OPIS A DOW JONES COMPANY

Spotlight Analysis

California's Gasoline Market:

How the State's Unique Structure Impacts Pricing at the Pump

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Background and Introduction

In 2022 and 2023, California's retail gasoline saw multiple price spikes, all the more notable because of California's relatively high prices, when compared to the rest of the country. When prices rose in autumn 2022 and again in autumn 2023, the state approved early waivers of seasonal environmental regulations. Under the waivers, California was allowed to switch to lower-cost winter gasoline specifications with a higher Reid Vapor Pressure (RVP) before the official change date on October 31, alleviating the pressure on prices.[1]

Looking specifically at 2022, California retail gasoline prices reached an all-time high at $6.438/gal on June 14 of that year (compared with a national average of $5.016/gal - also a record high - on that same date). That autumn, retail prices again approached that high ahead of the seasonal RVP specification changes.

In response, Governor Gavin Newsom in March 2023 signed SBx1-2 into law, with the goals of bringing transparency and oversight to the state's fuel market as well as holding oil companies accountable for price gouging. The new "gas price gouging law" authorized the California Energy Commission (CEC) to set a maximum gross gasoline refining margin and impose a civil penalty on refiners found to have exceeded it. Additionally, it created the Division of Petroleum Market Oversight, an independent agency within the CEC, focused on monitoring petroleum markets and flagging potential market manipulation.[2]

Statement of Purpose

In light of the price spikes seen in the past two years, OPIS looked at the factors behind California's relatively high gasoline prices. OPIS has found that many of those causes stem from the unique nature of the state's gasoline market.

To understand the factors at play in recent retail gasoline price spikes, OPIS looked at:

- ✔ California's fuel pricing chain
- ✔ California's supply structure
- ✔ Regulatory environment
- ✔ California retail gasoline price trends
- ✔ The 2022 and 2023 gasoline price spikes
- ✔ Retail and spot price volatility trends
- ✔ The "Rockets & Feathers" phenomenon

1 A glossary of standard industry terms can be found here: https://www.opisnet.com/resources/glossary-of-terms/

2 California Energy Commission. *Senate Bill X1-2 Implementation*. https://www.energy.ca.gov/proceeding/senate-bill-x1-2-implementation/

About OPIS

OPIS has served as the leading Price Reporting Agency for the U.S. West Coast for more than 30 years. OPIS provides accurate pricing, real-time news and expert analysis across the global fuel supply chain, including the spot, wholesale rack and retail markets. OPIS and its brands, McCloskey, PetroChem Wire, Axxis and Chemical Market Analytics, enable customers to buy and sell energy commodities with confidence across the globe by providing transparent data, expert-level customer support, educational events and energy data solutions. OPIS methodologies adhere to IOSCO (International Organization of Securities Commissions) principles for fuel Price Reporting Agencies.

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California's Fuel Pricing Chain

In order to understand the factors impacting California's retail gasoline prices, it is important to understand the gasoline pricing chain in general, which flows from crude oil futures through to retail sales as follows:

Crude Oil Futures → **RBOB (Gasoline) Futures** → **Spot Markets** → **Wholesale Rack Markets** → **Retail Sales**

While California faces unique challenges when it comes to fuel supply, its overall pricing structure is similar in many ways to that seen throughout the U.S.

Each segment of the pricing chain can be seen as a "building block" that factors into the final price consumers pay at the pump. Those segments include the Crude Oil and RBOB futures markets, spot markets, wholesale rack markets and retail markets.

Within this Fuel Pricing Chain section, most of the pricing segments discussed are applicable nationwide. Where California differs, that difference will be noted in the discussion.

Crude Oil Futures

The New York Mercantile Exchange (NYMEX), owned by the CME Group Inc. (CME), as well as the Intercontinental Exchange (ICE) provide price discovery and clearing services for trading, hedging and speculation in oil futures.

The two key global crude futures benchmarks are West Texas Intermediate (WTI) and Brent. Both are considered light sweet crudes.

Crude oil blends are unique, no two are the same and some will have different properties that can alter the yield percentages of products made by a refinery. As will be discussed in more detail later in this paper, the cost of crude oil will impact the cost of gasoline production and, therefore, gasoline prices.

There are many factors that can affect prices in the crude oil market, including geopolitical developments, OPEC supply announcements and macroeconomic trends.

RBOB Futures

The NYMEX RBOB (Reformulated Blendstock for Oxygenate Blending) futures contract underlies U.S. gasoline prices, serving as a reference for gasoline spot market trading.

As with crude oil futures, RBOB futures are a highly liquid market that sees participation from oil producers, refiners, traders, transportation firms and marketers as well as investors, speculators and hedge funds.

National supply and demand factors such as driving season trends or extreme weather events that impact large refinery hubs can impact gasoline futures trading.

The delivery point for RBOB futures contracts is New York Harbor, and prices can differ dramatically from physical prices for CARBOB (California reformulated gasoline blendstock for oxygenate blending).

Prices for CARBOB in the spot markets of Southern California and Northern California do not typically align exactly with RBOB futures due to numerous factors, among them differences in regional supply structure, as well as California's unique specification for gasoline. Instead, CARBOB trades at a differential to RBOB futures settlements. Those spot markets are the next step in the pricing chain.

Los Angeles and San Francisco Spot Markets

While the RBOB futures contracts discussed above provide a ballpark measurement of the value of gasoline blendstock in the U.S., California has two active spot markets where physical barrels of CARBOB are traded. On any given day, traders will procure CARBOB originating on pipelines in the Los Angeles or San Francisco spot markets.

California's distance from New York as well as its unique specifications for gasoline blendstock can lead to volatile relationships between the state's spot market prices and RBOB futures prices.

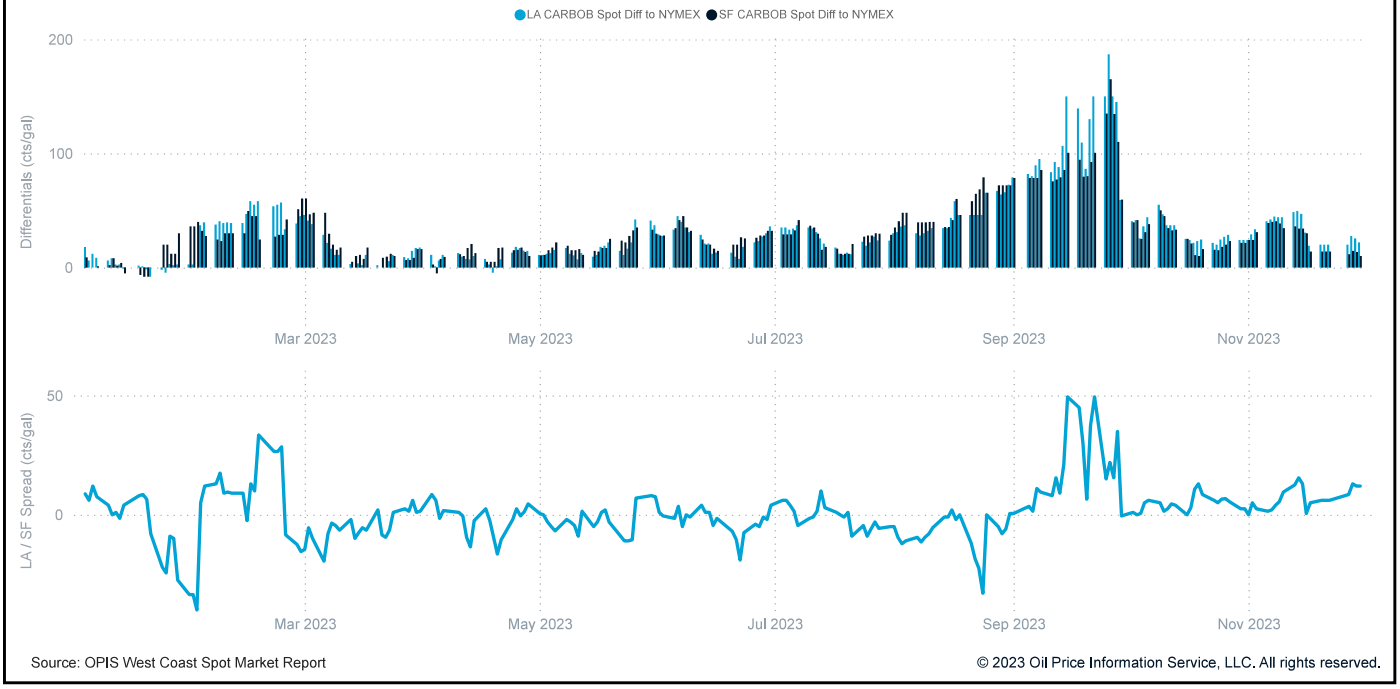
In California, the Los Angeles and San Francisco spot markets are where high-volume fuel transactions are executed "on the spot" for physical delivery throughout each California region or for export to other states or countries. Typically, buyers and sellers enter the spot market to bid for or offer incremental barrels that are in excess of production and not already committed under supply agreements. The spot market provides an insight into real-time pricing in this way. Physical market dynamics and broader geopolitical trends are incorporated into these prices because spot market barrels trade even with, at a premium, or at a discount to the NYMEX RBOB contract based on these real-time factors.

It is important to note that there is no pipeline connection between Los Angeles and San Francisco that could permit fuel to flow easily between these two California markets. Ships and barges are used, however, to transport fuel from one region to another. One of the two California markets can send extra barrels to the other by water transport. Such deliveries require a Jones Act

vessel that is U.S. built, flagged and crewed, and Jones Act vessels typically cost more to charter than international-flagged ships. For those reasons, a supply disruption in Los Angeles—or even the perception of one—can dramatically impact prices in San Francisco, or vice versa.

OPIS notes that the majority of fuel is purchased through long-term agreements. Because of both their long-term nature and because the terms of the contracts are opaque, those contracts do not provide real-time price insight.

Los Angeles and San Francisco CARBOB differentials to NYMEX futures reflect differences in regional market fundamentals



Source: OPIS West Coast Spot Market Report

Wholesale Rack Market

WHOLESALE RACK PRICING

Further downstream, the wholesale rack market plays a crucial role in the fuel price chain. Following a spot market transaction, gasoline is transported through pipelines to storage facilities located in metropolitan areas. These fuel storage terminals serve as key points where fuel distributors, known as "jobbers," buy truckloads of fuel, or up to 8,500 gallons. Jobbers then distribute product to retailers and other end users. The loading points for these trucks, known as "loading racks," define this stage of the supply chain as the "rack market." Across the U.S., there are roughly 400 rack markets and 1,500 fuel terminals, with 14 rack markets and 50 fuel terminals in California.

Transactions within the rack market can be based on volume-committed supply agreements or made without a pre-established contract. Pricing is determined by formulas tied to spot prices or rates "posted" by suppliers. This stage is also where gasoline is blended with ethanol, typically at a concentration of 10%, as well as with brand-specific additives.

Notably, the prices at this stage typically exclude environmental credits and various federal, state, and local taxes. But these costs may be added as separate line items on invoices.

In California, some suppliers incorporate compliance costs of the cap-and-trade and LCFS programs into their posted wholesale prices, while others pass them along as separate line items.[3] Compliance costs such as these play a role in shaping the final prices of gasoline.

BRANDED AND UNBRANDED PRICING

The wholesale rack price is typically split into two categories, "branded" and "unbranded." Normally, each will come with a contract to purchase a certain amount of gallons per month. [4]

Branded Contracts

The branded contract represents commerce between a major brand supplier and its customers. Branded gasoline is sold under a refiner or reseller's trademark, and is typically offered at a higher rack price than are unbranded supplies, which is a common occurrence throughout the country.

There are various terms and conditions in the branded contract such as minimum gallons to be purchased per month. There are also different contract durations. Although most branded contracts default to 10 years, the exact duration of a contract is often negotiated. Typically the branded price is higher than the unbranded price. In addition to supply guarantees, major brands blend their gasoline with a proprietary additive package to improve fuel performance above and beyond state and federal standards.

Some advantages to a branded contract include guaranteed fuel supply as well as access to capital provided by a major company for retail station imaging. When there is a supply disruption, major brands will typically ensure that their branded contracts are supplied first.

Unbranded Contracts

An unbranded contract involves fuel not marked by a proprietary branded additive package.

Additionally, the unbranded rack may often be the first class of trade that sees volumes restricted or cut off when supplies are low. [5]

Transportation Logistics

Gasoline throughout California is moved from refineries to wholesale rack terminals via pipelines that are owned and operated by Kinder Morgan. A series of pipeline segments serves Southern California, and another separate system serves Northern California.

These same pipelines also flow out of the state, carrying product to Arizona and Nevada, but notably, there is no flow of products into California via pipeline. These pipeline logistics will be discussed further in the upcoming section on California's Supply Structure.

The next step in fuel transportation logistics is to move from the rack market to retail stations via tanker trucks, which is the "last mile" haul for finished products.

3 Cap-and-trade regulation places a threshold on emissions and creates a carbon market for allowances to pollute beyond that cap. Cap-and-trade is designed to reduce greenhouse gases (GHGs). Low Carbon Fuel Standard (LCFS) regulations require fuel producers and importers in California to meet specified average carbon intensity requirements for fuel, with credits being generated and traded as part of the program.

4 Sometimes, unbranded "open" racks are offered. The open rack is where gallons are available for sale without the need for a contract, allowing qualified marketers to purchase them.

5 While unbranded prices are usually lower than branded, there are times where unbranded prices can be higher due to supply constraints, a phenomenon described in the market as an "inversion."

Retail Market

The final step along the supply chain is the retail station where consumers see the final price as they fuel up their vehicles.

California's Supply Structure

CARBOB — California's gasoline blendstock

As mentioned earlier, California requires unique gasoline blending specifications for fuel that can be sold to consumers in the state. Unfinished gasoline sold in California's spot markets is called CARBOB. The fuel then becomes CARB reformulated gasoline (CARB RFG) after being blended with ethanol at the rack terminal for transportation to retail stations.

CARBOB can be a costly and complex fuel to produce, a fact acknowledged by the U.S. Energy Information Administration (EIA) in its 2015 assessment of the PADD 5 (West Coast) transportation fuels market.[6,7] Not all PADD 5 refineries are capable of producing CARBOB gasoline – especially during the spring and summer when the state requires gasoline to be blended to a lower RVP specification. With limited options to source the boutique fuel blend from other U.S. refineries, California suppliers are often forced to rely more heavily on imports for gasoline components that can be blended to meet the most environmentally friendly summer RVP specifications in the nation.

Lack of pipeline infrastructure between regions

While U.S. regions east of the Rocky Mountains are characterized by spider-like pipelines that traverse multiple states and connect fuel hubs with demand centers, California is not connected with other major fuel-producing hubs via pipeline.

The U.S. Gulf Coast refines the most material of any U.S. region.[8] Gasoline can be sent via pipelines from the Gulf Coast to both the Midwest and East Coast; however, pipelines on a similar scale do not exist to connect the West Coast to this key source of the nation's gasoline supply.

Some Gulf Coast refineries can produce CARBOB, but they face significant logistical challenges to deliver the fuel into California. Furthermore, in 2023, those challenges included restrictions on passage through the drought-ravaged Panama Canal.

In California, the Kinder Morgan North Line pipeline transports gasoline, diesel fuel and jet fuel from the San Francisco Bay Area to northern California and Reno, Nevada.

Similarly, Kinder Morgan's West Line originates in Los Angeles and ships fuel through the southern half of the state and to Las Vegas and Phoenix. No common carrier pipeline runs between Los Angeles and San Francisco and no line in place has the ability to ship fuel from the Gulf Coast refining hub into California.

6 PADD stands for Petroleum Administration for Defense District, and PADD 5 refers specifically to the states of Alaska, Arizona, California, Hawaii, Nevada, Oregon and Washington.

7 U.S. Energy Information Administration (2015, September). *West Coast Transportation Fuels Markets.* https://www.eia.gov/analysis/transportationfuels/padd5/pdf/transportation_fuels.pdf

8 According to the U.S. Energy Information Administration (EIA), for the week ended December 8, 2023, gross inputs to PADD 3 (U.S. Gulf Coast) refineries were gauged at 8.967 million b/d. By comparison, gross inputs for the whole U.S. that same week were 16.476 million b/d. U.S. Energy Information Administration (2023, December 13). *Petroleum & Other Liquids: Weekly Supply Estimates.* https://www.eia.gov/dnav/pet/pet_sum_sndw_dcus_nus_w.htm

Declining Gasoline Production in California

Refinery consolidation in the region has exacerbated gasoline supply challenges, reducing spot trade liquidity. According to Energy Information Administration data, as of January 1, 1983, California had 40 operating refineries, and by 2008, that number was reduced by half. There were 14 refineries operating in the state at the start of 2023.[9]

Looking at overall capacity, California refineries in 1983 had a capacity of nearly 2.5 million barrels per stream day. In 2008, that production had been reduced to about 2.1 million barrels. By 2023, California refinery capacity was down to approximately 1.8 million barrels per stream day, according to the EIA.[10]

Reliance on Gasoline Imports

While fewer barrels are being produced in California, buyers also are facing more difficulty securing supplies from abroad. Fixing gasoline cargoes for import to the West Coast is a multi-week endeavor and the option only becomes available once pricing dynamics, known as the arbitrage, are favorable.

The lag time to receive a shipment of gasoline blending components from Asia is three weeks, and it takes cargoes from Europe about four weeks to arrive.

9 U.S. Energy Information Administration. *Petroleum & Other Liquids: California Number of Operating Refineries as of January 1.* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=8_NA_8O0_SCA_C&f=A

10 U.S. Energy Information Administration. *California Refinery Operating Atmospheric Crude Oil Distillation Capacity as of January 1.* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=8_NA_8D0_SCA_5&f=A

"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," EIA said in its West Coast Transportation Fuels Markets report.[11]

West Coast Crude Oil Supply

With crude oil as a key input for refining, crude oil supply in turn impacts gasoline supply, and ultimately gasoline pricing.

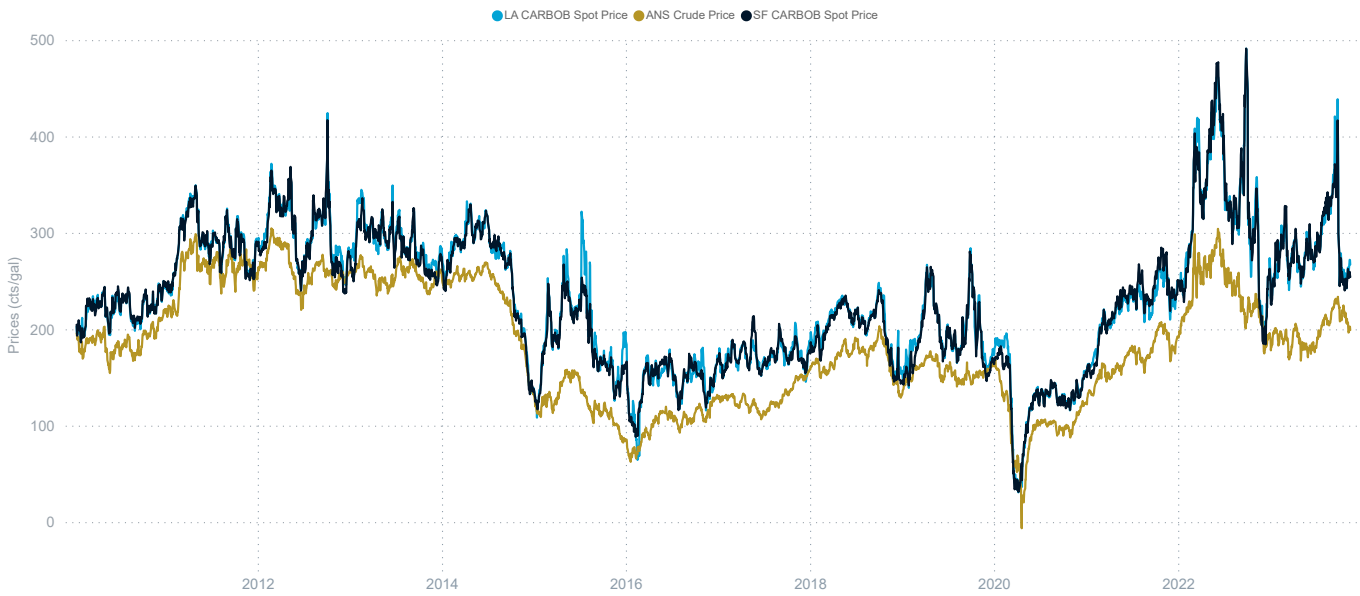
California crude oil logistics are further complicated by the breadth of crude blends that are refined on the West Coast.

At any given point, $10/bbl or more may separate the prices of the many blends of crude processed by PADD 5 (West Coast) refiners. Many of the California refineries were built to run the heavy grades of crude produced in the state, and processing costs for these high-sulfur, low-gravity crudes may be as high as $14/bbl.

Additionally, the amount of crude oil produced within California has declined over time, while the amount of crude oil brought in from other countries has increased.

Foreign crude made up 59% of California's oil supply in 2022, according to CEC data. That's up from 51.2% in 2013 and 34% in 2003. In-state crude production totaled 25.8% in 2022. That's down from 36.9% in 2013 and 43.2% in 2003.[12]

Alaska North Slope crude price fluctuations often result in corresponding shifts in the spot market although anomalies are frequent



Source: OPIS West Coast Spot Market Report

11 U.S. Energy Information Administration (2015, September). *West Coast Transportation Fuels Markets.* https://www.eia.gov/analysis/transportationfuels/padd5/pdf/transportation_fuels.pdf

12 California Energy Commission. *Annual Oil Supply Sources To California Refineries.* https://www.energy.ca.gov/data-reports/energy-almanac/californias-petroleum-market/annual-oil-supply-sources-california

California's Regulatory Environment

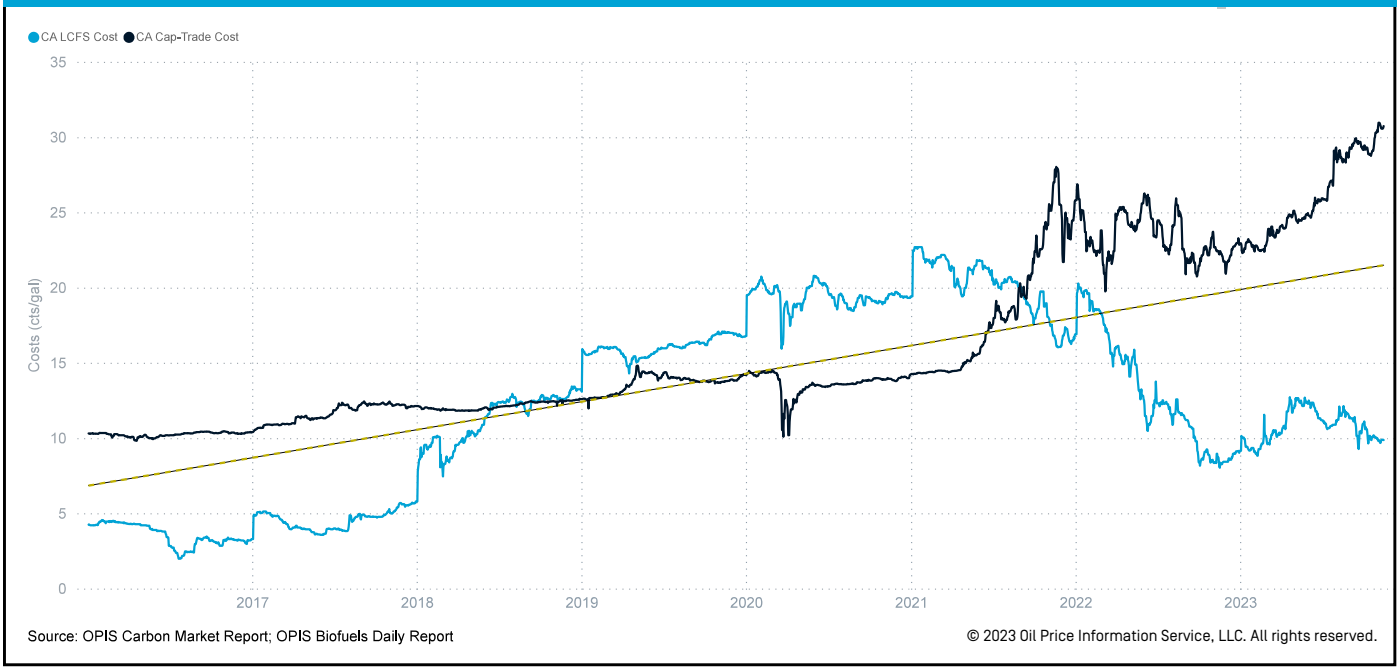
A leader in the energy transition, California was the first in the nation to approve a phase out of new internal combustion engine vehicles, with the goal to drastically reduce California's dependence on fossil fuels.[13]

"With fossil fuels powering much of the global energy system, it's critical that we partner with other states and nations around the world to build momentum for the phase-out of oil and gas production," Governor Newsom said at COP26 in November 2021. "Together, we must move beyond oil and usher in a cleaner and greener future that safeguards our communities, environment and the economy."[14]

The transitional period is poised to be marked with continued tightness for gasoline supplies, possibly resulting in imbalances and further price spikes.

With the aim of reducing the carbon intensity of transportation fuels, Low Carbon Fuel Standard (LCFS) regulations require fuel producers and importers in the state to meet specified average carbon intensity requirements for fuel, with credits being generated and traded as part of the program.

Regulatory costs to fuel sales in California trend higher, with a 200% increase in fees related to complying with the cap-and-trade program



Source: OPIS Carbon Market Report; OPIS Biofuels Daily Report

13 Office of Governor Gavin Newsom (2020, September 23). *Governor Newsom Announces California Will Phase Out Gasoline-Powered Cars & Drastically Reduce Demand for Fossil Fuel in California's Fight Against Climate Change.* https://www.gov.ca.gov/2020/09/23/governor-newsom-announces-california-will-phase-out-gasoline-powered-cars-drastically-reduce-demand-for-fossil-fuel-in-californias-fight-against-climate-change/

14 Office of Governor Gavin Newsom (2021, November 11). *Governor Newsom Announces California has Joined New Global Alliance Committed to Ending Reliance on Fossil Fuels.* https://www.gov.ca.gov/2021/11/11/governor-newsom-announces-california-has-joined-new-global-alliance-committed-to-ending-reliance-on-fossil-fuels/

Cap-and-trade regulation is designed to reduce greenhouse gases (GHGs) from multiple sources by placing a threshold on emissions and creating a carbon market for allowances to pollute beyond that cap.

Compliance costs associated with both cap-and-trade and LCFS programs play a role in the gasoline prices that consumers pay at the pump.

In response to the cap-and-trade program's design, costs to comply with the regulations have increased since the regulation's inception. According to OPIS Carbon Market Report pricing data, compliance costs for CARB RFG sold at the wholesale rack level in California grew from around 10cts/gal in 2015 to over 30cts/gal by Q4 2023.

An analysis of OPIS data reveals that the spread between West Coast crude oil prices, gasoline spot prices, and rack and retail fuel prices widened further since 2015 – the year when transportation fuels sellers at the wholesale rack were required to comply with cap-and-trade regulations.[15]

Further, the state has a gas tax of about 58cts/gal, up from 39.5cts/gal in 2013 and 18cts/gal in 2003, according to California Department of Tax and Fee Administration (CDTFA) data.[16]

As of December 11, 2023, CEC estimated that fuel taxes and fees added $1.386 to the price of each gallon of gasoline in California.[17]

15 California Environmental Protection Agency, Air Resources Board. *Information for Entities That Take Delivery of Fuel for Fuels Phased into the Cap-and-Trade Program Beginning on January 1, 2015.* http://ww2.arb.ca.gov/sites/default/files/cap-and-trade/guidance/faq_fuel_purchasers.pdf

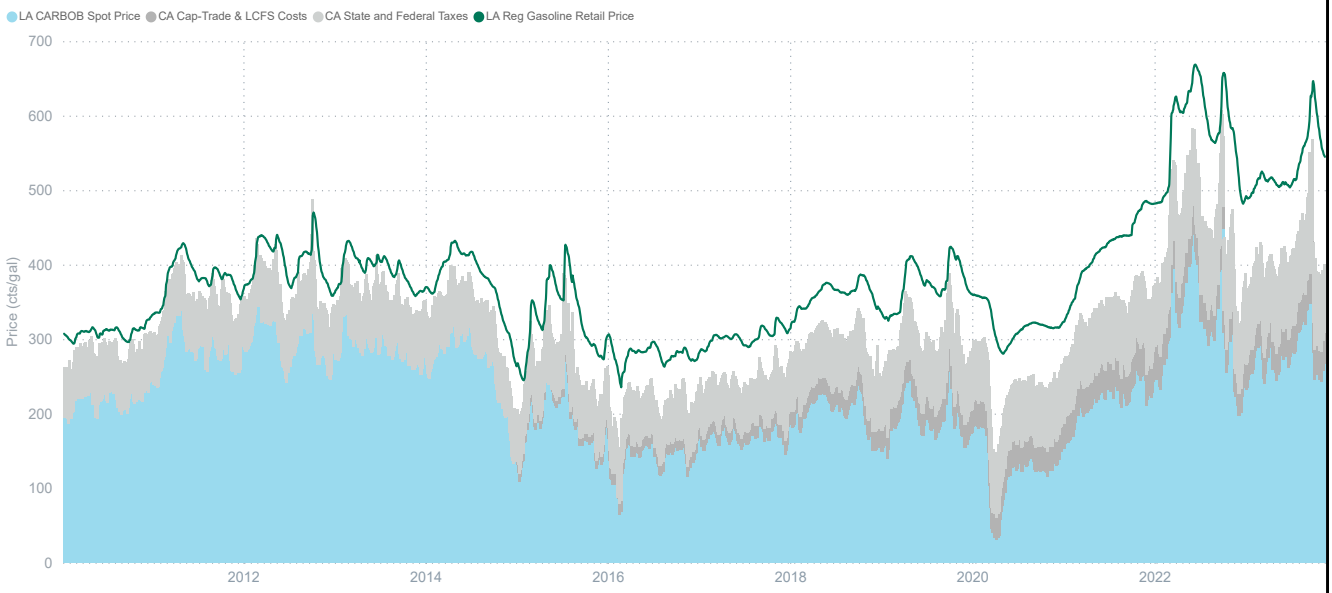
16 California Department of Tax and Fee Administration. *Tax Rates - Special Taxes and Fees.* https://www.cdtfa.ca.gov/taxes-and-fees/tax-rates-stfd.htm

17 California Energy Commission (2023). *California Energy Commission Estimated Gasoline Price Breakdown and Margins.* Data last updated December 11, 2023. Retrieved December 20, 2023 from https://www.energy.ca.gov/estimated-gasoline-price-breakdown-and-margins

Included in that $1.386/gal are state and federal excise taxes, environmental fees, state and local sales taxes and underground storage tank fees.

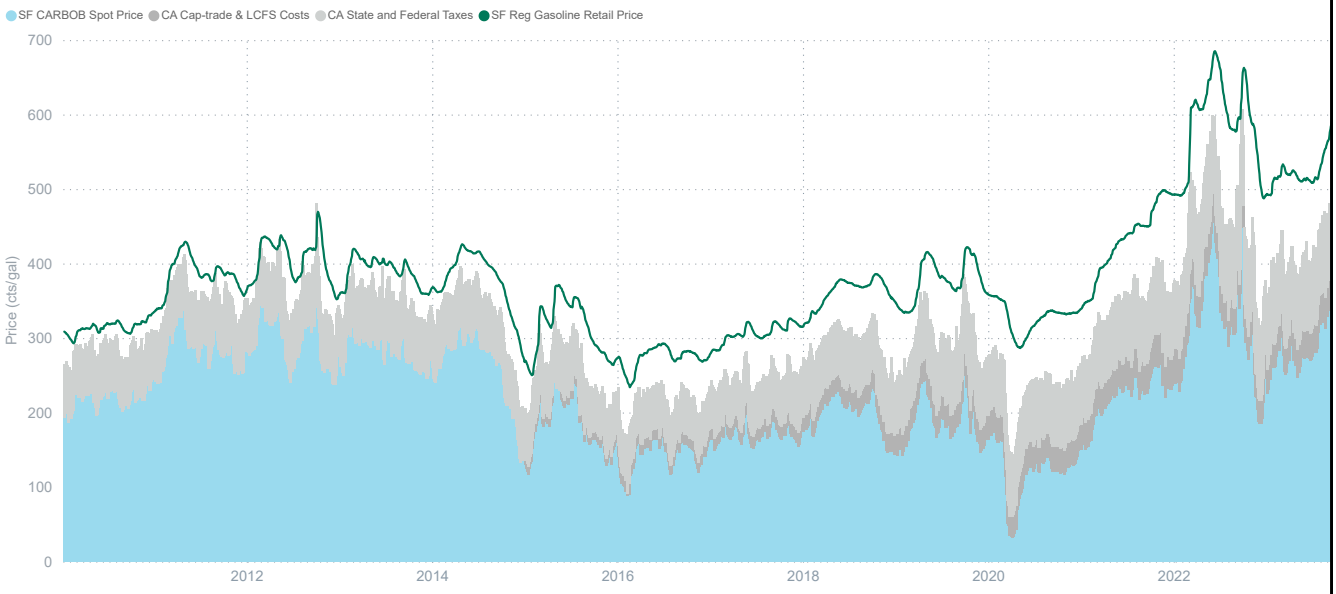
These additional costs may be one reason for the growing divergence between spot prices, wholesale rack prices and retail prices within the state.

CA fuel taxes and fees combined reached above $1/gal in 2023, up 78% from 2013, demonstrated here in the Los Angeles retail gasoline market



Source: OPIS West Coast Spot Market Report; OPIS Carbon Market Report; OPIS Biofuels Daily Report; OPIS Retail DataHouse

California fuel taxes and fees demonstrate a similar trend in San Francisco's retail gasoline market



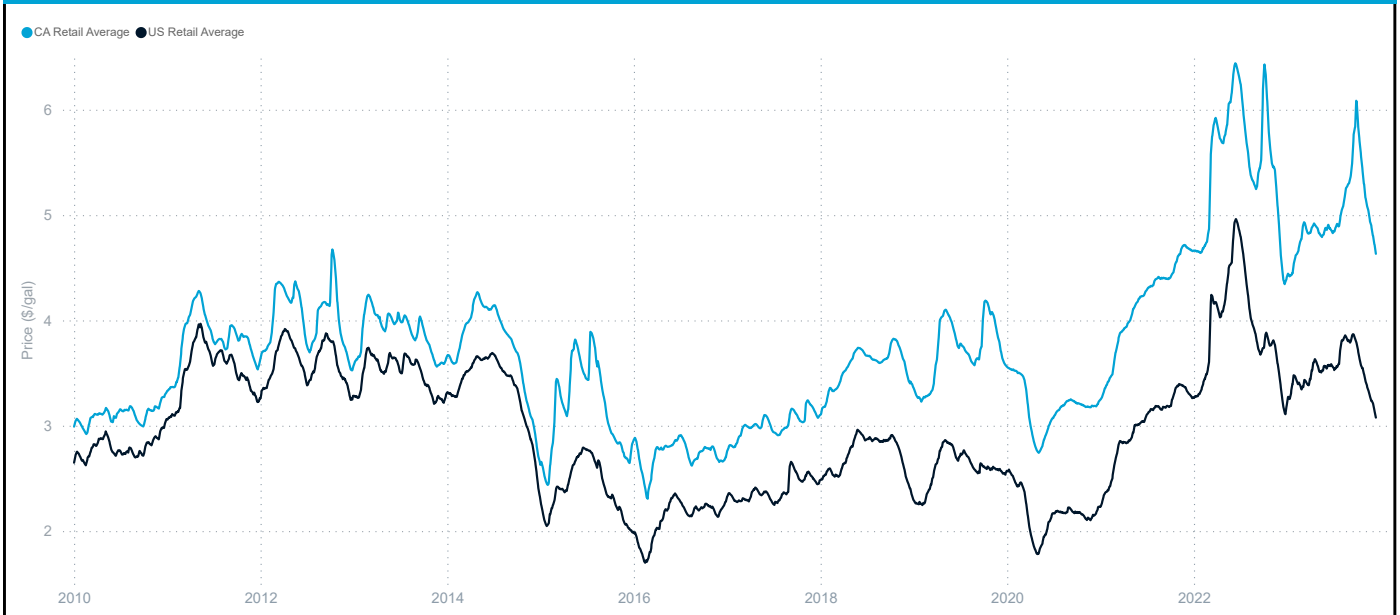
Source: OPIS West Coast Spot Market Report; OPIS Carbon Market Report; OPIS Biofuels Daily Report; OPIS Retail DataHouse

California Retail Gasoline Price Trends

Before examining the 2022 and 2023 gasoline price spikes more closely, it is important to examine retail gasoline price trends in the state.

OPIS looked at retail price data, averaged by state, from 2010 to mid-December 2023, comparing California retail prices with retail prices for all other U.S. states and the District of Columbia. Throughout this time period, California's retail prices have averaged above those seen in other states. However, the difference between prices seen in California and the rest of the country has significantly increased over time. In 2010, California's retail gasoline prices were about $0.31/gal above, or roughly 11% higher than the non-California national average. By 2022, California retail prices were $1.55/gal more, or approximately 39% higher, than in the rest of the U.S., and in 2023, they were $1.46/gal more, or about 41% higher, than in the other states.[18]

California retail average gasoline prices have trended above the US average for other states for over a decade, with that premium increasing substantially since 2015



Source: OPIS Retail DataHouse

The 2022 and 2023 Gasoline Price Spikes

Steep price jumps for retail gasoline prices in California have brought increased attention to the factors underlying the state's gasoline market, even as the causes behind the spikes have varied.

2022

California gasoline retail prices spiked during the spring of 2022, reaching $5.91/gal on March 29, according to OPIS retail pricing data. That increase appeared to be linked to supply challenges. In March 2022, prices increased amid refinery turnaround and unplanned upsets, including reports that PBF's Torrance refinery experienced difficulty in restarting its fluid catalytic cracking unit

18 Retail regular gasoline price data through December 14, 2023.

(a key unit for the production of gasoline) as well as planned maintenance at Valero Energy's Wilmington refinery.

Retail gasoline prices in the state climbed to a record high of $6.438/gal on June 14, 2022. These increases took place at the height of the summer driving season. At the spot level, the Los Angeles CARBOB price on June 8, 2022, rose to what was then an all-time high of $4.6169/gal. Driving season demand and RBOB futures gains appeared to be the main factors behind that June 2022 spike.

That autumn, retail prices spiked again to $6.43/gal during the first week of October 2022. Leading into autumn 2022, the U.S. West Coast region grappled with multiple market fundamentals that pressured fuel prices higher. According to U.S. Energy Information Administration (EIA) data, PADD 5 refinery run rates had fallen to 80.1% for the week ended October 7. Refinery utilization rates had only fallen that low on one other occasion within the previous five months.[19]

In the week ended September 30, 2022, gasoline inventories had slipped to a decade low of 24.675 million bbl, well under the 30 million bbl level that is considered comfortable for supplies.[20] Also, regional gasoline imports had dried up, further tightening an already-short market. That same week ending September 30, 2022, imports of total gasoline to the West Coast fell to 1,000 b/d.[21]

In addition, refiners were experiencing operational issues that impacted fuel production and led to declining inventories. Three California refineries had units undergoing planned maintenance in September 2022, which the companies confirmed through refiner notices and filings or in direct communication with OPIS. An additional unplanned power-related issue may have occurred at a fourth California refinery that month, but the company did not confirm.[22]

Retail gasoline prices in the state climbed to a record high of $6.438/gal on June 14, 2022. These increases took place at the height of the summer driving season.

2023

California retail gasoline prices rose to $6.083/gal on September 29, 2023, according to OPIS Retail DataHouse pricing data. The underlying causes appeared to be similar to those seen in autumn 2022: low gasoline inventories throughout the region, meager imports and below-average refinery run rates. On September 28, the California Air Resources Board ordered, at Governor Newsom's direction, an early transition to winter-blend gasoline specifications in order to relieve the price squeeze.[23] Higher RVP winter-grade gasoline is typically less expensive than its summer-grade counterpart due to the blending of less costly fuel components.

19 U.S. Energy Information Administration. *Weekly West Coast (PADD 5) Percent Utilization of Refinery Operable Capacity.* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=W_NA_YUP_R50_PER&f=W

20 U.S. Energy Information Administration. *Weekly West Coast (PADD 5) Ending Stocks of Total Gasoline.* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=WGTSTP51&f=W

21 U.S. Energy Information Administration. *Weekly West Coast (PADD 5) Imports of Total Gasoline.* https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=WGTIM_R50-Z00_2&f=W

22 Raji, B. & Tang, M. (2022, September 23). *OPIS News: Los Angeles Diesel Basis Runs Up With Reports of Refiner Buying.*

23 California Air Resources Board. (2023, September 28). *Regulatory Advisory: September 28, 2023: Early Transition to Winter-Blend Gasoline.* https://ww2.arb.ca.gov/sites/default/files/2023-09/RVP_Advisory_2023.pdf

At the spot level, on September 26, 2023, Los Angeles CARBOB spot prices hit a peak of $4.3866/gal, with a cash differential of $1.87/gal over the NYMEX RBOB contract, according to OPIS data. By September 27, though, that price had dropped to $4.0501/gal, and by September 29 – after the early RVP transition – LA CARBOB spot prices had plunged to $2.9895/gal.

The U.S. West Coast gasoline spot market, with its unique market design, regulatory environment, and constrained supply infrastructure, is sensitive and responds quickly, both in terms of price increases and price decreases, to shifts in market fundamentals. The spot market can trade with volatility in response to regional refinery issues, dramatic changes in fuel inventories, import and export shifts and even macroeconomic issues like a pandemic or conflicts that impact the global energy supply chain.

In contrast to the quick-responding spot market, price declines took longer to reach the retail level following the September 29 RVP waiver. On October 3, 2023, California retail gasoline prices moved below the $6/gal mark, to $5.978/gal. By mid-October, those retail gasoline prices had dropped to $5.623/gal.

While retail gasoline prices do respond to changes in the spot market, price volatility at that level is demonstrated at a smaller scale due to the varying design of supply contracts and how volume is strategically managed in station tanks.

OPIS analysis of Los Angeles and San Francisco gasoline market prices after the RVP waivers in both 2022 and 2023 shows that the sharp drop at the spot and rack level was not reflected as quickly in the retail segment, with declines taking longer to reach customers at the pump.

Retail and Spot Price Volatility

While it may be tempting to describe 2022 and 2023 gasoline prices as "volatile" based on these spikes, an examination of the data tells a more complex story.

OPIS's data analysis shows California's retail gasoline price volatility from 2006-2014 at 21.23%, while volatility from 2015-2023 was at 20.53%[24]. Retail prices do not appear to have become more volatile in recent years. It may be that price shifts have been more keenly felt by customers in light of the overall increase in retail gasoline prices over time.

However, a comparison of spot price volatility indicates that between 2006 and 2014, Los Angeles CARBOB spot price volatility was at 129.9%, compared to a 2015-2023[25] value of 206.4%, showing a substantial increase in volatility at the spot level. Likewise, San Francisco CARBOB spot price volatility was 134% between 2006 and 2014 and increased to 181.5% between 2015-2023.

Why would retail and spot volatility follow different trends?

In recent years, trading participation in California's spot markets has declined; the California market may see just a dozen or so companies engage in trading on a regular basis.[26]

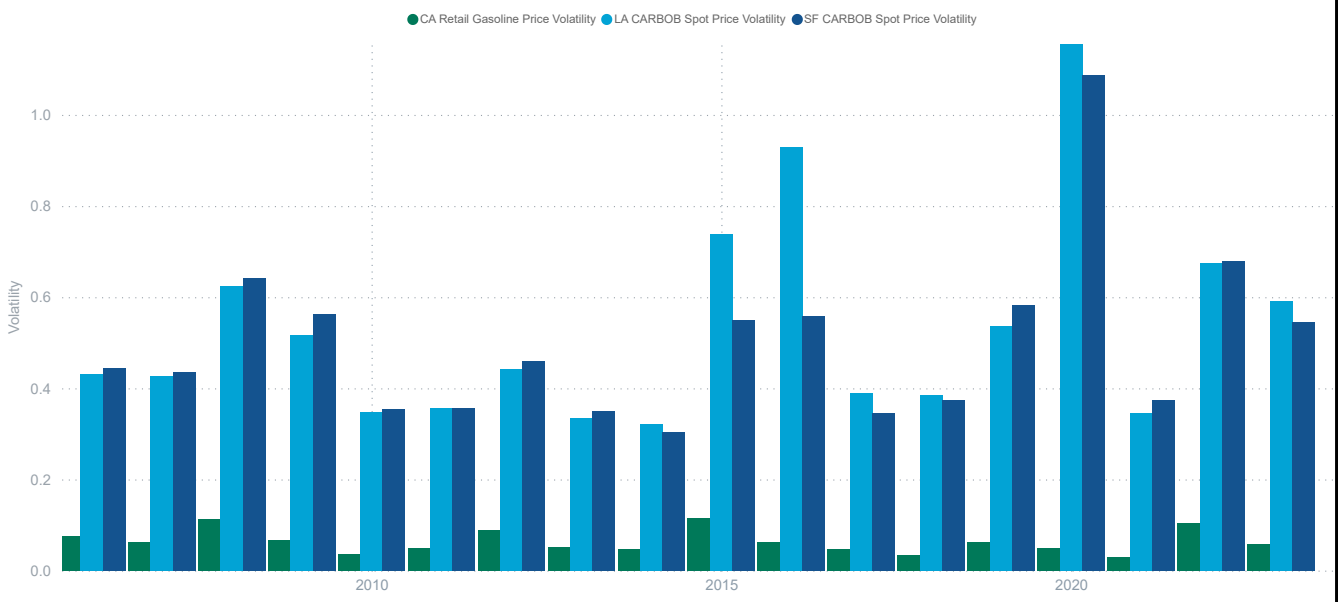
24 CA retail regular gasoline price data through November 15, 2023

25 Los Angeles CARBOB spot price data and San Francisco CARBOB spot price data through December 29, 2023

26 On a daily basis, OPIS staff canvases hundreds of West Coast sources, tracking bids, offers and confirmed trades.

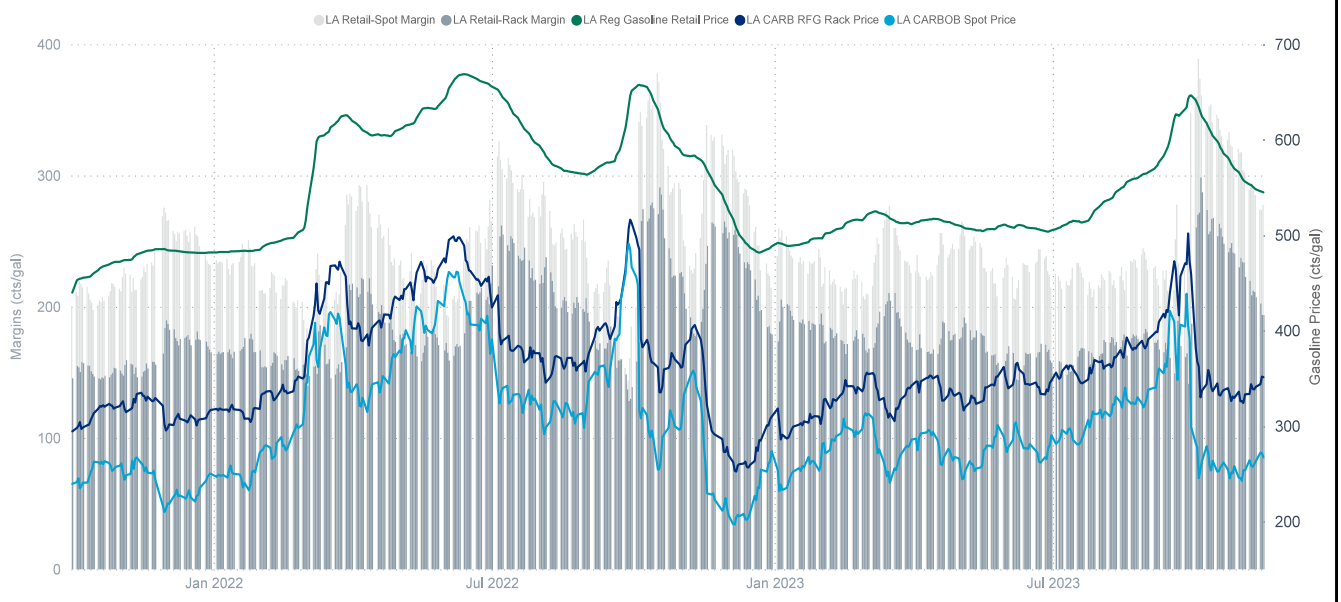
In this environment, spot prices rise quickly, but they also fall quickly, a trend that is not mirrored at the retail level, with its steadier pricing. The delay in retail price decreases may be another reason that price spikes may be felt strongly by gasoline users in the state. This "Rockets & Feathers" phenomenon will be discussed in the following section.

LA and San Francisco CARBOB spot prices have become more volatile over time, but California retail gasoline has not seen the same level of volatility



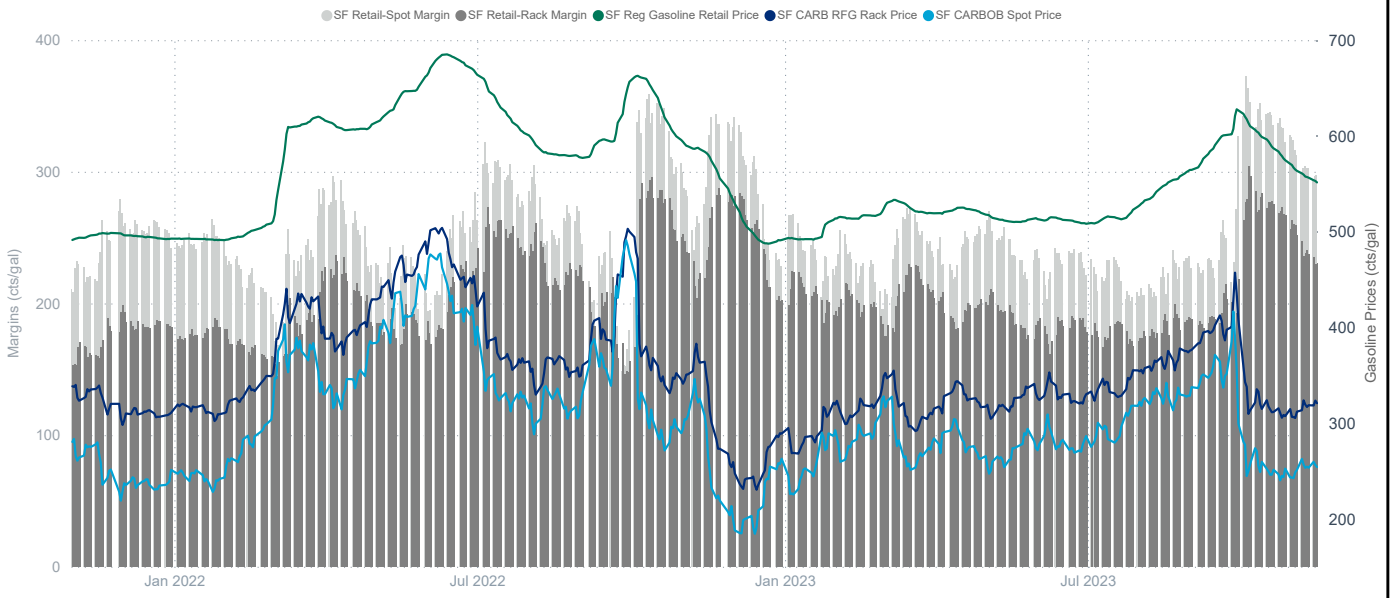
Source: OPIS West Coast Spot Market Report; OPIS Retail DataHouse

Los Angeles gasoline retail prices lag rack and spot market declines after California issues 2022 and 2023 RVP waivers



Source: OPIS West Coast Spot Market Report; OPIS Wholesale Rack Prices; OPIS Retail DataHouse

San Francisco retail gasoline prices demonstrate a similar trend to Los Angeles following California's 2022 and 2023 RVP waivers



Source: OPIS West Coast Spot Market Report; OPIS Wholesale Rack Prices; OPIS Retail DataHouse

The "Rockets & Feathers" Phenomenon: Asymmetric Pass-Through

Retail gasoline prices in California – and throughout the U.S. in general – often follow the rockets and feathers dynamic. The phenomenon refers to retail prices moving higher rapidly, but falling at a slower rate.

This dynamic can occur as retailers navigate the dilemma of replacement costs of resupply. For example, when a retailer is faced with a five-cent increase in what they expect to pay for resupply, they may raise their current prices in response.

But when prices are moving in the opposite direction – hypothetically, if a wholesale rack price drops from $2.60/gal to $2.50/gal – the gasoline retailer still has the previously purchased $2.60/gal supply in their station's tanks and would take a 10ct/gal loss on that inventory if they were to cut prices immediately.

Retailers often see their greatest profits when wholesale prices retreat and there is little pressure on them to pass through those savings to customers.

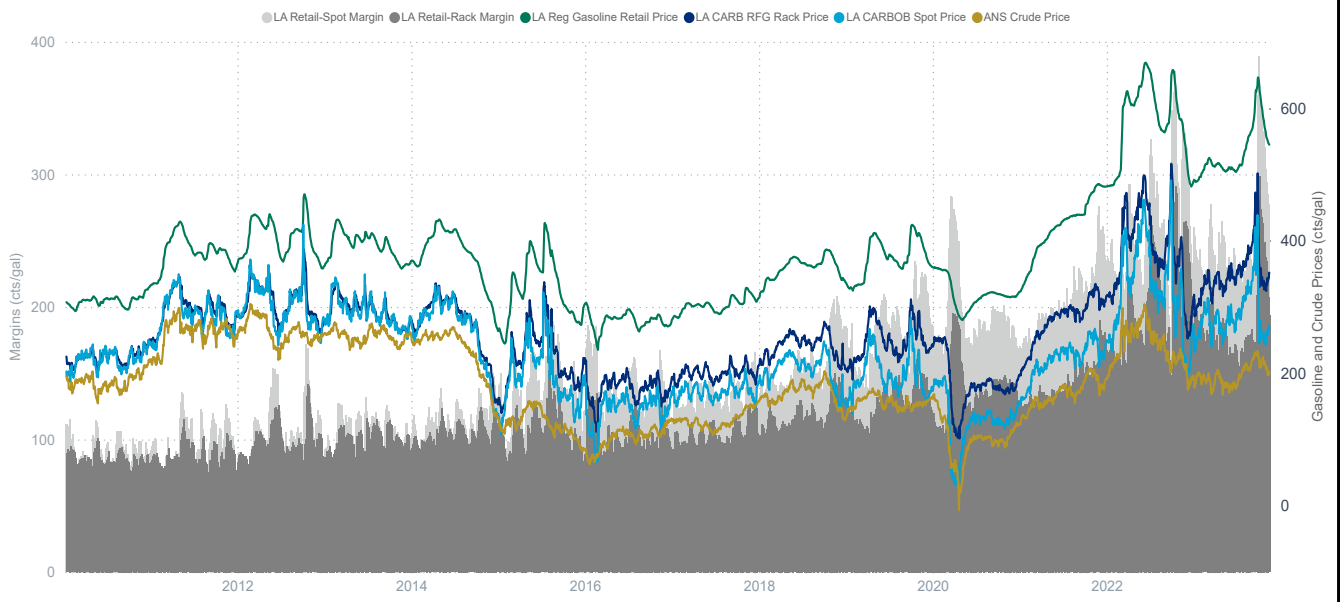
This well-known phenomenon was explored by the St. Louis Federal Reserve bank branch in 2022[27], which looked at how the price changes for crude oil compared with price changes for retail gasoline nationally.

The St. Louis Fed noted that "although oil is a key input in the production of retail gasoline, oil and gas prices don't always move in tandem," adding that, "[w]hen oil prices shoot upward, gas prices

27 Owayang, M. & Bennett, J. (2022, June 23). *Oil and gas prices move together like rockets and feathers*. FRED Economic Data. https://fredblog.stlouisfed.org/2022/06/oil-and-gas-prices-move-together-like-rockets-and-feathers/

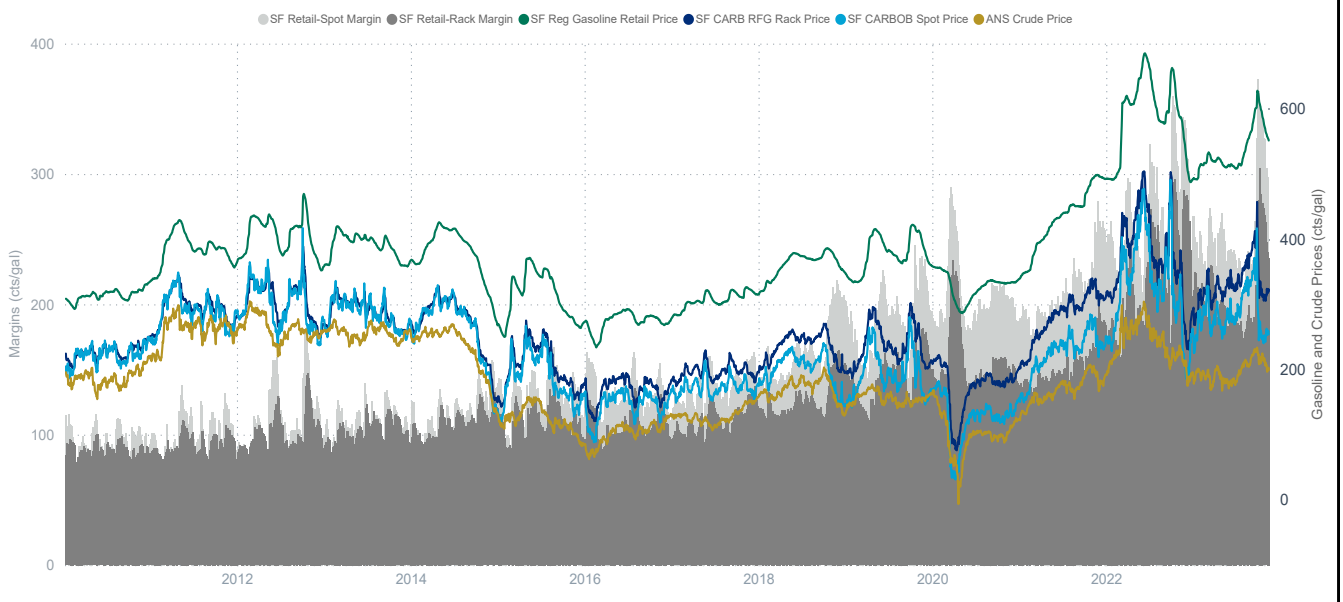
rise with them. And when oil prices fall, gasoline prices also fall; but they can fall at a slower rate. Economists refer to this market dynamic as 'asymmetric pass-through.' A more colorful description of the phenomenon is 'rockets and feathers.'"[28]

Los Angeles retail gasoline prices respond more slowly to market declines exhibited further up the supply chain



Source: OPIS West Coast Spot Market Report; OPIS Wholesale Rack Prices; OPIS Retail DataHouse

San Francisco retail gasoline prices responded in a similar way to price declines further up the supply chain



Source: OPIS West Coast Spot Market Report; OPIS Wholesale Rack Prices; OPIS Retail DataHouse

28 Ibid.

The Impact of Branded Retailers

Branded Retailers and Competition

At a November 29, 2022 California Energy Commission hearing, Severin Borenstein, faculty director of the Energy Institute at the University of California Berkeley's Haas School of Business, noted that California has a disproportionately higher ratio of branded to unbranded stations, with street prices for branded stations significantly higher than those for unbranded stations, affecting the overall gasoline prices in the state.[29]

Looking at 2018 GasBuddy data, Borenstein noted that California branded station prices were about 23cts/gal higher than unbranded stations, while in the rest of the country branded gasoline was about 7cts/gal above unbranded gasoline, adding that "we just don't have the competition and discipline from those off-brand stations disciplining the gasoline market."

Borenstein also looked at the difference between Los Angeles spot prices and spot prices in New York and the Gulf Coast between 2003 and 2022, accounting for the 10ct/gal difference in production cost for California gasoline. The data showed there was no increase in that differential over time, and even a slight downward trend, despite spikes in 2015 and 2022.

Looking Forward

Regulation

Governor Newsom signed Senate Bill X1-2, also known as the California Gas Price Gouging and Transparency Law, in March 2023. The law authorized the CEC to set a maximum gross gasoline refining margin and a penalty for refiners that exceed it. It also called for transparency in documentation, including reporting requirements for planned and unplanned refinery maintenance, and documentation of spot market transactions and petroleum product imports that are 96 hours away from landing.[30]

It is not yet clear whether the new law will be effective in keeping a lid on fuel prices at the retail level, given the various factors behind retail prices in the region, as well as challenges with finding benchmarks to measure profitability.

The CEC is holding a rulemaking process for SBx1-2 to determine, among other things, if a gross gasoline refining margin will be set. If a cap is enacted and a refiner exceeds the refining margin, the bill authorizes the CEC to impose a penalty on the refiner. Penalties would be deposited into the state's Price Gouging Penalty Fund.

Hawaii enacted a gasoline price cap law in 2005, known as Act 77. That law differed from SB X1-2 in that it set price ceilings on wholesale gasoline prices, rather than addressing refining margins. But like California's new law, Hawaii's Act 77 was aimed at managing upstream costs for retailers.

Hawaii suspended Act 77 in 2006 after officials determined the law increased rather than decreased retail gasoline prices.

29 "Commissioner Hearing on California Gasoline Price Spikes & Refinery Operations. Panel: Petroleum Experts." Youtube.com, Uploaded by CalEnergyCommission, 30 November 2022, https://www.youtube.com/watch?v=-icB33iPJk4&t=8958s.
30 "Senate Bill X1-2 Implementation." California Energy Commission. https://www.energy.ca.gov/proceeding/senate-bill-x1-2-implementation

Some participants in the West Coast refined products spot market have voiced concern that a profit margin cap may discourage state refiners from producing fuel once they approach the profit margin, though it doesn't seem likely refiners would be able to simply idle plants at will.

But in an October 2023 earnings call, Valero Energy officials warned that the company might ultimately determine that the "carrying value" of California assets are not recoverable, and that could lead to an impairment loss that might be material to earnings. The impairment loss might reduce the assessment of how long the assets might be useful. The company raised the possibility of recognizing an "asset retirement obligation" that could be material.

During a roundtable session at a November 28, 2023, CEC workshop, Western States Petroleum Association President Catherine Reheis-Boyd said there are no consumer benefits to a refiner profit margin, "only costs" that may lead to decreased production or refiners leaving the state altogether.

"California's policies have made Chevron's investments in its home state riskier than investing in other states, with projects being lower in quality and higher in cost," Andy Walz, president of products at Chevron said in public comments posted to the California Energy Commission's website.

However, at that November 28, 2023, workshop, Elena Kriger, director of research at Physicians, Scientists and Engineers for Healthy Energy, noted that a reduction in supply is part of the energy transition. "Gasoline supply should go down in the state, demand has decreased 20% in the last five years and at the end of the day we need to transition entirely away from the fossil fuel system to support our climate goals, which includes transitioning entirely away from refineries." Kriger added "It's unrealistic to think that all of California's refineries will or should stay open."

Overall, gasoline volumes in California have been declining. Taxable gallons of gasoline sold within the state peaked at 15.9 billion between 2003 and 2004, and sales have generally been falling since then. Between 2021 and 2022 13.9 billion gallons of taxable gasoline sales were reported to the California Department of Tax and Fee Administration.

"The state faces challenges with finding strategies that reduce emissions while keeping the [gasoline] system safe and reliable, minimizing rate impacts to customers, and achieving equity."

Gasoline consumption within the state will continue to decline as vehicle fuel efficiency increases and more drivers turn to zero emissions vehicles. In the interim however, prior to the phasing out of new internal combustion engine vehicles, production shifts are expected to create an even greater dependence on imported gasoline.

"The state faces challenges with finding strategies that reduce emissions while keeping the [gasoline] system safe and reliable, minimizing rate impacts to customers, and achieving equity," the CEC wrote in its 2022 Integrated Energy Policy Report.

Anticipated Changes to Supply

Looking ahead, anticipated changes to supply could potentially apply upward pressure on retail gasoline prices.

The next major challenge for California fuel supply will arrive in early 2024 when Phillips 66 plans to stop running crude at its 128,000 b/d Rodeo refinery in the East Bay area. The move is part of a

planned shift to renewable fuels production, including renewable diesel and sustainable aviation fuel. When the refinery stops processing crude, it will reduce gasoline supplies in the region by about 50,000 b/d.

Only three traditional refineries in Northern California will remain: Chevron's 257,200 b/d plant in Richmond, Valero Energy's 149,000 b/d facility in Benicia and PBF's 157,000 b/d refinery in Martinez.

Declining fuel demand and added environmental costs for traditional refined fuels combined with incentives for production of low-carbon intensity fuels such as renewable diesel and sustainable aviation fuel could encourage refiners in the state to repurpose additional refineries into renewable fuels plants.

The CEC's 2022 Integrated Energy Policy Report (IEPR) noted that the "challenges may become even more serious as the state transitions away from gasoline and more refineries begin to either shut down or reduce gasoline output," citing the expected closure of Phillips 66's smaller refinery in Santa Maria, which took place in early 2023.[31]

"Further shutdowns will mean more reliance on a smaller number of refineries, and various planned or unplanned temporary shutdowns of those remaining will have an even greater impact on volatility," the IEPR report added.

Key Takeaways

Based on this examination of California's gasoline market structure, OPIS has observed that:

California's retail gasoline prices have not become more volatile in recent years. Shifts in pricing may feel more notable to consumers, due to the overall relatively high prices of gasoline in the state.

The difference between California's average retail gasoline prices and those seen in the rest of the country has widened significantly, from just over $0.30/gal in 2010 to about $1.55/gal in 2022.

The overall higher retail gasoline prices in California stem from numerous factors.

One main factor is California's supply structure, including the lack of pipelines from other parts of the U.S.; lag time and reliance on arbitrage economics for imports from abroad; declining gasoline production within the state; and boutique gasoline blend requirements which make CARBOB more costly and difficult to produce.

California's regulatory environment may also be a factor in gasoline prices, including cap-and-trade costs, LCFS costs and taxes.

The "Rockets and Feathers" phenomenon may be one cause of slower retail price declines, when compared with steeper spot and wholesale rack price declines.

The disproportionate number of branded retailers, with less competition from unbranded retailers, may also factor into higher retail gasoline prices in California.

31 California Energy Comission. (2022). *COMMISSION REPORT: Final 2022 Integrated Energy Policy Report Update.* California Natural Resources Agency. https://www.energy.ca.gov/sites/default/files/2023-02/Adopted_2022_IEPR_Update_with_errata_ada.pdf

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