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PNNL-37597

Trends and Effects of Changes in Business Cases for Petroleum Refineries

May 2025

Vanessa Hamilton
Bhaskar Mitra
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U.S. DEPARTMENT of ENERGY

Prepared for the U.S. Department of Energy
under Contract DE-AC05-76RL01830

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Abstract

In September 2024, the Oregon Department of Energy released the 2024 Oregon Energy Security Plan, which highlights the state's reliance on out-of-state gasoline imports, primarily from refineries located in the state of Washington. This study investigates recent trends and effects in business cases for petroleum refineries throughout the United States, with a focus on gasoline price effects in recent years. Case studies were developed for three specific business cases. In addition to reviewing refinery closures, we explore historical events that affected Oregon's gas prices. Finally, we propose a series of refinery closure indicators based on the case studies. By reviewing historical events and impacts on the gasoline supply chain, this study may help inform future discussions on Oregon's energy and fuel supply resilience.

Executive Summary

The state of Oregon's dependence on Washington refineries for gasoline is a significant factor in Oregon's fuel supply chain and energy security goals. The Washington State Department of Commerce recently issued the Washington State Economic Impact Study, which noted that refineries are likely to change operations in response to changes in demand and net zero emission limits (Western Washington University 2025), with unclear impacts cascading to Oregon.

Review of Recent Refinery Closures

This study reviewed recent refinery closures in the United States from January 1, 2019, through April 1, 2025, to identify recent refinery trends. The analysis assumed a size threshold of 40,000 barrels per day or greater; the smallest refinery in Washington has a capacity of approximately 40,700 barrels per day. A list of closures can be found in Table 2.

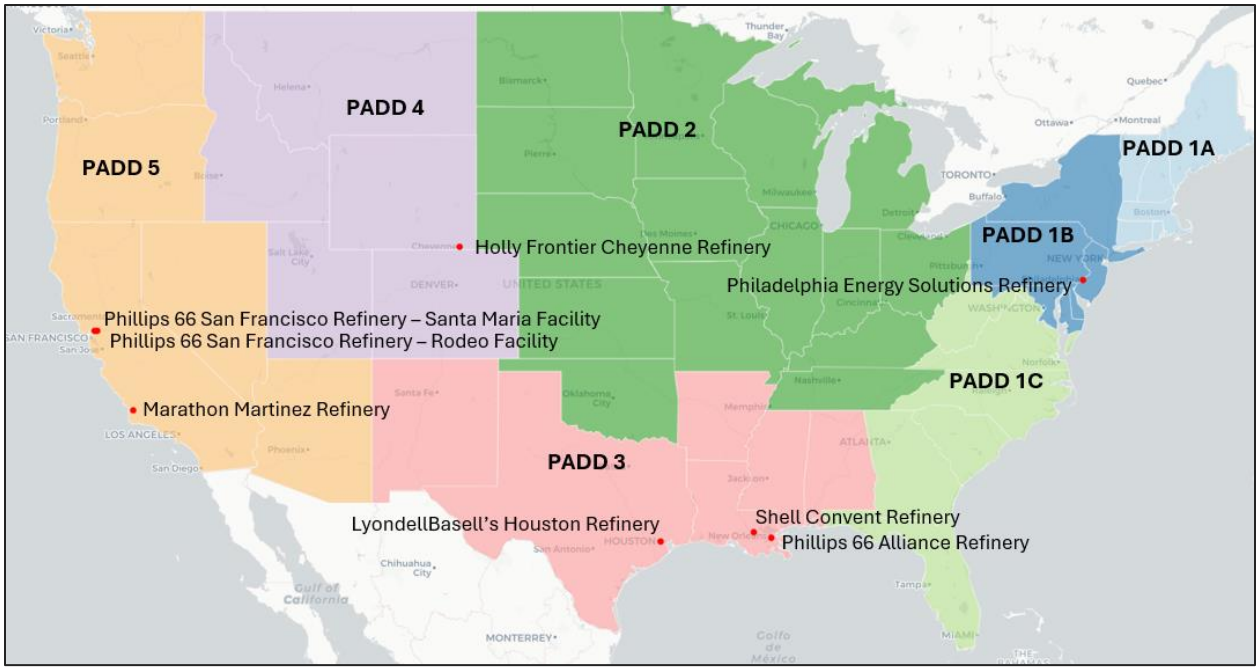

Figure 1. Map of refinery closures January 1, 2019, through April 1, 2025 (EIA 2024f) (CEC 2024) (EIA 2025) (Maugaotega 2020) (LB n.d.).

These eight refinery closures include the following:

- Phillips 66 San Francisco Refinery - Santa Maria Facility
- Phillips 66 San Francisco Refinery - Rodeo Facility
- Shell Convent Refinery
- Philadelphia Energy Solutions Refinery
- Marathon Martinez Refinery
- Holly Frontier Cheyenne Refinery
- Phillips 66 Alliance Refinery
- LyondellBasell's Houston Refinery

A notable insight from this study is that half of the reviewed refineries only issued a closure notice within one month of closure. Short closure notices give stakeholders a limited amount of time to respond to changes in supply and demand.

Historical Review of Gas Price Impacts on Oregon

For Oregon, one of the primary reasons to monitor refinery production and financial posture is the impact on local gas prices. Below is a list of examples where trends in Oregon and California gas prices notably differed from the U.S. average, based on a review of GasBuddy data (Figure 9) and news articles. Maintenance, both unplanned and planned, contributed to gasoline price increases in Oregon.

These gas price events include the following:

- **October 2019:** Gas prices on the West Coast increased as a result of multiple refineries experiencing unplanned outages (AAA 2019).
- **September and October 2022:** Four California refineries conducted planned maintenance. This is estimated to have reduced California's capacity by 55,000 barrels per day (CEC 2022).
- **June 2023:** The Olympic Pipeline underwent planned maintenance, and gasoline prices in Oregon increased relative to the U.S. average (Booker 2023).
- **April 2024:** Refinery maintenance and a shift to summer blends were cited as reasons for gas price increases in California, which could have affected the rest of Petroleum Administration for Defense District (PADD) 5 (Chow 2024).

Refinery Closure Indicators

Refineries may close or curtail operations for several reasons. Nevertheless, we identified the following indicators as material to the likelihood for a refinery closure, by reviewing recent refinery closures and more comprehensively investigating the circumstances leading up to the refinery closures identified in this report. These indicators provide a useful framework and relative posture to consider when assessing the potential for a refinery closure.

This framework is not a definitive list: There may be many additional factors that can be taken into consideration, and they should be modified and adjusted depending on the market conditions at the time. The framework can be found in Table 4. The indicators defined include the following:

- **Refinery age:** This was selected as an indicator as all the refinery closures identified in this study had operational spans of about 50 years or greater.
- **Regional production and demand:** In half of the refinery report closures analyzed, a reason for closure was the coronavirus pandemic, which was a period of low gasoline demand.
- **Events damaging infrastructure or affecting safety:** Two refineries permanently closed because of devastating events, and the refineries did not restart afterward.
- **Corporate and state emissions goals and associated investments:** Six of the refinery closures are associated with the conversion to alternative fuels facilities, such as hydrogen or biofuels. Emissions goals were also cited as a consideration for closure that affected two interdependent refineries.
- **Financial and corporate stability:** Recent changes in ownership resulting in new objectives or financial concerns can indicate levels of corporate stability.

Acknowledgments

This project was supported by the Office of Cybersecurity, Energy Security, and Emergency Response (CESER) as part of a collaboration on a pilot project between Pacific Northwest National Laboratory and the Oregon Department of Energy (ODOE) to evaluate risks to petroleum fuel infrastructure, supply chains, and compounding effects from transportation trends. The authors are indebted to Megan Levy (CESER) for sponsoring state collaborations for energy security planning and to Maxwell Woods (ODOE) for prompting and collaboratively designing this study for Oregon's fuel security into the future.

Definitions

American Petroleum Institute (API) gravity – API gravity is a metric measured in degrees that is used to assess how heavy a crude oil is compared to water (WSGS n.d.).

California Air Resources Board (CARB) – CARB sets emission reduction standards for gasoline to meet in three phases, including with respect to eliminating lead, regulating deposit control additives, and Reid vapor pressure. This program sets specifications for components such as sulfur, aromatics, and benzene as well as eliminated methyl tertiary-butyl ether from California gasoline (California Air Resources Board n.d.).

Crack spread – The crack spread measures the difference between the purchase price of crude oil and the selling price of finished products. The crack spread quantifies the short-term profit margin of oil refineries by comparing the cost of refinery inputs to the spot prices of the outputs (EIA 2013).

Heavy crude oil – Heavy crude oil has a higher density and a lower API gravity. These oils are highly viscous and can have a higher wax content (WSGS n.d.).

Hydrocracker – Utilizing hydrogen and a catalyst to crack heavy molecules, a hydrocracker is used to upgrade heavy gas oil into jet fuel, diesel, and gasoline (EIA 2013).

Jones Act – This statue provides that "[N]o merchandise shall be transported by water, or by land and water, on penalty of forfeiture thereof, between points in the United States, including districts, territories, and possessions thereof embraced within the coastwise laws, either directly or via a foreign port, or for any part of the transportation, in any other vessel than a vessel built in and documented under the laws of the United States and owned by persons who are citizens of the United States" (U.S. CBP 2024).

Light crude oils – Light crude oils have a low density, high API gravity, low viscosity, and low wax content (WSGS n.d.).

Nelson Complexity Index (NCI) – This is a measure of refinery complexity, and it was developed in the 1960s by W. L. Nelson in the *Oil & Gas Journal*. The larger the value is, the higher the complexity of the refinery. The distillation column is 1, and other units are assigned a value based on the conversion and cost relative to the distillation column (EIA 2012b). While secondary units allow the refinery to process lower-quality crude and produce higher-value products, they also come with increased operational and construction costs. For context, within the Phillips 66 refinery portfolio, NCI values range from 14.3 (Phillips 66 n.d.) to 7.7 (Phillips 66 n.d.). While U.S. refineries are known to be among the most complex globally, the Jamnagar refinery complex in India is the most complex, with an NCI score of 21.1, and can process almost all grades of crude oil (Reliance n.d.). Not all refinery owners publicly publish NCI scores for their assets, limiting the metric's usefulness for comparisons.

Petroleum Administration Defense Districts (PADDs) – The PADDs divide the country into five different districts. The PADDs were originally created in the 1950s and utilized to account for gasoline (ODOE 2021).

Philadelphia Energy Solutions (PES) – Owner of a refinery in Philadelphia that is no longer in operation (Board 2022).

Refinery utilization rate – This is represented by the percentage of the atmospheric crude distillation column that is used in a refinery. The refinery utilization rate calculation process is dividing the input to the units by the refining capacity of operable units (EIA n.d.).

Resilience – The ability to prepare for, adapt to, and recover rapidly from disruptions to operations. These disruptions can include attacks, accidents, or naturally occurring incidents (U.S. DOE 2023).

Sour crude oil – Sour crude oil has a total sulfur content greater than 0.5 percent. It also has high hydrogen sulfide and carbon dioxide concentrations (WSGS n.d.).

Sweet crude oil – Sweet crude oil contains a low amount of sulfur (<0.42 percent). Other contaminants, such as hydrogen sulfide and carbon dioxide, are present in trace amounts. An example of sweet crude oil is West Texas Intermediate crude oil (WSGS n.d.).

U.S. Energy Information Administration (EIA) – This independent agency is part of the Department of Energy; it collects data and conducts analysis and surveys regarding energy (EIA n.d.).

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1.0 Introduction

1.1 Overview of Oregon's Gasoline Supply Chain

The state of Oregon relies exclusively on out-of-state imports for gasoline, which creates a significant dependency for the state's energy security. Oregon does not have active wells or refineries to process crude oil into gasoline within the state. Oregon receives 77 percent of its gasoline supply via the Olympic Pipeline (ODOE 2024).

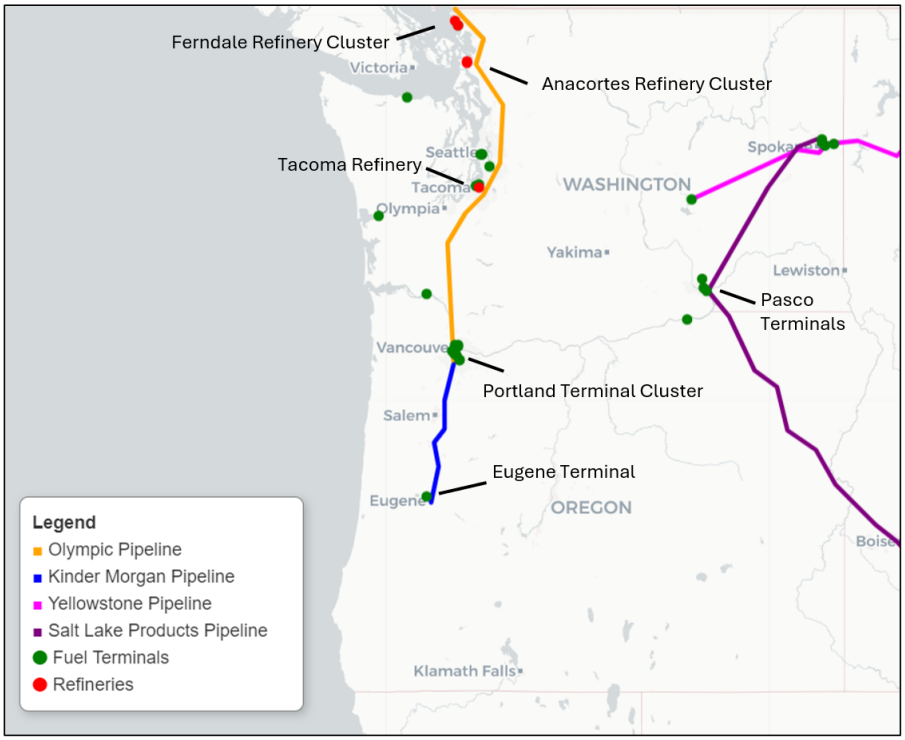


Figure 2. Map of critical fuel infrastructure in the Pacific Northwest (EIA 2024g) (EIA 2024h) (EIA 2025).

The northern terminus for the Olympic Pipeline is in Washington. From this point, it spans 400 miles and terminates at the Portland terminal cluster, which includes eight bulk terminals (Figure 2).

Four out-of-state refineries feed the Olympic Pipeline and are part of two refinery "clusters": the Ferndale refinery cluster and the Anacortes refinery cluster. The Ferndale refinery cluster includes the BP Cherry Point and Phillips 66 refineries. The Anacortes cluster includes two refineries: HF Sinclair's Puget Sound Refinery and a Marathon Petroleum refinery. The largest of these is the BP Cherry Point refinery, and the smallest is the Marathon Petroleum Anacortes Refinery. In addition to these four refineries that feed the Olympic Pipeline, there is a small refinery in Washington, the Par Pacific Refinery in Tacoma, which mainly serves the McChord Air Force Base and does not feed the Olympic Pipeline. The total crude oil refining capacity of the refineries that supply the Olympic Pipeline is 648,200 barrels per day (Table 1) (ODOE 2021).

Table 1. Washington refineries.

Refinery Name	Owner	Refinery Cluster	Crude Oil Refining Capacity (Barrels/Day)	Percentage of WA Refining Capacity	Supplies the Olympic Pipeline
Cherry Point	BP	Ferndale	238,500	31%	Yes
Ferndale	Phillips 66	Ferndale	105,000	16%	Yes
Puget Sound	HF Sinclair	Anacortes	145,000	22%	Yes
Anacortes	Marathon	Anacortes	119,000	18%	Yes
US Oil & Refining Co.	Par Pacific	Tacoma	40,700	6%	No

Sources: (ODOE 2024), (EIA 2024i).

As of 2021, the four Washington refineries receive crude from Canadian sources through the Trans Mountain pipeline and through Alaska via barge. The remainder is made up of foreign barge imports and North Dakota crude, which arrives by rail (ODOE 2024).

Once the gasoline arrives in Oregon from the Olympic Pipeline to the Portland terminal cluster, it is blended with ethanol. The remainder of the gasoline is sent through the Kinder Morgan Pipeline to the Eugene terminal (ODOE 2024).

Oregon's renewable fuel standard requires gasoline sold within the state to be 10 percent ethanol (ODOE n.d.). Ethanol is delivered to the Portland fuel terminals by barge and rail. The Portland fuel terminals also receive ethanol by rail at a rate of 5,400 barrels per day. The Portland fuel terminal has some storage capacity for ethanol. Ethanol is transported primarily by rail from Portland to the Eugene terminal. Small amounts of ethanol are also transported by rail from Washington, California, and Idaho into the state. After being blended with ethanol at the fuel terminals, the gasoline is distributed throughout the state via truck (ODOE 2024).

The Marathon Northwest Products Pipeline System's Salt Lake Products Pipeline system also supplied gasoline to the Pacific Northwest region. The pipeline originates in Salt Lake City, Utah, crosses through Oregon, and terminates in Spokane, Washington. There is a fuel terminal in Pasco, Washington. Trucks deliver fuel from Pasco, Washington, to eastern Oregon. Barges may also deliver fuel to the Pasco, Washington, terminal by barge on the Columbia River (ODOE 2024).

The remainder of gasoline imported into Oregon originates from the San Francisco Bay Area and is transported into the state through barge or truck. In addition, small quantities of fuel may also be delivered to the state via rail from other areas.

A diagram of Oregon's gasoline supply chain can be found in Figure 3.

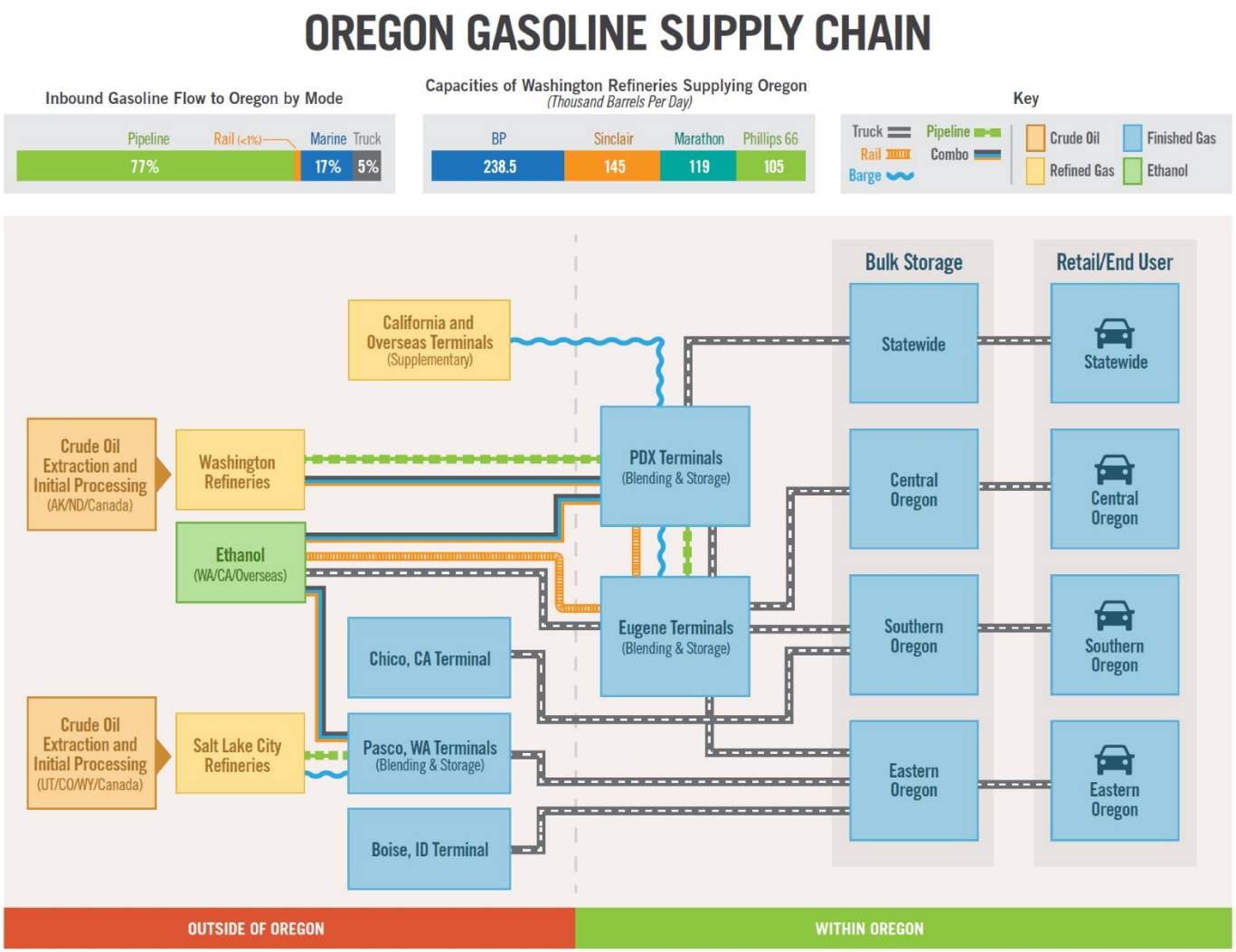


Figure 3. Diagram of the Oregon gasoline supply chain.

1.2 Petroleum Administrative Defense Districts

The Petroleum Administrative Defense Districts (PADDs) are five districts dividing the country. The PADDs were originally created in the 1950s and utilized to account for gasoline (ODOE 2021). Figure 4 shows the average movement of finished gasoline between PADDs from January 2000 through January 2023 (monthly-thousand barrels) (Mitra 2024). The figure shows that PADD 3 significantly feeds PADD 2 in the Midwest and PADD 1 on the East Coast, but there is limited movement of gasoline between PADD 3 and PADD 5. Currently, PADD 5, which includes Oregon, Washington, Nevada, California, Arizona, and Alaska, meets most of its demand through its own refinery production; however, this can create unique vulnerabilities for PADD 5 and affect the region's ability to adapt to supply chain disruptions (ODOE 2021).

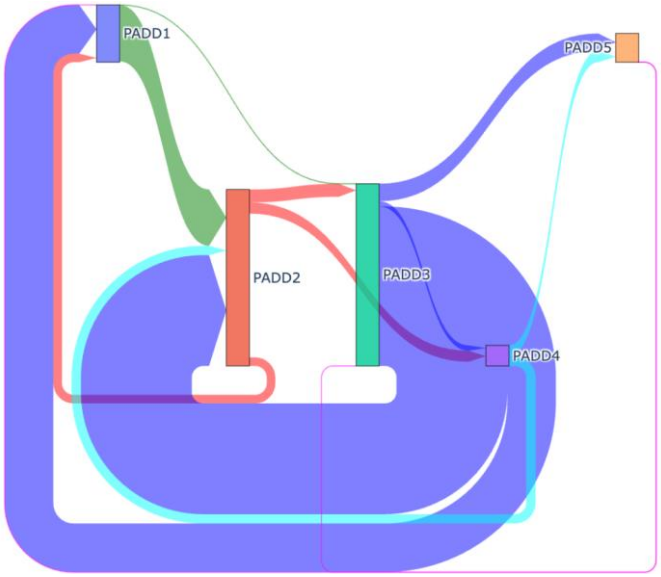


Figure 4. Movement of finished gasoline between PADDs (Mitra 2024).

1.3 Cost Factors for Gasoline and Potential Impacts for Oregon

Oregon gasoline consumers are attentive to the changing price of gasoline, which is influenced by market factors such as supply chain and distribution channels. Fuel shortages are more likely to be related to local events affecting truck delivery routes, such as during the 2022 snowstorm that slowed fuel delivery routes in Central Oregon (Central Oregon Daily 2022). If a single Washington refinery closes, gasoline will still be available on the domestic and international market; however, there is a concern that a refinery closure could put pressure on available gasoline, causing prices to increase and affect Oregon consumers. Public concern about events affecting or potentially affecting the fuel supply chain can also prompt panic buying, which can exacerbate the issue.

The price of gasoline varies throughout the nation and is influenced by multiple factors, such as the costs of crude oil, refining cost and profits, distribution and marketing costs, and federal and state taxes. These factors are described in detail in the following sections.

1.3.1 State, Federal, and Local Fuel Tax

Federal and state taxes account for about 14 percent of gasoline prices nationally (EIA 2024d). Oregon's state gas tax was $0.40 per gallon as of January 1, 2024 (ODOT 2024). These funds are used to pay for preservation and improvements for the state's roadways (ODOT 2022). The national average state gasoline tax as of July 1, 2024, was $0.33 per gallon (EIA 2024a). The federal tax as of July 1, 2024, was $0.1840 per gallon. There have been examples of states, in response to high gasoline prices, implementing a "gas tax holiday" during which the state tax is temporarily waved to provide relief to consumers. Four states have implemented gas tax holidays as of June 2022, during a period of high prices related to the Russian invasion of Ukraine (Tsvetanov 2024). The state of Oregon did not lift state fuel taxes. President Biden proposed a three-month suspension of federal gas taxes, but this did not go into effect (LeBlanc 2022). Finally, some local governments, including the City of Portland, also added an additional tax on gasoline.

1.3.2 Distribution and Marketing

Distribution and marketing also accounted for about 14 percent of gasoline prices nationally (EIA 2024d). Distribution prices can vary depending on the method of transportation (e.g., pipeline, rail, barge, or truck) and the distance.

As explained in Section 1.1, most of the gasoline that Oregon consumes is transported 400 miles through the Olympic Pipeline. Some of the fuel is then delivered 115 miles from Portland to the Eugene fuel terminals through the Kinder Morgan pipeline (ODOE n.d.).

After being blended with ethanol at the fuel terminals, the fuel is distributed throughout the state via truck. As the fuel terminals are in Oregon's largest cities, there is variation in the distance required to distribute fuel throughout the state to different counties, which may affect local fuel prices.

1.3.3 Crude Oil

The price of crude oil accounts for about 53 percent of the price of gasoline nationally (EIA 2024d). The cost of crude oil changes in response to many factors, such as supply, demand, and geopolitics. Washington refineries primarily receive crude oil from Canada and Alaska. Canadian crude is predominantly heavy sour, such as Western Canadian Select crude oil, though there is a wide range of crude types that are produced. Most of Alaska's production originates from the North Slope, which produces Alaska North Slope crude, a medium sour grade. The Canadian crude is delivered through the Trans Mountain pipeline from Edmonton, Alberta, to Burnaby, British Columbia. The pipeline connects to the Trans Mountain Puget Sound pipeline that delivers crude oil to the Ferndale and Anacortes Refinery clusters. The price per barrel of Western Canadian Select crude oil is typically lower than West Texas Intermediate, the crude that the United States uses as a benchmark. Additionally, there is limited pipeline capacity to transport crude and geographically limited access to international markets, which also contributes to the lower cost.

1.3.4 Refining Cost and Profits

Refining cost and profits account for just under 20 percent of gasoline prices nationally (EIA 2024d). The crude oil being received by the refineries is processed into a variety of components, such as light ends, gasoline, naphtha, kerosene and jet fuel, diesel, heavy gas

oils, and residual oil. Refining cost can include costs from the refinery, equipment, and labor. The Washington refineries receive heavy crude oil from the Canadian oil sands, which can be more expensive to process into gasoline than lighter crudes because they require more refining and processing (EIA 2024c).

2.0 Recent Refinery Closure Business Cases

2.1 Review of Recent Refinery Closures

Past examples of refinery closures can provide insights into the indicators and impacts associated with refinery closures, including the potential consequences for fuel availability and price impacts. The impacts of refinery closures may vary in response to market conditions and current events affecting crude oil supply.

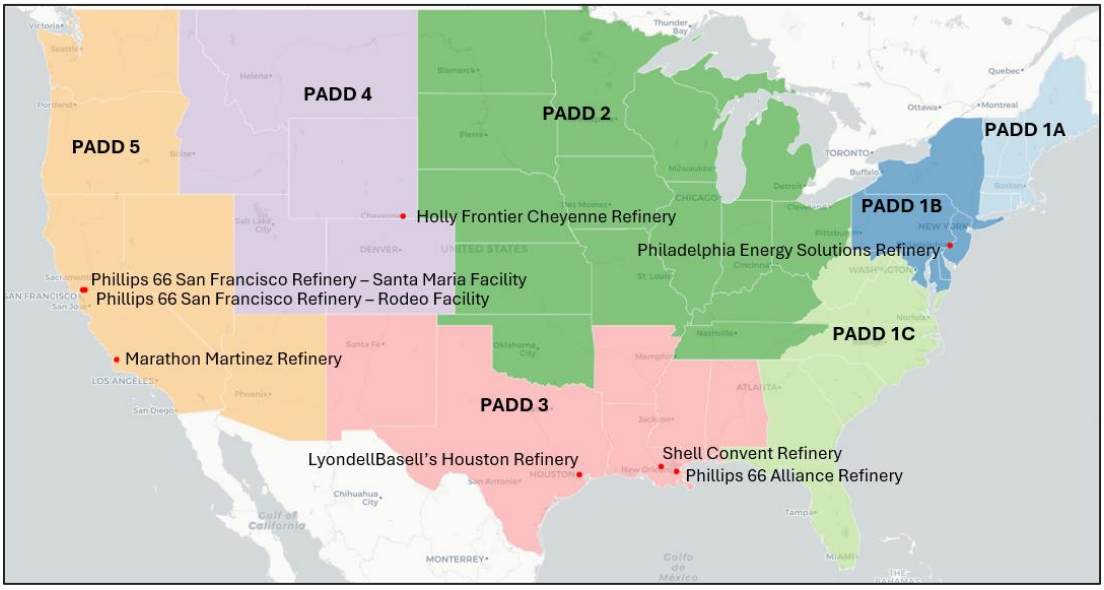
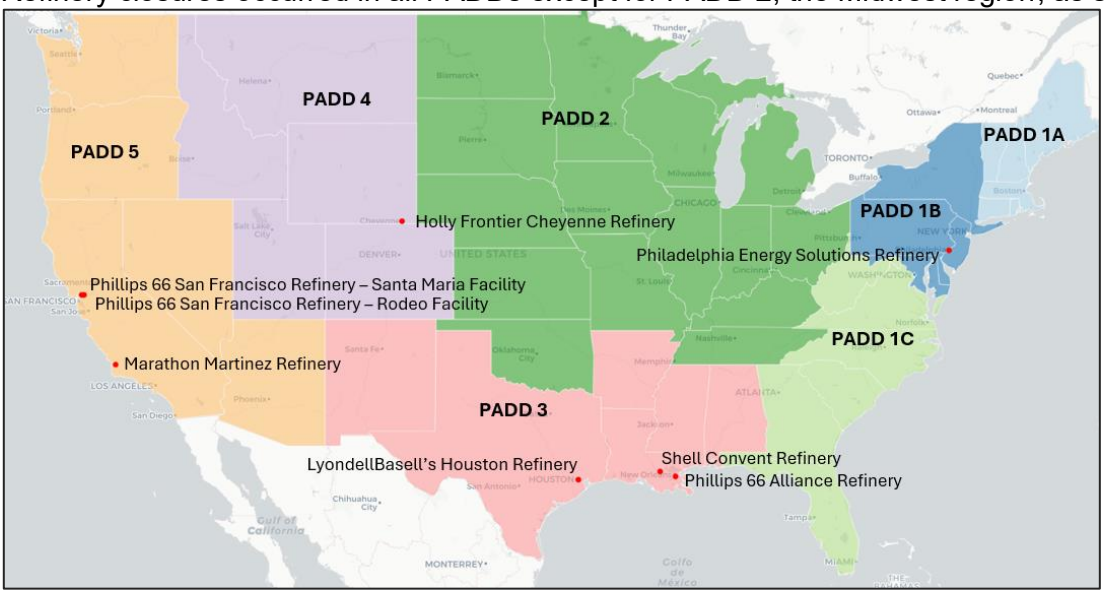


Figure 5 and Table 2 compile data from recent refinery closures in the United States from January 1, 2019, through April 1, 2025, to investigate recent refinery closures. As the smallest Washington refinery has a capacity of 40,700 barrels per day, refineries that have under 40,000 barrels per day of refining capacity were excluded to focus the analysis on refineries that were similar in capacity to Washington refineries. Eight refinery closures were identified.

Summary of Statistics:

- Half (50 percent) of the refineries had a period of about one month or less between closure announcement and shutdown, excluding refineries that ceased operations because of unplanned disasters.
- Three-quarters (75 percent) of the refineries either support the development of an alternative fuel facility, such as for renewable fuels or hydrogen, or have plans to be retrofitted into one of these facilities.
- Three out of eight refinery closures (38 percent) cited coronavirus impacts as a concern for cost or demand, highlighting vulnerabilities of the refineries to supply and demand shifts.
- Two refineries did not restart after devastating events, namely an explosion and severe damage from a hurricane. Public notices were issued after production stopped.

- Refinery closures occurred in all PADDs except for PADD 2, the Midwest region, as shown in



- Figure 5.

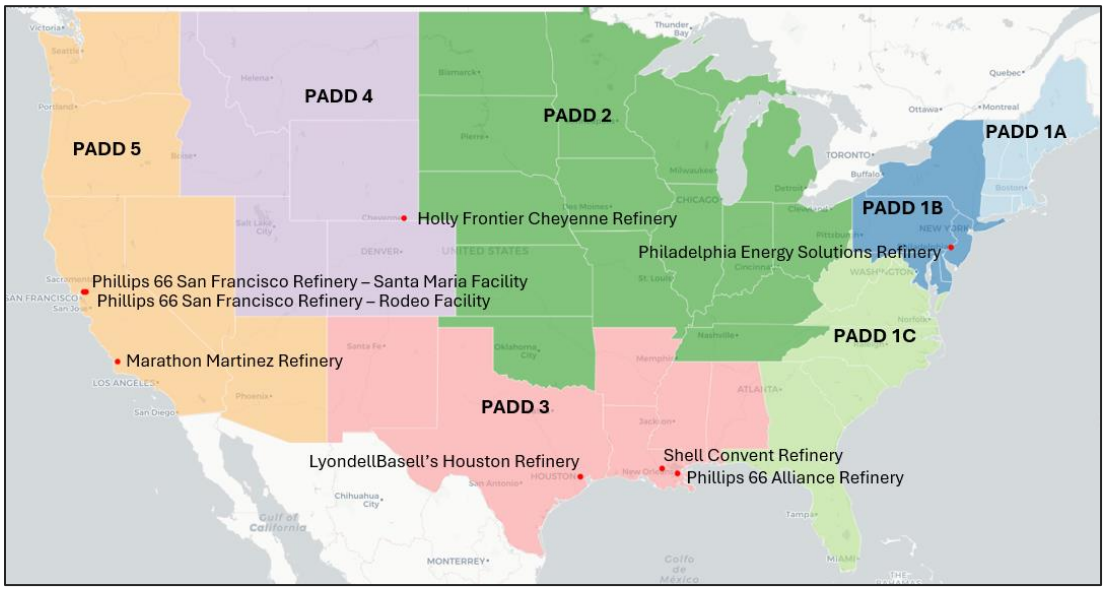


Figure 5. Map of refinery closures from January 1, 2019, to April 1, 2025 (EIA 2024f) (CEC 2024) (EIA 2025) (Maugaotega 2020) (LB n.d.).

Table 2. Closures of refineries with a capacity greater than 40,000 barrels per day in the United States from January 1, 2019, through April 1, 2025.

Refinery	Location	Opening Year	Crude Oil Capacity (Barrels per Day)	Notice Date	Refining Cease Date	Driving Factors	Plans
Phillips 66 San Francisco Refinery (Santa Maria Facility)	PADD 5 Arroyo Grande, CA (Keith n.d.)	1955 (CEC 2024)	120,200* (CEC 2024)	August 2020 (Maugaotega 2020)	January 2023 (Keith n.d.)	Conversion of the Rodeo Facility to renewables (Keith n.d.)	Demolition and remediation (Keith n.d.)
Phillips 66 San Francisco Refinery (Rodeo Facility)	PADD 5 Rodeo, CA (Phillips 66 n.d.)	1896 (Phillips 66 n.d.)	120,200* (CEC 2024)	August 2020 (Phillips 66 2020)	February 2024 (Voegele 2024)	Demand for renewable fuels and California emission goals (Phillips 66 2020)	Reconfigured to produce renewables facility (Voegele 2024)
Shell Convent Refinery	PADD 3 Convent, LA (Sanicola 2020)	1967 (PPS 2020)	211,146 (Sanicola 2020)	November 2020 (Sanicola 2020)	December 2020 (EIA 2024f)	Reduced demand due to the coronavirus pandemic (Sanicola 2020)	Renewable fuels and low-carbon products complex (Shell 2023)
Philadelphia Energy Solutions Refinery	PADD 1B Philadelphia, PA (Board 2022)	1870 (Board 2022)	335,000 (EIA 2024f)	June 2019[2] (Board 2022)	June 2019 (Board 2022)	June 2019 fire at the refinery complex (Board 2022)	Demolition and repurpose (Bellwether District 2024)
Marathon Martinez Refinery	PADD 5 Martinez, CA (CEC 2020)	1915 (CEC 2024)	161,000 (EIA 2024f)	August 2020 (CEC 2020)	October 2020 (CEC 2020)	Reduced demand due to the coronavirus pandemic (CEC 2020)	Conversion to a renewable fuels facility (MPC 2021)
Holly Frontier Cheyenne Refinery	PADD 4 Cheyenne, WY (Reuters 2020)	1940 (Mast 2015)	48,000 (EIA 2024f)	June 2020 (Reuters 2020)	July 2020 (Reuters 2020)	Cost concerns due to the coronavirus pandemic (Reuters 2020)	Conversion to a renewable diesel unit (Sinclair n.d.)
Phillips 66 Alliance Refinery	PADD 3 Bell Chase, LA (EIA 2022)	1971 (Golden 2021)	255,600 (Sanicola 2020) (EIA 2022)	November 2021 (Reuters 2022)	August 2021 (EIA 2022)	Hurricane Ida (EIA 2022)	Conversion to a storage and transit terminal (Phillips 66 2021)
LyondellBasell's Houston Refinery	PADD 3 Houston, TX (LB n.d.)	1918 (LB n.d.)	268,000 (LB 2022)	April 2022 (LB 2022)	1Q 2025 (LB n.d.)	Advances decarbonization goals (LB 2022)	Conversion to a hydrogen hub (Drane 2023)

*Phillips 66 San Francisco Refinery reported the Santa Maria Facility and the Rodeo Facility as combined capacity.

Elapsed time between the closure announcement and closure date provides insight into how sudden the closure was and how long the state may have to react to a potential refinery closure. While 50 percent of the planned closures gave a notice period of about a month or less, shutdowns due to devastating events that caused significant damage were the most sudden. Because of safety events, Philadelphia Energy Solutions (PES) never restarted operations after a fire and the Phillips 66 Alliance Refinery never restarted operations after Hurricane Ida. The closure announcements were made after the events.

Driving factors for refinery closure can vary among reduction in demand, financial issues, safety events, hurricanes, and conversion of integrated facilities. The most cited reason for closure was reduction in demand due to the coronavirus pandemic.

Following closure, seventy-five percent of the refineries had plans to convert to low-carbon solutions such as the production of renewable fuels or hydrogen products. Other plans included demolition and repurposing into fuel storage terminals or non-fuel-related spaces such as buildings.

Refinery closures occurred in all PADDs except for PADD 2, the Midwest region. PADD 5 and PADD 3 both had three refinery closures, while PADD 1 and PADD 4 only had one refinery closure.

Of these refineries with closures, the refinery with the longest operational span was the PES Refinery, which had been operating for over 145 years, and the one with the shortest operational span was the Phillips 66 Alliance Refinery, at about 50 years. None of the refineries closed before 50 years of operation.

The largest refinery to close was the PES Refinery, which had a capacity of over 335,000 barrels of crude per day. Because of this refinery's large capacity and sudden closure, it was selected for further analysis in a case study.

The Marathon Martinez Refinery closure and PES Refinery closure are discussed in more detail in Sections 2.3 and 2.4.

2.1.1 Types of Impacts from Refinery Closures

For each case study, we provide a discussion of "closure impacts" that characterizes the effects to the industry, the site, and the supply chain, with an emphasis on impacts to gasoline pricing and availability.

In addition to these types of impacts, there are certainly local and widespread economic impacts and sociocultural impacts, such as for the workforce, local tax base and employment, and community cohesion. A recent study by Western Washington University, conducted on behalf of the Washington Department of Commerce and required by law, evaluated these broader impacts for five Washington refineries (Western Washington University 2025).

While this report remains focused on the business cases for refinery closures and effects on gasoline supply and pricing, we do not intend by omission to imply that additional impacts and consequences of these refinery closures are not important: They are serious, and they should not be overlooked.

2.2 Review of Recent Refinery Closure Announcements

Two refineries were identified as having planned closures. These are the Phillips 66 Los Angeles Refinery in California (PADD 5), which announced active plans to close operations by the end of 2025, and the Valero Benicia Refinery, located in the San Francisco area, which plans to close by April 2026. Both of these refinery closures have the benefit of being planned well in advance, so affected stakeholders have time to plan and adjust accordingly. However, two refineries closing in the same state in short succession creates cumulative impacts that increase supply chain impacts. The Phillips 66 Los Angeles Refinery closure is discussed in detail in Section 2.5, and the Valero Benicia Refinery closure is discussed in Section 2.6.

Table 3. Recent refinery closure announcement.

Refinery	Location	Opening Year	Capacity (Barrels per Day)	Notice Date	Anticipated Closure Date	Driving Factors	Plans
Phillips 66 Los Angeles Refinery (Carson and Wilmington)	PADD 5 Los Angeles, CA (Lloyd 2024)	1923/1919 (Lloyd 2024)	139,000 (CEC 2024)	October 2024 (Lloyd 2024)	4Q 2025 (Lloyd 2024)	Long-term uncertainty (Lloyd 2024)	Undetermined (Lloyd 2024)
Valero Benicia Refinery	PADD 5 Benicia, CA (N. Jao 2025)	1968 (CEC 2024)	170,000 (N. Jao 2025)	April 2025 (N. Jao 2025)	April 2026 (N. Jao 2025)	Declining fuel supplies and high gasoline prices (N. Jao 2025)	Undetermined (N. Jao 2025)

2.3 Marathon Martinez Refinery Business Case

2.3.1 Overview

The Marathon Martinez Refinery was located in Pacheco, California, in the San Francisco Bay Area. Marathon Petroleum Corporation announced the closure of the refinery in August 2020 due to a reduction in gasoline demand resulting from the coronavirus pandemic (Phillips 66 2020). This refinery was the fourth largest refinery in California by crude refining capacity before its closure (EPA 2023). The refinery processes California crude along with other sources that originate domestically and abroad. The main products of the refinery include CARB-compliant gasoline, CARB-compliant diesel, conventional gasoline, distillates, feedstocks, petrochemicals, propane, and heavy fuel oil (MPC 2019).

2.3.2 Conditions Before Closure

2.3.2.1 Refinery Age

The refinery opened in 1915 (CEC 2024). At the time of closure, the Marathon Martinez Refinery was over 100 years old.

2.3.2.2 Production and Demand

Prior to the closure, there was a sharp drop in gasoline demand due to the coronavirus pandemic. Travel was reduced starting in the second half of March 2020. Demand for petroleum fuels such as gasoline and jet fuel dropped sharply. In March, the demand for finished motor gasoline nationally fell by 1.2 million barrels per day, a drop of about 13 percent. Jet fuel demand dropped by 242,000 barrels per day, a drop of nearly 15 percent. According to EIA data, this was the lowest level since January 2000 for gasoline demand. Refinery gross inputs dropped by 267,000 barrels per day from February to March 2020 for the West Coast, about 10 percent (EIA 2020).

2.3.2.3 Ownership History

The Marathon Martinez Refinery opened in 1913, was originally owned by the Associated Oil Company, and underwent at least nine ownership changes throughout its operational life (CEC 2024). Marathon Petroleum acquired the refinery in 2018, when the company merged with Andeavor (MPC 2018).

2.3.2.4 Cost and Risk of Refinery Acquisition

Prior to the refinery closure, the Marathon Petroleum Corporation's annual report highlighted the cost of acquiring the refinery and noted that there was market risk associated with the volatility of the price of both crude oil and refined products. The company's total cost of revenue increased by almost $24.18 billion because of cost associated with the acquisition of Andeavor (MPC 2019). The change in demand due to the coronavirus pandemic is an example of the market volatility that the company had identified.

2.3.2.5 Recent Safety Record

Prior to the closure, the Marathon Martinez Refinery received an award for its safety record. In 2020, the refinery was awarded the American Fuel and Petrochemical Manufacturers Distinguished Safety Award (MPC 2019).

2.3.2.6 Companywide Commitment to Reduce Greenhouse Gas Emissions

The Marathon Petroleum Corporation has a companywide commitment to reduce greenhouse gas intensity (emissions per barrel of oil equivalent processed) 30 percent below 2014 levels by 2040. The Martinez Renewable Fuels Project is estimated to reduce total greenhouse gas emissions by 60 percent, total criteria air pollutants by 70 percent, and water use by 1 billion gallons per year (MPC 2021).

2.3.3 Closure Impacts

2.3.3.1 Local Gas Price Impact

In the immediate months following the closure of the Marathon Martinez Refinery, gasoline prices appeared to not significantly increase in the San Francisco area. This was likely due to the low gasoline demand from the coronavirus pandemic reduction in travel. The gasoline price steadily rose in San Francisco following the coronavirus pandemic, similar to the rise across the rest of the United States. The next significant price spike occurred nationally because of the conflict between Russia and Ukraine.

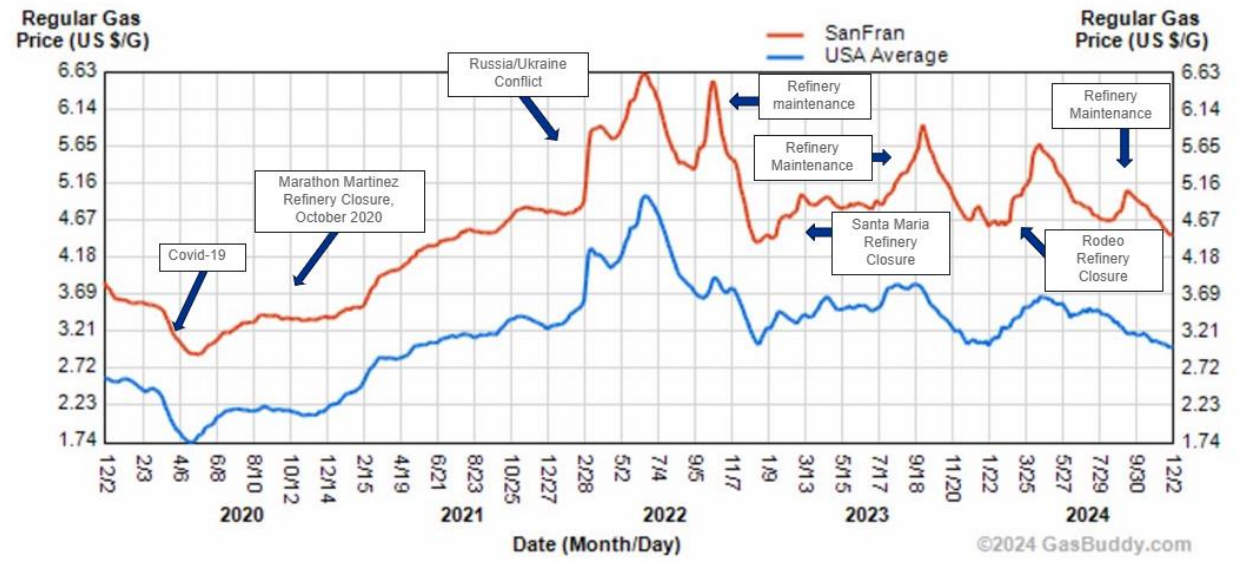


Figure 6. Average gas prices in San Francisco compared to the United States (GasBuddy, LLC n.d.).

2.3.3.2 Reduction in Gasoline and Diesel Production in California

The California Energy Commission estimated that removing the refinery from the 2019 California average would result in about 560 thousand barrels per day less of CARB-compliant gasoline production weekly. This would be about 8.7 percent of California's total production in 2019. For diesel, the impact was more significant. The Marathon Martinez Refinery produced about 14 percent of the state's diesel (CEC 2020).

2.3.3.3 Impacts on Crude Imports in California

The crude imports to California were projected to be affected by the closure of the Marathon Martinez Refinery. Most crude imported to California is from Iraq, Saudi Arabia, and Ecuador and is mostly sour. Crude imports from Ecuador were likely to be reduced as a result of the Marathon Martinez Refinery closure (CEC 2020).

2.3.4 Post-Closure Plans

The Marathon Martinez Refinery was converted into the Martinez Renewables biorefinery facility. The facility was operating at 50 percent capacity on April 30, 2024, and is expected to ramp up to 100 percent of capacity by the end of the year.

After the conversion is complete, the biorefinery is expected to process 48,000 barrels per day of renewable feedstock, such as distillers corn oil, soybean oil, and previously rendered fats, also known as tallow. The biorefinery will produce a slate of products, including renewable diesel, renewable propane, and renewable naphtha. The company plans on potentially producing renewable aviation fuel in the future (Contra Costa County Department 2021).

As part of the project's conversion, new units were added to the facilities, some existing units were modified, and others are to be permanently shut down. New units support pretreatment, wastewater, and emission reduction. The modification and shutdowns of units are needed to

transition the facilities' processes to utilizing renewable feedstock (Contra Costa County Department 2021) (Lawlor Jr. n.d.).

2.4 Philadelphia Energy Solutions Refinery Closure Business Case

2.4.1 Overview

The PES Refinery was located in Philadelphia, Pennsylvania. Two facilities, the Girad Point Refinery and the Point Breeze Refinery, were originally developed and operated separately, but they were combined into a single operating complex under PES ownership, having the largest capacity of the East Coast refineries prior to its closure. On June 26, 2024, PES announced that the refinery would be shut down (Board 2022). The PES Refinery had a Nelson Complexity factor of 9.8 (SEC 2015).

2.4.2 Conditions Before Closure

2.4.2.1 Refinery Age

The refinery was built in 1870 after originally existing as a warehouse with refinery oil product storage capacity (Board 2022). At the time of closure, the refinery had been operating for at least 150 years.

2.4.2.2 Ownership History

The refinery was initially owned by Atlantic Petroleum Company and has been owned by different companies, such as ARCO, Chevron, John Duess, and Sunco. PES purchased the refinery from Sunco in 2012 (Board 2022).

2.4.2.3 Safety Event

On June 21, 2019, the PES Refinery had a major safety event. A corroded pipe elbow in the hydrofluoric acid alkylation unit ruptured, and a large vapor cloud was released and ignited. The cloud was composed of 95 percent propane and 2.5 percent hydrofluoric acid, and the remainder was composed of other hydrocarbons. Three explosions occurred in the unit related to the fire that broke out (Board 2022).

The unit was severely damaged from the fire and explosions. Marsh JLT Specialty, a large risk management firm, estimated the property damage to be $750 million, the third largest refinery loss to occur worldwide since 1974 (Board 2022). The U.S. Department of Labor's Occupational Safety and Health Administration issued $132,600 in fines and cited PES for process safety management violations related to the fire and explosions (OSHA 2020).

2.4.2.4 Financial Issues

In January 2018, PES filed for bankruptcy to reduce debt. The refinery again filed for bankruptcy in 2019, following the refinery fire (Kearney and Renshaw 2019). The first PES bankruptcy was attributed to three factors. The first was compliance with the U.S. Renewable Fuel Standard. The standard requires a volume of petroleum-based fuels to be replaced by renewable fuels. Refineries can comply by buying credits or blending petroleum with renewable fuels (Abernathy and Thiel 2019). The second factor was a lack of access to domestic crude at competitive prices. PES had constructed a railyard that could import up to 280,00 barrels per day of Bakken

crude oil from the Dakotas, which was competitively priced at the time. However, when the Dakota Access Pipeline was constructed, Bakken crude oil was made available to refineries in the Gulf Coast and Midwest. PES began relying mainly on crude from the Atlantic. The PES Refinery did not have the capability to process sour Canadian tar-sand crude oil. The third reason was declining gross refining margins (Abernathy and Thiel 2019).

2.4.3 Closure Impacts

2.4.3.1 Local Gasoline Price Impacts

Figure 7. Average Gas price in Philadelphia compared to the United States (GasBuddy, LLC n.d.).

While there may have been a subtle short-term price increase following the explosion, there was not a significant price shock noted in 2019, relative to the price increase that was seen after Russia invaded Ukraine in 2022. According to the City of Philadelphia, there were no major fuel shortages or price spikes reported (Abernathy and Thiel 2019).

Gasoline prices were already being affected by other factors, such as geopolitical risk from rising tensions between Iran and the United States. This had already driven oil prices up by about 10 percent. The refinery accounted for 27 percent of the East Coast's refinery capacity; however, capacity could be made up from European imports as well as imports from other sources. Refining capacity in the Gulf Coast, such as at the Baytown Refinery, was planning to be reestablished, and there was an expectation that additional refining capacity would be coming online (Domm 2019).

Following the refinery closure, in June 2019, the price of gasoline both in Philadelphia and the broader United States trended downward for the remainder of the year.

2.4.3.2 PADD 1 Impacts

The PES Refinery was located in PADD 1, on the East Coast, which relies heavily on gasoline imports. While PADD 1 only accounted for 36 percent of total motor gasoline consumption nationally in April 2019, it accounted for 71 percent of gasoline imports into the United States. PADD 1 also relies heavily on PADD 3 on the Gulf Coast because of limited refining capacity

internally. EIA estimated the reduction in gasoline supply to be approximately 160,000 barrels per day due to the refinery closure. PADD 1 was expected to increase the reliance on imported fuels from other areas because of the shutdown (Oil and Energy Online n.d.).

Refineries in the local area, such as the PBF Delaware City refinery, the Monroe Energy Trainer Refinery, and the PBF Paulsboro refinery, were expected to increase utilization rates. The Colonial Pipeline, running from the U.S. Gulf Coast through Philadelphia to New York, operated at maximum capacity.

During this time, it was likely that the East Coast could import gasoline from the Atlantic Basin, which includes Eastern Canada, Northwest Europe, and the Mediterranean. The East Coast was estimated to import 586,000 barrels per day of motor gasoline in 2018 (Oil and Energy Online n.d.). While the Jones Act does not apply to international shipments of gasoline, it does apply to the movement of products between U.S. ports, which may be constrained by limited compliant barge availability.

However, if a similar event were to occur today, the Atlantic Basin would likely have reduced ability to export refined gasoline due to U.S. and European Union sanctions on Russian crude, which have limited crude oil supply and constrained refining markets.

2.4.4 Post-Closure Plans

Hilco Redevelopment Partners acquired the site in February 2020. The redevelopment company plans to turn the refinery into a campus composed of multiple buildings, called the Bellwether district, that will support e-commerce, logistics, life science, and innovation. The groundbreaking ceremony took place in October 2023 (Bellwether District 2024).

2.5 Phillips 66 Los Angeles Refinery Closure Business Case

2.5.1 Overview

The Phillips 66 Los Angeles Refinery consists of two facilities located five miles apart. The Carson facility refines crude oil, and the Wilmington facility upgrades the intermediate products to finished products. In addition to transportation fuels, other products include fuel-grade petroleum coke (Phillips 66 n.d.). The refinery complex capacity accounts for 8.57 percent of California's crude oil refining capacity (CEC 2024). The refinery produces specialty CARB-compliant gasoline and fuel-grade petroleum coke. The Phillips 66 Los Angeles Refinery has a Nelson Complexity factor of 14.3 (Phillips 66 n.d.) and is the most complex refinery in Phillip 66's refinery portfolio.

Phillips 66 announced plans to close its Wilmington and Carson facilities in Los Angeles by the end of 2025. Philipps 66 noted that the refinery closure decision was due to concerns about the long-term sustainability of the refinery and effects from market dynamics (Lloyd 2024).

2.5.2 Conditions Before Closure Announcement

2.5.2.1 Refinery Age

The Carson facility was built in 1923, and the Wilmington facility was built in 1919; both have been operating for just over 100 years (Phillips 66 n.d.).

2.5.2.2 Production and Demand

The crack spread for CARB-compliant gasoline in Los Angeles dropped approximately $0.50 per gallon in May 2024. A lower crack spread has been an issue nationally, reflecting the reduced profitability of refining crude oil into gasoline. Increased international refining capacity and weaker demand are also contributing factors (EIA 2024b). Since the 1980s, the production of crude oil has been declining by a rate of about 2 percent per year in California (Still Water Associates 2024).

2.5.2.3 Ownership History

The Phillips Petroleum Company entered a merger with Tosco on February 4, 2001. The refinery was one of seven Tosco refineries that were part of the merger. The refinery has remained with Phillips 66 since (SEC 2000).

2.5.3 Closure Impacts

The cumulative impacts of the Phillips 66 Los Angeles Refinery closure with the Valero Benicia Refinery closure are discussed in Section 2.6.3 Cumulative Closure Impacts.

2.5.3.1 Crude Oil Impacts

The Phillips 66 Los Angeles Refinery primarily processed California crude; however, the refinery imported 15.5 million barrels of crude into the United States from January to August 2024. Canada was the largest supplier, followed by Guyana, Mexico, Brazil, and Ecuador (Swanson 2024). The Wilmington refinery closure may have a limited impact on tanker activity within Cananda as it is expected to be offset by an increase in tanker demand on the British Columbia Coast due to the Trans Mountain pipeline (Swanson 2024).

2.5.4 Post-Closure Plans

The company is currently working with real estate development firms to conduct evaluations for future use of the site (Lloyd 2024).

2.6 Valero Benicia Refinery Closure Business Case

2.6.1 Overview

The Valero Benicia Refinery is located north of San Francisco and produces jet fuel, gasoline, diesel, and asphalt, which are primarily distributed by rail and truck. This refinery plays a key role in supplying California with CARB-compliant gasoline. In addition to supplying Californians with gasoline, the refinery supplies Travis Air Force Base with jet fuel (Kohli 2025).

Valero has spent $1.6 billion since 2000 to make environmental improvements, including flare gas recovery and reduced energy consumption. The plant also received a Safety Achievement Award from the American Fuel & Petrochemical Manufactures in 2020, 2021, and 2022 (Valero 2025). It includes a cogeneration system that can generate 50 megawatts of power, reducing the need to depend on the grid.

Valero's CEO highlighted regulatory and environmental challenges as well as high maintenance costs as key reasons for the decision to close the refinery (N. Jao 2025).

2.6.2 Conditions Before Closure Announcement

2.6.2.1 Refinery Age

The Valero Benicia Refinery has been in operation since 1982 and is over 40 years old (CEC 2024).

2.6.2.2 Production and Demand

Similar market conditions are present for the Valero Benicia Refinery closures as the Phillips 66 Los Angeles Refinery closures discussed in Section 2.5.2.2.

2.6.2.3 Ownership History

This refinery was originally owned by Humble Oil, which later became ExxonMobil Corporation. Valero purchased the refinery in 2000 (CEC 2024).

2.6.3 Cumulative Closure Impacts

Because of the Valero Benicia Refinery closure, combined with the Phillips 66 Los Angeles Refinery closure, California is expected to lose 17 percent of its refining capacity and PADD 5 is expected to lose 11 percent of its refining capacity. In addition to a large loss of the state's refining capacity, sourcing gasoline that is CARB-compliant adds another challenge.

As California is geographically isolated from other PADDs, the most likely primary source to make up this fuel is Asia. Thailand and South Korea both have refineries that can produce CARB-compliant gasoline (EIA 2025g). However, as these refineries are located across the Pacific Ocean, there would likely be costs associated with transportation. As California becomes more reliant on imports, it increases its vulnerability to supply and price disruptions from events affecting maritime trade and foreign crude oil availability. As these deliveries must cross the Pacific Ocean, foreign imports likely will take a longer amount of time to adjust to sudden changes in demand.

Phillips 66 has reported plans to produce some CARB-compliant gasoline at its refinery in Washington. (EIA 2025g) Imports from U.S. ports, would need to be delivered on Jones Act compliant vessels, which are in limited supply. There are only 93 U.S. flagged vessels that are compliant with the Jones Act as of 2022 (Rodriguez 2025).

Michael Mische, a professor at the University of Southern California, created a series of analyses of gas price impacts on California. In a worst-case projection, it was estimated that gas prices could potentially increase as much as 75 percent from April 23, 2025, to the end of 2026, when combined with a series of legislative actions. The complexity of modeling retail gas prices was noted. Projections varied under different model assumptions, with some models showing gasoline prices ranging from $7.03 to $10.00 per gallon. In all models, price increases were noted unless the spot price of oil dropped to historical lows (Mische 2025). Lower crude oil prices are predicted in 2026, which may help to partially offset the price increases (EIA 2025g).

2.6.4 Post-Closure Plans

In response to concerns about protecting fuel supplies in California, government officials are trying to try to find a buyer for the refinery (Jao, French and Khan 2025). Valero is working with

Signature Development Group to evaluate redevelopment opportunities for the property (Fang 2025).

2.7 Washington Refinery Production Impacts on Oregon

2.7.1 BP Cherry Point Refinery Overview

The BP Cherry Point refinery is located near Bellingham, Washington. It has been owned by BP since January 2002. The facility began operating in 1917. It is the largest refinery in Washington by capacity; therefore, a production loss from this refinery would have a relatively great impact on the gasoline supply chain. The facility has a Nelson Complexity Index of 10 (NS Energy 2021).

Most of the crude oil that supplies the BP Cherry Point refinery is imported from Alaska through tankers that deliver it directly to the refinery's marine terminals. The remainder of the crude oil that supplies the refinery is crude oil from Canada and Bakken crude from North Dakota.

The BP Cherry Point refinery is the largest supplier to the SeaTac and Portland international airports. The refinery also supplies a large amount of anode-grade calcium coke to the world's aluminum industry (BP n.d.).

Recently, the refinery started up a new vacuum tower in the hydrocracker unit. This unit operates under high temperature, using pressure and hydrogen to produce gasoline and jet fuel from heavy gas oils. The refinery also improved cooling water efficiency through the installation of a new cooling tower (BP 2025).

In 2012, a fire at the BP Cherry Point refinery in Washington caused a refinery shutdown and affected operations for three months; this was due to a corroded "dead leg" pipe rupturing, causing a fire and damage (CSB 2014).

2.7.2 Marathon Anacortes Refinery Overview

The Marathon Anacortes Refinery is in Anacortes, Washington. Ownership has changed several times; previous owners include Tesoro and Texaco. The refinery is the third largest refinery in Washington and processes crude from Alaska, Canada, and the Bakken region. The refinery produces gasoline, diesel, jet fuel, and propane (MPC n.d.). The refinery has a Nelson Complexity Index of 10.98 (NS Energy 2021).

In 2010, the refinery had one of the most severe refinery safety incidents in recent history while under ownership of Tesoro. An explosion from a heat exchanger failure led to the fatalities of seven workers. The refinery did not restart operations for seven months (CSB 2014).

2.7.3 HF Sinclair Puget Sound Refinery Overview

The HF Sinclair Puget Sound refinery near Anacortes, Washington, opened in 1957. The refinery was acquired by Holly Frontier in 2021 from Shell. The refinery is the second largest refinery in Washington and produces gasoline, diesel, jet fuel, and specialty chemicals. The refinery processes Canadian crude oil and Alaskan North Slope crude oil and serves the Pacific Northwest and British Columbia. It also produces fuel for major regional international airports and seaports. The facility has 5.8 million barrels of product storage capacity on site (HF Sinclair n.d.).

The refinery has a Nelson Complexity Index of 9.43 (Offshore Technology n.d.). The refinery has catalytic cracking and delayed coking units that add to its complexity. It also includes a cogeneration facility (HF Sinclair 2021).

2.7.4 Phillips 66 Ferndale Refinery Overview

The Phillips 66 Ferndale Refinery is in Ferndale, Washington. The refinery was built in 1954 (Department of Ecology, State of Washington n.d.). BP purchased the refinery in 1988, and in 1993, Tosco Corporation purchased the refinery. When Phillips 66 bought Tosco in 2001, Phillips 66 acquired the refinery. The Ferndale Refinery is the smallest of the four refineries that supply fuel to Oregon.

This refinery has a Nelson Complexity Index score of 7.7 and is one of the least complex refineries in Phillips 66's portfolio of refineries (Phillips 66 n.d.).

Facilities include crude distillation, naphtha reforming, fluid catalytic cracking, alkylation, and hydrodesulfurization units.

The refinery produces a high percentage of transportation fuels. Residual fuel oil is sold to the Northwest marine bunker fuel market (Phillips 66 n.d.).

2.7.5 Impacts on Washington Refining Capacity and Utilization Rate

The state of Washington has five operable refineries with a combined capacity of 648,200 barrels per day. It is estimated that gasoline makes up 44 percent of products from a barrel from crude oil (EIA 2024e). Therefore, it can be estimated that the five refineries produce 285,208 barrels per day of gasoline. If the state's largest refinery, the BP Cherry Point refinery, were to shut down, the refining capacity in Washington would drop by 31 percent, affecting up to 200,942 barrels per day of total refining capacity and an estimated 88,414 barrels per day of gasoline production.

Refinery Utilization Trends in PADD 5

The PADD 5 weekly refinery utilization rates have fluctuated in recent years, as exemplified by the rates from January 2018 to January 2025 shown in Figure 8. The average weekly refinery utilization rate for PADD 5 was 86 percent in 2024. During the coronavirus pandemic, the utilization rate of PADD 5 refineries dropped close to 60 percent in May 2020 as a result of reduced demand. Refineries typically cannot operate safely below their turndown rate, which is between 65 and 70 percent of capacity (American Fuel & Petrochemical Manufacturers 2022). By contrast, during a period of high diesel margins in July 2018, the weekly refinery utilization rate for PADD 5 surged to nearly 99 percent (EIA 2025). Refineries may not run at 100 percent utilization for several reason, including maintenance, weather events, and changes in demand (American Fuel & Petrochemical Manufacturers 2022).

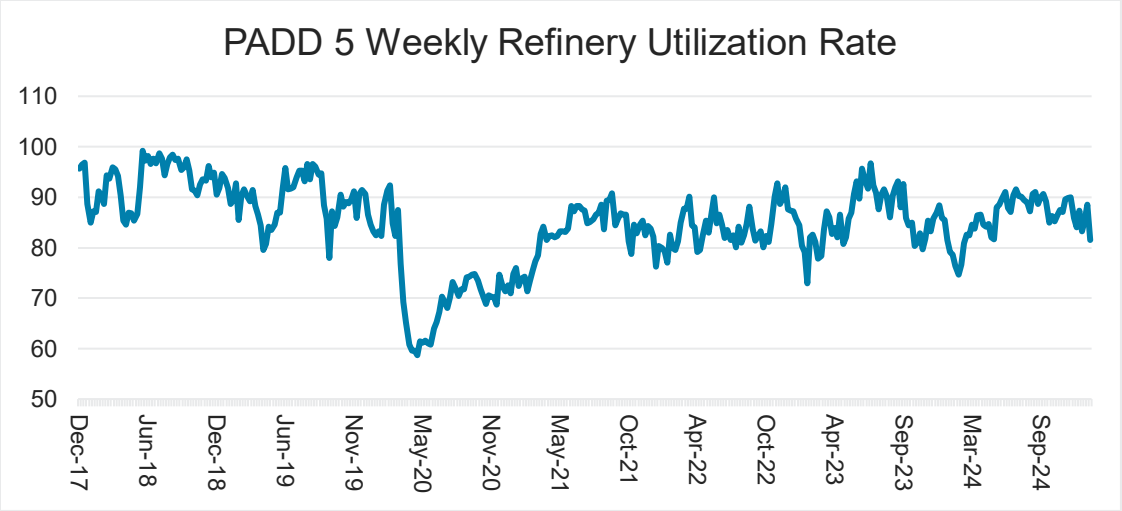


Figure 8. West Coast PADD 5 weekly refinery utilization rate (EIA 2025).

If Washington refineries are running at lower utilization rates during the time of a refinery closure, other local refineries may increase production, which could potentially help offset impacts on the broader supply chain. An analysis of two scenarios can provide insights into the regional ability to adapt to supply chain imbalances. Using 2024 market conditions, the scenarios assume all Washington refineries are operating at the average weekly utilization rate for PADD 5 (86 percent) at the time one refinery closes.

Scenario 1: Closure of the BP Cherry Point Refinery

In the first scenario, we explore the closure of the largest Washington refinery, the BP Cherry Point refinery, with a refining capacity of 238,500 barrels of crude oil per day. If the BP Cherry Point refinery was operating at an 86 percent utilization rate prior to closure, the site would be refining 205,110 barrels of crude oil per day.

If the remaining Washington refineries had up to 14 percent of their total combined crude oil refining capacity of 409,700 barrels per day available, they could potentially increase the refining of crude oil up to a combined 57,358 barrels per day. However, this would only replace 28 percent of the crude oil the BP Cherry Point refinery would have been refining at the time of closure, which is not enough to fully replace the refining rate.

Scenario 2: Closure of Marathon Anacortes Refinery

In the second scenario, we explore the closure of the smallest refinery that feeds the Olympic Pipeline, the Marathon Anacortes refinery, with a crude oil refining capacity of 119,000 barrels per day. At an 86 percent utilization rate, it would be producing 102,340 barrels per day prior to closure.

If the remaining Washington refineries had up to 14 percent of their total combined crude oil refining capacity of 529,200 barrels per day available, they could potentially increase the refining of crude oil by up to 74,088 barrels per day. This would be 72 percent of the crude oil that the Marathon Anacortes refinery would have been refined prior to closure, suggesting a greater ability to offset losses compared to the BP Cherry Point refinery closure scenario.

2.7.6 Impacts on Oregon Gas Prices

If a Washington refinery were to close, one of the primary concerns would be the impact on local gas prices. Gas prices can fluctuate as a result of numerous factors, as explained in Section 1.3. Historical examples of gasoline price spikes in Oregon can offer insights into potential impacts on gas prices. In the past five years, the average Oregon gasoline price closely followed the U.S. average, with a few exceptions (Figure 9). Below is a list of examples where trends in Oregon and California gas prices notably differed from the U.S. average, according to GasBuddy data and news articles. Maintenance, both unplanned and planned, contributed to gasoline price increases in Oregon.

- In October 2019, gas prices on the West Coast increased due to multiple refineries experiencing unplanned outages (AAA 2019).
- In September and October 2022, four California refineries conducted planned maintenance. This is suggested to have reduced California's capacity by 55,000 barrels per day (CEC 2022).
- In June 2023, the Olympic Pipeline had planned maintenance, and gasoline prices in Oregon increased relative the U.S. average (Booker 2023).
- In April 2024, refinery maintenance and a shift to summer blends were cited as reasons for gas price increases in California, which could affect the rest of PADD 5 (Chow 2024).

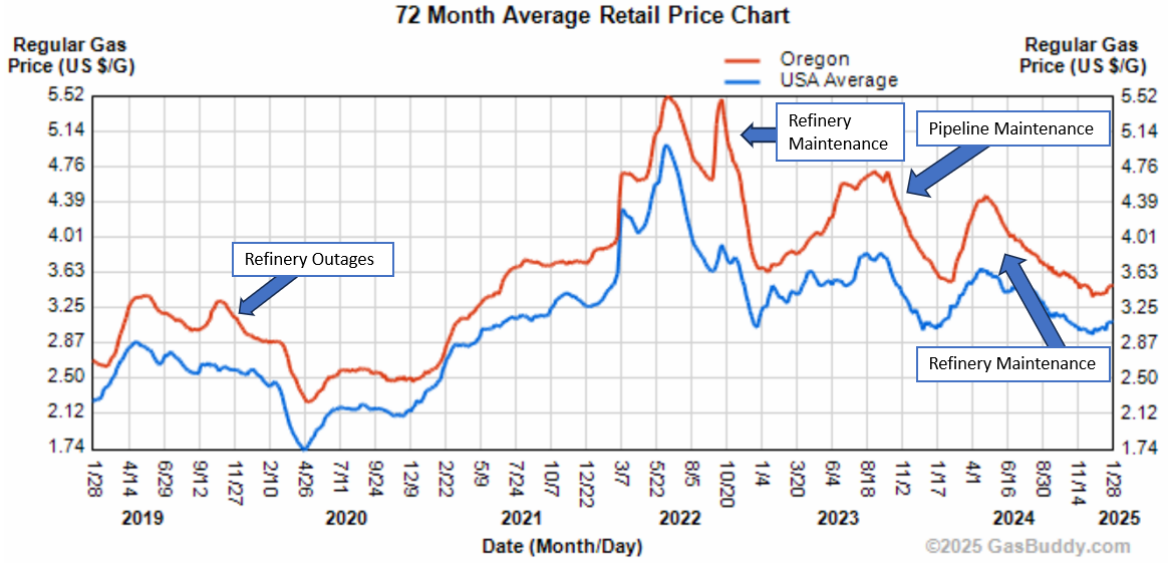


Figure 9. Average gasoline price in Oregon and the United States (GasBuddy, LLC n.d.).

There are additional cases where supply chain disruption events have affected local gas prices historically.

The 2012 fire at the BP Cherry Point refinery resulted in immediate price spikes in Oregon and Washington. In Washington, residents noted a price increase from $3.89 to $4.15 in one week, representing a 6.7 percent change (KIRO7 2012). In Oregon, it was reported that gas prices skyrocketed $0.31 in two weeks. When the fire first started, the average Oregon gas price was

$3.67; two weeks later, it had climbed by 8.5 percent to $3.98 (Rose 2012). This was higher than the average gas price for Oregon in 2012, which was $3.81 (KTVZ 2013).

The average gas price in Oregon was $4.03 in 2024 (AAA n.d.). For illustrative purposes, if a similar disruption were to happen at this price point, an 8.5 percent price increase would result in a price of approximately $4.37.

In addition to the immediate price spike, the three-month shutdown combined with unplanned refinery outages in the region led to prolonged increases in gas prices for both Oregon and Washington, at a time when the average gas price in the United States was decreasing. This combination of events led to the lowest gasoline inventories on the West Coast since 1999 (Lehner 2012).

On June 19, 1999, in Bellingham, Washington, the Olympic Pipeline ruptured and released 277,000 gallons of gasoline. Gasoline imports from the Olympic Pipeline dropped from 2.65 million barrels per month in June 1999 to 1.49 million barrels per month by September 1999. This was noted to cause local price spikes. These price spikes were affected by panic buying from gasoline dealers buying more gasoline because of supply concerns. This resulted in a price increase of about 19 percent. Other gasoline transportation methods were used, such as marine, but these transportation methods were at a higher cost. In 1999, Oregon was receiving an estimated 26 percent of gasoline from California and about 68 percent of gasoline from Washington (Hill 2000).

2.7 Resilience Recommendations for Oregon

Diversify the Gasoline Supply Chain

As closure of refineries occurred in nearly all PADDs, states can consider ways to diversify available supply chains to reduce dependency on a single PADD or state. Following the PES Refinery closure, access to diverse gasoline imports and alternative refineries (Baytown) was anticipated to reduce negative impacts both locally and throughout the PADD. Oregon's dependence on Washington refineries and isolation from other refining markets adds to the state's vulnerability.

Monitor for Situational Awareness

Many of the refineries gave closure notice periods of one month or less. The time between the closure announcement and closure date provides insights into how sudden the closure was and how long the state may have to react to a potential refinery closure. The most sudden closures were due to devastating events. The indicator framework in Section 2.7.2. can be referenced to help guide increased situational awareness of refinery conditions.

Evaluate Strategies to Increase Supply

The ability of other Washington refineries to mitigate the impacts of a closure depends on the current refining utilization rates at the time of shutdown and the size of the refinery that is closing. While a smaller refinery may be able to be largely offset by increased production at other sites, the closure of a large refinery could create a supply gap that Washington refineries could not fully replace. Several strategies may be considered to further increase the availability

of gasoline in the state, including diversification of gasoline supply sources and exploration of alternatives to traditional gasoline as a long-term strategy.

Consider Regional and Local Reserves of Finished Product

As Oregon and the broader western region have less integration with finished petroleum products than other regions in the country, establishing strategic reserves of finished products can help improve the region's ability to manage supply disruptions. Additionally, smaller local reserves in Oregon can help manage local supply disruptions, particularly to areas of the state that are distant from major fuel terminals in Eugene and Portland.

Further Analyze, Plan for, and Mitigate Disruptions to the Gasoline Supply Chain

In addition to refinery closures, other potential scenarios could affect the gasoline supply chain, such as disruption to the Olympic Pipeline, local in-state gasoline supply chain, or ethanol supply chain. While this study explores refinery closures, other studies may also provide insights to increase the resilience of the fuel supply chain. Oregon has proposed legislation to investigate strategic geographic distribution of fueling storage stations (e.g., Oregon State Legislature, HB 2152, 2025 Regular Session) (Oregon State Legislature 2025).

2.7.1 Significance for State Energy Security Leaders

Refinery closures create challenges for state energy security leaders, and the impacts are not limited to gasoline—they also extend to other petroleum products, such as diesel, heating oil, aviation fuel, and propane. These fuel sources are essential for emergency response, home heating, and critical infrastructure.

State energy security managers may address these issues in the following ways:

Assess baseline conditions and track refineries in- and out-of-state (*situational awareness*). The lack of granular publicly available data can limit insight into baseline conditions of the gasoline supply chain, monitoring of in-state fuel flows, or forecasting of impacts. Nevertheless, the state can monitor in-state vulnerabilities to fuel supply chains and track sensitivities to refinery conditions or related conditions (e.g., prices or transportation routes).

Identify significant in-state supply chain vulnerabilities and consider responsive mitigation. As part of an energy security risk assessment for the state, the state can investigate fuel supply chain infrastructure vulnerabilities to disruptions and clarify the consequences of these events—spatial effects, distribution alternatives, back-up capacity, duration, and customer exposure. With a finer sense of the risks, the state can consider mitigation strategies.

Study the demand and opportunity for strategic storage or reserve capacity. Holding strategic regional or local reserves may be a potential way for states to address supply shortages. An example of this is the New York State Strategic Fuel Reserve, which was developed in response to Superstorm Sandy. The feasibility and strategic value of these storage facilities need to be evaluated because of the complex operational, logistic, financial, and regulatory challenges involved.

Additional ways that state energy officials may engage or use this information include:

- Regional coordination for emergency planning between states.
- Uneven impacts on specific local, vulnerable, or rural communities.
- Programmatic cooperation with the private sector.

2.7.2 Indicator Framework

Although refineries may close or curtail operations for several reasons, several indicators were identified as material to the likelihood for a refinery closure. Table 4 provides a framework for indicators and relative posture to consider when assessing the potential for a refinery closure. This framework is not a definitive list, as there may be many additional factors that can be taken into consideration. The criteria identified should be modified and adjusted depending on the market conditions at the time.

The indicators identified below also may not contribute equally to the likelihood of a refinery closure at the same weight and may also be interdependent. For example, for the PES closure, a greater weight would have been placed on a safety event being the primary indicator, but refinery age and financial issues also played a role. These nuances must be carefully considered in evaluation of the potential for closure.

Table 4. Potential indicators for refinery closures.

Indicator	Low	Medium	High
Refinery age	The refinery is less than 50 years old.	The refinery is 50–100 years old.	The refinery is greater than 100 years old.
Regional production/demand	No significant change in production or demand noted.	Small reduction in production or demand.	Sharp and sudden decrease in demand.
Corporate and state emissions goals and associated investments	No established corporate emissions goals. The refinery has made significant emissions reduction investments in the past 5 years. The state has neutral policies regarding emissions.	The corporation aims to reduce greenhouse gas emissions by a certain percentage. The refinery has made minor improvements to reduce emissions in the past 5 years The state has moderate policies regarding emissions.	The corporation has set net zero goals. The refinery has not implemented improvements or investments to meet emissions goals. The state has passed ambitious emissions goals.
Events damaging infrastructure or affecting safety	No major damaging events have occurred in the past 5 years, demonstrating a strong safety record.	Some major damaging events have occurred in the past 5 years, with manageable outcomes.	A severe damaging event has occurred in the past 5 years, resulting in a prolonged shutdown, multiple injuries, or fatalities.
Financial and corporate stability	Stable financial track record. The company may have recorded a small decline in earnings. No change of ownership within the past 5 years.	The corporation has indicated financial concerns, but they are manageable. Change of ownership within the past 5 years.	The corporation has severe financial issues, such as recent bankruptcies. Change of ownership within the past 1 year.

The reason for the selected refinery age range is that this study did not identify any refinery closures that occurred before the refinery reached 50 years old. The oldest refinery to close was over 145 years old. An older refinery can have an increased need for maintenance and may also lack the latest competitive technologies.

A decline in regional gasoline production over time can signal a change in gasoline demand, affecting the profitability of the site. This indicator was identified by many refineries that cited a reduction in gasoline demand due to the coronavirus pandemic that began in 2019.

Recent changes in ownership, shown in the Marathon Martinez Refinery closure, can signal business instability or a change in strategic priorities for a site.

Corporate emissions goals may affect the strategic decisions made by the company that owns the refinery. For example, the refinery may be more inclined to invest in renewables or other low-carbon alternatives. This was shown through the Phillips 66 San Francisco Refinery Rodeo Facility and Marathon Martinez Refinery closures. A lack of emission reduction investments paired with corporate emissions goals highlights inconsistencies. Phillips 66 also mentioned California emissions goals as a factor.

Recent events that damaged infrastructure or the safety of personnel or the community may signal that there are systemic concerns in the reliability of the site, which can have both severe implications for public perception and financial consequences for repair, as was the case with the PES Refinery. Additionally, damage caused by events may be too expensive to repair, as was the case for the Phillips 66 Alliance Refinery closure due to impacts from Hurricane Ida.

Finally, a refinery that is operated by a company that is having major financial concerns may indicate business instability. This was seen as the case with the PES Refinery, which declared bankruptcy before closing.

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Pacific Northwest National Laboratory

902 Battelle Boulevard
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Richland, WA 99354

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