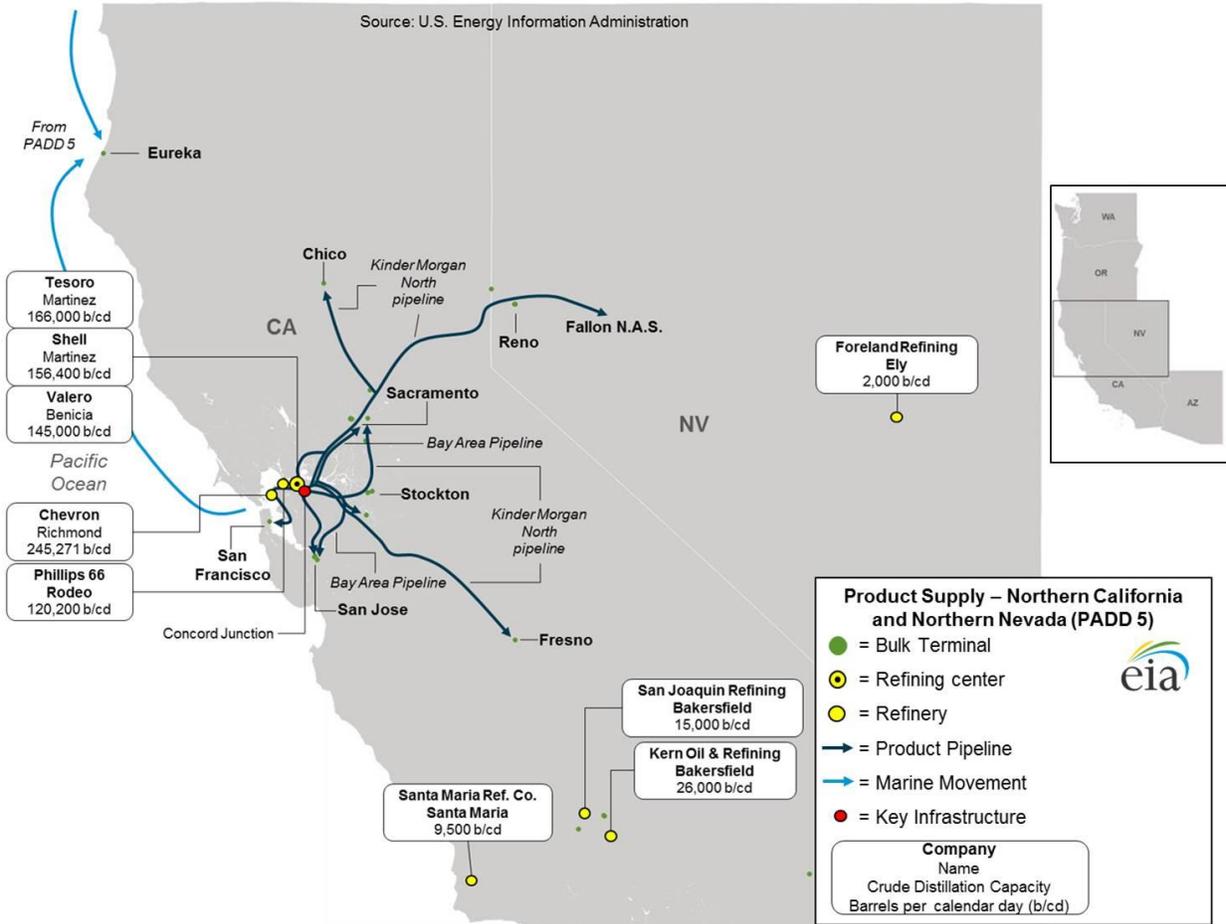
Source: Stillwater Associates analysis of EIA data

In 2013, NCNN refineries produced an average of 421,000 b/d of gasoline blending components and finished motor gasoline, 185,000 b/d of distillate, and 96,000 b/d of jet fuel. This production was more than sufficient to meet in-region demand. NCNN refineries produced product sufficient to meet 102% of regional demand for finished motor gasoline (112% when blended with ethanol), 108% of jet fuel demand, and 147% of diesel fuel demand. Production from refineries in Northern California regularly supplies parts of Southern California and Oregon by marine vessel.

Product is shipped by pipeline from the refineries in San Francisco to storage and distribution terminals in the San Francisco area and to terminals further inland in Fresno and Chico, California, and also in Nevada. The large regional product distribution pipelines are owned and operated as common carrier pipelines by Kinder Morgan, Inc. No pipelines connect the NCNN region to other PADDs or other PADD 5 regional markets, and, as a result, supply from NCNN to those areas moves by marine vessel. The major port facilities through which product is exported into the global market and from which product is shipped to other regional markets in PADD 5 are located on the San Francisco Bay.

Critical supply chain infrastructure includes the refineries, pipelines, ports, and storage facilities of the San Francisco Bay area. In particular, the Concord pipeline junction is the gathering and entry point for the Kinder Morgan pipeline system, the main distribution artery for the region. Power outages and earthquakes can affect the region's infrastructure, and heavy fog can disrupt the port facilities within the San Francisco Bay.

Figure 15. Northern California and Northern Nevada refineries and petroleum product flows

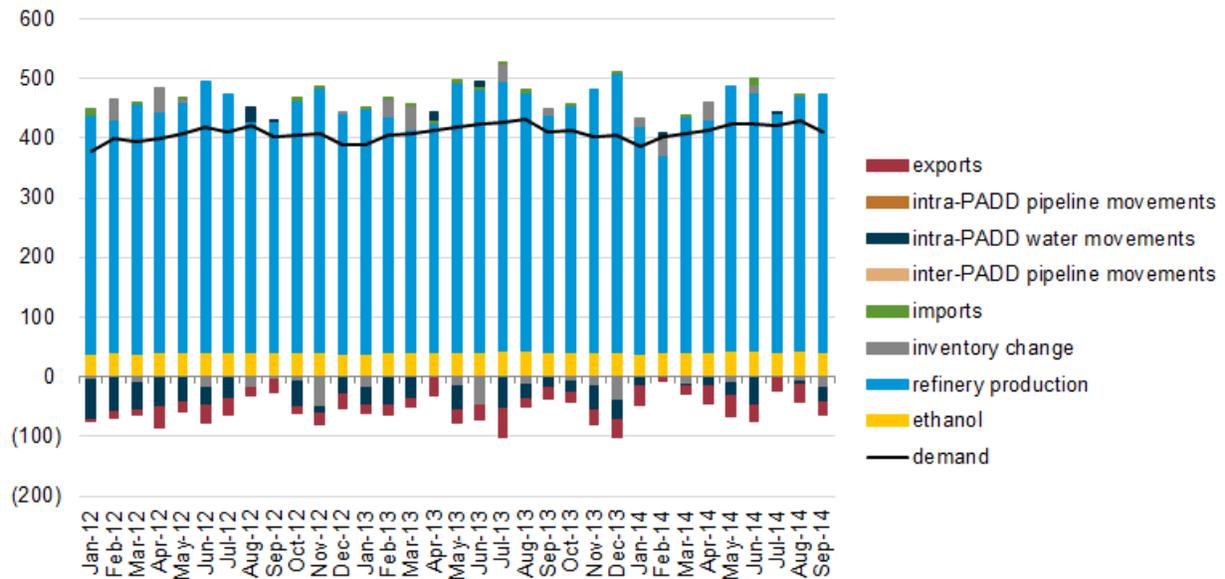


### Motor gasoline supply/demand

In 2013, NCNN refineries produced an average of 421,000 b/d of motor gasoline blending components that when blended with ethanol was sufficient to supply about 112% of 2013 finished gasoline demand. Without pipeline interconnections to other regional markets in PADD 5, surplus gasoline must be shipped out of the region by marine vessel. In 2013, the NCNN region supplied about 26,900 b/d to other PADD 5 regional markets, primarily Southern California but also Reno, Nevada, and exported 22,100 b/d into the global market, principally supplying Latin America.

**Figure 16. Northern California and Northern Nevada motor gasoline supply/demand balance**

thousand barrels per day



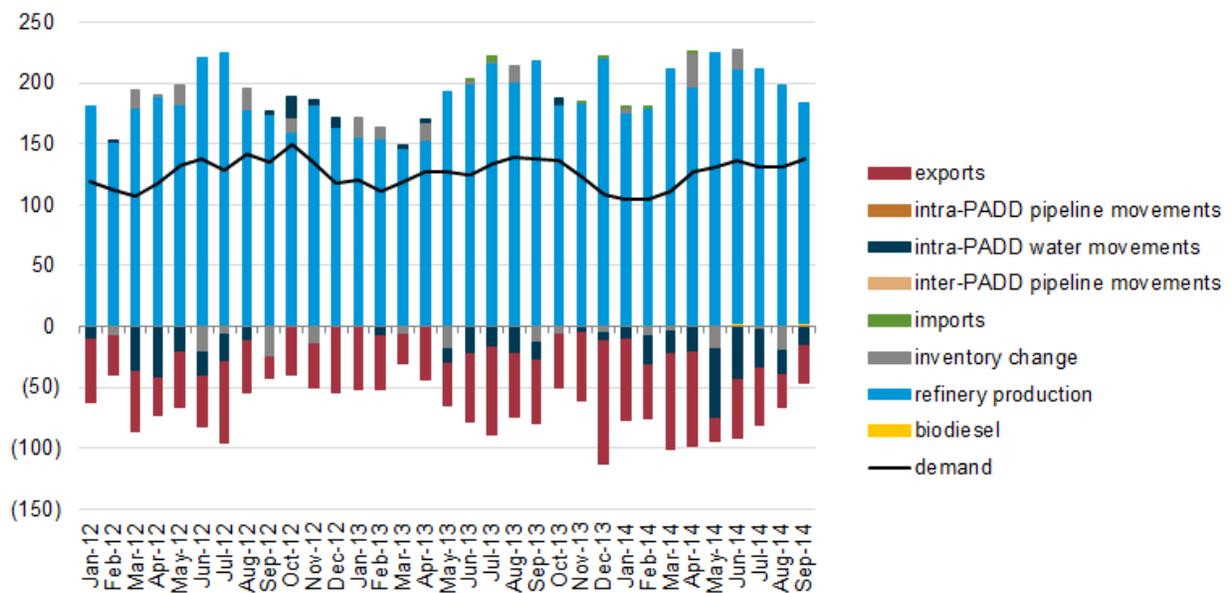
Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Distillate fuel supply/demand

In 2013, NCCN refineries produced an average of 185,000 b/d of distillate fuel, which when blended with biodiesel was sufficient to supply about 147% of finished distillate fuel demand. Without pipeline interconnections to other regional markets in PADD 5, surplus distillate fuel must be shipped out of the region by marine vessel. In 2013, the region transferred 8,200 b/d to other regional markets in PADD 5 and exported 52,400 b/d of distillate, mostly to Central America and South America, principally to Mexico. Because the region produces substantially more diesel fuel than is needed to meet local demand, NCCN has become an important source of diesel fuel for other regions within PADD 5 as well as the Pacific basin.

Figure 17. Northern California and Northern Nevada distillate supply/demand balance

thousand barrels per day

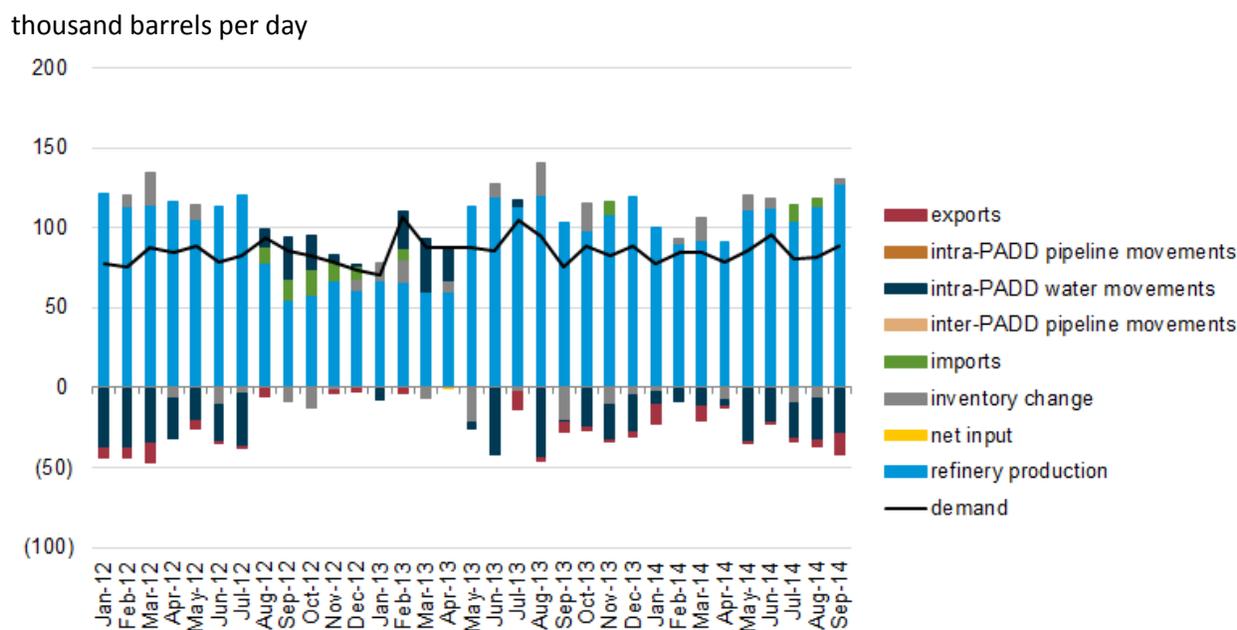


Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Jet fuel supply/demand

The Northern California and Northern Nevada region produces more jet fuel than is consumed in the region, albeit by a much narrower margin than distillate fuel, with in-region refineries producing about 96,000 b/d on average in 2013, 108% of regional demand. The region has also imported small volumes of jet fuel, likely to balance the timing of supply and demand and/or to take advantage of economic supply opportunities. Refinery production beyond that needed to meet in-region demand is principally shipped to other PADD 5 regional markets, but it also is exported. In 2013, about 7,200 b/d was shipped to other PADD regional markets and 2,300 b/d was exported to Canada and Latin America. The region typically produces more jet fuel than is needed to meet in-region demand. However, in the second half of 2012, following a major disruption at Chevron's Richmond refinery, NCNN shifted from producing more jet fuel than needed to meet in-region demand, to producing less. This circumstance illustrates the sensitivity of the Northern California region as well as the sensitivity of PADD 5 as a whole to refinery disruptions.

**Figure 18. Northern California and Northern Nevada jet fuel supply/demand balance**



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

## Renewable fuels and biofuels supply/demand

The region's demand for biofuels is driven by California's Low Carbon Fuel Standard (LCFS), which creates demand for fuels with lower carbon intensity, including low carbon-intensity corn-based ethanol and sugar-based ethanol, biodiesel, and renewable diesel.

Ethanol blending is limited to 10% of the CARB specification for motor gasoline, which is reflected in ethanol's 10% share of gasoline demand. Ethanol supply is a combination of imported sugar-based ethanol and receipts from the PADD 2 (Midwest) delivered by rail and truck to blending terminals.

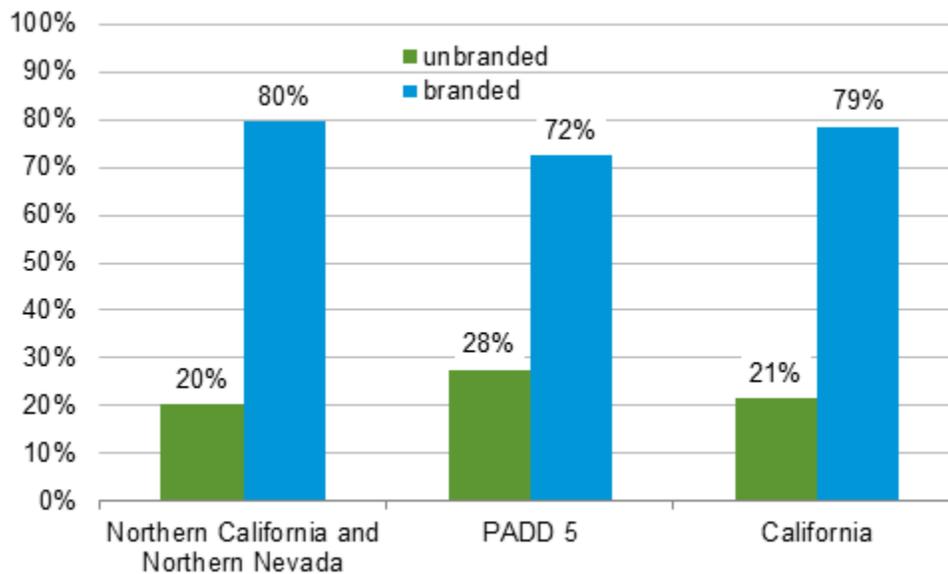
Biodiesel and renewable diesel supplied a very small percentage of the region's distillate demand in 2013, less than 1%. Biodiesel and renewable diesel supply is from a combination of PADD 5 production, receipts from other PADDs, and imports.

## Retail markets

In the Northern California and Northern Nevada region, 80% of retail outlets are branded and 20% are unbranded. In Northern California, about 21 branded and unbranded companies participate in the retail market for gasoline and distillate fuel,<sup>13</sup> compared with about 12 in the Reno/Carson City, Nevada market. In Northern California, major oil company branded outlets dominate the retail sector, and the top five brands have 76% of the number of retail outlets. The Reno/Carson City market is characterized by a mix of branded and unbranded retail outlets.

**Figure 19. Northern California and Northern Nevada retail market structure**

percent of retail outlets



Source: Stillwater Associates analysis of Oil Price Information Service (OPIS) data for the week of December 31, 2014

Note: OPIS data are survey rather than census data, and survey data include transactions from large commercial trucking fleet customers using company credit cards and not from cash or credit card sales to the general public.

<sup>13</sup> Northern California counties with less than 1% of total state gasoline sales are excluded from these numbers.

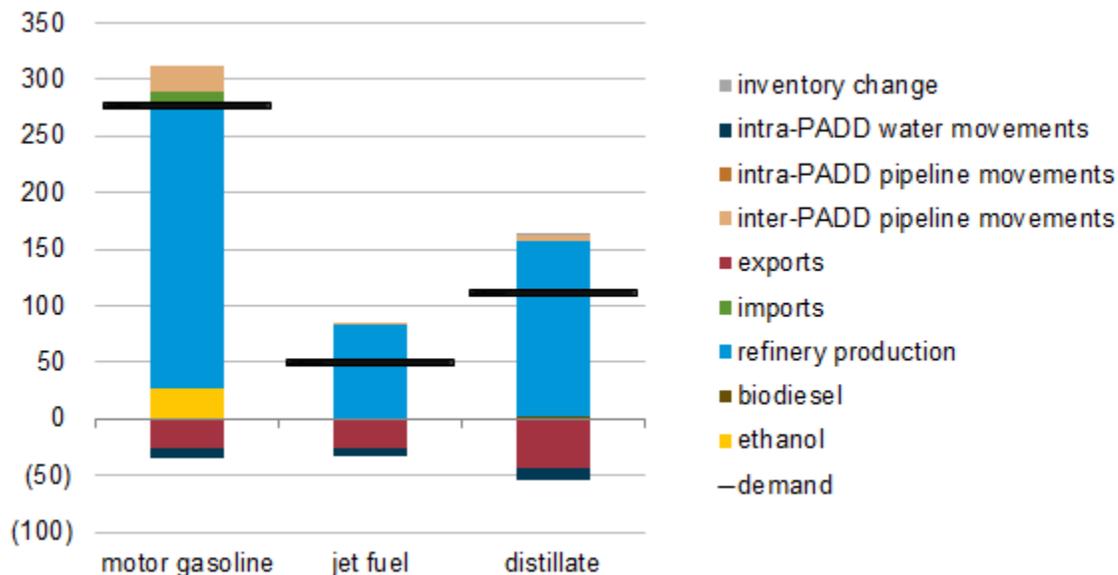
## Pacific Northwest

The Pacific Northwest region (PNW) includes Oregon and Washington. In 2013, with 277,300 b/d of motor gasoline demand, the region accounted for 18% of total PADD 5 motor gasoline demand and 3% of total U.S. demand. At 111,400 b/d, PNW demand for distillate fuel was 23% of PADD 5 demand and 3% of U.S. demand. Jet fuel demand in the Pacific Northwest averaged 51,400 b/d in 2013, 12% of PADD 5 demand and 4% of U.S. demand.

The region is supplied by a combination of in-region refinery production, imports, and receipts of product manufactured at refineries in other PADDs. Refineries in the PNW produce about as much gasoline as is consumed in the region, but considerably more than enough distillate fuel and jet fuel than is needed to meet in-region demand. The region supplies distillate fuel and jet fuel to the global market and to other regions within PADD 5 and also exports motor gasoline. PNW also imports motor gasoline and a small amount of distillate. The combination of imports and exports reflects the configuration of the distribution system and gasoline grade imbalances. The PNW typically does not receive product from other regions within PADD 5. In 2013, the region exported 26,000 b/d of motor gasoline, 26,800 b/d of jet fuel, and 43,200 b/d of distillate fuel, primarily to Canada, Mexico Central America, and South America.

**Figure 20. Pacific Northwest 2013 supply/demand balance**

thousand barrels per day



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

### Supply and logistics

There are five operating refineries in the PNW region, located in and around Puget Sound, Washington. There are no refineries in Eastern Washington or in Oregon. Historically, the PNW refineries processed a

combination of Alaska North Slope crude oil, Canadian crude oil delivered by the Kinder Morgan Trans Mountain Pipeline,<sup>14</sup> and waterborne imports of other globally-produced crude oil. More recently, Bakken crude oil produced in the United States has been added to refinery crude slates. Bakken crude oil is delivered by railroad and has displaced both ANS and waterborne imports.

**Table 6. Pacific Northwest refineries**

<b>Company</b>	<b>Location</b>	<b>Atmospheric Crude Distillation Unit (ACDU) capacity b/cd</b>	<b>Markets served</b>
BP	Ferndale (Cherry Point)	225,000	Western Washington, Oregon, exports
Phillips 66	Ferndale	101,000	Western Washington, Oregon, exports
Shell	Anacortes	145,000	Western Washington, Oregon, exports
Tesoro	Anacortes	120,000	Western Washington, Oregon
U.S. Oil & Refining	Tacoma	40,700	Western Washington

Source: Stillwater Associates analysis of EIA data

In 2013, PNW refineries produced an average of 253,400 b/d of motor gasoline and motor gasoline blending components, 156,300 b/d of distillate fuel, and 83,600 b/d of jet fuel. This production was sufficient to meet 91% of regional demand for motor gasoline (102% when blended with ethanol), 163% of jet fuel demand, and 138% of distillate fuel demand. Production from refineries in Washington State regularly supplies Alaska and California.

Product is shipped from the refineries by pipeline north and south to supply Portland, Oregon and Seattle, Washington, and product is shipped by marine vessel to supply the global markets and other regions within PADD 5. Many of the Portland, Oregon storage and distribution terminals have access to the Columbia River and can ship and receive product by marine vessel. Each of the five refineries also have associated dock infrastructure for loading and discharging marine vessels, which supports imports and exports of petroleum products.

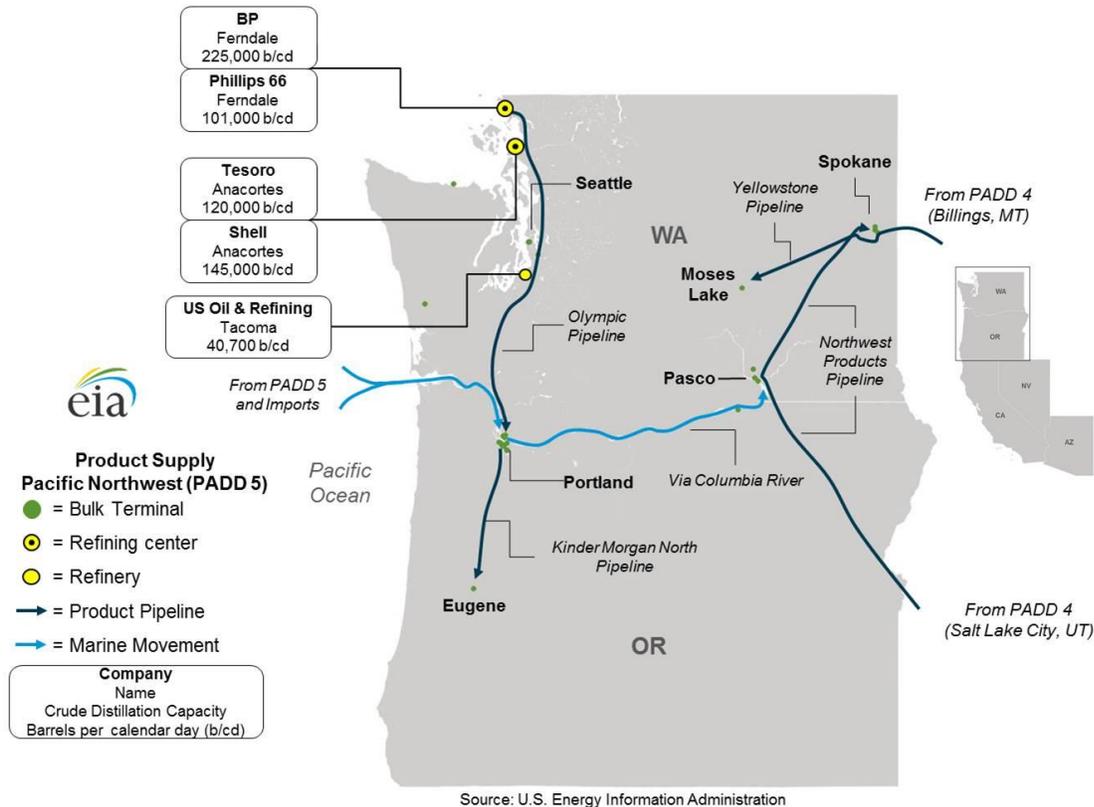
Product moves from storage and distribution terminals in Portland, Oregon south to Eugene, Oregon by pipeline. Distribution infrastructure to move product from the western portions of Washington and Oregon east is limited. The only connection between the western and eastern portions of the region is marine transport along the Columbia River, specifically between Portland, Oregon and Pasco, Washington. There is no pipeline infrastructure to move products across the Cascade Range of mountains. As a result, Eastern Washington is supplied with product from refineries in PADD 4. Product moves by pipeline from Salt Lake City, Utah into eastern Washington and Oregon and by pipeline from refineries in Billings, Montana into eastern Washington.

Critical infrastructure in the region includes the refinery complexes, pipelines, storage and distribution terminals, and the marine facilities at refineries and terminals, notably those along the Columbia River.

<sup>14</sup> The Kinder Morgan Trans Mountain Pipeline (TMPL) transports both crude oil and refined products to the west coast of Canada and the United States. TMPL moves product from Edmonton, Alberta, to marketing terminals and refineries in the central British Columbia region, the Greater Vancouver area, and the Puget Sound area in Washington state, as well as to other markets such as California, the U.S. Gulf Coast, and overseas through the Westridge marine terminal located in Burnaby, British Columbia. Only crude oil and condensates are shipped into the United States.

Weather can disrupt the region’s marine facilities. The Olympic pipeline,<sup>15</sup> which runs from Puget Sound to Portland, Oregon and is connected to four of the five PNW refineries, is the main north-south corridor for petroleum product transportation in the PNW region. Disruptions to flows on the Olympic pipeline can have a major impact on regional supply. Many of the storage and distribution terminals connected to the pipeline lack other supply options. As a result, during supply disruptions, product typically supplied from these terminals may need to be sourced from other terminals, which can increase supply costs and therefore prices.

**Figure 21. Pacific Northwest refineries and petroleum product flows**



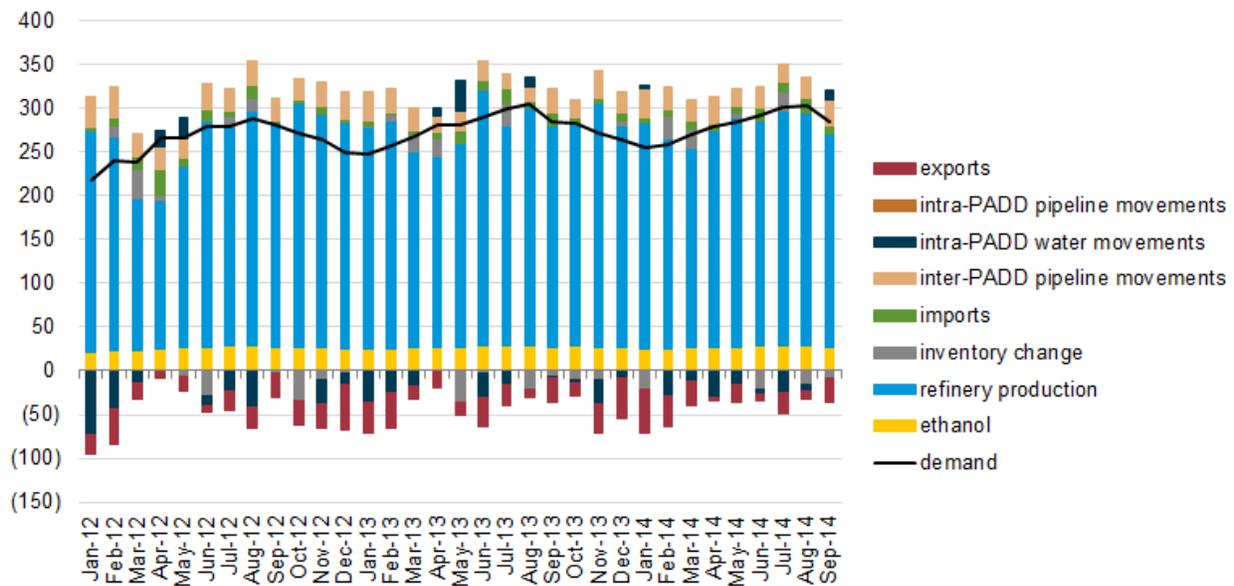
<sup>15</sup> The pipeline runs along a 299 mile corridor from Blaine, Washington to Portland, Oregon. The system transports gasoline, diesel, and jet fuel. This fuel originates at four Puget Sound refineries, two in Whatcom County and two in Skagit County, and is delivered to Seattle's Harbor Island, Seattle-Tacoma International Airport, Renton, Tacoma, Vancouver, Washington, and Portland, Oregon.

### Motor gasoline supply/demand

In 2013, PNW refineries produced an average of 253,000 b/d of motor gasoline, including motor gasoline blending components and finished motor gasoline, about 91% of 2013 demand (102% when blended with ethanol). The PNW region also imports and exports gasoline to balance gasoline quality imbalances and is supplied with gasoline from PADD 4 because it is more efficient to supply the eastern part of the region east of the Cascade Range mountains with product from refineries in Salt Lake City, Utah and Billings, Montana. In 2013, the region imported 8,200 b/d of transportation fuels, mostly from Canada, and was supplied with an additional 15,200 b/d from PADD 4 (Rocky Mountains). The PNW typically does not receive product from other regions within PADD 5. In 2013, the region exported 26,000 b/d of motor gasoline, principally to Mexico and Canada.

Figure 22. Pacific Northwest motor gasoline supply/demand balance

thousand barrels per day



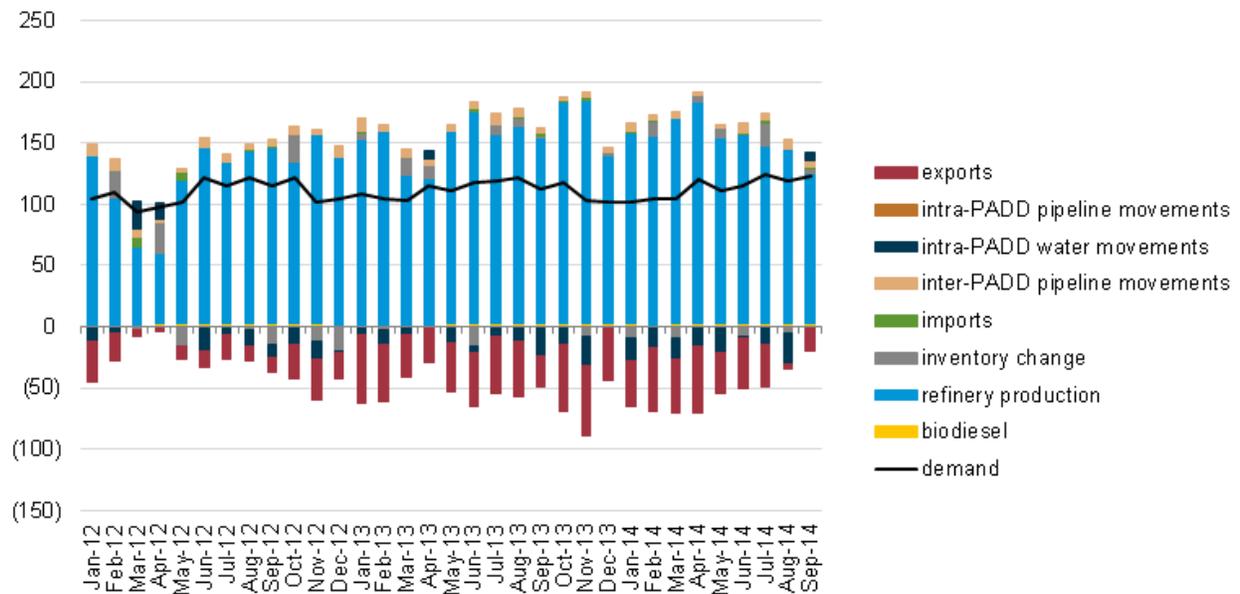
Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Distillate fuel supply/demand

The Pacific Northwest produces considerably more distillate fuel than is needed to meet in-region demand. In 2013, the region produced 154,000 b/d of distillate fuel, 138% of demand. The region exports significant volumes of distillate fuel into the Pacific Basin market, 43,200 b/d on average in 2013, to Central and South America, western Canada (which lacks sufficient refining capacity), and Mexico. The Pacific Northwest region also supplies distillate, 10,100 b/d on average in 2013, to the rest of PADD 5 via marine vessel. PADD 4 supplied 5,800 b/d of distillate fuel to the eastern part of the Pacific Northwest region.

**Figure 23. Pacific Northwest distillate supply/demand balance**

thousand barrels per day



Note: All movements are on a net basis.

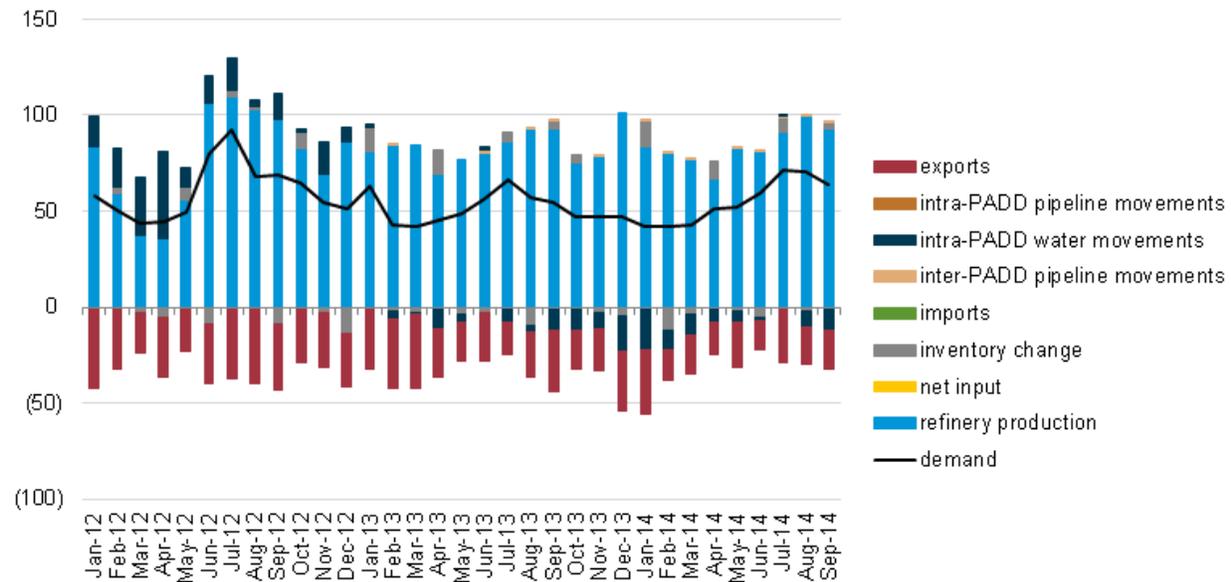
Source: Stillwater Associates analysis of EIA data

## Jet fuel supply/demand

Refineries in the PNW region produced approximately 163% of in-region jet fuel demand, or 84,000 b/d on average in 2013, making the region significantly net long jet fuel. The oversupply allowed the region to export 27,000 b/d of jet fuel and to send 7,000 b/d of supplies via marine vessel to other regions of PADD 5 on average in 2013. The region's jet fuel exports were mainly destined for Canada, with smaller amounts bound for Central America, South America, and Asia.

**Figure 24. Pacific Northwest jet fuel supply/demand balance**

thousand barrels per day



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

## Renewable fuels and biofuels supply/demand

Almost all of the gasoline in the Pacific Northwest is blended with ethanol to a level of 10%, driven by the federal Renewable Fuel Standard program and the state's requirement that diesel fuel sold in Oregon must be blended with a minimum of 5% biodiesel. The Oregon Renewable Fuel Standard, which was adopted in 2005, set the requirement for biodiesel blending in the state. Oregon also has a low-carbon fuels law that was passed in 2009 but for which regulations have not been promulgated. The low-carbon fuel law was scheduled to sunset in 2015, however, in February, the Oregon state senate introduced a bill to make the law permanent. In January, the Oregon Environmental Quality Commission proposed regulations to require fuel importers and producers to reduce the carbon content of transportation fuels by 10% over the next decade, starting in January 2016.

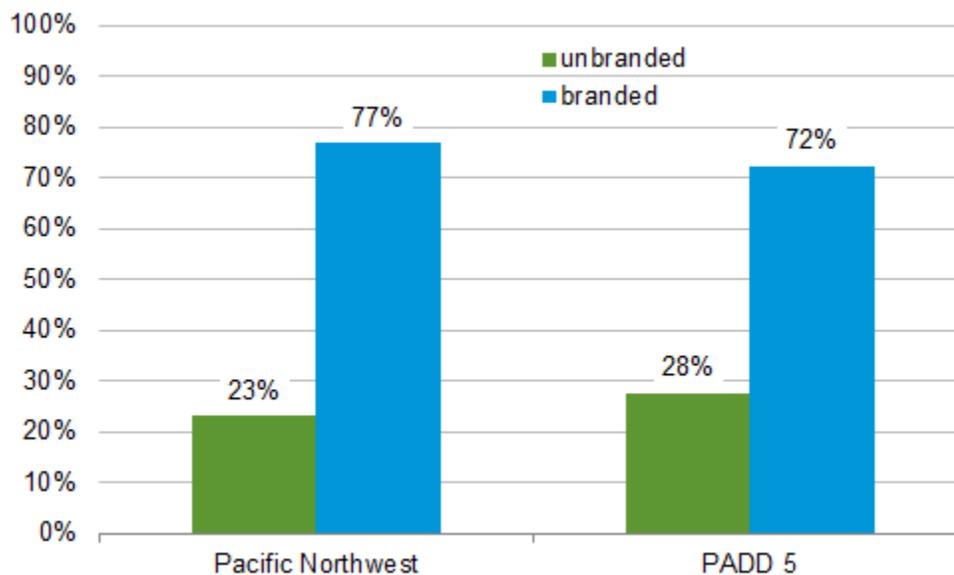
Ethanol supply to the PNW is from a combination of receipts from other PADDs, delivered by rail and truck to blending terminals, and in-region production. Biodiesel, which supplied a small percentage of the region's diesel demand in 2013 (about 2,200 b/d, or about 2% of in-region demand) is supplied primarily from in-region production.

## Retail markets

Oregon is one of two states in the country that does not permit customer self-service dispensing of transportation fuels at retail outlets. The mandate has its origins in efforts to support independent gasoline wholesalers, which helped minimize the number of retail outlets owned and operated by major oil companies. The Pacific Northwest actually has a slightly higher percentage of branded outlets compared with PADD 5 overall. The region has about 25 branded and unbranded retailers, with 77% of retail stations selling branded fuels compared with the PADD 5 average of 72%. Brands in the Pacific Northwest include Chevron, Shell, 76, Conoco, ARCO, Pilot, Costco, and Sam's Club.

**Figure 25. Pacific Northwest retail market structure**

percent of retail outlets



Source: Stillwater Associates analysis of Oil Price Information Service (OPIS) data for the week of December 31, 2014

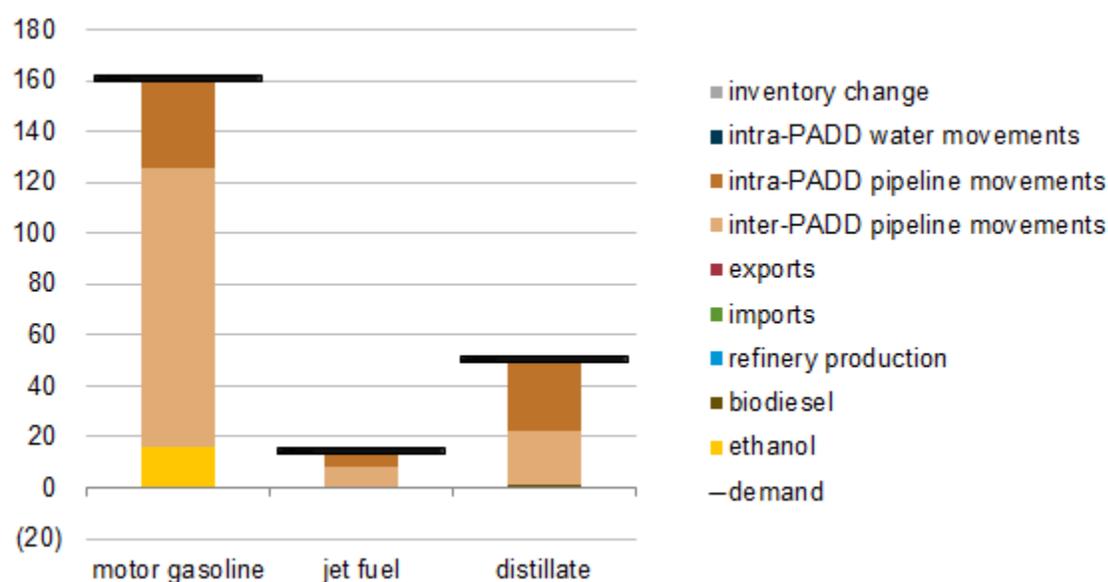
Note: OPIS data are survey rather than census data, and survey data include transactions from large commercial trucking fleet customers using company credit cards and not from cash or credit card sales to the general public.

## Arizona

Arizona accounts for 11% of demand for motor gasoline in PADD 5, 3% of demand for jet fuel, and 10% of distillate fuel demand. There are no petroleum refineries in Arizona, and the region is supplied with product by pipelines that originate in Southern California and West Texas. In 2013 the region consumed 161,500 b/d of motor gasoline, 14,600 b/d of jet fuel, and 50,600 b/d of distillate fuel.

**Figure 26. Arizona 2013 supply/demand balance**

thousand barrels per day



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

### Supply and logistics

Arizona is supplied with all transportation fuels via pipeline from Southern California, New Mexico, and Texas. The 400-mile long Kinder Morgan East Line originates in El Paso, Texas and consists of two parallel pipelines that end in Phoenix, Arizona. Refineries in Texas and New Mexico can supply product into the East Line for delivery to five storage and distribution terminals in Phoenix and two in Tucson, Arizona. A disruption to fuel supply from refineries in New Mexico and West Texas into the East Line reduce East Line supply into Arizona as there may not be sufficient fuels supply or pipeline capacity from other sources to replace the lost fuels supply.

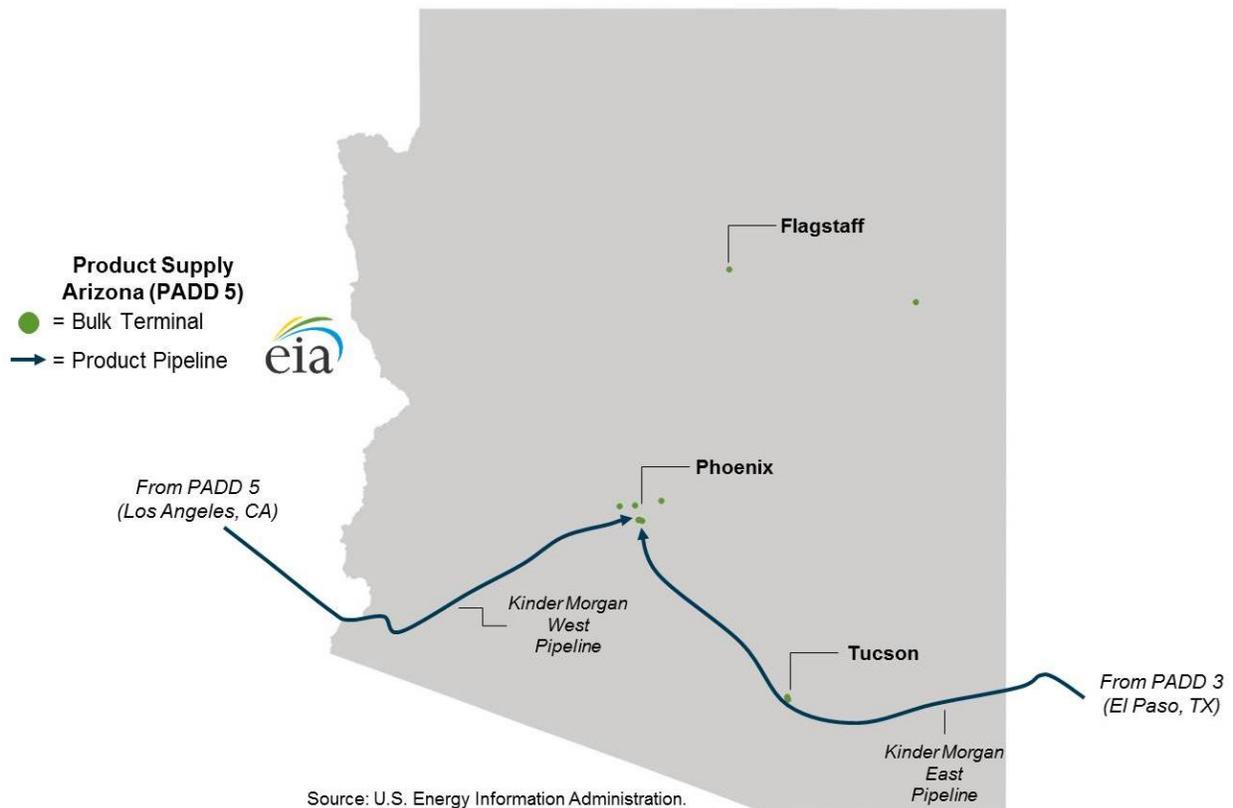
The Kinder Morgan West Line is part of the Kinder Morgan SFPP system. The West Line runs 515 miles from the Watson Station in the Los Angeles Basin to Phoenix, Arizona and delivers product into storage and distribution terminals in Phoenix.

The two pipelines of the East Line operate at close to full capacity, while the West Line operates at well below capacity. As a result, the West Line is a source of incremental supply for Phoenix should supply from the East Line be reduced. However, because the transportation time for fuels delivered into

Phoenix from Los Angeles, California, is about a week to 10 days, incremental supply to Phoenix would not be immediately available. There is no backup pipeline capacity for fuels supply from Phoenix into Tucson. Incremental supply to Tucson is via long-haul trucking.

The Kinder Morgan East and West Lines are critical to fuels supply to Arizona. Train derailments, as well as washouts and pipeline ruptures, have affected the pipelines, sections of which lie in the Union Pacific Railroad right of way. Most disruptions have been of short duration.

**Figure 27. Arizona petroleum product flows**



### Motor gasoline supply/demand

In 2013, Arizona consumed 161,500 b/d of motor gasoline. The Kinder Morgan East pipeline supplied 109,000 b/d, or 67%, of total gasoline from refineries in New Mexico and Texas. An additional 35,000 b/d of gasoline was sourced from Southern California. Arizona's Cleaner Burning Gasoline (CBG) Program calls for a number of different specifications of cleaner burning gasoline in different areas of the state, including the greater Maricopa County area (Phoenix metropolitan area); part of Pinal County, which is between Phoenix and Tucson, and a small portion of Yavapai County; and part of Pima County, which includes the Tucson metropolitan area.

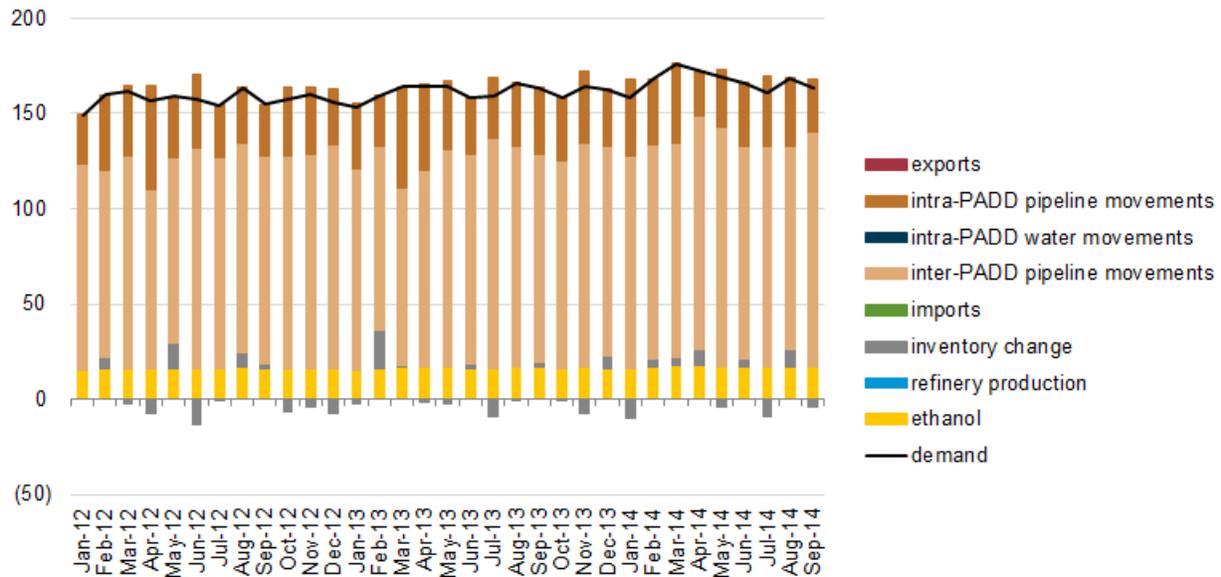
The CBG program has two key elements: a summer cleaner-burning fuel blend with a low Reid Vapor Pressure (RVP) to reduce ozone levels and a winter clean-burning fuel blend with a minimum oxygenate

content to reduce carbon monoxide levels. Winter CBG must also meet the specifications for CARB Phase 2 reformulated gasoline. Summer CBG must either meet the winter CARB Phase 2 specifications or meet specifications patterned after the federal Phase 2 reformulated gasoline (RFG) program. As a result, much of the gasoline required in Arizona is similar to CARB or federal RFG, which provides supply advantages. The petroleum component of gasoline blended specifically to meet Arizona gasoline specifications is Arizona Blendstock for Oxygenate Blending (AZBOB).

Arizona’s gasoline demand is primarily supplied by shipments from refineries in El Paso, Texas and other refineries on the Gulf Coast, with additional volumes sourced from refineries in Southern California. The same supply pattern exists for jet fuel, with most of the region’s jet fuel supplies sourced from the Gulf Coast. However, Arizona’s distillate demand is supplied mostly from Southern California refineries, representing that region’s relative net length in distillate supplies.

**Figure 28. Arizona motor gasoline supply/demand balance**

thousand barrels per day



Note: All movements are on a net basis.

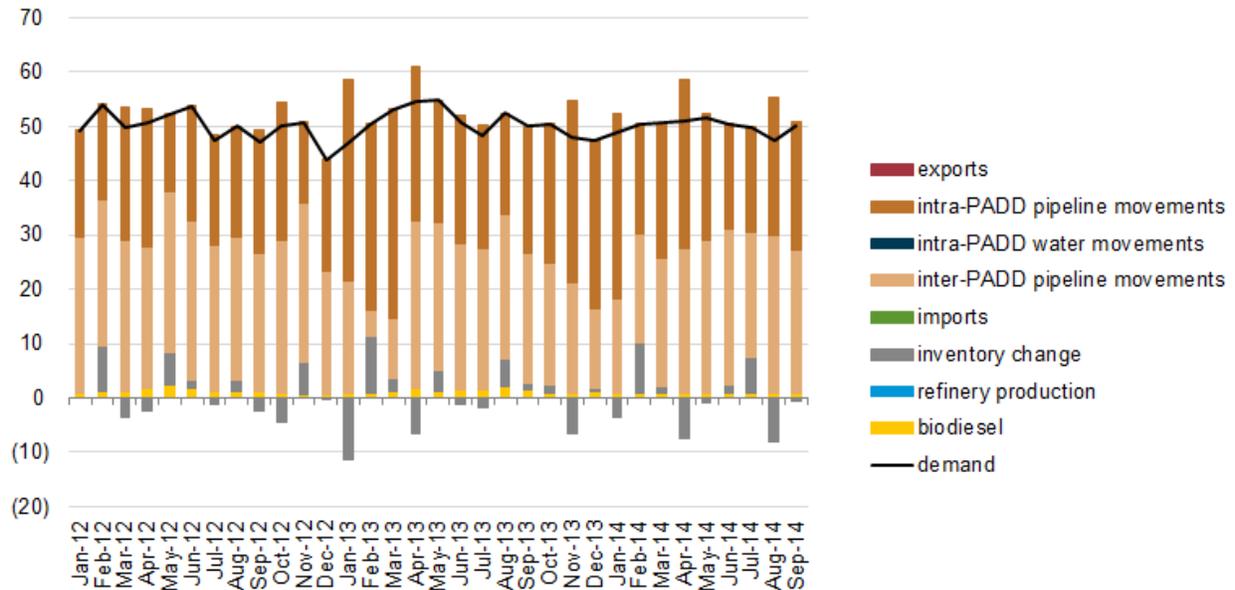
Source: Stillwater Associates analysis of EIA data

## Distillate fuel supply/demand

In 2013, Arizona region consumed 50,600 b/d of distillate fuel. Supply from Southern California averaged 28,200 b/d (56% of demand), and supply from Texas and New Mexico averaged 21,300 b/d (42% of demand). Biodiesel supplied about 3% of Arizona diesel fuel demand in 2013. Arizona requires ultra-low sulfur diesel, the specifications for which are less restrictive than CARB diesel.

Figure 29. Arizona distillate supply/demand balance

thousand barrels per day



Note: All movements are on a net basis.

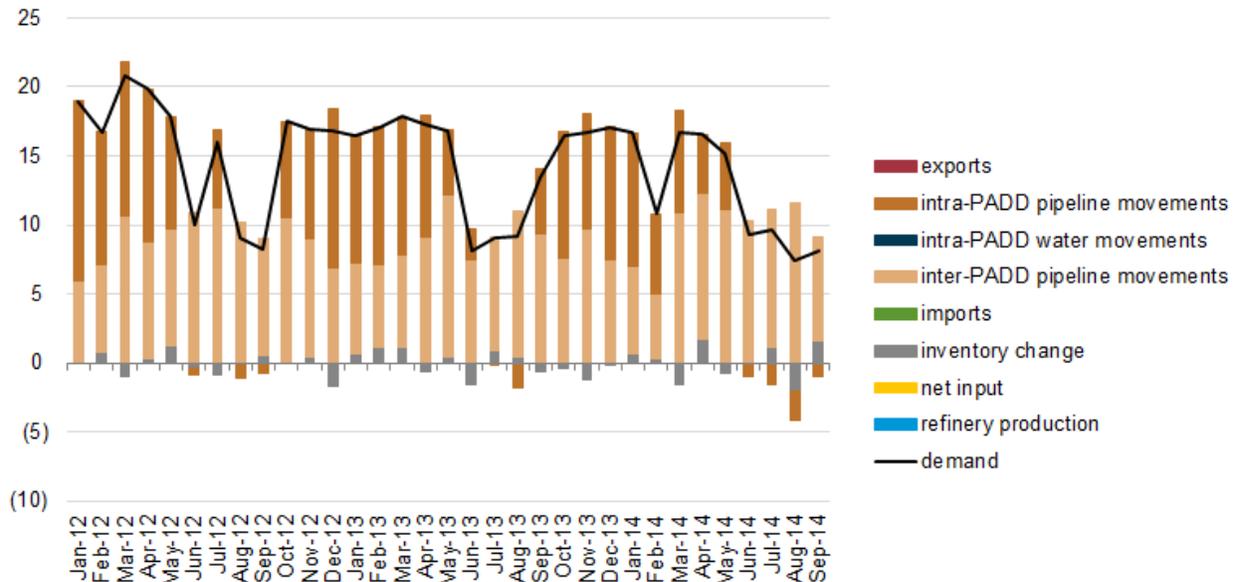
Source: Stillwater Associates analysis of EIA data

## Jet fuel supply/demand

In 2013, Arizona consumed 14,600 b/d<sup>16</sup> of jet fuel, most of which was supplied from Texas and New Mexico. Jet fuel demand is principally at the Phoenix Sky Harbor International Airport and the Tucson International Airport, both of which are supplied from the Kinder Morgan pipeline systems.

Figure 30. Arizona jet fuel supply/demand balance

thousand barrels per day



Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Renewable fuels and biofuels supply/demand

Motor gasoline sold in Arizona is blended with ethanol to an average level of 10%, driven by the federal RFS program and also by the EPA’s State Winter Oxygenated Fuel program that requires minimum oxygenate levels to reduce carbon monoxide emissions. The winter oxygenated fuel season is generally October through February or March. Arizona has one ethanol production facility, Pinal Energy, which restarted in March 2014 after having been idle for 18 months. Arizona also has biodiesel production capacity.

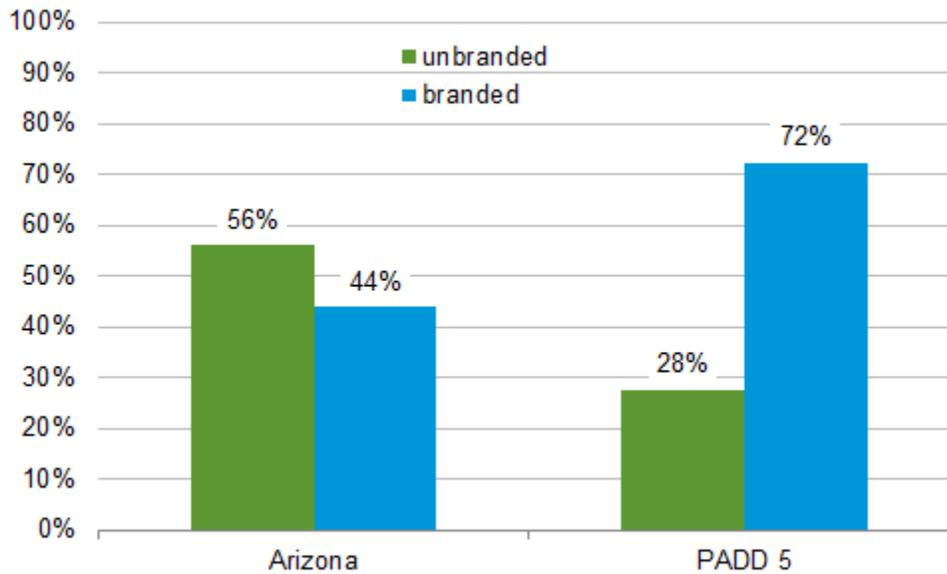
<sup>16</sup> Non-EIA sources of data estimate Arizona jet fuel consumption at higher levels.

## Retail market

There are about 23 branded and unbranded fuels retailers operating in Arizona and most, 56%, of the retail outlets are unbranded meaning they are unaffiliated with a major oil company brand, although they may purchase product from a major oil company and market that product under a different brand. Major retail brands in Arizona include Chevron, Circle K, Fry's, Quik Trip, Shell, and Valero.

**Figure 31. Arizona retail market structure**

percent of retail outlets



Source: Stillwater Associates analysis of Oil Price Information Service (OPIS) data for the week of December 31, 2014

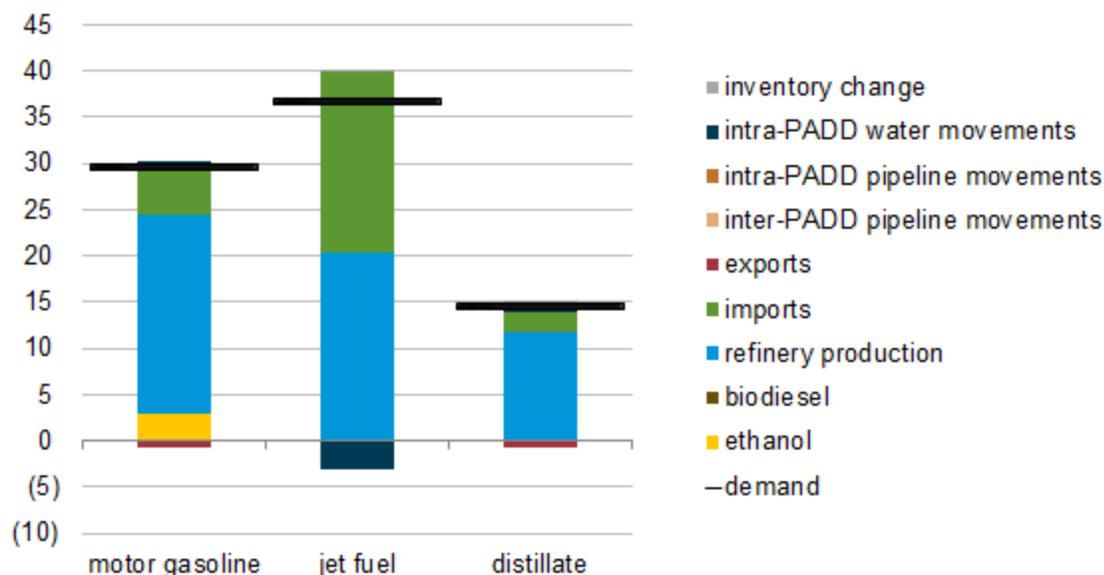
Note: OPIS data are survey rather than census data, and survey data include transactions from large commercial trucking fleet customers using company credit cards and not from cash or credit card sales to the general public.

## Hawaii

Hawaii is remote and isolated from other PADD 5 regional markets and other PADDs. Hawaii relies primarily on in-region refinery production and imports. In 2013, refineries in Hawaii produced 21,500 b/d of motor gasoline, 20,300 b/d of jet fuel, and 11,800 b/d of diesel fuel sufficient to meet 72% of motor gasoline demand, 55% of jet fuel demand, and 81% of distillate fuel demand. Refinery production was supplemented with motor gasoline imports of 5,400 b/d, jet fuel imports of 19,700 b/d, and distillate imports of 2,200 b/d. Hawaii was also supplied with small volumes of motor gasoline and diesel fuel from other PADDs and a small volume of diesel fuel from other PADD 5 regional markets.

The state's island geography supports air travel, and as a result, Hawaii's jet fuel demand, which averaged 36,700 b/d in 2013, is higher than demand for both motor gasoline and diesel fuel. Hawaii's jet fuel demand accounted for 8% of PADD 5 demand in 2013, compared with 2% of motor gasoline and 3% of diesel fuel demand. The state's diesel demand is boosted by demand from the electric power sector and U.S. Navy demand for marine fuels.

**Figure 32. Hawaii 2013 supply/demand balance**



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

### Supply and logistics

There are two operating refineries in Hawaii with a combined atmospheric crude distillation unit capacity of 147,500 barrels per calendar day (b/cd). The Chevron Barbers Point refinery with capacity of 54,000 b/cd refines light and very low-sulfur-content crude oil into motor gasoline, distillate fuel, and jet fuel. The Par Petroleum Ewa Beach refinery, doing business as Hawaii Independent Energy, has atmospheric crude distillation capacity of 93,500 b/cd, and produces mostly jet and diesel fuels. The Ewa Beach refinery processes a mix of sweet and moderately heavy crude oils, including imports and oil from

the Alaska North Slope. In addition to transportation fuels, Hawaiian refineries produce significant quantities of heavy fuels used in electric power generation.

**Table 7. Hawaii refineries**

<b>Company</b>	<b>Location</b>	<b>Atmospheric Crude Distillation Unit (ACDU) capacity b/cd</b>	<b>Markets served</b>
Chevron USA	Honolulu (Barbers Point)	54,000	Hawaii
Par Petroleum dba Hawaii Independent Energy	Ewa Beach (Kapolei)	93,500	Hawaii

Source: Stillwater Associates analysis of EIA data

In the first quarter of 2013, the refinery at Ewa Beach (then owned and operated by Tesoro Corporation) was idled and did not operate for several months. As a result, 2013 data on refinery transportation fuels supply are atypical for Hawaiian petroleum product markets. Par Petroleum purchased the Tesoro refinery and restarted it in the second quarter of 2013. The refinery is now doing business as Hawaii Independent Energy. With the restart, supply is now more consistent with historical patterns.

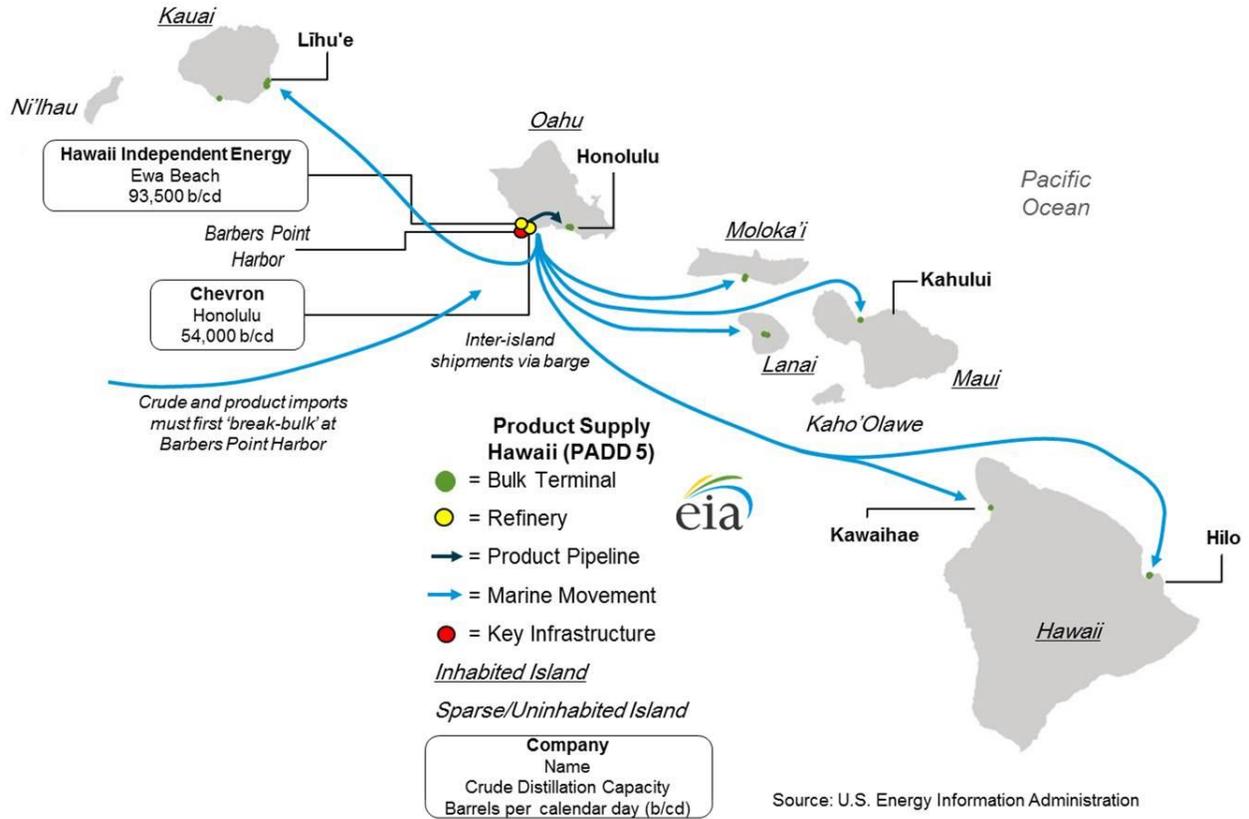
In 2013, refineries in Hawaii produced 21,500 b/d of motor gasoline, 20,300 b/d of jet fuel, and 11,800 b/d of diesel fuel sufficient to meet 72% of motor gasoline demand (81% when blended with ethanol), 55% of jet fuel demand, and 75% of diesel fuel demand. Refinery production was supplemented with motor gasoline imports of 5,400 b/d, jet fuel imports of 19,700 b/d, and diesel imports of 2,200 b/d. Hawaii was also supplied with small volumes of motor gasoline and diesel fuel from other PADDs and supplied a small volume of diesel fuel from other PADD 5 regional markets.

Product from the refineries on Oahu moves by pipeline to supply storage and distribution terminals on Oahu and by marine vessel from the Barbers Point Harbor to terminals on the islands of Maui, Kauai, and Hawaii. Product that arrives in Hawaii by marine vessel from other U.S. regions is also processed through the Barbers Point Harbor where large seagoing marine vessels can be accommodated. Large cargoes are offloaded, and then smaller volumes are shipped by barge to the storage and distribution terminals on the other islands. There are 14 storage and distribution terminals outside the Honolulu area, many of which are small.

Product is also shipped to Honolulu International Airport by pipeline across Pearl Harbor and by truck from Honolulu area terminals.

The two refineries on Oahu and the Barbers Point port facilities and associated barge fleet are critical to Hawaii transportation fuels supply.

Figure 33. Hawaii refineries and petroleum product flows

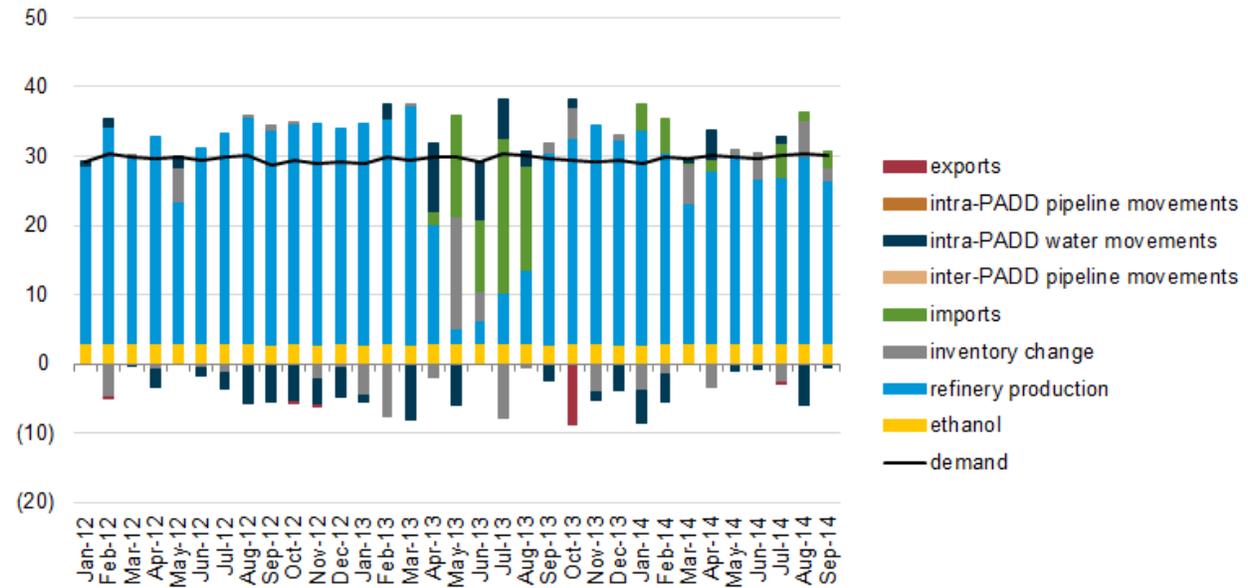


### Motor gasoline supply/demand

Hawaii is typically a tightly balanced market for motor gasoline. In 2012, in-region refinery production when blended with ethanol was sufficient to supply 99% of motor gasoline demand. On average in 2013, in-region refinery production in Hawaii was sufficient to supply only 72% of demand (81% when blended with ethanol). Imports and receipts from other PADDs supplied the balance. After the restart of the closed refinery, EIA data indicate that balances are more consistent with historical levels.

Figure 34. Hawaii gasoline supply/demand balance

thousand barrels per day



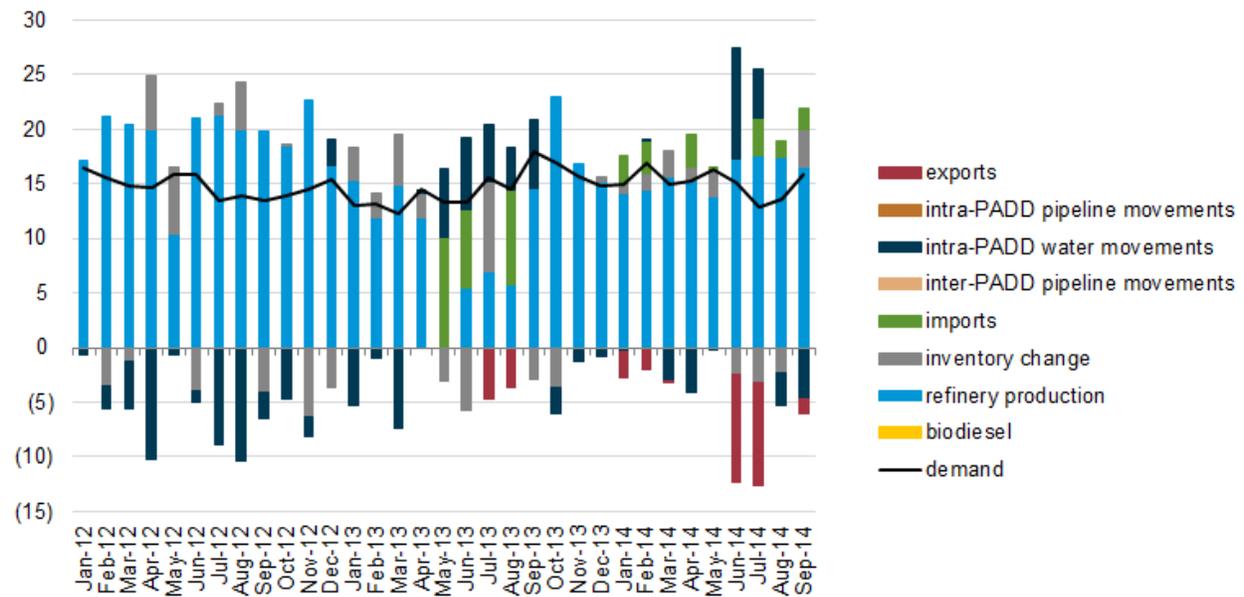
Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

### Distillate fuel supply/demand

Refineries in Hawaii typically produce more distillate fuel than is consumed locally. In 2012, in-region refineries produced 129% of average distillate demand and in the first nine months of 2014 produced 104% of average demand. However, refineries in Hawaii are configured to produce some diesel fuel to meet power generation demand. The refineries also lack de-sulfurization capacity. This creates an imbalance between the distillate fuels produced in Hawaii, with excess supplies of heavy higher-sulfur diesel fuel and a shortage of lower-sulfur distillate fuels like ULSD. As a result, Hawaii exports or ships to other parts of PADD 5 heavier distillate fuels, and either imports ULSD or receives it from other PADD 5 regional markets. The lack of desulfurization capacity at Hawaiian refineries limits crude slate flexibility and favors crude oil with very low sulfur content.

Figure 35. Hawaii distillate fuel supply/demand balance

thousand barrels per day



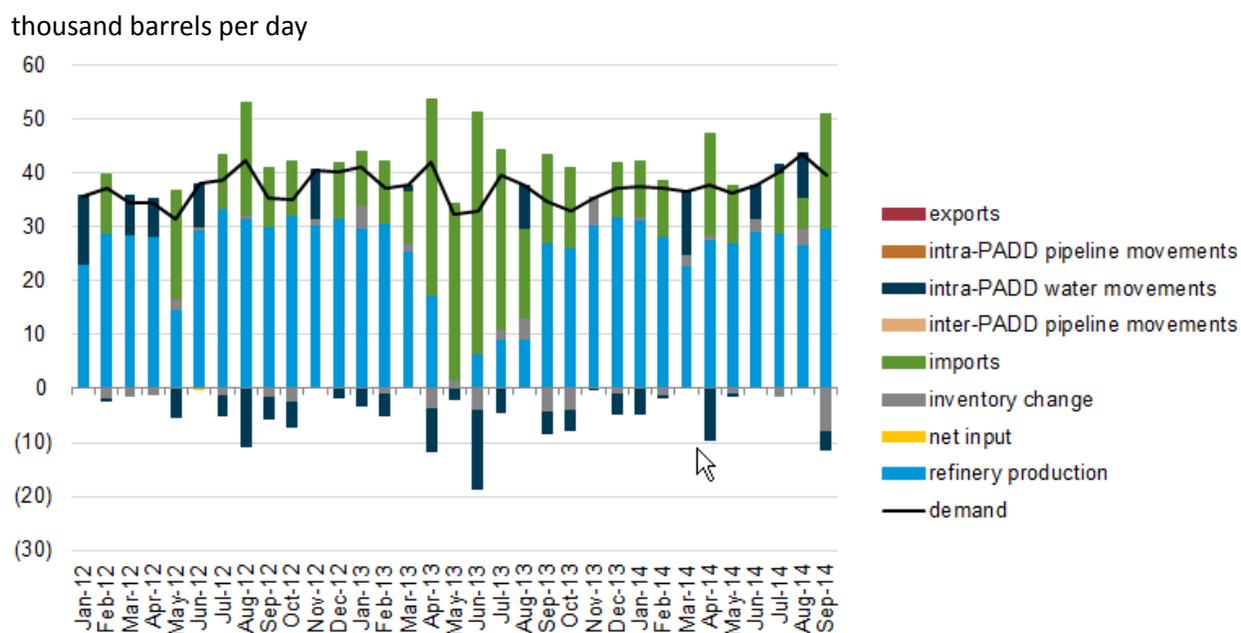
Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

## Jet fuel supply/demand

Hawaii consumes more jet fuel than motor gasoline or diesel fuel. As in-region refineries cannot produce sufficient quantities of jet fuel to meet demand, Hawaii imports substantial volumes of jet fuel. In 2013, Hawaii imported 19,700 b/d of jet fuel (54% of demand) and in 2012 the state imported jet fuel to meet 21% of demand. Jet fuel is occasionally transferred to Hawaii from other regions of PADD 5.

**Figure 36. Hawaii jet fuel supply/demand balance**



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

## Renewable fuels and biofuels supply/demand

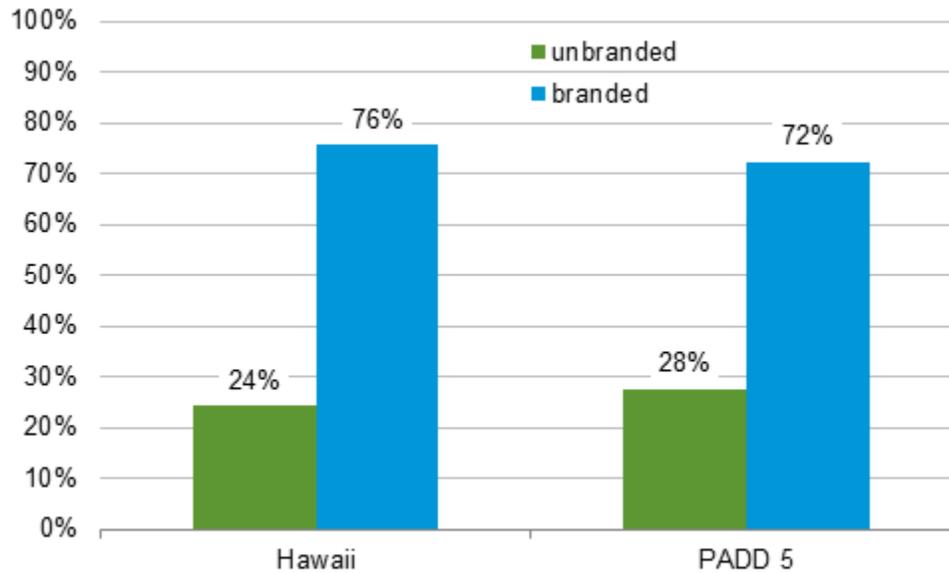
Transportation fuels sold in Hawaii must comply with the federal Renewable Fuels Standard (RFS) that mandates transportation fuels sold in the United States contain a minimum volume of renewable fuels. However, Hawaii recently passed legislation to eliminate the mandate to blend ethanol into gasoline. It is unclear what practical impact the legislation will have because producers will still be required to blend renewable fuel into gasoline and diesel under the federal Renewable Fuel Standard program. Ethanol is currently shipped to Hawaii from the other regional markets in PADD 5 or from Brazil. Ethanol shipped from the West Coast typically originates in the Midwest and moves to the West Coast by rail. Plans to produce ethanol in Hawaii using locally grown feedstocks have been slow to materialize despite state incentives.

## Retail market

There are about nine branded and unbranded retailers of transportation fuels in Hawaii, and 76% of retail outlets sell branded fuels. Chevron, 76, Aloha, Tesoro, and Shell are among the major retail brands in Hawaii.

**Figure 37. Hawaii retail market structure**

percent of retail outlets



Source: Stillwater Associates analysis of Oil Price Information Service (OPIS) data for the week of December 31, 2014

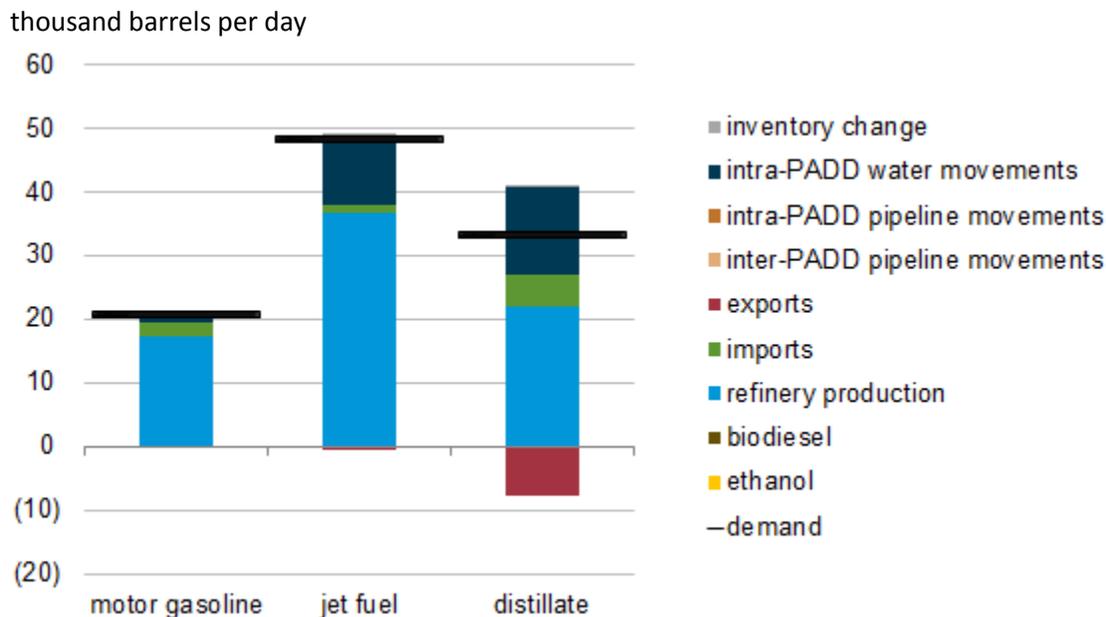
Note: OPIS data are survey rather than census data, and survey data include transactions from large commercial trucking fleet customers using company credit cards and not from cash or credit card sales to the general public.

## Alaska

Alaska has the lowest population of all PADD 5 regions, and as a result, Alaska's demand for motor gasoline accounts for a small percentage of total PADD demand. However, the region's remoteness and wide geographic expanse make air travel essential, and Alaska's demand for jet fuel is higher than for motor gasoline. The region's distillate fuel demand is supported by resource extraction activities and oil production in the north. In 2013, Alaska's demand for motor gasoline was 20,800 b/d, less than 2% of total PADD 5 demand; jet fuel demand was 48,400 b/d, 11% of PADD 5 demand; and diesel fuel demand was 33,400 b/d, 7% of PADD 5 demand.

The region is supplied primarily by in-region refinery production, by production from refineries in other regions of PADD 5 that is delivered by marine vessel from Washington and California, and by imports.

**Figure 38. Alaska 2013 supply/demand balance**



Note: All movements are on a net basis.

Source: Stillwater Associates analysis of EIA data

### Supply and logistics

There are five operating refineries in Alaska with combined atmospheric crude distillation unit capacity of 165,200 barrels per calendar day (b/cd). A sixth refinery, Flint Hills Resources North Pole refinery, with 126,535 b/cd crude distillation capacity, was closed in 2014 and is being dismantled and converted to a storage and distribution terminal.

The operating refineries are dispersed across the state. On the North Slope, two of the three major crude oil producers, BP and ConocoPhillips, operate small distillation-only refineries that process Alaska North Slope (ANS) crude oil to produce arctic diesel fuel for production operations. The refineries inject unsold distillation products back into the Trans-Alaska Pipeline System (TAPS). Petro Star also operates

two distillation-only refineries, one in North Pole in central Alaska and the other in Valdez in southern Alaska. Both of these facilities blend unsold distillation products back into TAPS.

Tesoro operates the largest and most complex refinery in Alaska at Kenai. The Tesoro refinery produces a wider range of transportation fuels, including motor gasoline, jet fuel, and diesel fuel. The refinery also produces asphalt.

**Table 8. Alaska refineries**

<b>Company</b>	<b>Location</b>	<b>Atmospheric Crude Distillation Unit (ACDU) capacity b/cd</b>	<b>Markets served</b>
Tesoro	Kenai	65,000	Anchorage
Petro Star	Valdez	55,000	South Alaska/Islands
Petro Star	North Pole	19,700	Fairbanks/Central Alaska
Conoco Phillips	Prudhoe Bay	15,000	Conoco Phillips Production Operations
BP	Prudhoe Bay	10,500	BP Production Operations

Source: Stillwater Associates analysis of EIA data

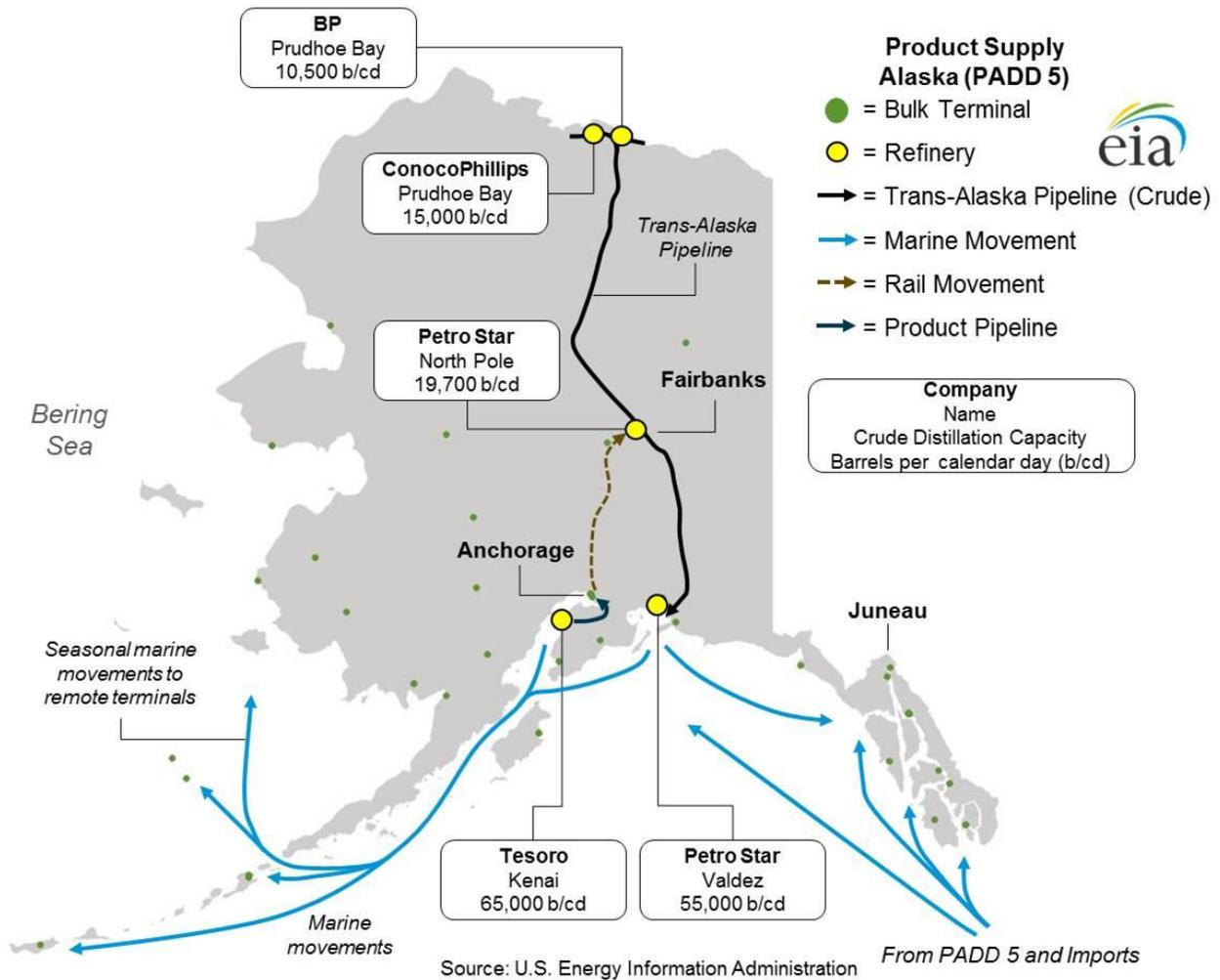
On an annual average basis, the refineries in Alaska supply 83% of motor gasoline demand, 76% of jet fuel demand, and 66% of diesel fuel demand. However, Alaska's seasonal weather patterns result in seasonal differences in consumption. Supply/demand balances and supply patterns vary across the year. Refinery supply is supplemented with receipts from other PADD 5 regions and imports. Product is regularly supplied to southeastern Alaska by marine vessel from Washington and California. Alaska also exports a small amount of fuel to Canada and Asia.

Shipment of product within Alaska is by pipeline between Kenai and Anchorage, by rail between Anchorage and Fairbanks, and by marine vessel. The Anchorage-to-Fairbanks rail line and the pipeline to Anchorage are critical to the supply chain.

There are 42 small storage/distribution terminals outside the Anchorage area that serve isolated areas. Deliveries to some locations are seasonal, occurring only during the summer and fall when barge movements are possible. In Southeast Alaska, where there are few roads, fuels are supplied by barge from the U.S. West Coast and Canada.

Jet fuel is delivered to the Ted Stevens International Airport via both pipeline and trucks from Anchorage-area terminals.

Figure 39. Alaska refineries and petroleum product flows



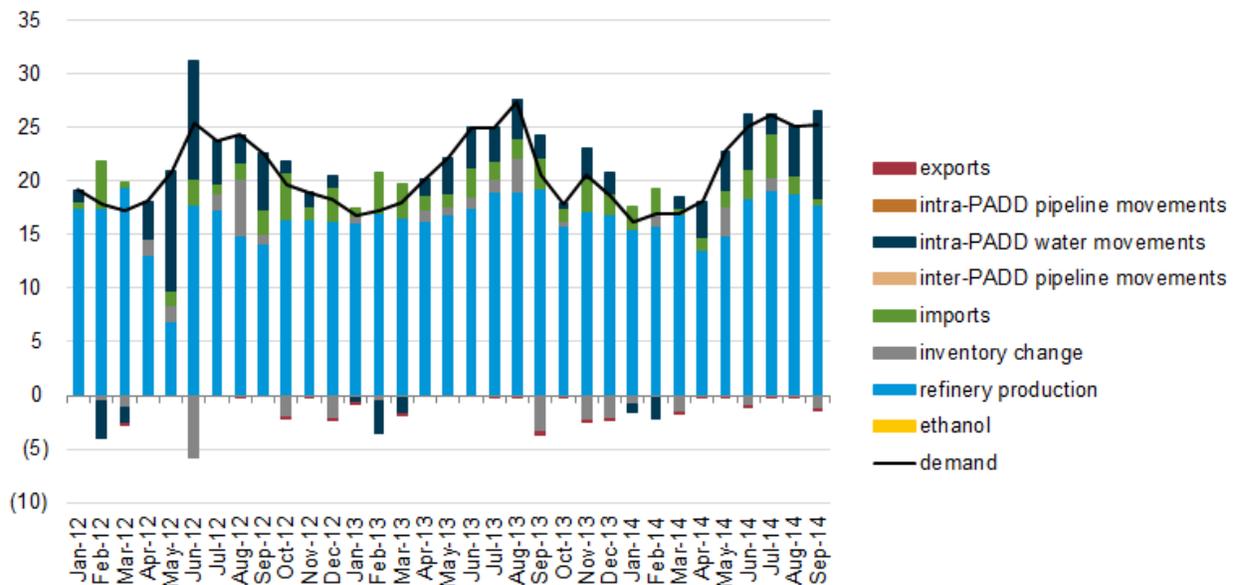
## Motor gasoline supply/demand

Motor gasoline demand in Alaska is highly seasonal. Demand in the peak summer months is significantly higher than in the winter months. In the winter months, in-region refinery production of gasoline is almost sufficient to meet demand; during the summer, a combination of imports and marine deliveries from other PADD 5 regions supplements in-region refinery production. In 2013, Alaska motor gasoline demand averaged 20,800 b/d. In January 2013, demand was about 16,800 b/d and in July demand was 25,000 b/d.

Alaska does not require the blending of ethanol with motor gasoline so ethanol does not represent the typical 9%–10% of motor gasoline as it does in other regions of PADD 5.

**Figure 40. Alaska motor gasoline supply/demand balance**

thousand barrels per day



Note: All movements are on a net basis.

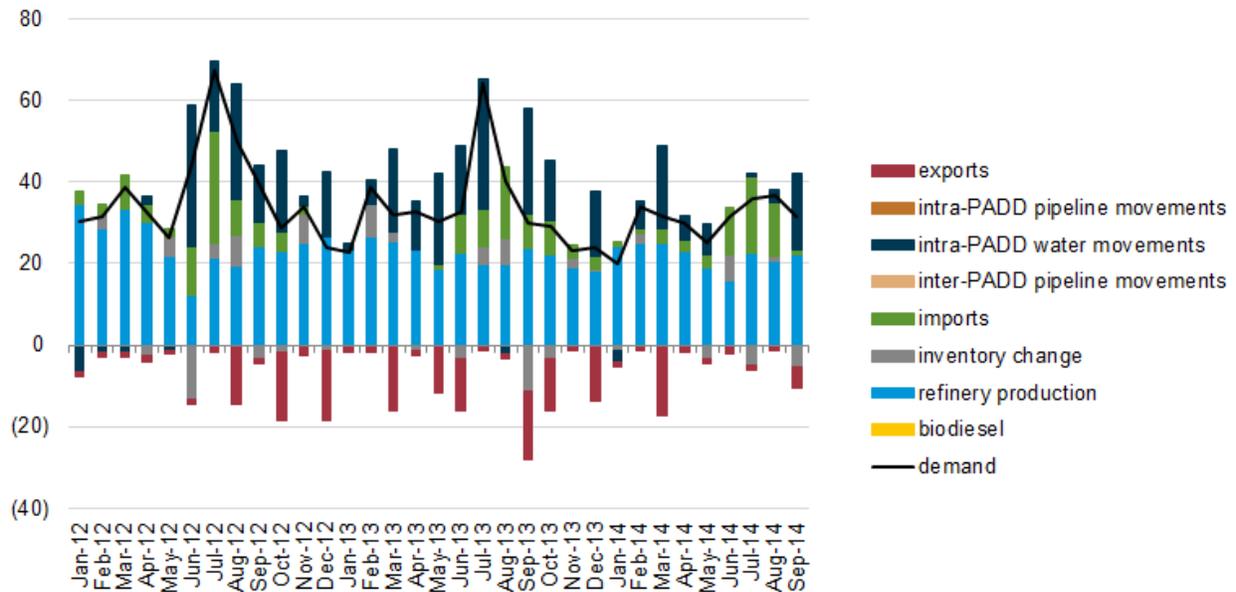
Source: Stillwater Associates analysis of EIA data

## Distillate fuel supply/demand

Alaskan distillate demand, 33,400 b/d on average in 2013, is supplied mostly by in-region refinery production (66%), imports (15%), and marine movements from other regions (41%). Some of the refineries in Alaska’s North Slope produce off-road diesel fuels for use in oil and natural gas exploration and production activities. Diesel is also exported from Alaska to Canada and Asia.

**Figure 41. Alaska distillate fuel supply/demand balance**

thousand barrels per day

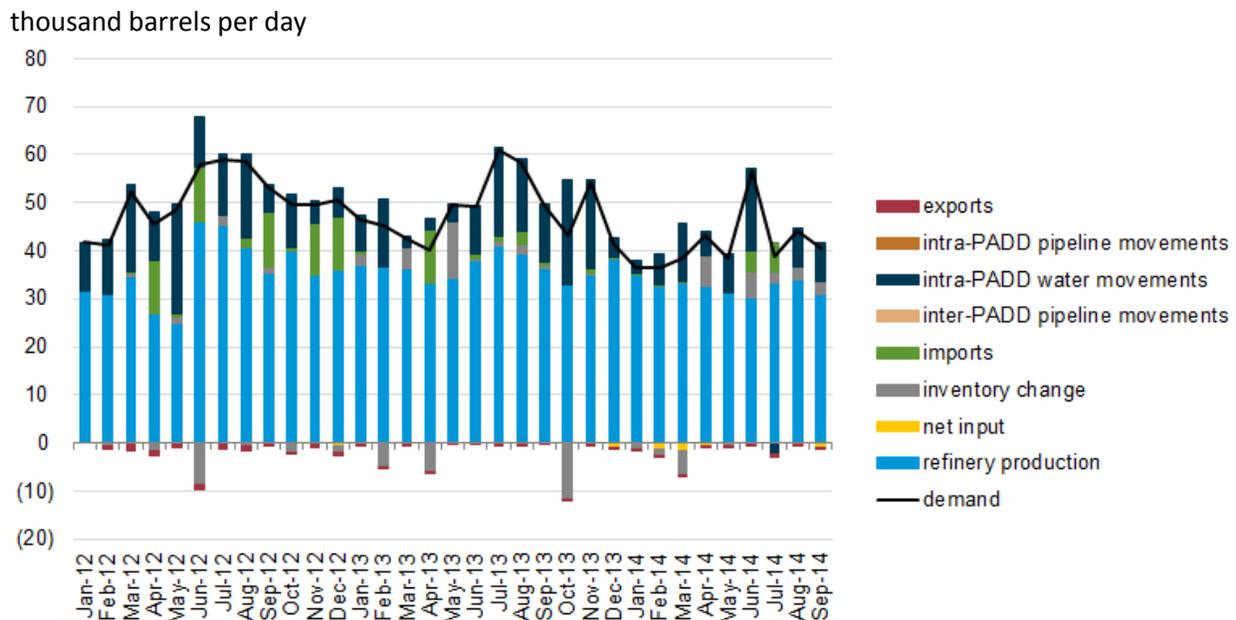


Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Jet fuel supply/demand

Jet fuel is a critical transportation fuel in Alaska. With vast distances to cover across rugged terrain, aviation is often the only way to access many parts of the state. Alaska’s jet fuel consumption of 48,400 b/d on average in 2013 accounts for 11% of PADD 5 jet fuel demand. Jet fuel demand is typically higher in summer months than in winter. In-region refineries produced jet fuel sufficient to supply 76% of average demand in 2013. Imports of 1,500 b/d and receipts of jet fuel from other PADD 5 regions, Washington and California, supplied the balance.

Figure 42. Alaska jet fuel supply/demand balance



Note: All movements are on a net basis.  
 Source: Stillwater Associates analysis of EIA data

## Renewable fuels and biofuels supply/demand

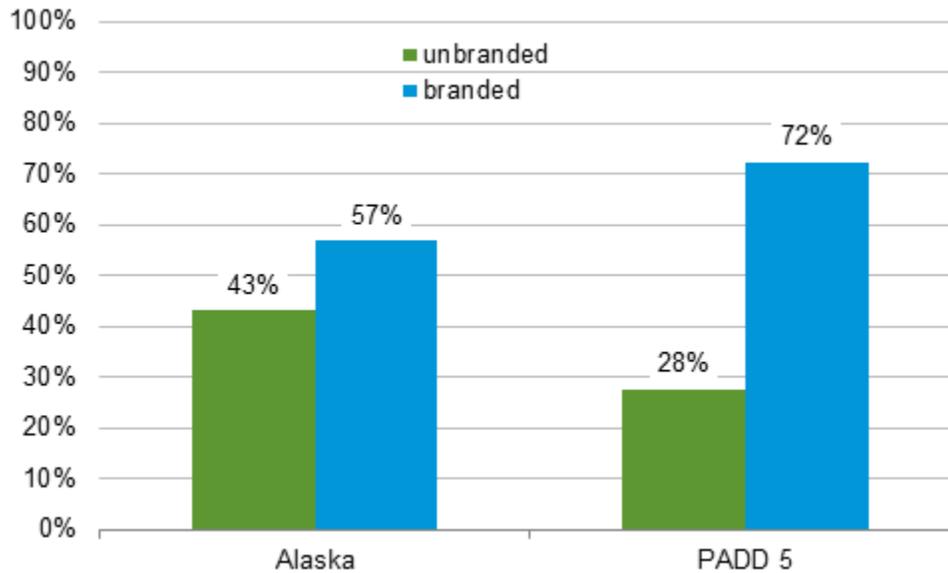
There is minimal biofuels demand in Alaska. There is no requirement to blend ethanol into motor gasoline. EIA data indicate that there is one biodiesel production facility in the state as of April 2015.

## Retail market

There are 9 branded and unbranded retailers with approximately 165 retail outlets in Alaska. Most of the retail locations (57%) are branded. Major retail brands include Holiday, Tesoro, Chevron, and Shell.

**Figure 43. Alaska retail market structure**

percent of retail outlets



Source: Stillwater Associates analysis of Oil Price Information Service (OPIS) data for the week of December 31, 2014

Note: OPIS data are survey rather than census data, and survey data include transactions from large commercial trucking fleet customers using company credit cards and not from cash or credit card sales to the general public.