Transportation Fuels Trends, Jet Fuel Overview, Fuel Market Changes & Potential Refinery Closure Impacts

BAAQMD Board of Directors Special Meeting
Via Zoom
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Overview

• Transportation Fuel Demand
  – California historical & pandemic demand impacts
  – Forecast trends

• California Jet Fuel Market & Infrastructure
  – SF Bay Area airport supply

• Refinery Closures & Potential Market Impacts
  – Decisions based on changing fuel demand & types
    • Consolidation & conversions
  – Decisions based on facility operational costs
    • Premature refinery closure
Transportation Fuel Demand - California
California primary transportation fuel consumption ranged between:

- 21.3 and 23.7 billion gallons per year
- 58.2 and 64.8 million gallons per day

Gasoline use roughly four times greater than either diesel or jet fuel. Diesel & jet fuel use similar from one year to the next.

Source: California Energy Commission.
Pandemic Impacts & Outlook - Gasoline

- Gasoline demand declined 18.2 percent in 2020
  - 12.58 billion gallons - lowest level since 1987
- Continues to recover
  - Still not back to pre-pandemic levels
  - Most recent estimate – still down 8.0 percent compared to April 2019
    - 4-week average demand (through week ending April 16)
  - Traffic counts still lag 2019 levels, despite much lower transit ridership
  - Varying degrees of remote work continues for private sector & government
- Forecast to continue declining over the next several years
  - Increasing percentage of ZEV light-duty vehicle sales
  - California gasoline demand peaked in 2017
  - By 2026, drop in demand (statewide) could exceed 1.0 billion gallons per year compared to current levels
California Gasoline Demand - 2020

Millions of Gallons per Day

Jan 39.5
Feb 41.3
Mar 32.8
Apr 23.8
May 29.8
Jun 34.3
Jul 35.1
Aug 36.1
Sep 35.7
Oct 36.2
Nov 34.6
Dec 33.2

Data includes ethanol.

Source: California Energy Commission analysis of CDTFA data through December 2020.
Mobility Trends – California

Source: Apple mobility trend reports – change in routing requests from baseline of January 13, 2020 – data through 5/1/2021
Mobility Trends – SF Bay Area

Driving & transit show even lower levels of activity in the SF Bay Area.

Source: Apple mobility trend reports – change in routing requests from baseline of January 13, 2020 – data through 5/1/2021
Traffic increased over the last week & is now **down 15.8 percent** for the week ending April 23 compared to the same period in 2019.

Maximum reduction of **56.9 percent** for week ending April 10, 2020 compared to the same period in 2019.

Source: California Energy Commission analysis of Metropolitan Transportation Commission (MTC) data.
Gasoline Demand Forecast

• Gasoline demand declines as population of ZEVs continues to climb.
  ○ 1.3 percent of light-duty vehicles at end of 2017
  ○ 2.3 percent at end of 2020
  ○ 6 to 12 percent of existing stock by 2030

**ZEV POPULATION**

<table>
<thead>
<tr>
<th>Total Light-Duty Vehicles end of 2020</th>
<th>635,602</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery Electric (BEV)</td>
<td>1.289%</td>
</tr>
<tr>
<td>Plug-in Hybrid (PHEV)</td>
<td>0.904%</td>
</tr>
<tr>
<td>Fuel Cell (FCEV)</td>
<td>0.025%</td>
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**NON-ZEV POPULATION**

<table>
<thead>
<tr>
<th>Total Light-Duty Vehicles end of 2020</th>
<th>28,030,332</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio Diesel</td>
<td>0.470%</td>
</tr>
<tr>
<td>Diesel</td>
<td>1.973%</td>
</tr>
<tr>
<td>Flex Fuel</td>
<td>3.993%</td>
</tr>
<tr>
<td>Gasoline</td>
<td>87.286%</td>
</tr>
<tr>
<td>Gasoline Hybrid</td>
<td>4.031%</td>
</tr>
<tr>
<td>Natural Gas</td>
<td>0.027%</td>
</tr>
<tr>
<td>Propane</td>
<td>0.003%</td>
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Pandemic Impacts & Outlook - Diesel

- Diesel fuel demand declined 4.3 percent in 2020
  - 3.56 billion gallons - lowest level since 2014
- Fully recovered
  - Higher than pre-pandemic levels
  - Most recent estimate – **up 12.6 percent** compared to April 2019
    - 4-week average demand (through week ending April 16)
    - Strong demand for goods movement – container imports & rail
- Forecast to continue rising over the next several years
  - However, recently adopted CARB standards for MD & HD vehicles will begin to erode those projections
California Diesel Demand - 2020

Data includes renewable diesel and biodiesel.

Source: California Energy Commission analysis of CDTFA data through December 2020.
Intermodal rail activity is reflective of goods movement and includes railcars transporting shipping containers and truck trailers. According to AAR, more than 90 percent of the rail activity originating in California is intermodal, while nearly 80 percent of the rail activity with California as the destination was intermodal.

Intermodal rail activity recovered last summer to pre-covid levels and has continued to improve over 2019 volumes.

2021 Y-T-D **up 4.9 percent** for intermodal rail activity versus 2019 Y-T-D.
• Container imports recovery similar to rail recovery – summer of 2020
• 2021 Y-T-D through March **up 27.6 percent** versus same period in 2019
• 56 percent of all U.S. container imports went through the Ports of LA & LB during March 2021
Diesel Demand Forecast

Regulations designed to replace existing medium duty (MD), heavy-duty (HD), and transit buses with zero emission makes and models (electric & hydrogen) will begin to push down diesel demand during the later portions of the forecast period.

- SCAQMD regulations – refuse and transit vehicles
- CARB Advanced Clean Trucks rule – MD & HD vehicles

Projections do not illustrate the commingled trends of *decreasing* fossil diesel demand & *increasing* renewable diesel demand

- Diesel demand growth flat to slight rise through 2030.
- Compliance with CARB’s Advanced Clean Trucks Rule could result in 70 to 90 thousand zero emission trucks and buses in operation by 2030.
- Pace of ZET & ZEB penetration will depend on such factors as size of cost incentives and how quickly or slowly existing MD & HD vehicles exit the existing fleet.

Jet fuel demand for West Coast declined 36.1 percent in 2020 compared to 2019
  - 348 thousand barrels per day - lowest level since 1989
Fuel type hardest hit by pandemic
  - Much lower than pre-pandemic levels
  - Most recent California estimate – down 31.9 percent compared to April 2019
    - 4-week average demand (through week ending April 16)
      - Decreased international travel & business flying
Forecast to slowly continue to recover over the next couple of years
  - However, recent Covid variant spikes around the world (Brazil, India, and parts of the European Union) could continue to depress international aviation activity longer than current forecasts
Global Flight Activity Still Down

- China & Hong Kong saw earliest impacts from coronavirus
- China showing nearly complete signs of recovery
- U.S. scheduled flights down by 50.2 percent for the week ending September 14
For the previous 7 days (thru April 26), passenger travel is at a level 43.0 percent lower than the same time in 2019.
Jet Fuel Overview
The primary source of fuels for SF Bay Area airports is production from local refineries
- Including supplies for Sacramento, Travis AFB, Fresno & Reno
- Trans-bay crossing to Brisbane & SFO
- Northern California refinery production periodically augmented with waterborne deliveries
  - Usually related to unplanned refinery outages
- At times, these imports have been as much as a third of average refinery production for a short period of time
- Marine terminals and pipeline connections not configured to transition to sustained marine importer of jet fuel
Jet Flows – Northern California

- Net exporter
- Imports intermittent – refinery outages
- Pipeline exports to Reno
- Domestic exports to PNW declined – replaced by WA refiners
- Exports to S. Calif. Have become a declining portion of their supply – recent volumes fluctuate based on refinery outages

Local refinery production of jet fuel averaged 3.6 million barrels per month from 2017-2019

Source: California Energy Commission.
Jet Flows – Southern California

- Balanced imports & exports
- Foreign imports steady
- Other waterborne imports not needed
- Pipeline exports to AZ & NV
- Waterborne exports intermittent
- Exports to N. Calif. unusual

Local refinery production of jet fuel averaged 5.8 million barrels per month from 2017-2019

Source: California Energy Commission.
Jet Fuel - Logistics

- Nearly all commercial airports receive jet fuel via pipeline, not tanker truck
  - Very limited capability to unload tanker trucks
- Jet A dispensed into aircraft from:
  - Mobile refueling trucks sourcing fuel from onsite storage tanks
  - Server trucks sourcing from hydrant system
  - Both types of vehicles are specialized
Refinery Closures & Potential Impacts
Recent Refinery Closures

• Refinery closures can occur when conditions of oversupply develop in a regional market due to Covid-19 fuel demand destruction
  – Marathon Martinez and Gallup refinery permanent idling – April 2020
  – Royal Dutch Shell Convent, Louisiana refinery – November 2020

• Closures tend to improve market conditions for other refiners in the region, diminishing degree of oversupply
  – Adequate supplies of transportation fuels still available for consumers and businesses
  – Usually a shift in source of supply through existing logistical infrastructure adequate to handle the changes
    • Marine terminals, pipeline connections/capacity & spare storage tank capacities
Recent Refinery Closures (cont.)

• Permanent idling of Marathon’s Martinez refinery during late April 2020 did not result in any supply shortfall for transportation fuels due to:

• Decreased gasoline demand related to pandemic
  – Full recovery of gasoline demand to pre-pandemic levels uncertain
  – Influenced by size of workforce that maintains remote working, along with pace of transit ridership recovery

• Refinery operational changes to maximize diesel production at expense of jet fuel production
  – Diesel supplies still adequate since jet fuel demand remains depressed and renewable diesel imports and local production expected to grow over the near-term

• The Martinez refinery closure has decreased spare refinery production capacity in the state
  – As demand continues to recover for gasoline and jet fuel, future significant unplanned refinery outages could result in more severe and prolonged price spikes
Refiners Adjust Ratio of Jet Production

Proportion of Jet Fuel & ULSD Production
California Refineries

<table>
<thead>
<tr>
<th>Year</th>
<th>Jet Fuel</th>
<th>Ultra Low Sulfur Diesel (ULSD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>46.9%</td>
<td>53.1%</td>
</tr>
<tr>
<td>2019</td>
<td>45.0%</td>
<td>55.0%</td>
</tr>
<tr>
<td>2020 Pre SAH</td>
<td>46.4%</td>
<td>53.6%</td>
</tr>
<tr>
<td>2020 Post SAH</td>
<td>32.5%</td>
<td>67.5%</td>
</tr>
</tbody>
</table>


Note: 2020 Pre-Stay-at-Home (SAH) is average of data through week ending 3/13/20. Post SAH is average of data from week ending 3/20/2020 through week ending 4/23/2021.
Gasolines Flows – Northern California

- Post closure of Martinez refinery – market rebalanced
- Marine exports declined
- Marine imports increased
- Most pronounced shift was increased reliance on supply from Southern California & the Pacific Northwest
- All of this change was manageable because demand was lower-than-normal due to the pandemic & incremental supply was readily available from nearby sources

Source: California Energy Commission.
Diesel Flows – Northern California

- Similar change for diesel
- Post closure of Martinez refinery – market rebalanced
- Marine exports declined
- Marine imports increased
- Most pronounced shift was increased reliance on supply from Southern California & the Pacific Northwest
- All of this change was manageable, despite rebounding demand
  - Incremental supply was readily available from nearby sources
  - Higher ratio of diesel output from local refiners due to low jet fuel demand

Source: California Energy Commission
Refinery Conversion Projects

• A refinery closure due to oversupply can also be accompanied by plans to cease traditional refining operations but convert some existing process equipment to produce different types of transportation fuels to meet new trends
  – Marathon – Martinez & Phillips 66 – Rodeo renewable fuel projects reflect such changes in operational plans

• Both companies see strong demand growth for renewable diesel fuel & sustainable aviation fuels
  – California Low Carbon Fuels Standard (LCFS), as well as other West Coast LCFS current (Oregon & British Colombia) and expected (Washington) regulations
  – Increasing demand for renewable diesel & jet fuel will displace additional volumes of fossil diesel and jet fuel over time, placing increased pressure on local refiners that continue producing fossil diesel
  – Decreased fossil diesel production and increased production/imports of renewable diesel help to better align with these growing trends
There is the potential that some of these planned projects could be delayed or even cancelled due to adequacy & economics of feedstock availability.

Current annual capacity - 909 million gallons
Projected
4th quarter 2021 - 1,297 million gallons
4th quarter 2022 - 2,980 million gallon
4th quarter 2023 - 3,838 million gallons
4th quarter 2024 - 5,222 million gallons

Source: California Energy Commission analysis of multiple reports and announcements.
Potential Impacts of Refinery Closures

• Refinery closures can also occur when proposed refinery modification requirements exceed a company capital expenditure threshold that compels a premature refinery consolidation unrelated to changing fuel market trends
  – PBF Energy’s letter & stated position to close facility if more stringent proposed standard is adopted

• A premature refinery closure could result in temporary fuel supply constraints that increase costs
  – Recent history illustrates the potential for fuel price increases
  – Torrance ESP explosion in 2015 & subsequent idling of gasoline producing equipment for 17 months
  – Statewide gasoline prices increased an average of 35 cents per gallon for drivers and businesses during 2015
Retail Gasoline Price Differences
California Less U.S. Average

Sources: California Energy Commission analysis of Energy Information Administration data.

Regular grade gasoline

Increase of 35.3 cents
Torrance Refinery Outage – Market Changes

- The loss of gasoline supply from the Torrance refinery resulted in a price spike of sufficient magnitude to incentivize:
  - Other California refiners to consistently over-produce gasoline during the higher demand season
  - Increased imports of more expensive gasoline and blending components at a higher level for a sustained period of time

Source: California Energy Commission analysis of weekly import data from the Energy Information Administration.

3/27/15-1/1/16 averaged 60.7 thous. bbls per day (TBD)
18.3 TBD same period during 2014
Highest quantity since 2007
• A premature refinery closure over the near-term could result in even greater market impacts compared to the Torrance refinery outage in 2015-2016:
  – Could be worse due to decreased refinery spare production capacity in the state that has been diminished due to the permanent idling of the Marathon – Martinez refinery
  – Gasoline & diesel fuel supply/demand balances have been tightening with strong diesel fuel demand growth & continued gradual rebound in gasoline consumption
  – A return to higher jet fuel demand levels will remove additional flexibility from the marketplace

• However, over the longer-term, continued demand declines for gasoline & the continued erosion of fossil diesel fuel demand can create conditions of oversupply that could result in additional refinery consolidation due to these trends
Additional Questions

Scott’s Oriole (male), Cat Creek, Palm Desert, CA - March 31, 2021.
Additional Information
Since the peak in 2004, gasoline consumption declined seven of the next eight years. Gasoline consumption dropped 8.94 percent between 2004 and 2012.

2019 consumption 15.366 billion gallons, 1.3 percent lower than 2018.

2019 consumption declined by 1.3 percent to 15.37 billion gallons.

- First multi-year decline not related to an economic downturn.
- Has California’s gasoline demand peaked?

Source: California Energy Commission.
Gasoline & Ethanol

California gasoline contains roughly 10 percent ethanol by volume.
- Little change due to E10 blend wall.
- Growing sales of E85 has edged up total ethanol concentration.
  - 10.01 percent in 2010
  - 10.19 percent in 2019

40.6 million gallons of E85 sold in 2019.

Source: California Energy Commission.
Increasing quantities of renewable fuels are being blended with fossil diesel fuel or used as R-100 & B-100.
- 5.1 percent in 2014
- 22.3 percent in 2019

Obligated parties under the Low Carbon Fuels Standard are preferentially electing to use renewable diesel over biodiesel.
Over the last five years, renewable diesel fuel use has steadily climbed to reach a record 618 million gallons by 2019 as additional production facilities came online and obligated parties under the state’s LCFS turned to ever greater quantities of renewable diesel to help achieve compliance with their carbon deficit for both gasoline and diesel fuel sales.

- Obligated parties under the Low Carbon Fuels Standard are preferentially electing to use renewable diesel over biodiesel.

Source: California Energy Commission analysis of CDTFA & CARB LCFS data.
Commercial jet fuel consumption has plateaued over the last three years. Alternative jet fuel use is limited but growing.

- 1.86 million gallons in 2019

Sources: California Energy Commission analysis of Petroleum Industry Information Reporting Act (PIIRA) & Energy Information Administration (EIA) data.
Importance of renewable diesel for LCFS compliance forecast to grow and remain strong through 2030.
Gasoline Production - North

Northern California CARB Gasoline Production (with 5-Year High-Low Band)

SF Bay Area refineries react to supply shortfall & higher margins – consistently producing above the high-low historical range.

Source: California Energy Commission.

Data through December 25, 2015
West Coast Foreign Gasoline Imports

Source: California Energy Commission analysis of weekly import data from the Energy Information Administration.

3/27/15-1/1/16 averaged 60.7 thou. bbls per day (TBD)
18.3 TBD same period during 2014

Highest quantity since 2007
Gasoline Production - North

Northern California CARB Gasoline Production (with 5-Year High-Low Band)

SF Bay Area refineries throttle back to within their historical range.

Source: California Energy Commission.

Data through August 26, 2016
West Coast Foreign Gasoline Imports

Unseasonal high imports continue.

Y-T-D 2016 averaged 32.3 TBD, 13.1 TBD same period 2014

Source: California Energy Commission analysis of weekly import data from the Energy Information Administration.
Retail Gasoline Price Differences
California Less U.S. Average

Sources: California Energy Commission analysis of Energy Information Administration data.

Y-T-D data through August 29, 2016

Regular grade gasoline

Since full restart of Torrance units – differential has averaged 54.4 cents per gallon, 47.2 cpg as of 8/29/16, back to new “normal” differential when accounting for CAR & LCFS

Decrease of 13.4 cents