California 2021 Fuel Price Forecasts

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Today's Talk

- Focus on gasoline and diesel price forecasts
- A variety of incremental improvements to the existing fuel price model are being implemented this year
- Bigger improvements are being planned for the next forecast

The Model in a Nutshell

- A linear regression model that uses ordinary least squares to obtain a model with a very good fit, a high R^2 (0.99)
- The parameters (coefficients) from this regression are then used with predicted values of the inputs (x values) to obtain a forecast of the y value
- This is an application of supervised machine learning

Some details

- Forecasts the fuel price differential between California and the rest of the nation
- The most influential input is the national average price (of either gasoline or diesel), which is obtained from EIA
- Other inputs account for factors specific to California that contribute to the difference in prices, e.g., LCFS credits

The List of Variables

Some of these variables move together from 2015 to 2019, making it difficult to separate their influences on the California price. This is known as multicollinearity.

California Gasoline Price = a +

b_1 * US Gasoline Price +

b_2 * West Coast less US Crude Cost +

b_3 * California Gasoline Taxes per Gallon +

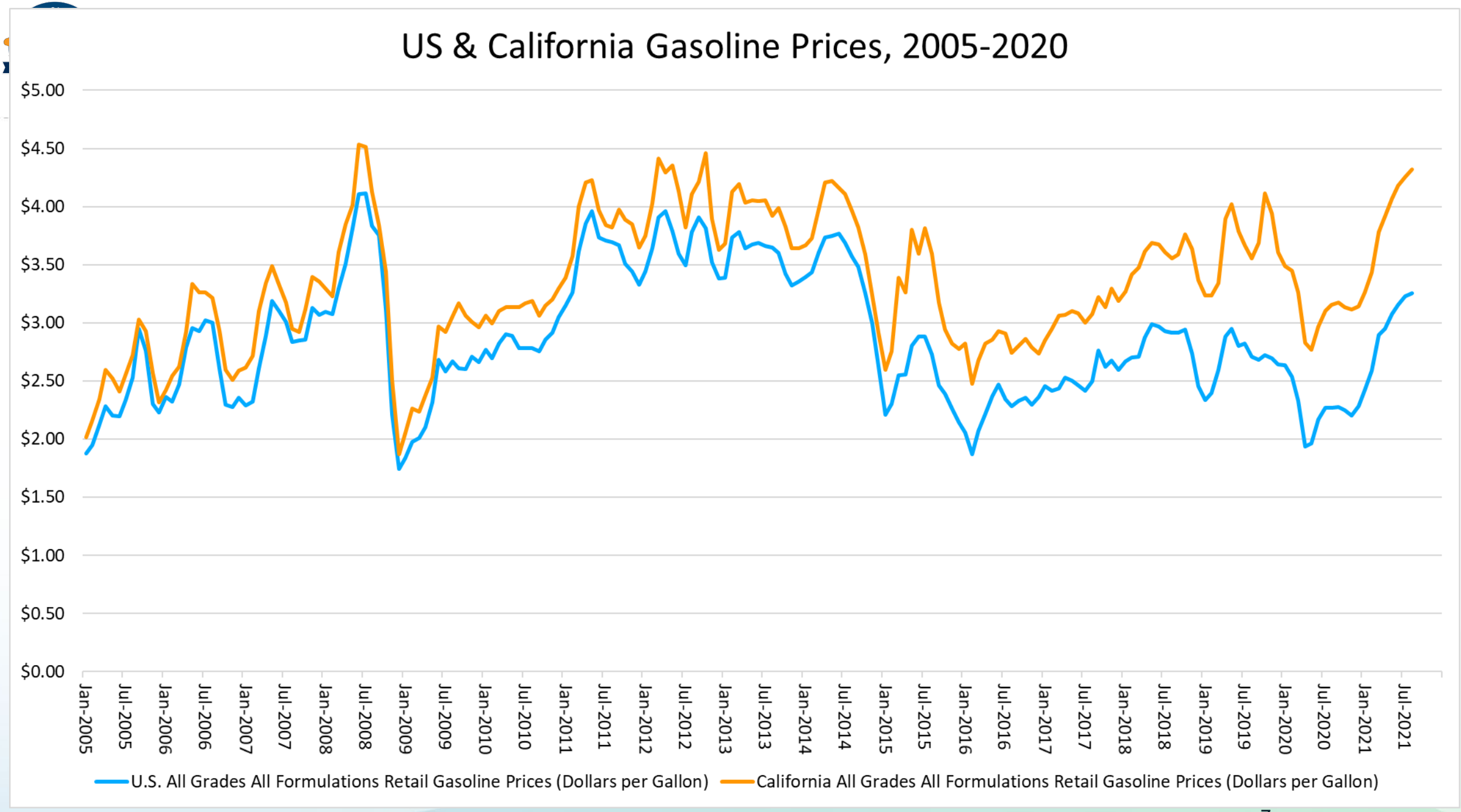
b_4 * LCFS Credit Price +

b_5 * Carbon Price +

b_6 * Refinery Outage Dummy

Gasoline vs Diesel Markets

- Refineries *generally* produce about 2 gallons of gasoline for every gallon of diesel
- The California market consumes about 3 gallons of gasoline for every gallon of diesel
- The gasoline market is tight: prices are more sensitive to refinery outages
  — marine imports of 20,000 bpd, to the south
- The diesel market is soft: prices are less sensitive to disruptions and producers are selling into a market that is oversupplied and not as profitable as gasoline
  —marine exports of 40,000 bpd, from the north


US & California Gasoline Prices, 2005-2020
$5.00
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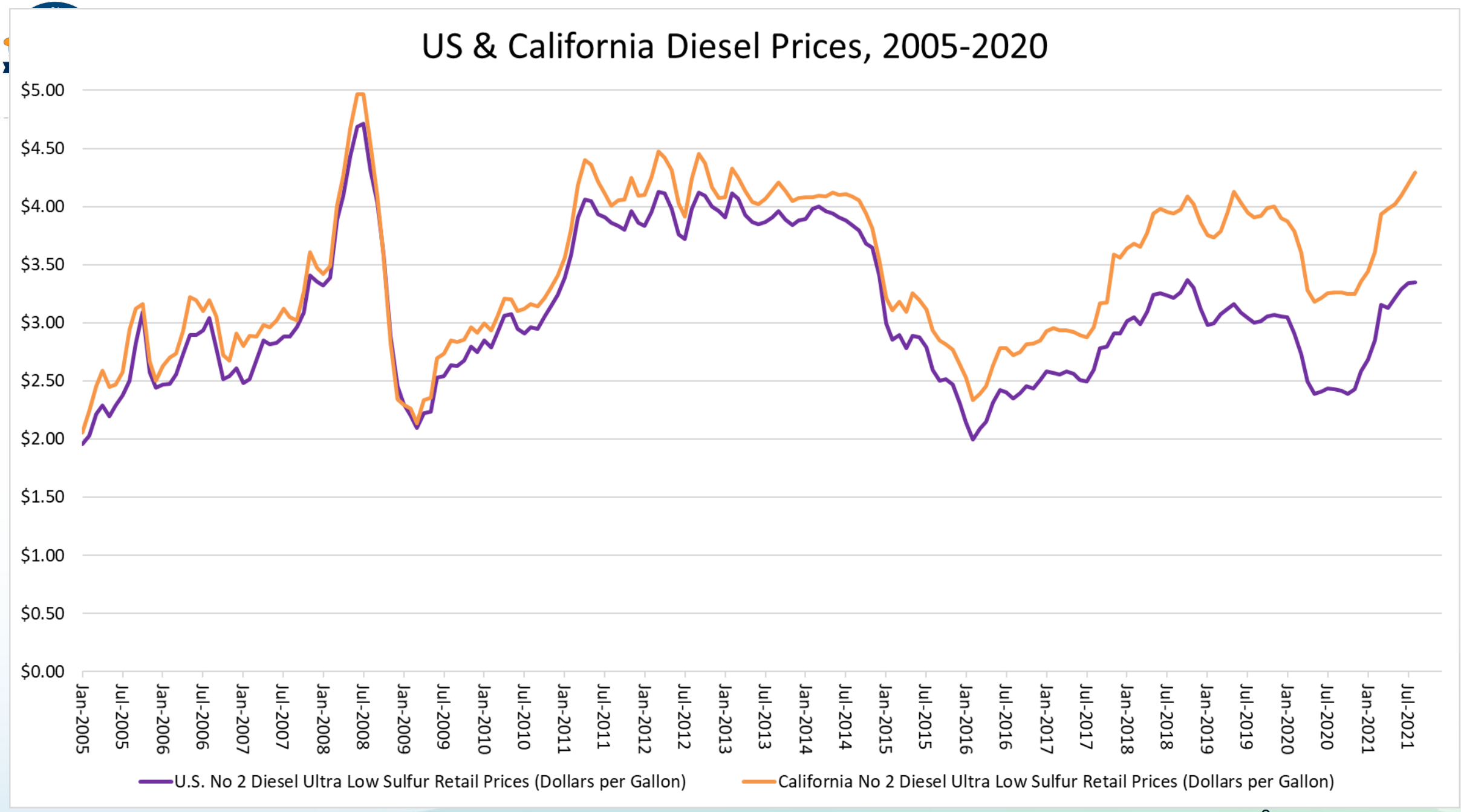
Jul-2021
U.S. All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon)
California All Grades All Formulations Retail Gasoline Prices (Dollars per Gallon)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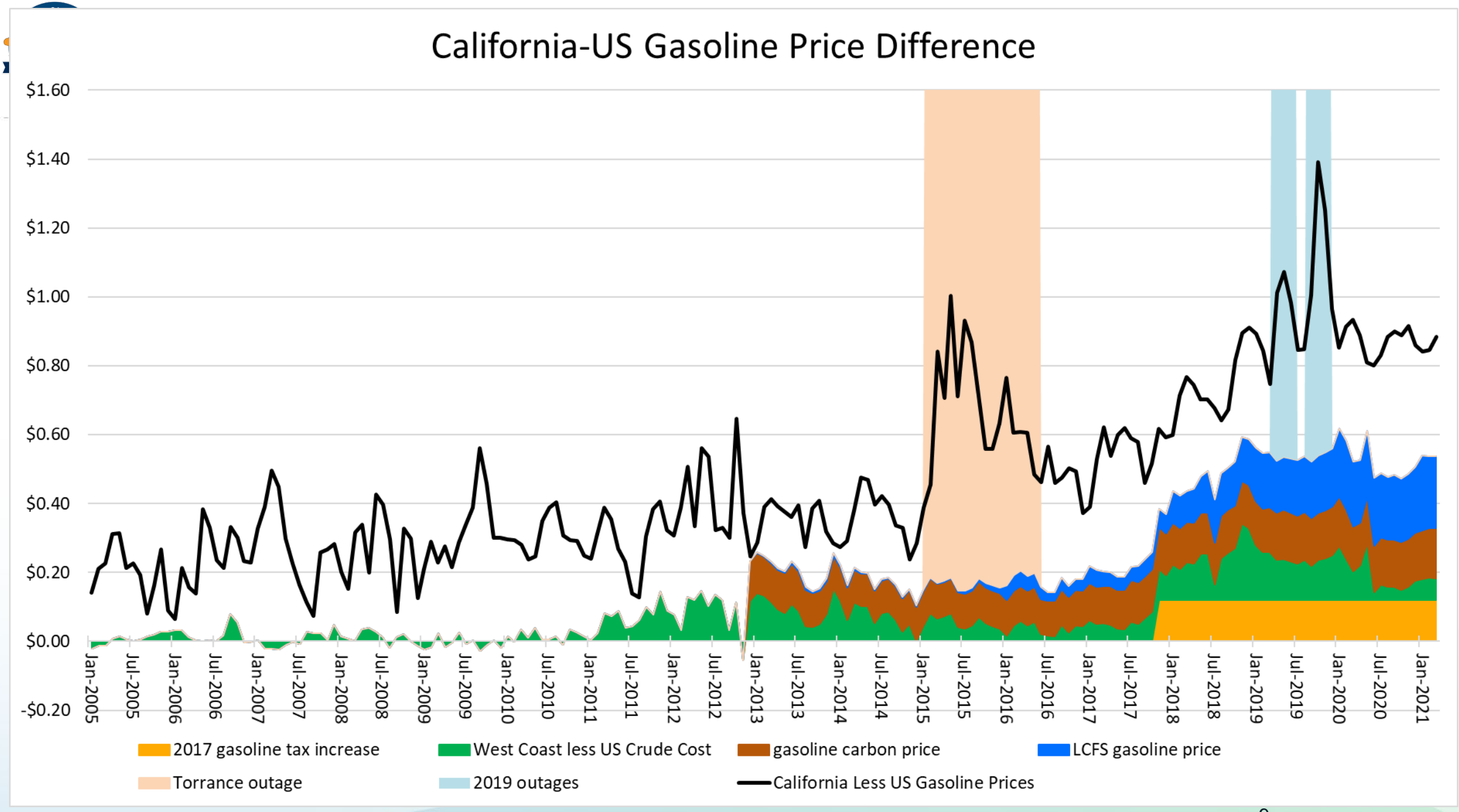
U.S. No 2 Diesel Ultra Low Sulfur Retail Prices (Dollars per Gallon)
California No 2 Diesel Ultra Low Sulfur Retail Prices (Dollars per Gallon)


California-US Gasoline Price Difference
$1.60
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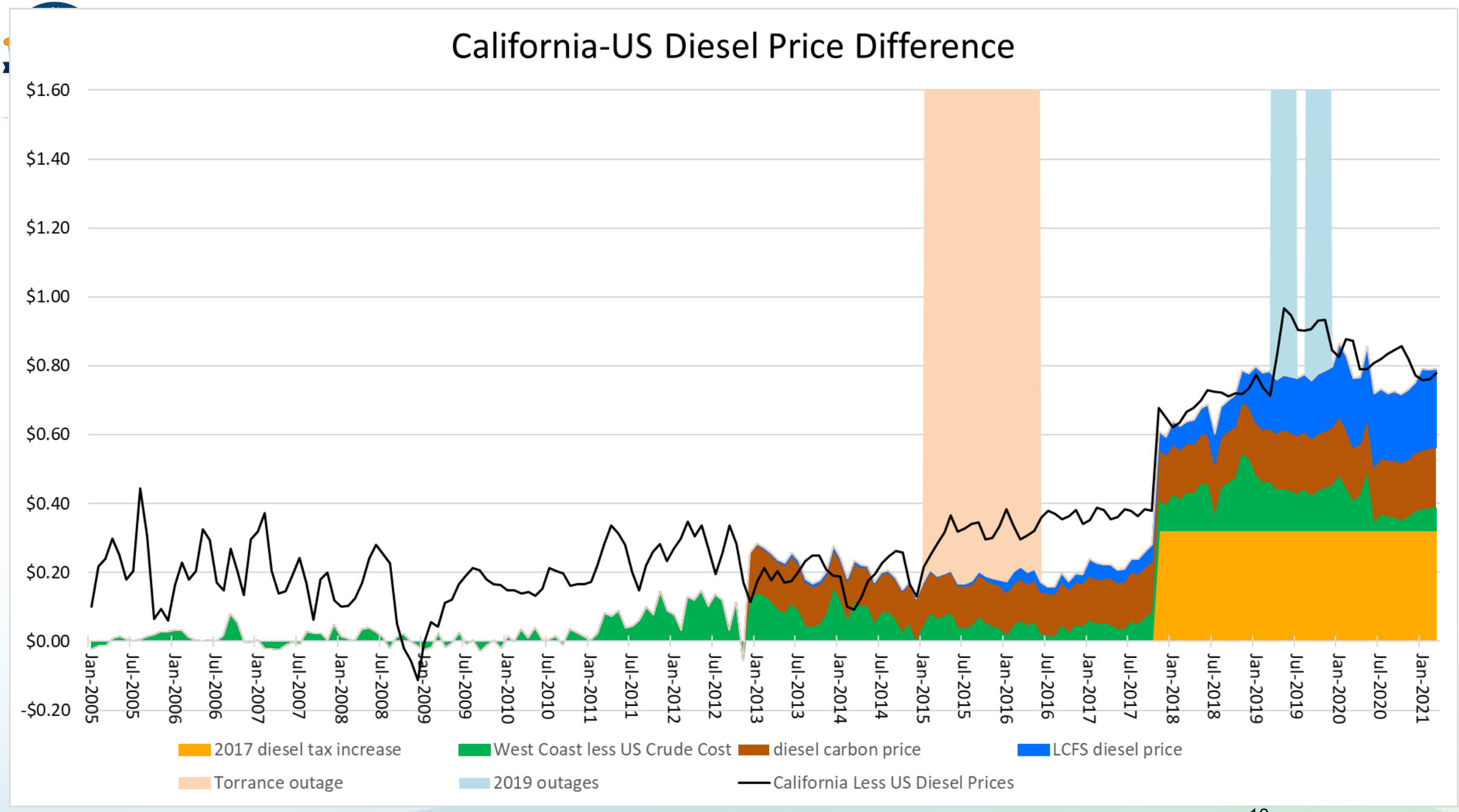
Jan-2021
2017 gasoline tax increase
West Coast less US Crude Cost
gasoline carbon price
LCFS gasoline price
Torrance outage
2019 outages
California Less US Gasoline Prices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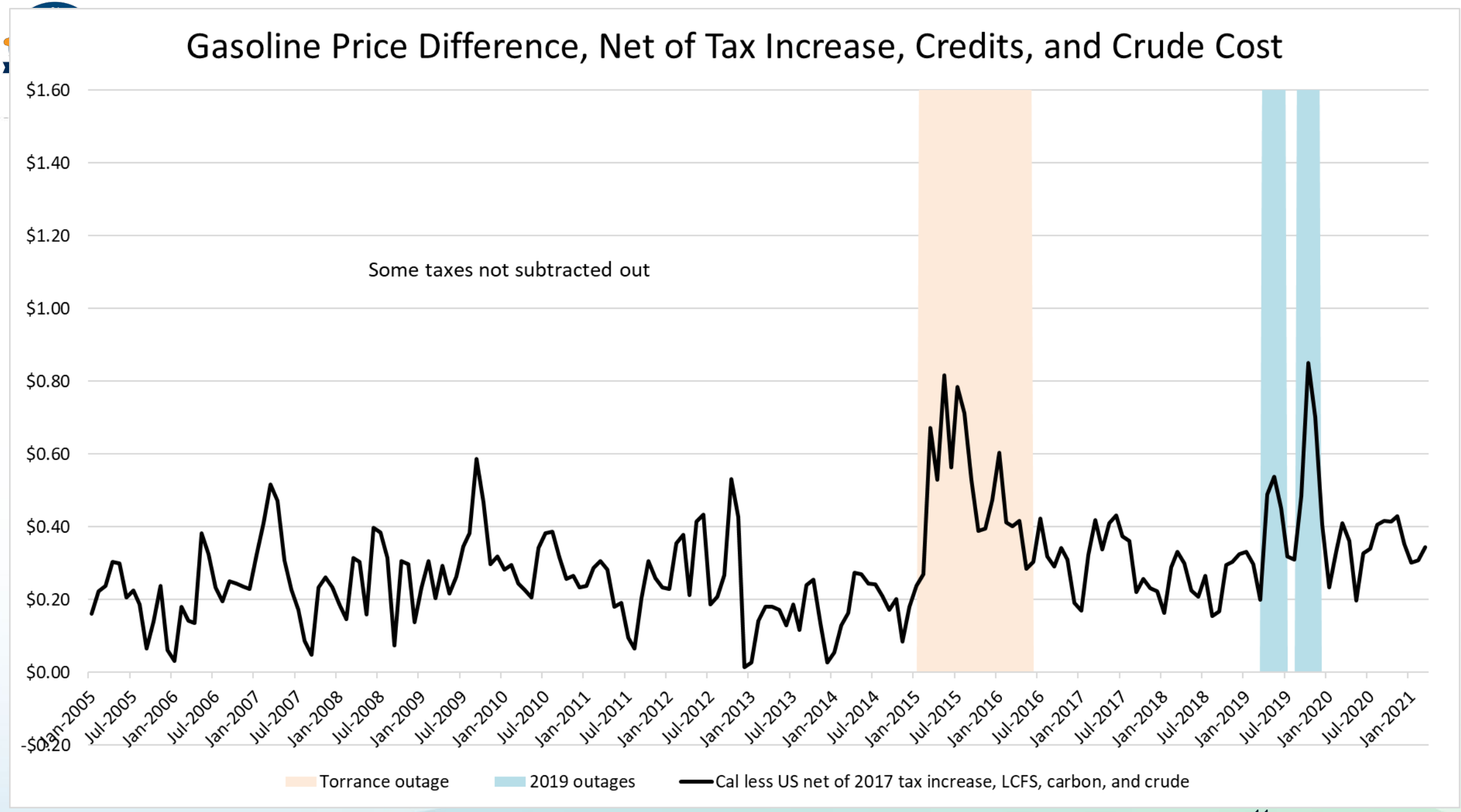
Gasoline Price Difference, Net of Tax Increase, Credits, and Crude Cost
$1.60
$1.40
$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
-$0.20
Some taxes not subtracted out
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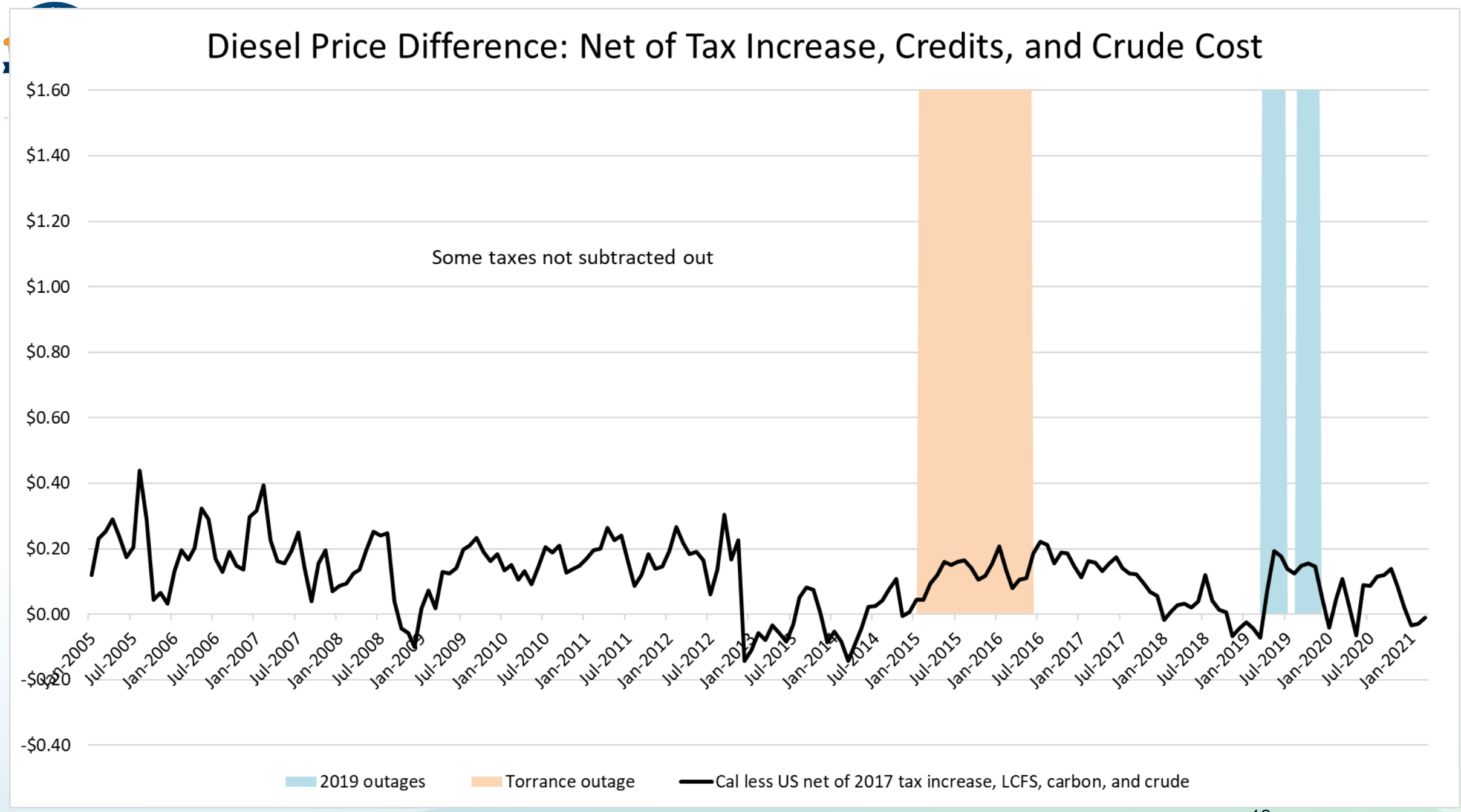
Jan-2021
Torrance outage
2019 outages
Cal less US net of 2017 tax increase, LCFS, carbon, and crude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$1.20
$1.00
$0.80
$0.60
$0.40
$0.20
$0.00
-$0.20
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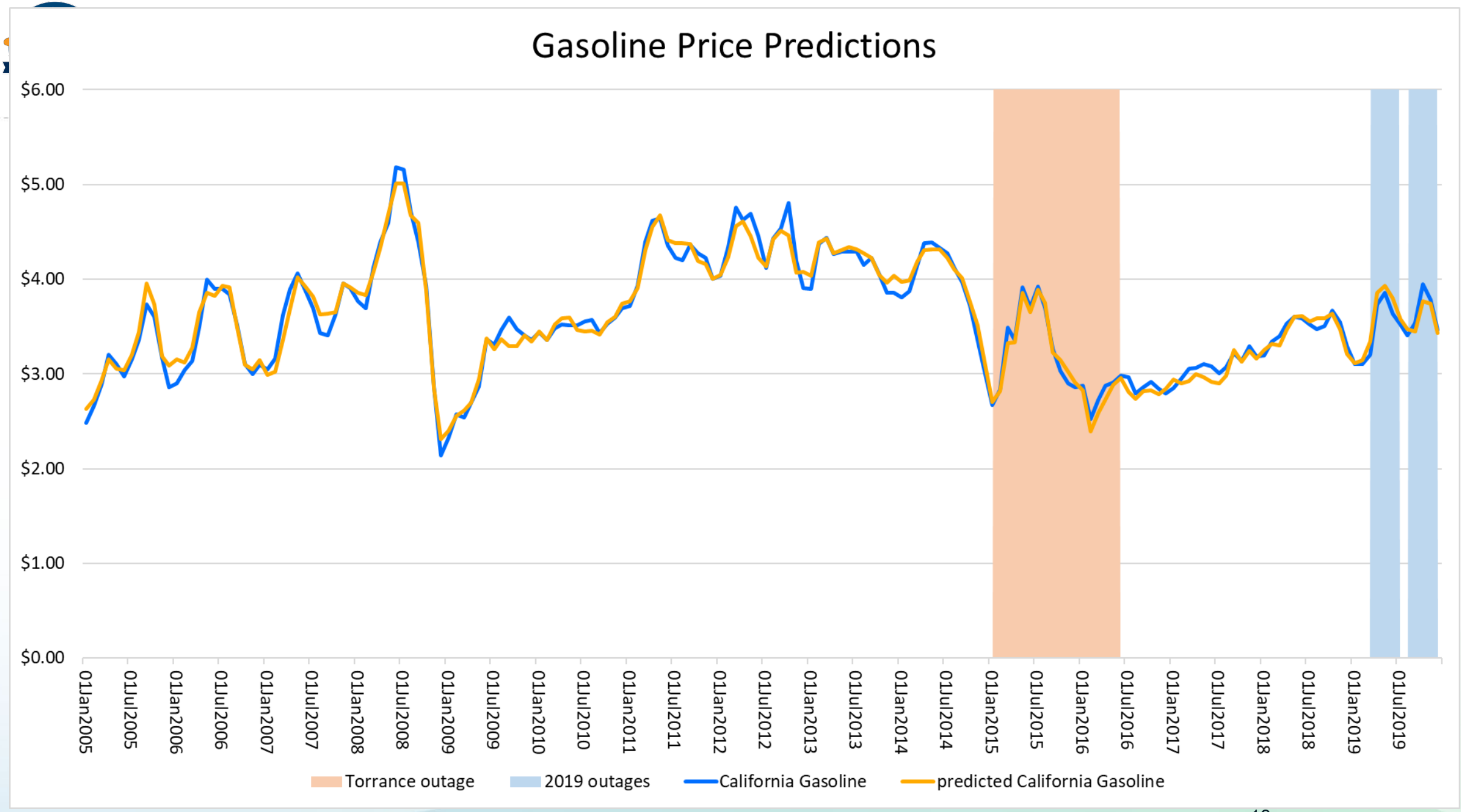
Gasoline Price Predictions
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
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01Jan2005
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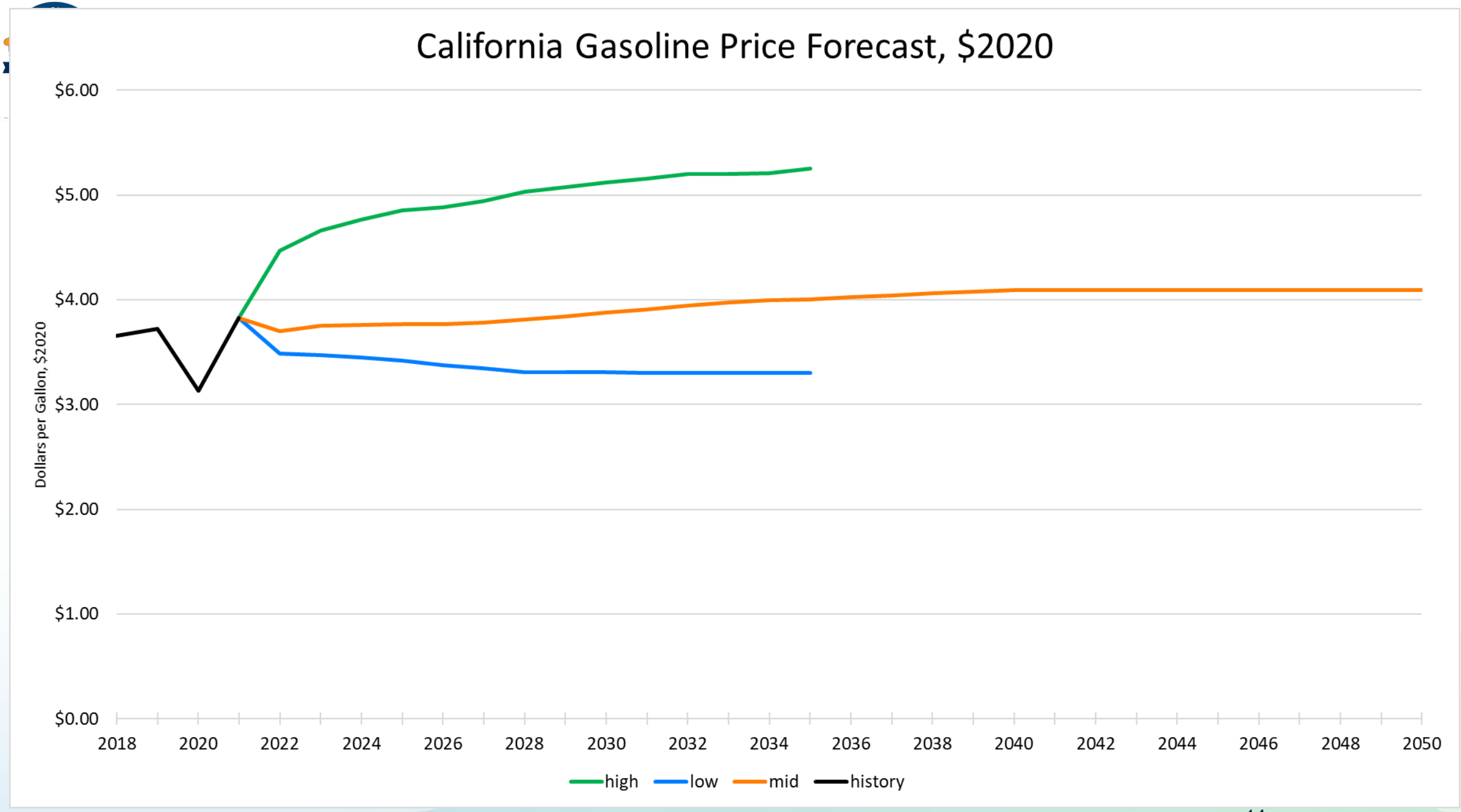
Torrance outage
2019 outages
California Gasoline
predicted California Gasoline


California Gasoline Price Forecast, $2020
$6.00
$5.00
$4.00
$3.00
$2.00
$1.00
$0.00
Dollars per Gallon, $2020
2018
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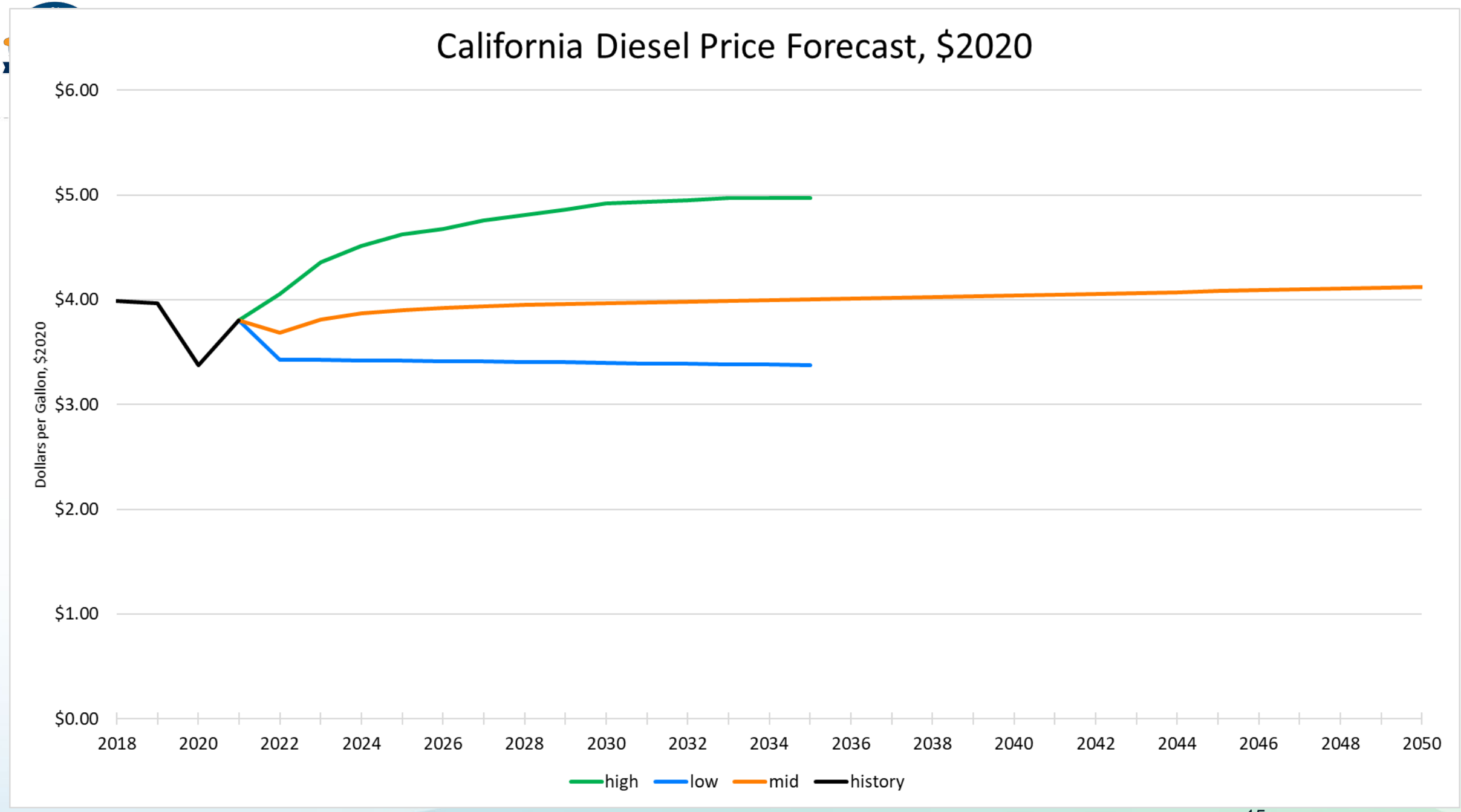
history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Still to Be Done

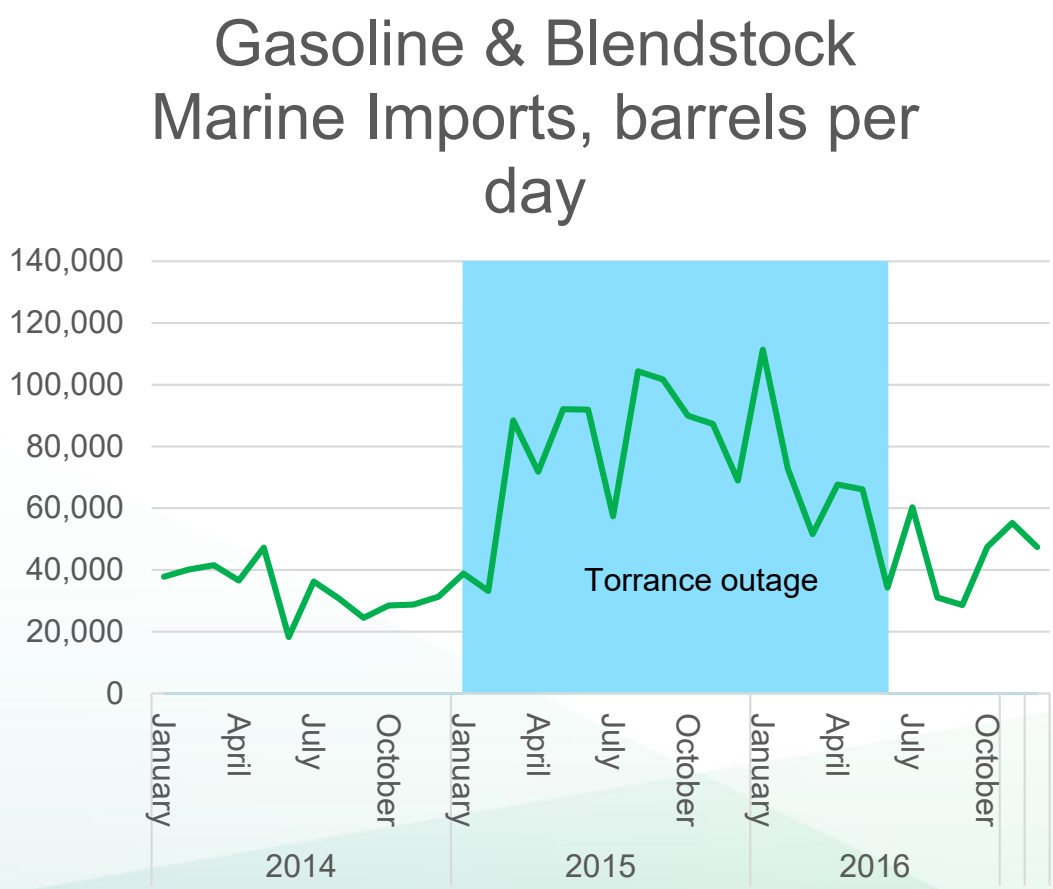
- Develop quantitative method to forecast LCFS credit prices
- Determine how to account for refinery closures in forecast
- Refinery closures also have an impact on industrial demand for electricity and on supply of electricity, which may influence the decision to close

Refinery Closures

- Fuel consumption has declined as a result of COVID
- Marathon has closed their Martinez refinery
- Phillips 66 is planning to close two refineries in 2023
- California has been an exporter of diesel, so no immediate effect, but a supply deficit could develop
- California has been an importer of gasoline, so that imbalance could increase, in spite of EV growth

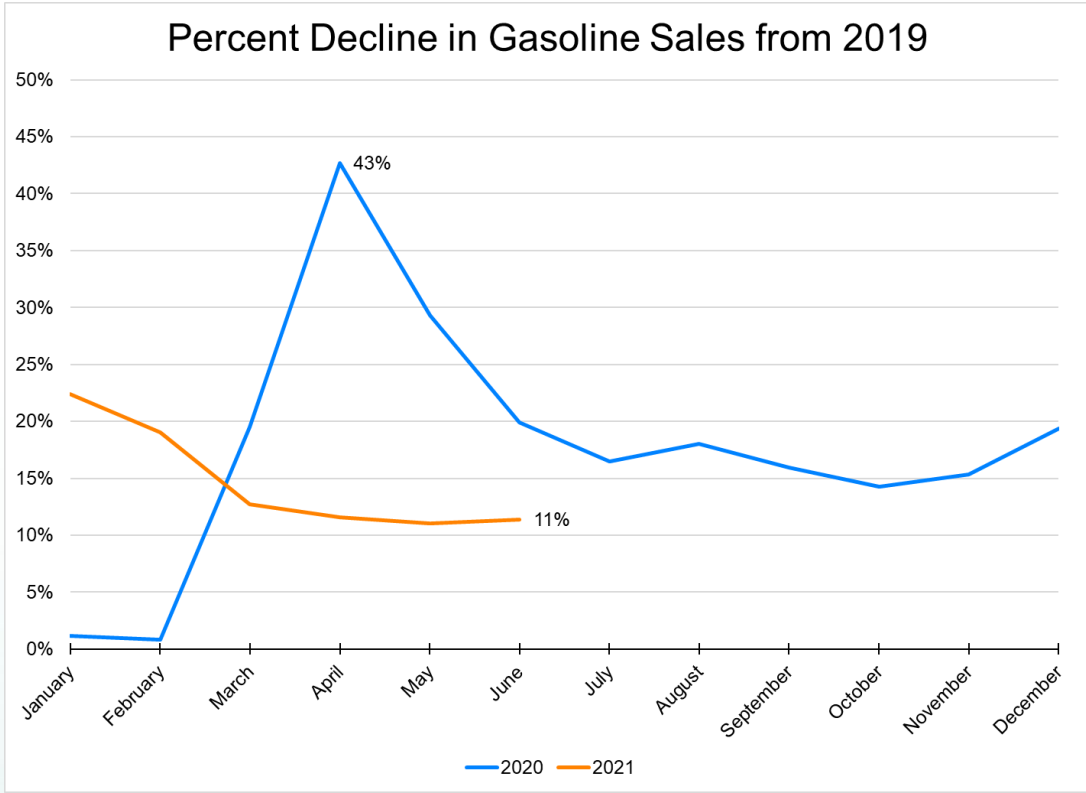
Look at Refinery Outages

- Gasoline imports during the outage at Torrance increased sharply
- We might see something similar as a result of California refinery closures
- The closures are planned, so there wouldn't be price spikes
- Estimate the incremental cost of importing, rather than refining, gasoline (and diesel)



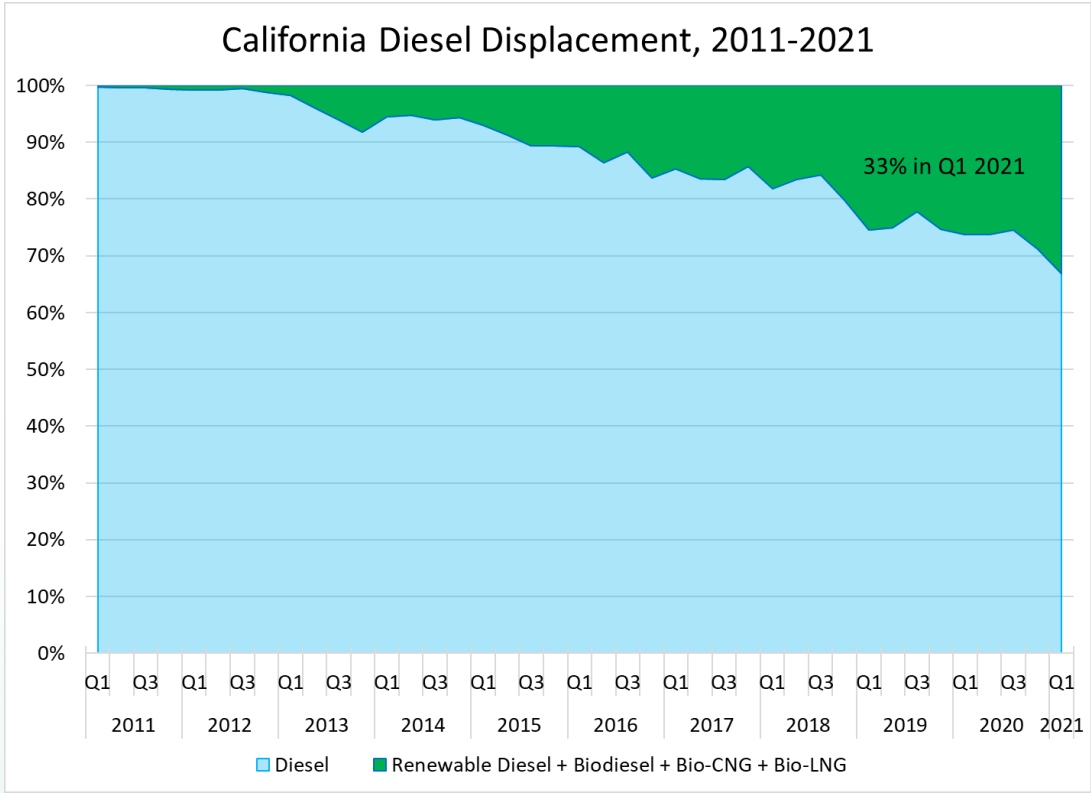
Impact of COVID on fuel demand

- Gasoline sales remain significantly below pre-COVID levels
- Decline in both supply and demand keeps prices high in this case
- This decline in demand combined with the decline in supply increases the uncertainties in forecasting
- Diesel demand did not fall as much (21%) and has fully recovered
- This is good for diesel, but there are other challenges in that market



Low Carbon Fuel Standard

- Cross-subsidy of renewable fuels by gasoline and diesel and of diesel alternatives by gasoline
- Less than 2% of gasoline has been displaced by low-carbon alternatives
- Over 30% of diesel has been displaced
- Many renewable diesel projects underway, enough to displace 100% of diesel consumed in California
- In combination with an already oversupplied diesel market facing refinery closures
- Producers of diesel alternatives receive income from fuel, RINs, and LCFS credits



Thank You!

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