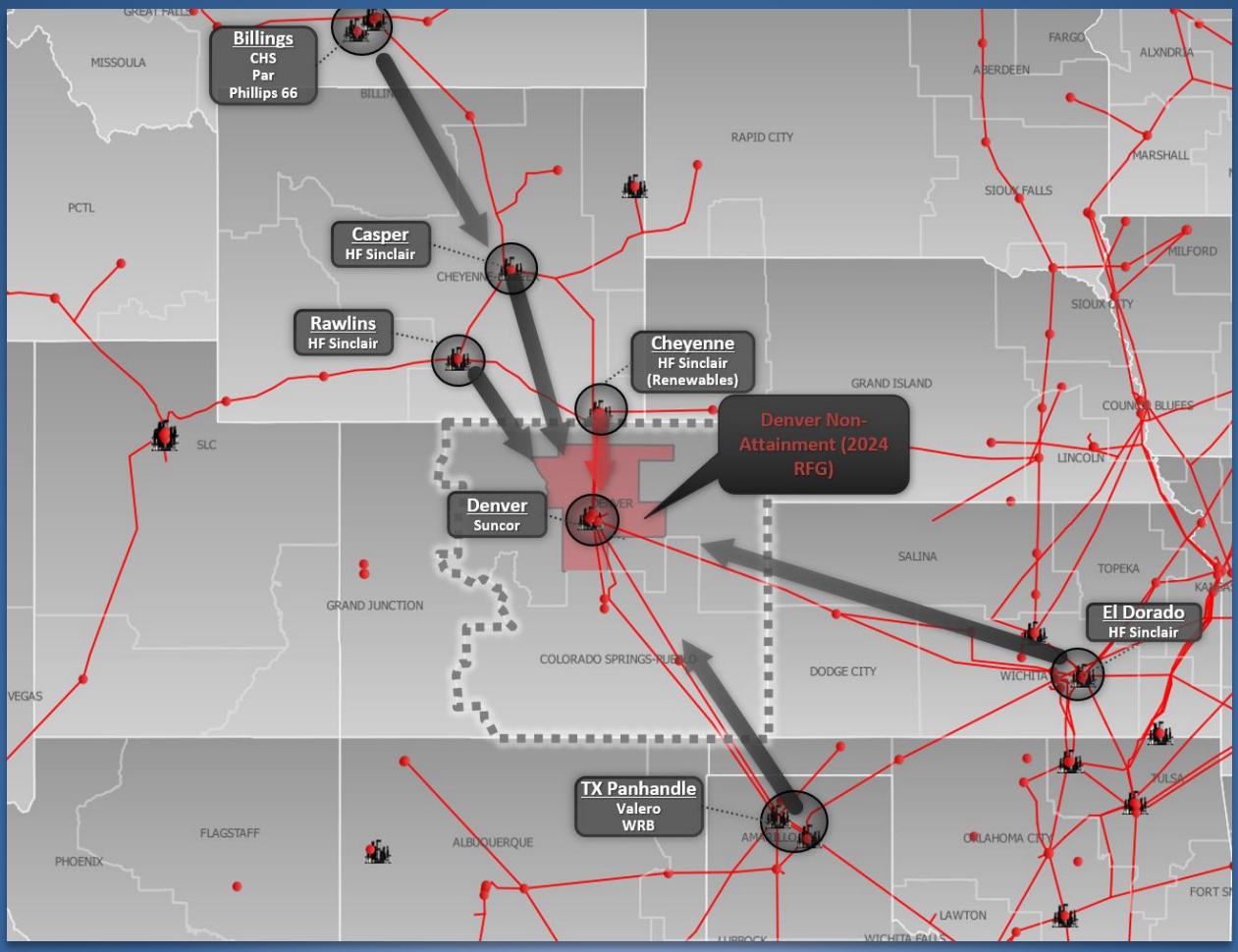


# IMPACT OF THE SHIFT TO REFORMULATED GASOLINE ON COLORADO AND FRONT RANGE FUEL MARKETS" WAS CONDUCTED BY EAI, INC. FOR THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE)

**MARCH 30, 2024**

*STUDY **DRAFT***

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# INTRODUCTION

## Regulatory Background and Purpose of Study

This study "IMPACT OF THE SHIFT TO REFORMULATED GASOLINE ON COLORADO AND FRONT RANGE FUEL MARKETS" WAS CONDUCTED BY EAI, INC. FOR THE COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT (CDPHE) to assess the potential impacts from the implementation of low RVP reformulated gasoline in the summer of 2024, resulting changes to existing fuel distribution patterns, and supply impacts on normal fuel distribution operations including but not limited to the following:

- Possible market disruptions
- Possible supply shortages
- Determine possible high level estimated price impacts a disruption involving the Colorado and/or Denver/Front Range (DFR) fuels markets could entail utilizing currently available data (without surveying refiners on their individual costs to produce RFG and conventional fuels)
- Detail and compare economic advantages and disadvantages to existing market suppliers and market competitiveness
- Investigate emergency measures that are available and that could be undertaken in the event of a supply disruption in the CO/DFR markets.

Effective as of October 7, 2022, nine counties (see **Figure 1**) within the Colorado Front Range (CFR, consists of the Denver and Colorado Springs-Pueblo micro-markets with boundaries also shown in **Figure 1**) had been reclassified as "Severe" non-attainment status for ambient air ozone levels. This area is collectively referred to as the non-attainment area (NAA).

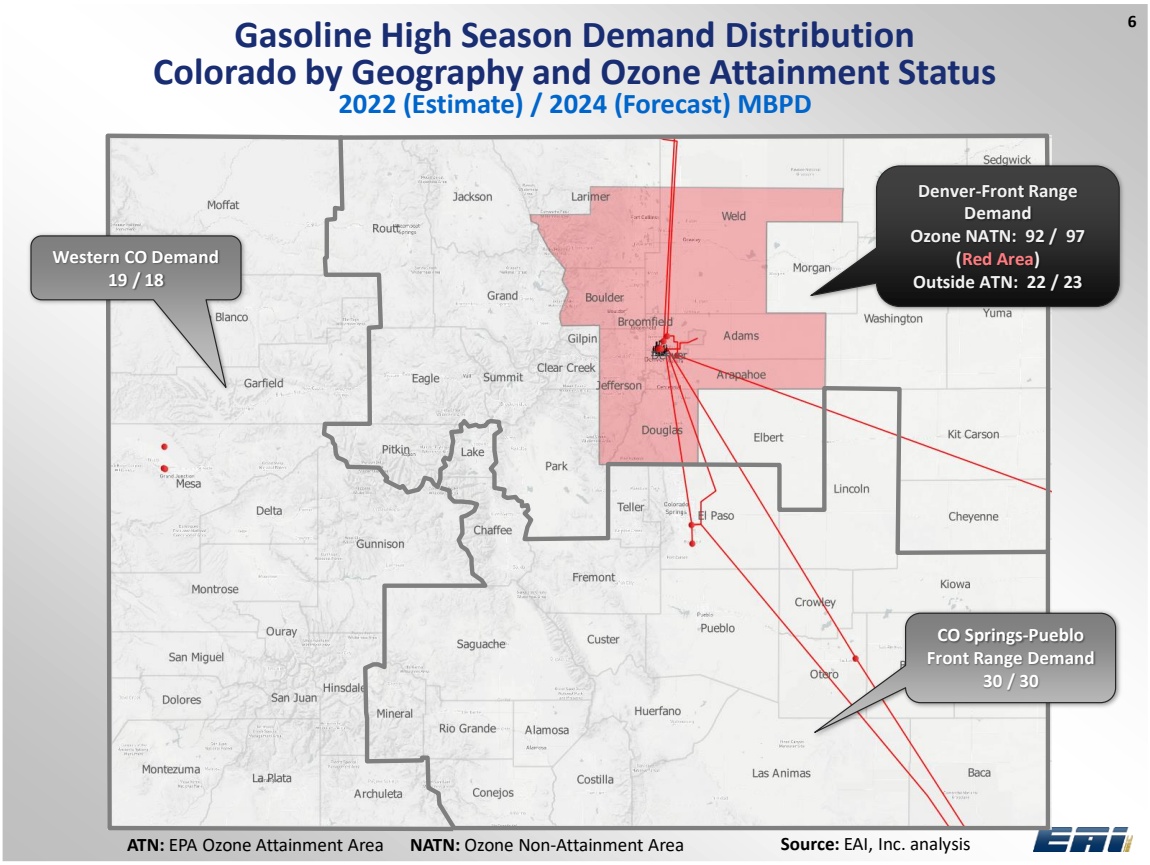


Figure 1

Along with this classification, the prohibition of conventional gasoline sales was to have begun on November 7, 2023. This requires that gasoline sold in the NAA will need to comply with the summer reformulated gasoline (RFG) Reid Vapor Pressure (RVP) standard of 7.4 psi beginning on June 1,2024 for wholesale purchaser consumers and for all other parties beginning on May 1, 2024.

Given the above mandate, the preparation time for companies operating refineries, pipelines/other transportation modes, terminals, and marketing is approximately 19 months with inclusion of a one-month allowance for start-up.

This allowable preparation period is considerably shorter than the estimated 24-to-36 months schedule minimum to support all the planning, permitting, implementation and startup activities that are necessary to support an orderly, reliable and economically viable shift to a completely new fuel type (in the CFR) in one of the most seasonally constrained large petroleum markets in the country.

As a result of the constrained time schedule, it is likely that not all the traditional gasoline suppliers to the CFR will be able to produce RFG in a 1-to-1 replacement of their historical gasoline market footprint. Furthermore, logistics ultimately constrain potential new sources of gasoline supply for the CFR market. These aforementioned factors and the remoteness of the

CFR market from known reliable and ratable sources of replenishment RFG are very likely to cause refined product shortages and corresponding price increases.

**EAI, INC. CFR RFG Mandate and Supply-Cost Impact Assessment Basis**

There are 5 refineries that have a regular and significant gasoline supply presence in the CFR market; Suncor-Commerce City, HF Sinclair-Rawlins, HF Sinclair-El Dorado, WRB-Borger, and Valero-McKee. Other Rocky Mountain refiners either have logistical barriers in accessing this market or limited to no excess sustainable gasoline supply for the CFR during the high demand season ("high season", May-September).

Pipeline capacity (Oneok Tulsa-Denver) supporting incremental Midcontinent and Gulf Coast supply into the CFR market is constrained and generally allocated during the high season.

EAI, Inc. employed its Network Balance Forecast (NBF) model process integrating the CFR market with all relevant supply/refining sources and supporting logistical options along with other markets that compete for the same refinery/supply sources. The NBF process was applied seasonally to address the May through September Low RVP gasoline supply mandate along with representative source barrel pricing, transportation costs and incremental supply costs for the CFR market.

Based on EAI, Inc.'s research and tracking of the U.S. / Rocky Mountain downstream business, there are no known, publicly announced refiner commitments to supply RFG to the 2024 CFR high season market. There are two refineries that are highly likely to or currently produce RFG:

1. Suncor-Denver which had not produced RFG and is highly dependent on the CFR market, and
2. Valero-McKee that has produced RFG for the Phoenix and Dallas-Fort Worth markets.

Given the relatively short supply network implementation schedule and, for some of the refineries, alternative market options, EAI, Inc. defined a set of scenarios (see **Figure 2**), their probability for occurring, and relative impact on pricing to bound likely supply and product pricing outlooks for the first CFR RFG High Demand Season 2024.

## Colorado Front Range RFG Supply Scenarios

8

CFR RFG Supply Scenarios

| Scenario | Price Impact (1 = Highest, 3 = Lowest) | Probability (1 = Highest, 3 = Lowest) | Refiner / Supplier 1 | Refiner / Supplier 2 | Refiner / Supplier 3 | Refiner / Supplier 4 | Refiner / Supplier 5 | Refiner / Supplier 6 | Gulf Coast via Oneok/Chase | Gulf Coast via Enterprise | Ethanol | RFG Supply Shortfall, MBPD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A | 3 | 3 | FULL | FULL | FULL | FULL | FULL | FULL | X | X | Maintain 10% blending | 0.0 |
| B | 3 | 1 | FULL | FULL | X | FULL | FULL | FULL | X | X | Maintain 10% blending | 15.1 |
| C | 3 | 2 | FULL | FULL | X | FULL | PARTIAL | FULL | X | X | Maintain 10% blending | 20.3 |
| D | 3 | 1 | FULL | FULL | X | FULL | FULL | PARTIAL | X | X | Maintain 10% blending | 20.8 |
| E | 3 | 2 | FULL | FULL | X | PARTIAL | FULL | FULL | X | X | Maintain 10% blending | 22.9 |
| F | 2 | 2 | FULL | FULL | X | FULL | PARTIAL | PARTIAL | X | X | Maintain 10% blending | 26.0 |
| G | 2 | 2 | FULL | FULL | X | PARTIAL | PARTIAL | FULL | X | X | Maintain 10% blending | 28.1 |
| H | 2 | 2 | FULL | FULL | X | PARTIAL | FULL | PARTIAL | X | X | Maintain 10% blending | 28.6 |
| I | 2 | 2 | FULL | FULL | X | PARTIAL | PARTIAL | PARTIAL | X | X | Maintain 10% blending | 33.8 |
| J | 1 | 3 | FULL | FULL | X | PARTIAL | X | PARTIAL | X | X | Maintain 10% blending | 44.2 |

**Refiner / Suppliers** are anonymized in consideration of confidentiality
**Full** = Supplier converts 100% of traditional gasoline supplied to NAA to RFG
**Partial** = Supplier converts a substantial portion of traditional gasoline supplied to NAA to RFG
**X** = Supplier does not convert NAA gasoline supply to RFG (exits market)

Figure 2

## KEY TAKEAWAYS

### CFR RFG Cost Impacts-Summer (High Season) 2024

The shift to RFG in the CFR market represents a considerable risk exposure to relatively high fuel costs for the wholesale, retail and commercial markets as well as to other Colorado markets that are connected to the CFR market. These cost impacts apply not only to RFG but also to conventional gasoline, distillate products and jet fuel which represent a sizeable share of the Colorado fuels market.

With the startup of the EPA RFG mandate in May 2024, the CFR ozone non-attainment area and peripheral market area for gasoline are projected to have a relatively high probability of experiencing exposure to sustained high RFG prices that are at least 60 CPG over Midcontinent spot conventional gasoline (MC spot CNV) pricing delivered into Denver with periodic sustained spikes to levels at least in the 117 to 141 CPG range over MC spot CNV. MC spot fuel pricing with added pipeline costs to access the CFR dominant wholesale fuel terminals is used by the petroleum industry as a benchmark for CFR wholesale terminal rack pricing.

The wholesale terminal rack fuel pricing directly translates to similar magnitude price increases at retail sites for the end-market consumer. Total impact to the consumer for the 2024 low RVP

RFG effective season (May 1st – Sept 15th) is $421 MM and $62 MM for gasoline and diesel, respectively (see **Table 1**).

| 2024 NAA RFG Implementation Price and Consumer Impact | | | |
|---|---|---|---|
| Product | Supply Shortfall / Shift, MBPD | Sustained Price Inpact, CPG | Consumer Impact, (2024 High Season), $MM |
| **Gasoline** | 15 | 62 | $ 431.22 |
| **Diesel** | 4 | 20 | $ 61.83 |

Table 1

**RFG Supply-Scenarios and CFR Shortfalls and Replenishment Needs**

The aforementioned pricing and cost to consumer impacts were realized for one of the most probable set of supply and market responses but also having the least impact with respect to fuel shortfall levels. In fact, for all of the 2024 Summer RFG supply-demand scenarios analyzed by EAI, Inc., supply capacity from traditional sources and transportation modes and routes were constrained and RFG shortfalls ranged from 15 MBPD to 44 MBPD. This corresponds to 15 and 45% of NAA gasoline demand, respectively.

To satisfy the likely range of CFR RFG product shortfalls, suppliers would have increasing reliance on; 1) shifting Texas Panhandle refinery RFG supply out of the high price Phoenix market to Denver, 2) railing Gulf Coast RFG into Denver and 3) trucking RFG from remote product terminals which would collectively result in increasing probabilities of sustained CFR market shortfalls occurring.

The EPA in association with the Department of Energy can issue emergency waivers which would relax the low RVP requirement for up to 20 days. However, there is uncertainty that it would issue one to Colorado for the NAA without a major refinery or logistics upset. The waiver would have to be requested by the governor of Colorado and EPA would have to make the determination that the RFG shortfall was an extreme and unusual circumstance, was unforeseeable, and that there wasn't a lack of prudent planning by the relevant stakeholders.

**CFR Supply-Cost Curve Foundation**

The supply-cost build up for the CFR 2024 summer season representing a highly probable set of supply and market condition occurrences even with the least RFG supply short fall is shown in **Figure 3**. The basis for each cost segment and its contribution to the overall RFG wholesale clearing price into a representative Denver terminal is summarized below with the costs equal to each component contribution relative to Midcontinent laid-in spot conventional gasoline:

- **GC Spot RFG minus CNV Gasoline Cost:** Using Gulf Cost spot RFG price minus GC spot CNV gasoline price (10 Cents Per Gallon or CPG) as a proxy for incremental production costs for the lowest cost source of RFG in one of the most transparent U.S. markets. The incremental production cost would represent the highest cost supply necessary to satisfy market demand.
- **Rocky Mountain Refinery Production Costs Over GC Costs:** Based on EAI, Inc.'s work as part of previous CFR special fuels studies, incremental refinery costs were estimated as being 4 to 8 CPG over the Gulf Coast RFG proxy production costs addressed previously.
- **Phoenix Opportunity Cost:** Represents Phoenix near equivalent "RFG" grade market price less transportation costs from the Valero, McKee refinery and added costs to transport these RFG swing barrels to Denver via NuStar Pipeline. The contribution of this alternative RFG supply source to the overall Denver RFG incremental supply costs is 36 CPG.
- **Long Haul Trucked RFG Cost:** Represents RFG sourced at the Grapevine terminal Northeast of Dallas and trucked to Denver with an added incremental cost contribution to Denver RFG of 11 CPG. It should be noted that this length of fuel haul is likely not feasible on a sustained basis and, as is the case for many refined product terminals, may not have open capacity to service another market.
- **Supply Upset Costs**: Represents the periodic and sustained supply shortfalls with increasing reliance on higher risk product sources and transportation modes and estimated to contribute a range of 56 to 76 CPG additional costs to Denver incremental RFG supply.

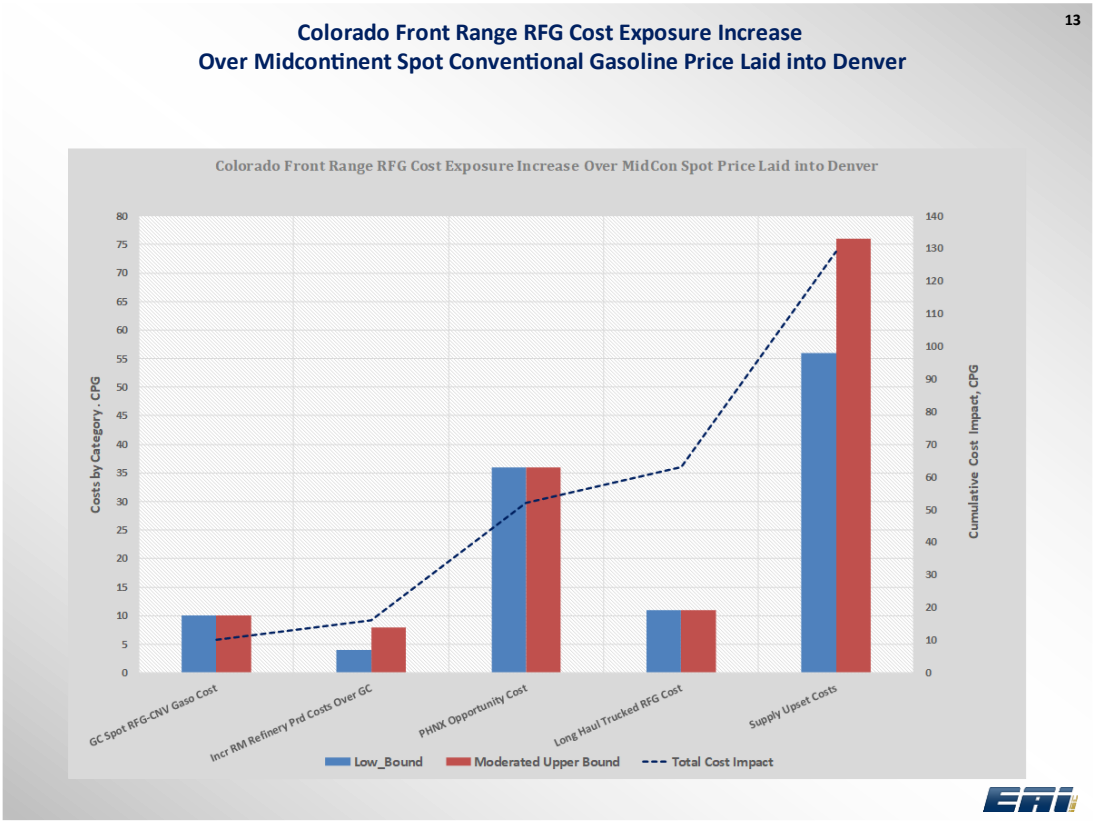


Figure 3

## CFR MARKET BACKGROUND AND CHARACTERISTICS

### Current State of the CFR Market

The CFR area consists of dynamic, complex, and interlocked markets that are rather distinct from the surrounding market areas in terms of refined product supplier mix, supply access, and market-specific grades. The CFR markets are relatively isolated from large, refined product supply hubs like the Gulf Coast (Houston-Beaumont) and thus are reliant on a relatively small number of supply sources. **Figure 4** shows the primary CFR market supply corridors (4 of them plus the local Suncor Energy refinery) and **Figure 5** shows the approximate gasoline contributions to the CFR from the major traditional suppliers in 2022.

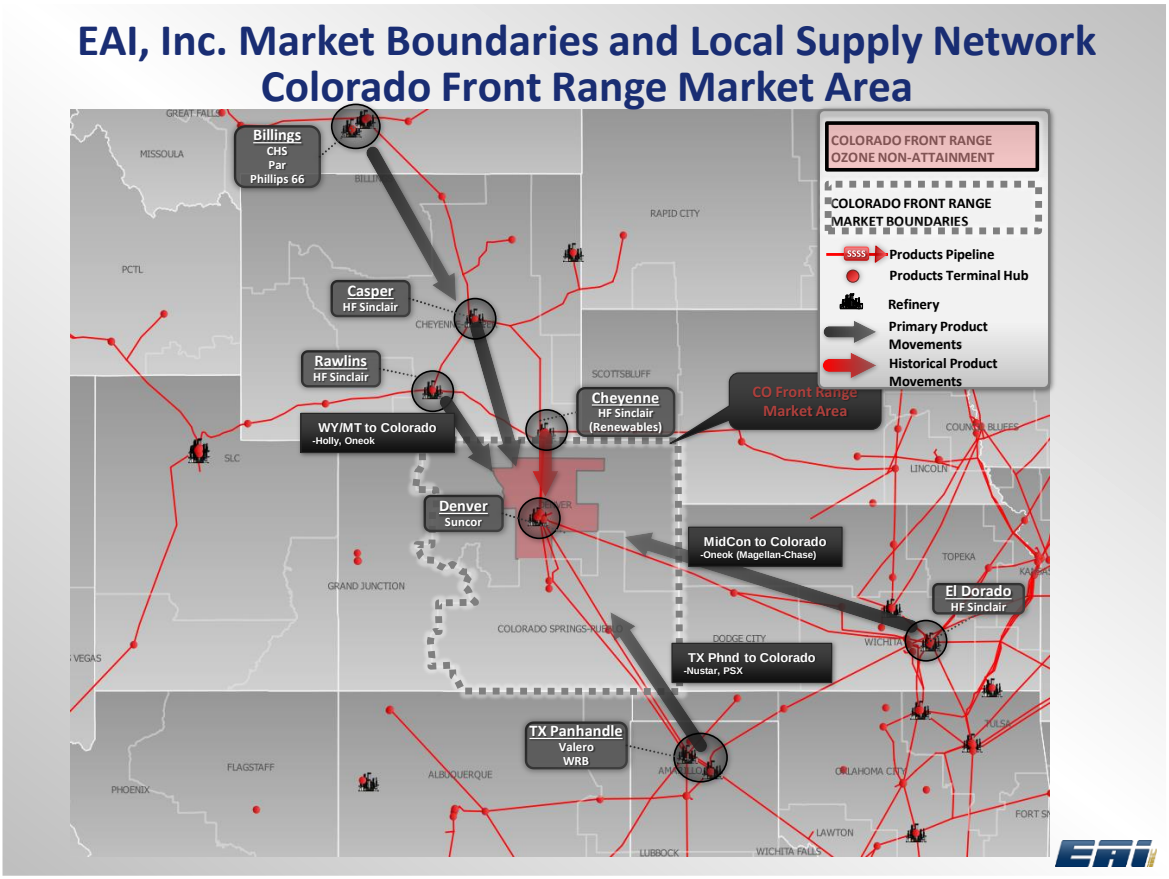
EAI, Inc. Market Boundaries and Local Supply Network
Colorado Front Range Market Area
COLORADO FRONT RANGE OZONE NON-ATTAINMENT
COLORADO FRONT RANGE MARKET BOUNDARIES
Products Pipeline
Products Terminal Hub
Refinery
Primary Product Movements
Historical Product Movements
Billings
CHS
Par
Phillips 66
Casper
HF Sinclair
Rawlins
HF Sinclair
WY/MT to Colorado
-Holly, Oneok
Cheyenne
HF Sinclair
(Renewables)
CO Front Range Market Area
Denver
Suncor
MidCon to Colorado
-Oneok (Magellan-Chase)
El Dorado
HF Sinclair
TX Phnd to Colorado
-Nustar, PSX
TX Panhandle
Valero
WRB
GREAT FALLS
MISSOULA
RAPID CITY
PCTL
SCOTTSBLUFF
SLC
GRAND JUNCTION
COLORADO SPRINGS
DODGE CITY
WICHITA
TOPEKA
LINCOLN
VEGAS
FLAGSTAFF
PHOENIX
ALBUQUERQUE
OKLAHOMA CITY
TULSA
LAWTON
LUBBOCK
WICHITA FALLS

Figure 4

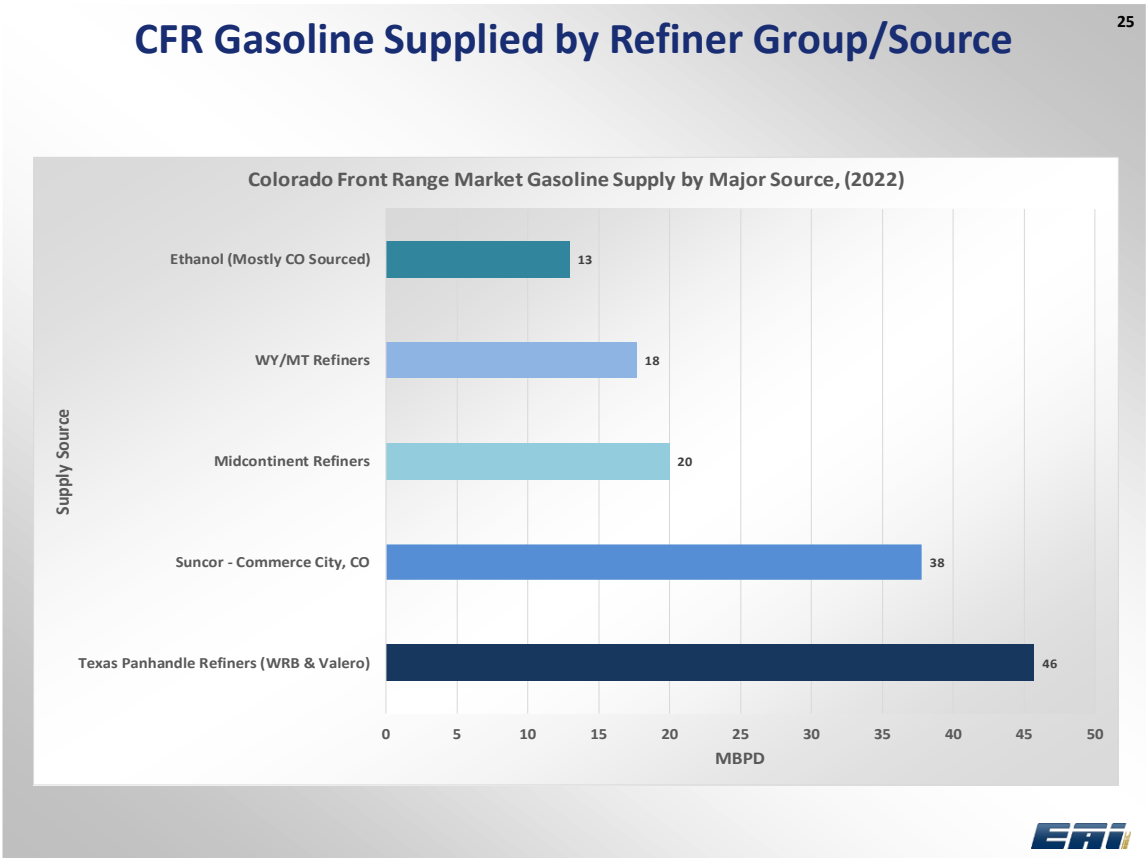


Figure 5

As stated previously, effective as of October 7, 2022, nine counties (the NAA) within the CFR market have been reclassified as "Severe" non-attainment status for ambient air ozone levels and thus will require reformulated gasoline grade starting in May of 2024. The NAA within the context of existing petroleum product distribution systems is shown in **Figure 6**.

This area encompasses major portions of the CFR market and includes both major populated areas (Denver, Boulder, Fort Collins, Castle Rock and Greeley) and a larger control area that includes areas of eastern, northeastern and northern Colorado.

Counties included in this area are Adams, Arapahoe, Boulder, Broomfield, Denver, Douglas, Jefferson, Larimer and Weld. The NAA previously required a boutique grade of gasoline having a lower RVP of 7.8 psi with a 1 psi ethanol waiver. Other gasoline market areas in Colorado include the Colorado Springs Front Range market area to the south and the Grand Junction – Western Slope market area to the west.

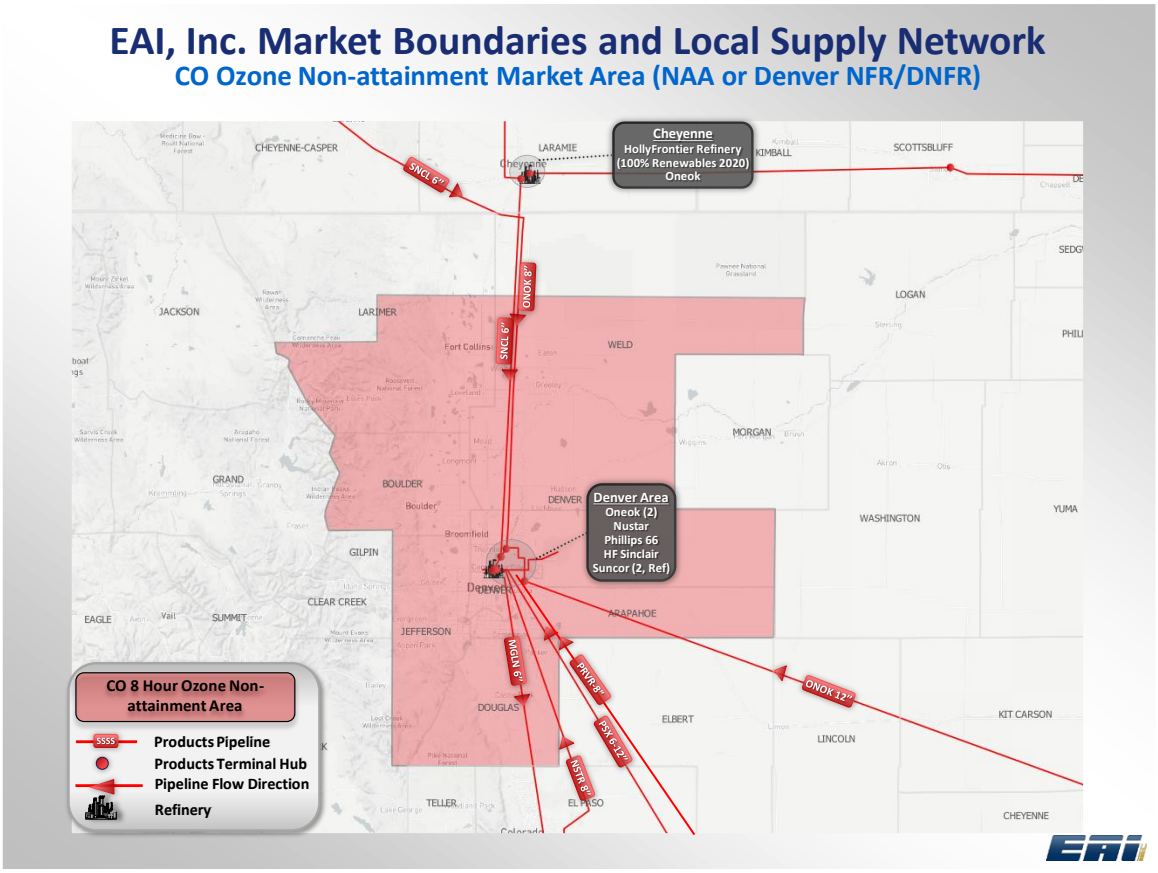


Figure 6

An overview of the state of Colorado and the Denver Metro/North Front Range program area are shown in **Figure 1** with estimates of gasoline consumed in the various sub-regions. Total gasoline, diesel, and jet fuel demand in the CFR market was estimated to be 134, 51, and 31 MBPD, respectively, in 2022.

The NAA where RFG is required consists of more than 80% of the total gasoline demand in the Denver micro-market, however it is likely that RFG will also be sold in adjacent regions to some degree as supply chains continue to adjust. The total gasoline demand in the Western Colorado and Colorado Springs – Pueblo markets is roughly 19 and 30 MBPD, respectively.

CFR has favorable demographics and population growth that supports strong refined product consumption relative to other U.S. markets. Gasoline consumption is likely to grow the next 3 to 4 years and then undergo flat to moderate decline with increasing EV penetration and declining vehicle miles traveled per person. Diesel and jet fuel consumption growth will offset much of this gasoline decline with total CFR demand approaching 2019 peak levels in the high season of 2024.

EAI, Inc forecasts total refined product consumption to peak around 2027 and decline thereafter (see **Figure 7**). This growth will further constrain pipelines supplying the CFR market and will be amplified during the peak demand months (high season).

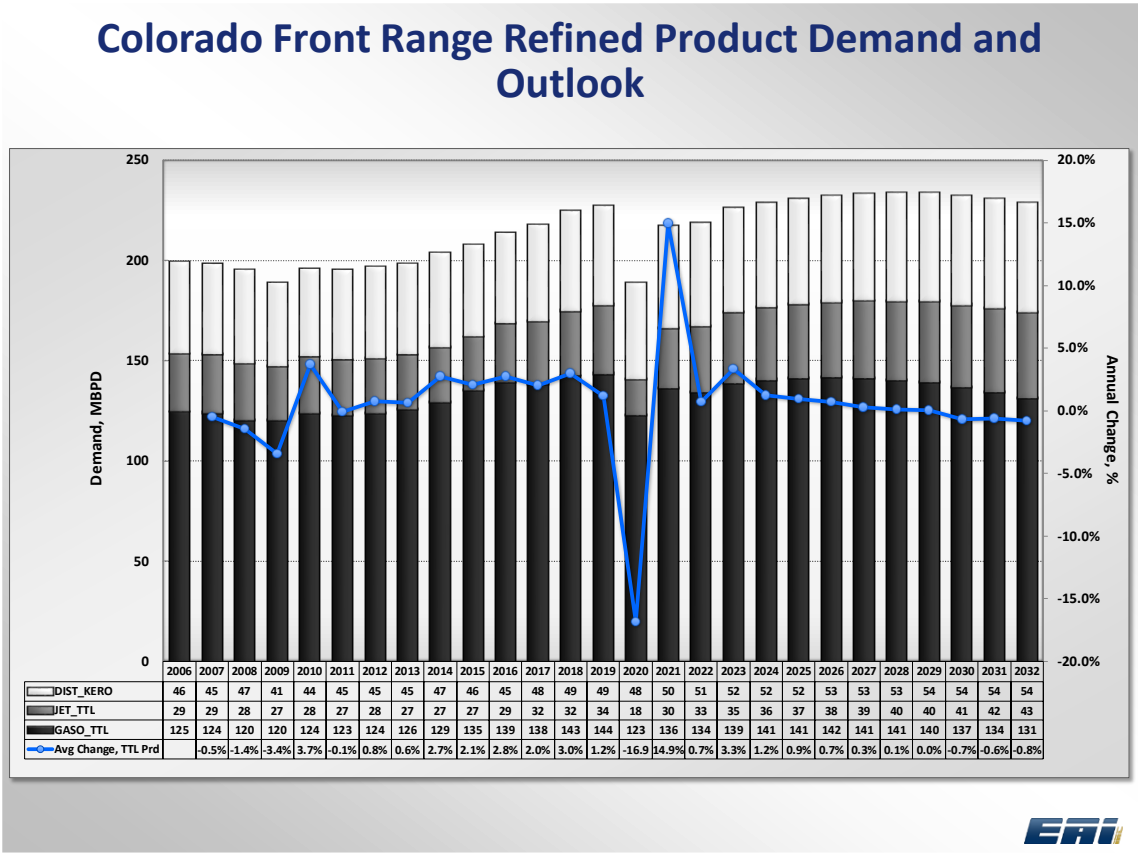


Figure 7

Recent regional refinery closures/conversions have decreased supply options to CFR with most of the refined product supply sources having limited incremental supply or logistical capacity available. With HollyFrontier Cheyenne closure and conversion to renewables in 2020, the CFR lost a major source of "local" gasoline/distillate supply.

Other closures/conversions in the region such as Calumet Great Falls and Marathon Gallup and Dickinson have further tightened refined product supply across the Rockies. This lost refining capacity has made other alternative sources of supply less available to the CFR, has increased the cost of the marginal barrel in the market. Utilization of the other Rockies refineries has steadily increased to between 90 and 100% in late 2023 into 2024 (see **Figure 8**).

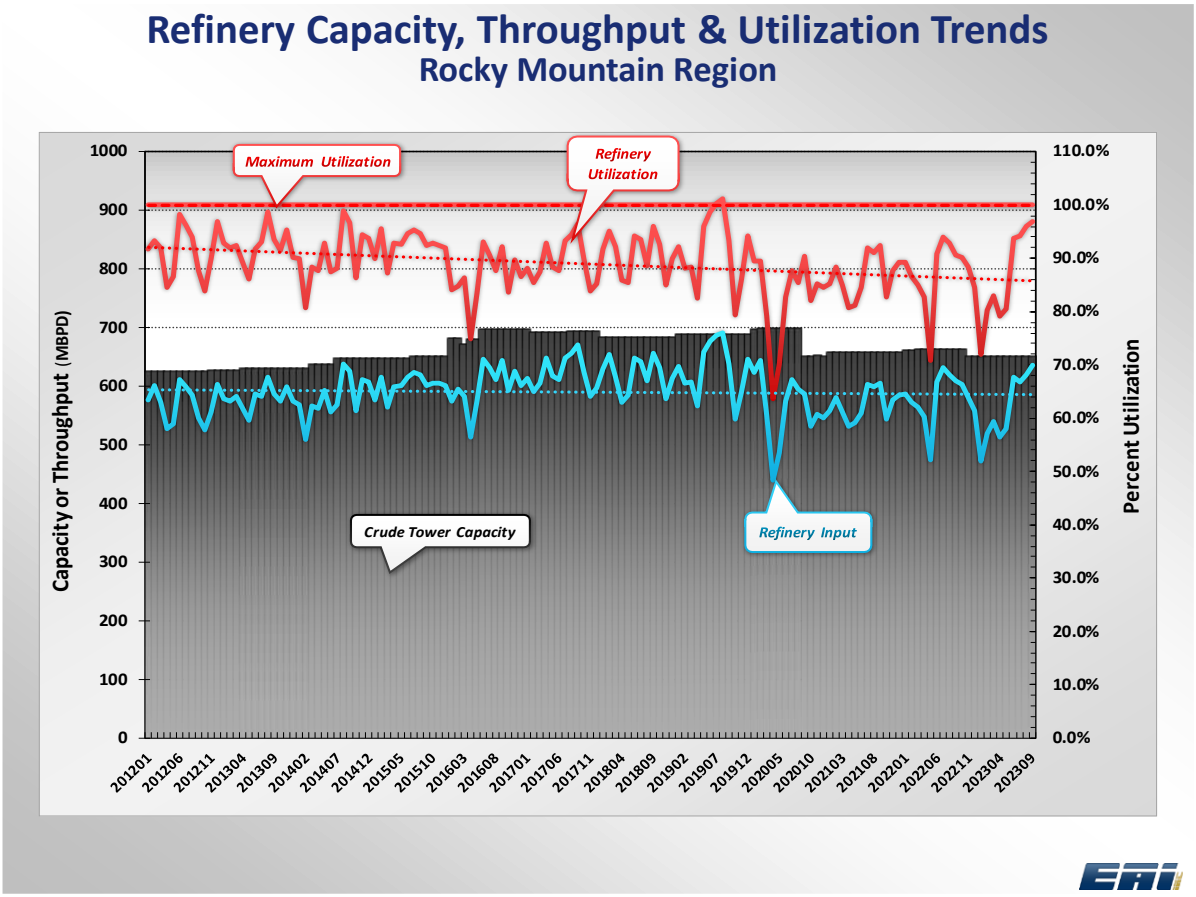


Figure 8

The capacities and utilization rates of the remaining refineries supplying the CFR market have also generally increased. With the exception of the local Suncor refinery, each supplier group significantly increased gasoline deliveries into the CFR market to offset the loss of other supply.

The Midcontinent refiners tend to be the swing/incremental supply into the CFR market depending on prevailing economics and typically have more market optionality than other major CFR suppliers.

Non-CFR/Cheyenne supply accounted for 53% of the total CFR supply in 2019 compared with 67% in 2022. The result of this is that the CFR market is more dependent on more distant, non-local supply and on fewer refiners/suppliers than ever before.

In addition, as supply has increased from sources located outside of the CFR and Cheyenne, the respective logistical systems facilitating these movements have become more highly utilized on average.

Major pipeline systems supplying CFR have very little or no incremental capacity during the high demand season and recent pipeline expansions have not been enough to overcome lost refining supply and expected consumption growth (see **Figure 9** and **Figure 10**).

## Impact of Lost Refining and Consumption Increase on Existing Refined Product Infrastructure

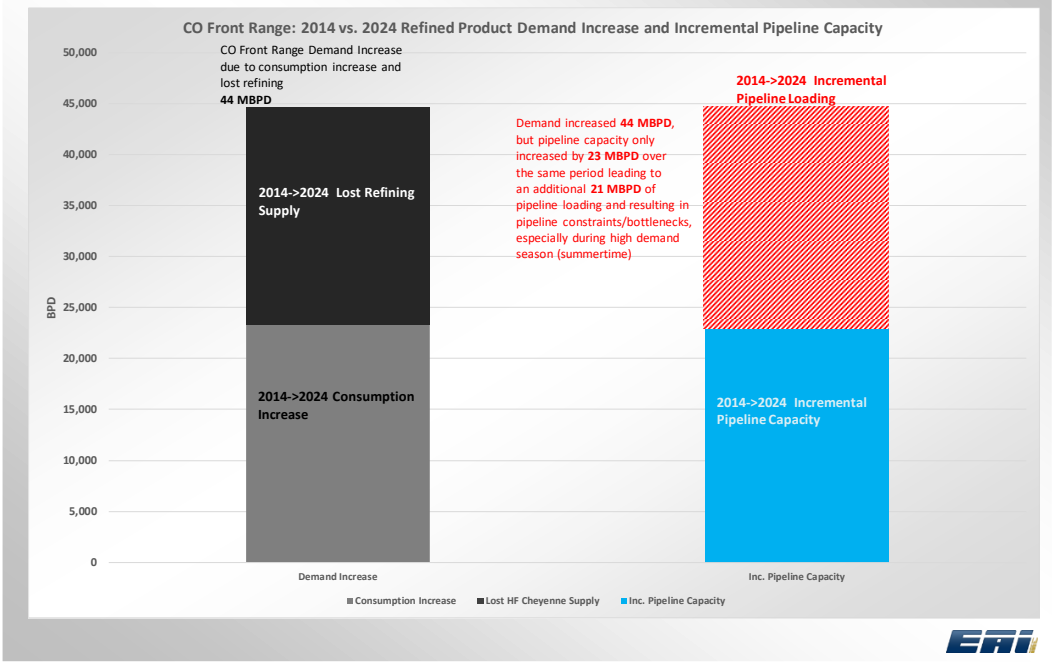


Figure 9

## CFR Pipeline Capacity vs. Movements

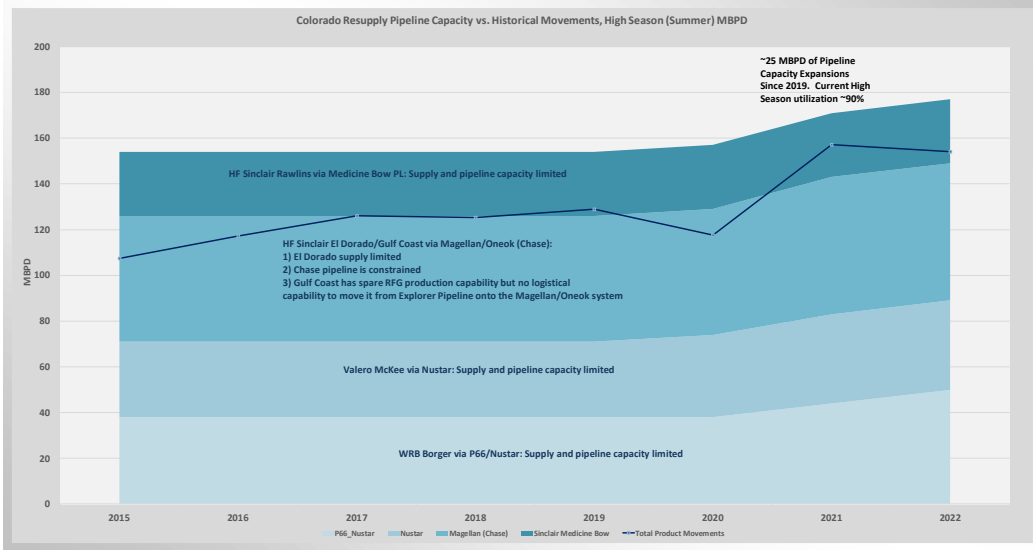


Figure 10

These factors lead to the CFR market being extremely sensitive to refined product supply upsets with limited-to-no slack in the system. Over the past few years, outages and production cuts at the primary refineries supplying the CFR market likely resulted in significant gasoline, diesel, and jet fuel price excursions. **Figure 11** shows the comparison of Denver and Tulsa wholesale rack pricing for gasoline and diesel from 2022 through 2023.

The Tulsa market sits on top of the Group 3 (Midcontinent) spot market and is generally considered the incremental supply and price basis for the Denver market when pipeline capacity (Oneok Tulsa-Denver) connecting the two areas is open. Outages at the Suncor Energy Commerce City refinery and corresponding price excursions are highlighted as follows:

1. Fluid catalytic cracking unit was shut down for a period of time in the summer of 2022 and is correlated to Denver gasoline price increases of up to $0.40/gallon compared to the Tulsa reference point.
2. The entire Suncor Energy refinery was shut down beginning December of 2022 and lasting through March of 2023. This resulted in gasoline and diesel price increases exceeding $1.00/gallon over the Tulsa reference point.
3. During the summer of 2023, Suncor shut down plant 2 (a significant portion of the refinery) resulting in gasoline prices increasing by more than $0.60 over the Tulsa reference point.

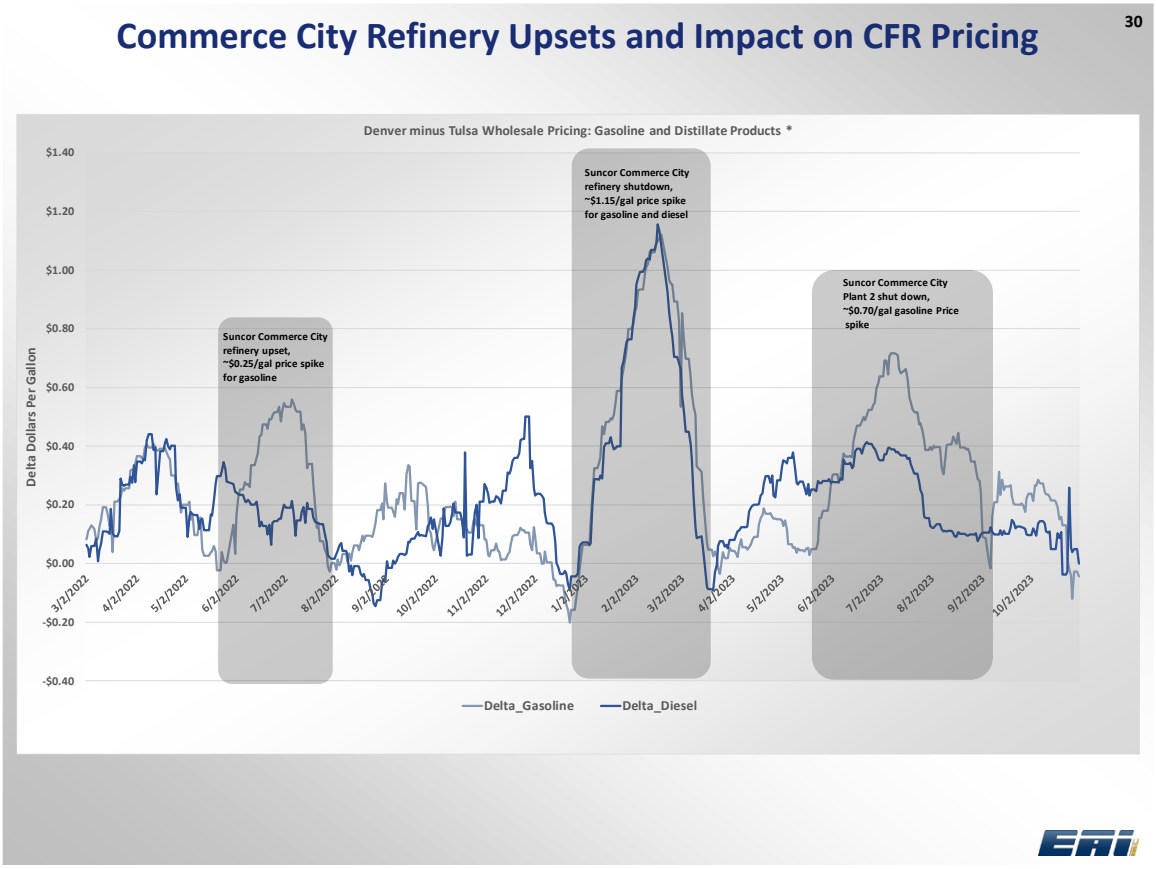


Figure 11

The existing system constraints and market supply tightness coincided with the previous environmental grade of gasoline required in the NAA. With the RFG requirement starting in May of 2024, the situation will be greatly exacerbated and the number of alternative supply sources that are available to the market in the case of supply shortages will be decreased significantly.

## NAA SHIFT TO RFG AND POSSIBLE STAKEHOLDER RESPONSE

The shift to RFG in the NAA will require traditional refiners/suppliers (those that have historically supplied the CFR market) to significantly change their operations and potentially lead to new players in the market.

### Traditional Refiner Conversion of Existing CFR Supply to RFG

To comply with the new RFG specification in the NAA, refiners would have to reduce the RVP of the gasoline they typically produce for the area by approximately 1.4 to 1.8 psi (7.8 psi to 6.4 psi with a 0.4 psi margin of safety depending on specific supply chains and assuming a 1 psi of allowance for 10% ethanol blending). In general, the least costly of refinery shorter term strategies for lower RVP compliance involves modifying operations for increased rejection of higher RVP gasoline blend stocks such as butane and light straight run (LSR) streams. This strategy

typically would require modifying or building fractionation/debutanizer units and modification or expansion of existing rail/tankage facilities to accommodate export of butanes and LSR from the refinery facilities to markets external to the Rockies such as the U.S. Gulf Coast and Midcontinent (Conway).

Aside from expanded capital cost, there are usually other financial consequences of removing butane, LSR, and other light-ends from the gasoline pool. The exported neat LSR and butane streams typically yield much lower value for the refiners vs. sale of those products as part of the gasoline pool. In addition, the removal of butane leads to a loss of octane which is difficult and costly to replace.

The octane loss can be offset by reducing sales of premium gasoline, importation of high octane blendstocks, and increasing reformer severity. However, given the shortfall and increasing value of octane, it's likely that the CFR traditional refiners are already maximizing octane production. In other regions of the U.S. where RFG is required, it is almost always priced at a premium to conventional (high RVP) gasoline reflective of the aforementioned factors that make it more costly to produce as well as the reduced refinery capacity to produce it.

**Figure 12** shows a price comparison between major U.S. RFG markets and adjacent or native conventional markets for the summer season (low RVP) in 2022 and 2023. RFG spot or local rack market pricing indicates a sustained RFG premium over conventional gasoline ranging from 12 to 60+ CPG. Assuming just the added cost of production and associated opportunity costs and no product shortfall, the baseline cost increase for RFG in the Denver NAA would be least 10 CPG and more likely 20+ CPG compared with the prior gasoline specification.

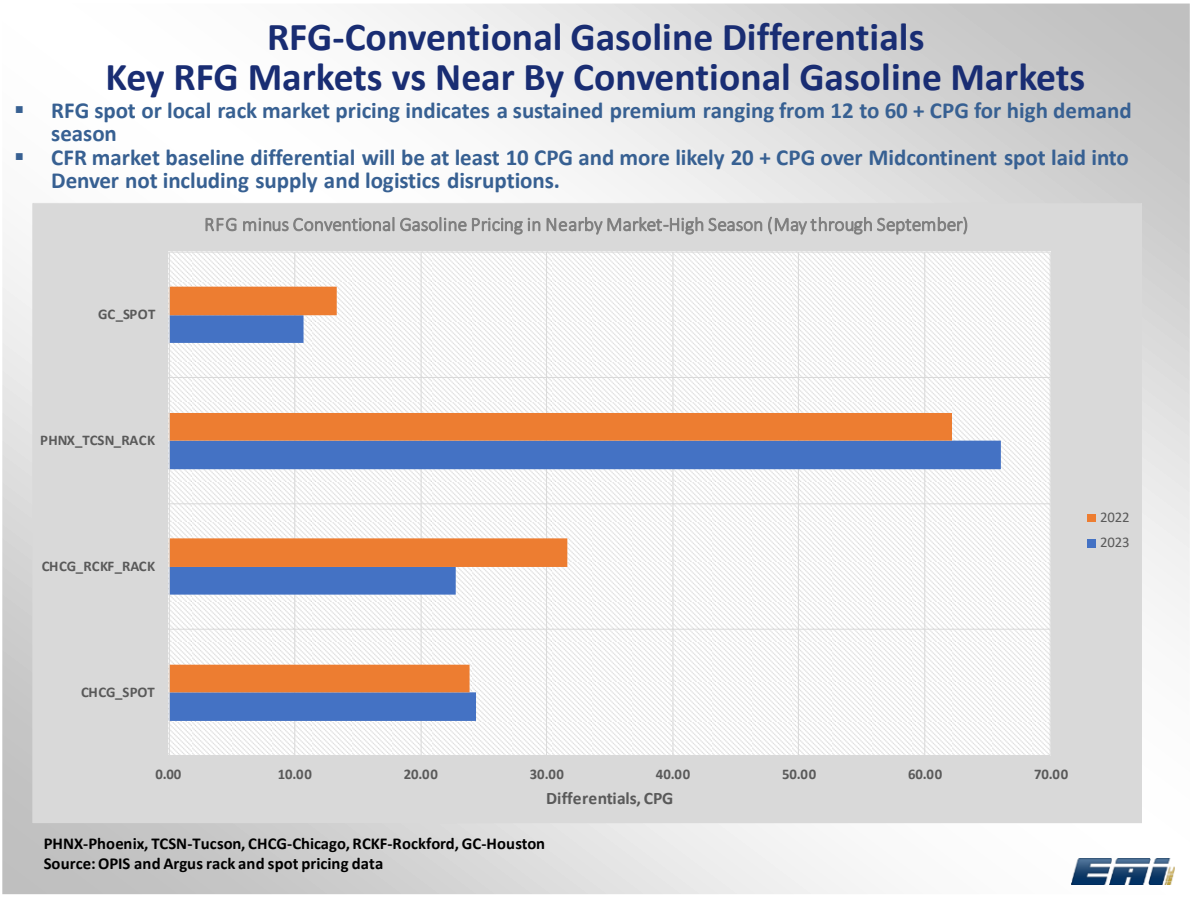


Figure 12

Given the short schedule of RFG implementation in the Denver NAA compared with the time it typically takes to reconfigure refineries to produce RFG in a cost-effective manner, shorter term, higher cost options will be required. This would include importation of high octane and low RVP gasoline blendstocks such as alkylate, forgoing ethanol blending, reducing refinery crude runs and gasoline production, and reducing sales of premium gasoline.

Some traditional NAA refiners that lack existing RFG production capability are likely to utilize some of these aforementioned strategies to convert existing gasoline production to RFG, but there is high probability that not 100% of their historic NAA supply levels could be replaced with RFG.

Importation of high octane and low RVP gasoline blendstocks would typically be done via rail from the Gulf Coast where there is more spare RFG production capacity. This would be a costly option and would be limited by inbound rail capacity at the refineries which are typically configured for moving product such as LPG and heavy fuel oils outbound on rail.

Reconfiguring the rail racks at the refineries to accommodate large, regular inbound shipments of alkylate would likely involve a longer schedule (greater than 12 months), capital investment, and may be limited by land constraints.

Given the short timeline of RFG implementation in the Denver NAA, it is unlikely that refiners/suppliers (including wholesale distributors at the terminal racks) would forgo ethanol blending at any large scale to reduce the RVP of the gasoline. Ethanol is an important blending component particularly for providing a low-cost source of octane.

The gasoline blendstocks provided to the terminal racks by refiners and suppliers would have to be modified to contain higher octane to offset the loss of ethanol. This would ultimately require refiners to reconfigure their production processes (such as increasing reformer severity, importation of high octane blendstocks, or longer-term capital investments).

Furthermore, there is often a disconnect between players at the terminal racks where ethanol is blended into gasoline, and the refiners/suppliers upstream of the rack providing the gasoline blendstocks. Gasoline wholesalers/distributors are incentivized to blend ethanol to "capture" renewable identification numbers (RINs) which can be used to subsidize the price of the fuel which is needed to effectively compete with other players.

Refiners are incentivized to blend ethanol to meet renewable volume obligations (RVOs) set forth by the federal Renewable Fuels Standard (RFS). A retraction of ethanol from the gasoline pool would directly translate to a volume loss and thus more gasoline blendstocks would need to be shipped in on constrained pipelines and sold to offset it. Ethanol is typically railed or trucked into NAA terminal facilities while gasoline is shipped via pipelines.

**Traditional Refiner RFG Capabilities and Shift of Existing Production to CFR**

Given the complexity and cost associated with producing low RVP RFG, it is likely that not all the traditional CFR suppliers will be able to convert 100% of their historical gasoline market footprint. Therefore, there likely will be some level of RFG supply shortfall in the CFR as well as incentive to shift existing RFG production from other markets. The following provides a short synopsis of each major traditional CFR supplier and their respective RFG production capabilities.

1. **Suncor Energy – Commerce City, CO**: EAI, Inc. estimates that the probability is high that Suncor will convert at least a portion of its gasoline supply to RFG grade to supply the Denver NAA as it does not have significant alternative markets to shift to. However, the refinery does not have a history of producing low RVP gasoline (beyond the legacy 7.8 psi w/ ethanol waiver grade) and thus Suncor would have had to have made significant investments/modifications and potentially rail in suitable gasoline blendstocks from outside regions (such as low RVP and high octane alkylate) which will add considerably to the cost of production.
2. **WRB – Borger, TX:** Having previously supplied low RVP gasoline to Kansas City (7.0 psi RVP, with ETOH waiver) and with CFR being an important market outlet for gasoline, P66/WRB is highly likely to shift at least some of its gasoline production to RFG. The refinery has also historically handled fractionation of NGL/straight run materials and has a dedicated pipeline (Phillips 66 Blue Line) which can move propane/butanes from the refinery to

winter storage at Conway, KS. This reduces some of the barriers associated with butane/LSR removal from gasoline.

3. **Valero – McKee, TX:** This is the only CFR supplier that is known to have existing RFG production capability because of its presence in the El Paso 7.0 psi RVP (RFG-like), Phoenix AZRBOB (RFG-like), and Dallas-Fort Worth (RFG) markets. Given Valero's existing RFG production capability and somewhat large CFR presence, it is likely they would invest in additional RFG production capacity and/or swing existing production from other markets. Most of Valero's existing RFG-like gasoline production is sent to the El Paso, TX and Phoenix, AZ markets. Shifted Phoenix RFG is likely to be one of the price setting mechanisms for the Denver market in 2024 as it represents one of the most accessible alternative RFG sources. Phoenix gasoline price has historically been related to Southern California (Los Angeles Spot market) CARB gasoline which is typically priced at a large premium to Gulf Coast and Midcontinent Spot pricing (both RFG and conventional grades). **Figure 13** illustrates this relationship as well as Phoenix vs. Midcontinent gasoline prices translated in the Denver market.

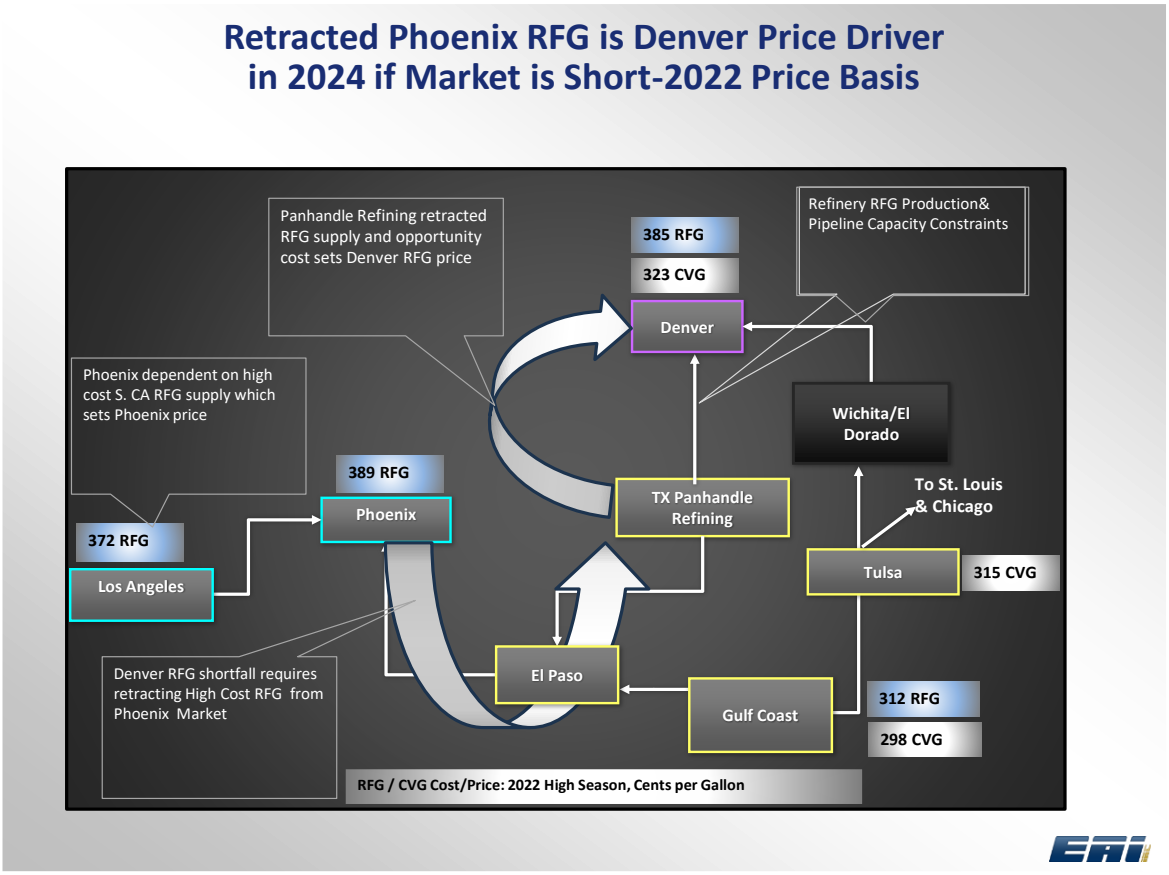


Figure 13

In other words, Phoenix price setting mechanisms would result in a greater than 60 CPG increase over Denver's historical Midcontinent gasoline price relationship. As gasoline supply has become

tighter in California as the result of refinery closures and more stringent Low Carbon Fuel Standards requirements, Phoenix's RFG pricing has increased significantly relative to Gulf Coast spot RFG pricing as shown in **Figure 14**.

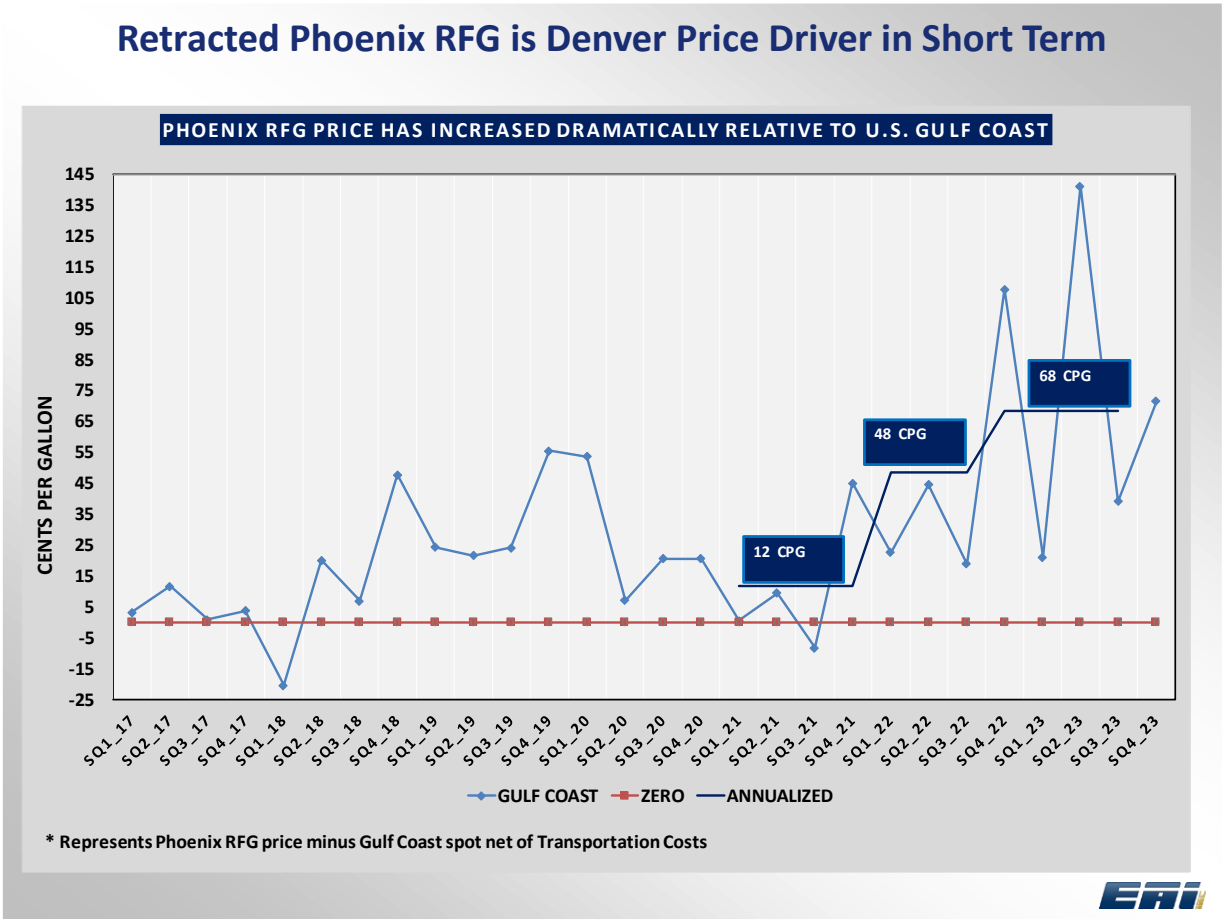


Figure 14

4. **HF Sinclair Rawlins/Casper/Northern (Billings):** Because Billings/Casper have not had a huge historical market presence in CFR, it is conceivable that they will not invest to produce RFG in such small quantities and will focus on supplying conventional gasoline markets. HF Sinclair Rawlins, on the other hand, has a large presence in CFR and thus could be incentivized to produce RFG (at least eventually if not in 2024). However, the refinery does not have a history of producing low RVP gasoline (beyond the 7.8 psi w/ ethanol waiver for Denver and Salt Lake City) and thus would likely need to make investments and/or bring in low RVP gasoline blendstocks.

   If the refinery opts not to produce RFG, they could still supply conventional (9.0 psi RVP summer grade) to areas outside of the non-attainment zone (CO Springs and outlier market areas) in CO and push more conventional to Salt Lake City, Las Vegas, and Idaho.

5. **Midcontinent (Midcon):** As the CFR market tends to provide much higher netback margins during the summer than alternative markets in the Group (OK, KS, NE, IA, etc.), it is likely that HF Sinclair El Dorado and potentially other refiners would pursue production of RFG for the CFR market, especially if HF Sinclair Rawlins does not produce RFG.

**Sourcing Incremental RFG from Non-Traditional Refiners/Suppliers**

If the traditional suppliers are unable to convert 100% of their CFR gasoline market footprint to RFG which is highly probable on a sustained basis for the Summer RFG 2024 startup season, more distant and costly sources will need to make up the shortfall. As **Figure 15** shows, current U.S. RFG production capacity is mostly located in California, Gulf Coast, Midwest, and Northeast with more limited production capability in other areas.

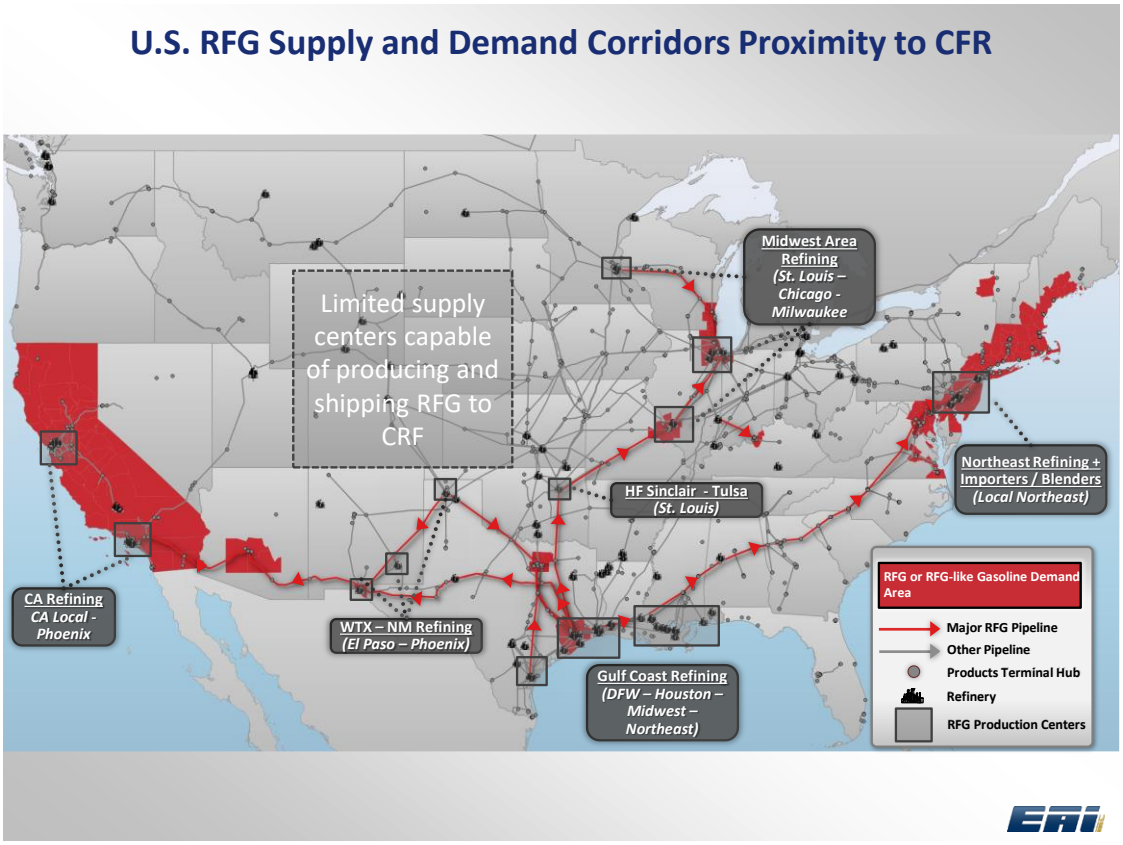


Figure 15

The most likely sources include shifted Phoenix RFG supply (via Valero McKee as discussed previously), and the Gulf Coast refiners which have the most spare production capacity.
According to industry polling that EAI, Inc. has conducted, there does not appear to be existing pipeline logistics that can accommodate RFG movements from the Gulf Coast to the CFR market in 2024 and therefore it would need to be moved via rail and truck.

The CFR market lacks any significant rail offloading logistics to facilitate large, regular inbound movements of refined product or blendstocks in such a short timeframe (2024) and thus it is unlikely to be a factor in shoring up RFG supply. **Figure 16** shows all known petroleum facilities in the CFR market that have existing rail access and/or rail loading/offloading facilities. "Rail access" signifies that there is a rail line/spur in the vicinity of the terminal but does not necessarily mean the facility can accommodate inbound rail movements.

## Colorado Front Range Rail Capabilities for Petroleum Product

33

| Map ID | Company | City | State | Type | Description | Rail Access | Rail Facilities | Gas/Diesel Rail Facilities | Est. Capacity, MBPD | Comment |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Suncor Energy | Commerce City | CO | Refined Product | Suncor refinery with rail facilities to service outbound refined products such as asphalt, residual fuel oil, and LPGs | X | X | | 5-10 | Manifest rail outbound capability. Could be repurposed to offload blendstocks/RFG/diesel but would disrupt LPG/heavy oil exports from the refinery and take significant time and capital investment |
| 2 | Holly Energy | Henderson | CO | Refined Product | Terminal for HF Sinclair's Medicine Bow pipeline originating at the Rawlins refinery. Has additional access to local pipeline systems such as RMPL | X | X | X | ~ 5 MBPD | Has manifest rail offloading capability. Primarily used for ethanol, but it might be able to handle distillates as well (per permit information). Repurposing for blendstocks/RFG/diesel would likely take time and investment and disrupt existing rail operations |
| 3 | Oneok (Magellan) | Dupont | CO | Refined Product | Terminal for Magellan's RMPL system originating in WY with connections to other Denver area facilities | X | X | | < 5 MBPD | Magellan recently constructed a manifest rail offloading rack for butane at their Dupont terminal. The rail rack was designed to handle butane in order to reduce logistical costs associated with that blendstock. Repurposing to blendstocks/RFG/diesel would likely take time and investment |
| 4 | Plains | Tampa | CO | Crude Oil | Built to ship crude by rail out of the DJ Basin prior to pipeline grassroots projects and expansions | X | X | | 70 MBPD | Could be repurposed for refined product inbound, but would need to build a new truck rack and/or retrofit the existing truck offloading facility |
| 5 | Nustar | Commerce City | CO | Refined Product | Terminal for Nustar's McKee to CO Springs and Denver system with connections to other local systems | X | | | N/A | Rail access and deactivated facilities. Does not look appear to have a rail offloading facility and not a lot of room to build a larger scale one |
| 6 | Phillips 66 | Commerce City | CO | Refined Product | Terminal for P66's Borger - Denver and Powder River systems | X | | | N/A | Rail access but no apparent rail offloading/loading facility and not much room to construct one |
| 7 | Oneok (Magellan) | Aurora | CO | Refined Product | Terminal for Magellan's Midcontinent system (formerly Chase) with connections to other local systems | | | | N/A | No rail access and no facilities |
| 8 | Oneok (Magellan) | Fountain | CO | Refined Product | Terminal for Magellan's RMPL system, located in CO Springs market area | X | | | N/A | Adjacent to major rail lines and has open land all. Could build rail facility, but would be costly and this facility is closer to Colorado Springs than Denver |
| 9 | Nustar | Colorado Springs | CO | Refined Product | Terminal for Nustar's McKee to CO Springs and Denver system. | | | | N/A | No rail access and no facilities |

Figure 16

Holly Energy at Henderson, CO and Suncor's Commerce City, CO rail rack are the only known facilities that could potentially accommodate railed refined product or feedstocks in 2024, but capacity would be small, and it would interfere with existing operations/movements. Investment and time would likely be required to repurpose piping and tankage to accommodate such a shift. Suncor could also already be utilizing rail for low RVP/high octane blendstocks for converting existing production to RFG.

Rail transloading (rail offloading directly to tanker trucks) could potentially be used without needing a huge capital investment but would be most suited to diesel as gasoline usually requires vapor recovery facilities and associated permitting.

In the event of the CFR market requiring non-traditional supply of RFG via truck logistics, it would most likely mean trucking from at least 400 miles away at a cost of between 45 and 70 CPG if such a movement were even feasible. The nearest potential RFG supply from alternative terminal rack sources via truck would be Valero-McKee, WRB Borger refinery sites, Grapevine (Dallas-Fort Worth) terminal facility and potentially the HF Sinclair refineries in El Dorado, KS and Rawlins, WY.

**Figure 17** shows the estimated trucking cost for gasoline (GASO) and diesel (DSL) from all potential RFG replenishment sources with those having the most available supply (1 = highest supply availability, 3 = lowest supply availability) being El Dorado, KS (ELDR_DNVR), Glenpool, OK (GLNP_DNVR), and Grapevine, TX (GRVN_DNVR). These long-haul trucking sources are high cost and not always reliable at these distances further adding to supply upsets and added costs.

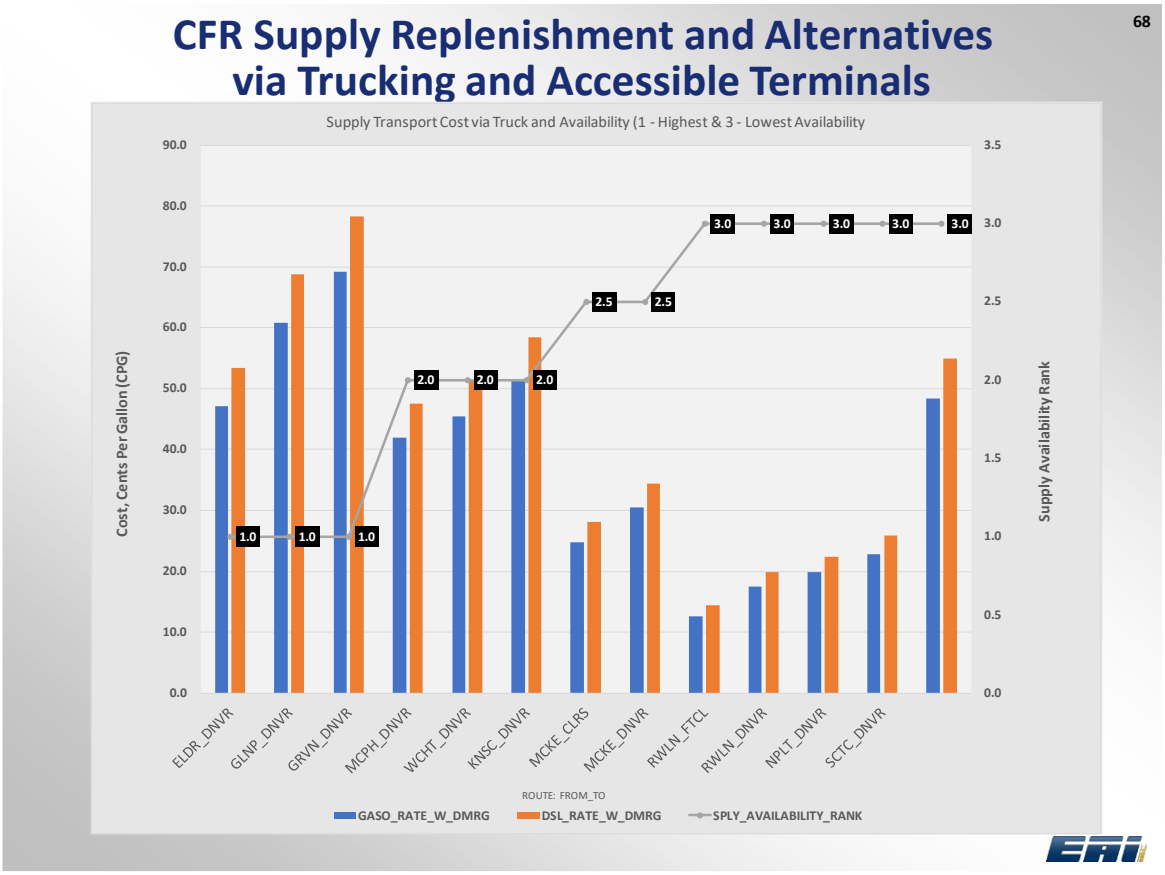


Figure 17

**Emergency Measures to Mitigate Supply Shortages**

If Denver NAA prices were to spike due to a supply shortage and no suitable lower cost alternative replacement supply, the state of Colorado could be incentivized to request an emergency waiver which would eliminate the low RVP requirement for a period of time. Based on the criteria provided in the Clean Air Act Section 211( c )( 4 )( C ), the EPA/Department of Energy could issue a waiver for low RVP reformulated gasoline in the Denver NAA under the following conditions:

1. **Extreme and Unusual Circumstances:** There must be a demonstration of extreme and unusual circumstances that prevent the distribution of an adequate supply of low RVP reformulated gasoline to consumers in the Denver area.
2. **Unforeseeable Events:** These circumstances should be the result of events such as a natural disaster, an Act of God, a pipeline or refinery equipment failure, or other similar events that could not have been reasonably foreseen or prevented.
3. **Public Interest:** It must be in the public interest to grant the waiver, such as when it is necessary to meet projected temporary shortfalls in the supply that cannot otherwise be compensated for.
4. **Geographic Limitation:** The waiver should apply to the smallest geographic area necessary to address the supply circumstances.
5. **Duration of Waiver:** The waiver is effective for 20 days or less if the Administrator deems a shorter period sufficient to address the supply circumstances and mitigate air quality impact.
6. **Transitional Period:** After the waiver ends, a transitional period will be allowed for wholesalers and retailers to adjust their inventory, with the duration determined by the Administrator.
7. **Inclusive Application:** The waiver applies to all entities within the motor fuel distribution system.
8. **Public Notice:** The Administrator must inform all relevant parties, including local and state regulators, in the affected area about the waiver.

Based on the criteria above and the precedence set by historical waivers, if there is a refinery or pipeline operational issue that causes a supply disruption in the CFR/NAA market then the EPA would likely be able to issue an emergency RVP waiver at the request of the Colorado governor.

However, assuming there is a supply shortage and resulting price escalation in the Denver area due to an insufficient number of refiners or suppliers able to provide the fuel in 2024 it is uncertain that the EPA would grant an emergency fuel waiver because it would have to make the determination that it wasn't due to a lack of "prudent planning".

In EAI, Inc's estimation, there was not enough time between the Denver NAA being reclassified as severe nonattainment in 2022 and the low RVP RFG requirement in the summer of 2024 for all potential suppliers, pipeline and terminal companies, etc. to make all necessary adjustments to assure adequate supply and therefore an emergency waiver should be warranted.

## NAA SHIFT TO RFG: MODELED SUPPLIER RESPONSE SCENARIOS AND SUPPLY AND PRICE IMPACTS

### Overall Impact

The shift to RFG in the CFR market represents a considerable risk exposure to relatively high fuel costs for the wholesale, retail and commercial markets as well as to other Colorado markets that

are connected to the CFR market. These cost impacts apply not only to RFG but also to conventional gasoline, distillate products and jet fuel which represent a sizeable share of the Colorado fuels market.

As previously mentioned, the CFR market is very prone to refined product price increases from supply upsets due to the lack of redundancy and slack in the system and constrained logistics. On top of a likely base escalation of gasoline prices due to refiner cost increase and alternative sourcing of RFG, there could be extreme price excursions due to major supply upsets. These escalations are likely to carry over to conventional gasoline, diesel and jet fuel which share pipeline and terminal logistics as suppliers are forced to optimize supply chains to mitigate RFG shortfalls.

With the startup of the EPA RFG mandate in May 2024, the Denver NAA and peripheral market area for gasoline are project to have a relatively high probability of experiencing exposure to sustained high RFG prices that are at least 60 CPG over Midcontinent spot conventional gasoline (MC spot CNV) pricing delivered into Denver with periodic sustained spikes to levels at least in the 117 to 141 CPG range over MC spot CNV.

This directly translates to similar magnitude price increases at retail sites for the end-market consumer. Total impact to the consumer for the 2024 low RVP RFG effective season (May 1st – Sept 15th) is $421 MM and $62 MM for gasoline and diesel, respectively (see **Table 2**).

| 2024 NAA RFG Implementation Price and Consumer Impact | | | |
|---|---|---|---|
| Product | Supply Shortfall / Shift, MBPD | Sustained Price Inpact, CPG | Consumer Impact, (2024 High Season), $MM |
| **Gasoline** | 15 | 62 | $ 431.22 |
| **Diesel** | 4 | 20 | $ 61.83 |

Table 2

**Supplier Response Scenarios**

Given the relatively short supply network implementation schedule of RFG in the Denver NAA and, for some of the refineries, alternative market options, EAI, Inc. defined ten plausible scenarios (see **Figure 2**), their probability for occurring, and relative impact to identify and assess likely supply and market upsets and resulting product pricing responses for the first CFR RFG high demand season in 2024.

Each scenario includes a set of plausible supply and market conditions addressing which of the traditional refiners/suppliers will supply RFG to the Denver NAA and at what quantity (specific

refiner/supplier information is withheld) resulting in varying levels of supply shortfall ranging from 0 MBPD (base case business as usual) and 44 MBPD. EAI, Inc. has estimated the probability of each scenario occurring (as shown in **Figure 2 and Figure 18,** 1 = highest probability, 3 = lowest probability).

Each scenario results in a certain amount of CFR RFG resupply requirement and EAI, Inc. assigns alternative sources of RFG from least to most costly until the requirement is completely satisfied. From the assumed traditional and alternative sources of RFG supply to the Denver NAA for each scenario, a supply – cost curve was constructed where the highest cost supply required to satisfy the demand in the market sets the market clearing price.

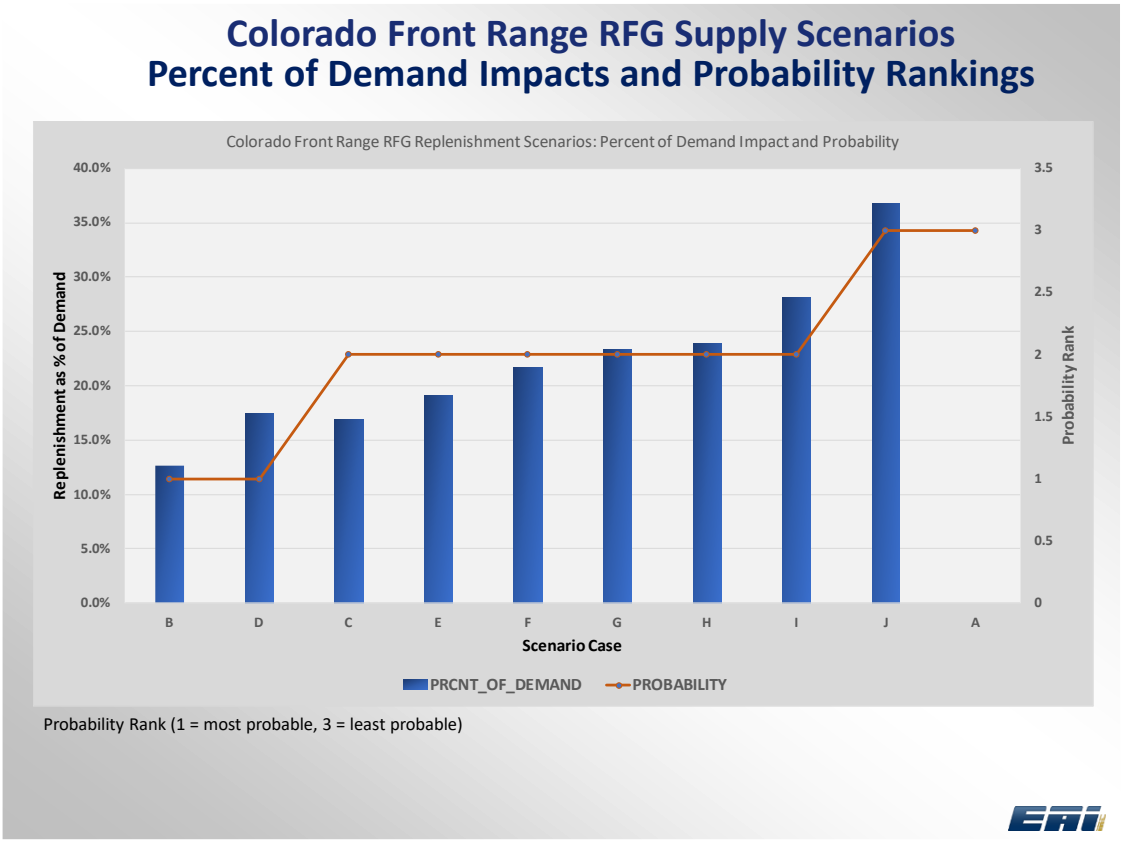


Figure 18

Based on analysis of EAI, Inc.'s assessment of likely supplier capabilities and responses, scenario B has the highest probability of occurring and has the smallest impact on supply and price upsets. This is the scenario that EAI, Inc. used as the basis for the estimated cost impacts for refined product in the Denver NAA and CFR during the 2024 RFG season.

In this scenario, it is assumed that one traditional CFR refinery source having conventional gasoline market alternatives is not making RFG for the CFR market in 2024. All other traditional refiners supplying the CFR market maintain their CFR market share and convert all this supply to low RVP RFG summer grade gasoline in 2024. One of the traditional CFR refiner-suppliers also

turns up production of RFG by 4 MBPD recognizing they are one of the few that has some remaining open pipeline capacity to supply the CFR market.

Scenario B shortfall of 15 MBPD requires RFG supply replenishment from alternative sources due to supply shortfalls and constrained pipeline capacity. The shortfall of CFR RFG is supplied via;

1) WRB – Borger incremental RFG supply (fully utilizing pipelines),

2) Valero-McKee retracting RFG from the Phoenix market and transporting it via open space on the NuStar Pipeline which connects the McKee refinery to the Denver market, and

3) long haul truck barrels from one of the closest RFG truck/terminal rack source which is Grapevine, TX a city 22 miles Northeast of Dallas.

The incremental costs for these sources is estimated to be 52 and 63 CPG over Midcontinent spot conventional gasoline, respectively. The supply-cost build up for scenario B is shown in **Figure 19**. The basis for each cost segment and its contribution to the overall RFG wholesale clearing price into a representative Denver terminal is summarized below with the costs equal to each component contribution relative to MC laid in spot conventional gasoline:

- **GC Spot RFG minus CNV Gasoline Cost:** Using Gulf Cost spot RFG price minus GC spot CNV gasoline price (10 Cents Per Gallon or CPG) as a proxy for incremental production costs for the lowest cost source of RFG in one of the most transparent U.S. markets. The incremental production cost would represent the highest cost supply necessary to satisfy market demand.
- **Rocky Mountain Refinery Production Costs Over GC Costs:** Based on EAI, Inc.'s work as part of previous CFR special fuels studies, incremental refinery costs were estimated as being 4 to 8 CPG over the Gulf Coast RFG proxy production costs addressed previously.
- **Phoenix Opportunity Cost:** Represents Phoenix near equivalent "RFG" grade market price less transportation costs from the Valero, McKee refinery and added costs to transport these RFG swing barrels to Denver via NuStar Pipeline. The contribution of this alternative RFG supply source to the overall Denver RFG incremental supply costs is 36 CPG.
- **Long Haul Trucked RFG Cost:** Represents RFG sourced at the Grapevine terminal Northeast of Dallas and trucked to Denver with an added incremental cost contribution to Denver RFG of 11 CPG. It should be noted that this length of fuel haul is likely not feasible on a sustained basis and, as is the case for many refined product terminals, may not have open capacity to service another market.
- **Supply Upset Costs**: Represents the periodic and sustained supply shortfalls with increasing reliance on higher risk product sources and transportation modes and estimated to contribute a range of 56 to 76 CPG additional costs to Denver incremental RFG supply.

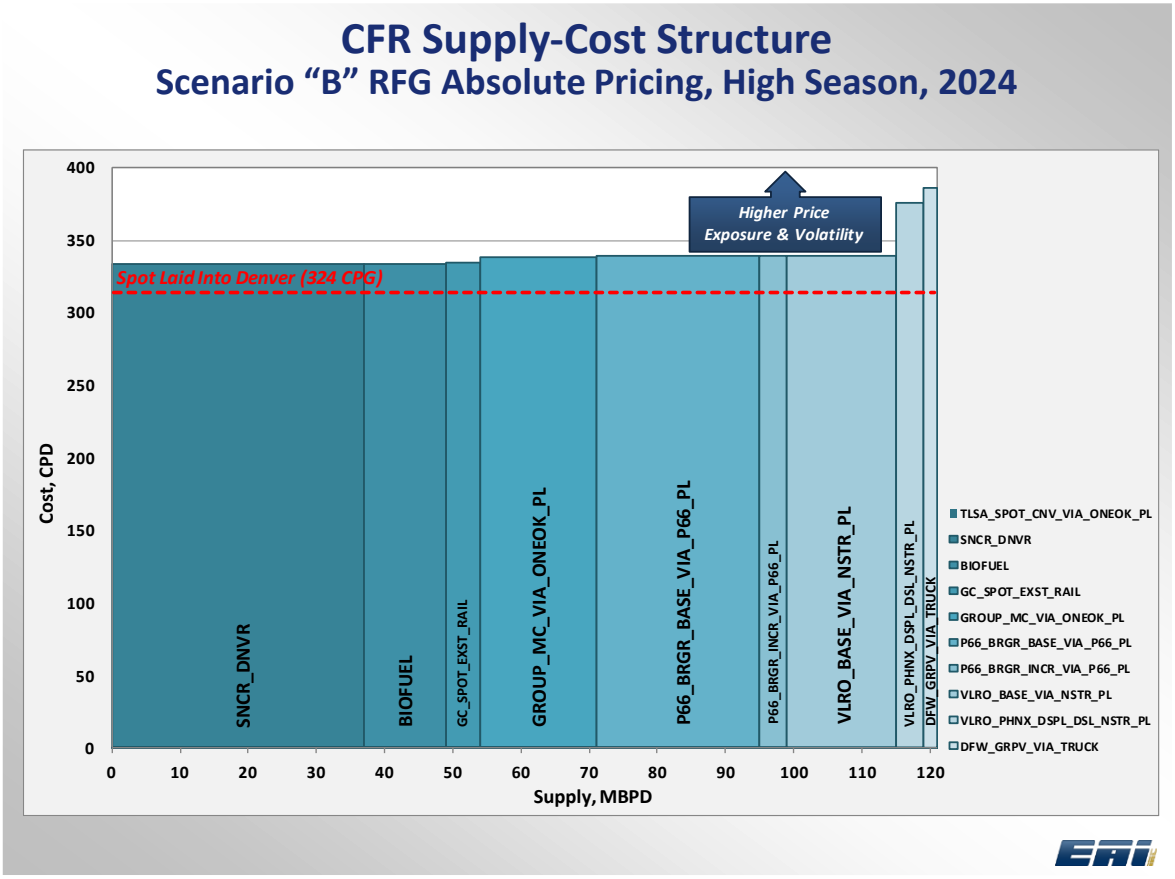
CFR Supply-Cost Structure
Scenario "B" RFG Absolute Pricing, High Season, 2024
Higher Price Exposure & Volatility
Spot Laid Into Denver (324 CPG)
Cost, CPD
Supply, MBPD
SNCR_DNVR
BIOFUEL
GC_SPOT_EXST_RAIL
GROUP_MC_VIA_ONEOK_PL
P66_BRGR_BASE_VIA_P66_PL
P66_BRGR_INCR_VIA_P66_PL
VLRO_BASE_VIA_NSTR_PL
VLRO_PHNX_DSPL_DSL_NSTR_PL
DFW_GRPV_VIA_TRUCK
TLSA_SPOT_CNV_VIA_ONEOK_PL

Figure 19

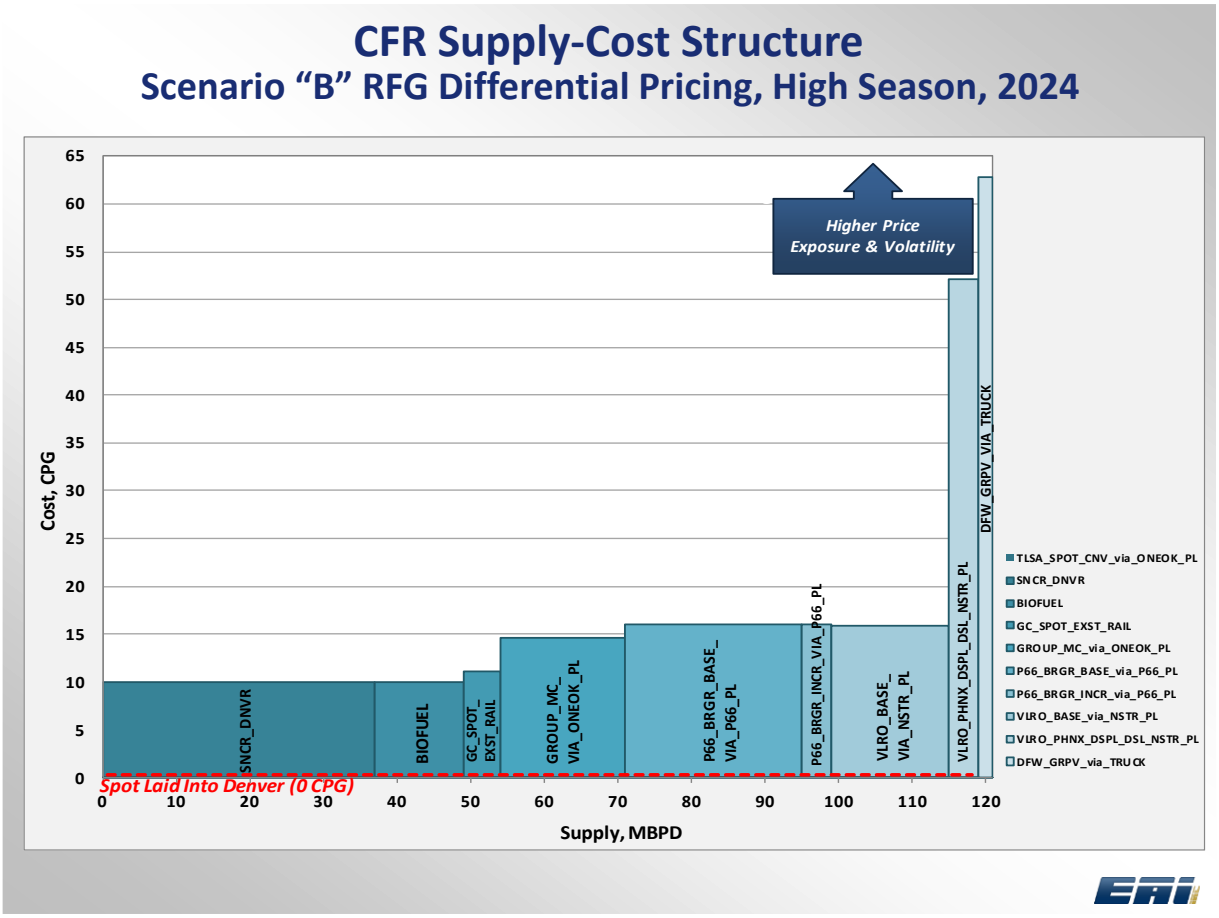


Figure 20

The accommodation of RFG and Jet fuel sourcing and transport into the CFR market under conditions of high season demand and key CFR pipeline constraints requires or could require (with additional supply upsets occurring) shifting some distillate supply to other sources and/or transportation modes.

This generally means transporting distillate on very limited existing rail capacity into Denver or trucking distillate into the CFR from distant terminals that may also have incremental throughput limitations due to markets they normally serve. The replenishment distillate supply shown in Figure 21 includes:

1. HF Sinclair Rawlins retracted distillate supply from Salt Lake (high price market) and shifting to the CFR and, potentially
2. Long-haul truck from some of the representative terminals that for alternative supply.

The long-haul trucking sources are "notional" volumes added to base supply to represent the minimum long haul trucking supply costs for a relatively small amount of replenishment diesel supply.

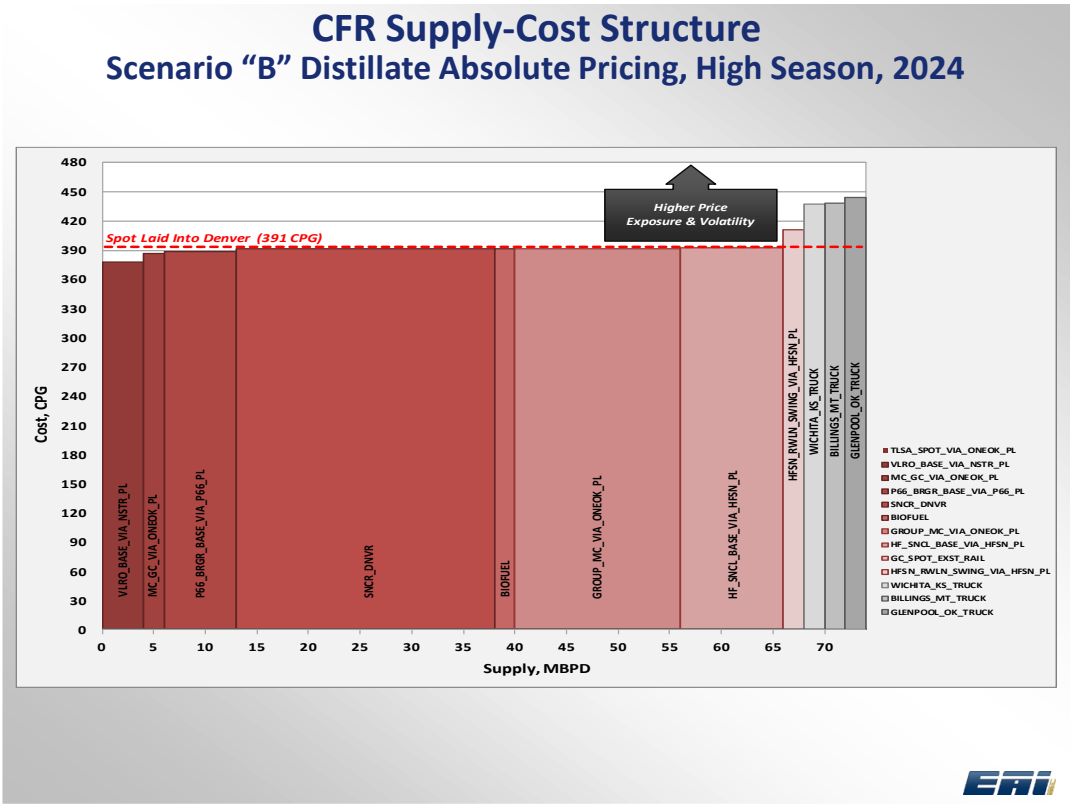


Figure 21

The distillate laid in cost to Denver from each source minus Midcontinent spot distillate pricing laid into Denver are summarized in **Figure 22** and represent the minimum average increase in costs for the RFG summer season in 2024 for one of the most probable scenarios (B) having the lowest RFG shortfall and replenishment requirement.

The long-haul trucking replenishment source is not a reliable source and any other disruptions incurred by other supply sources or increases in demand could result in CFR price shocks that are higher and longer lasting than the Q1 2023 Suncor Commerce City refinery outage event ($1.00 to 1.20 per gal higher costs) which occurred during low demand season and without low RVP/RFG mandates.

Distillate pricing upsets were 40 CPG during the Suncor Commerce City Plant 2 shut down as shown in the graphic presented previously.

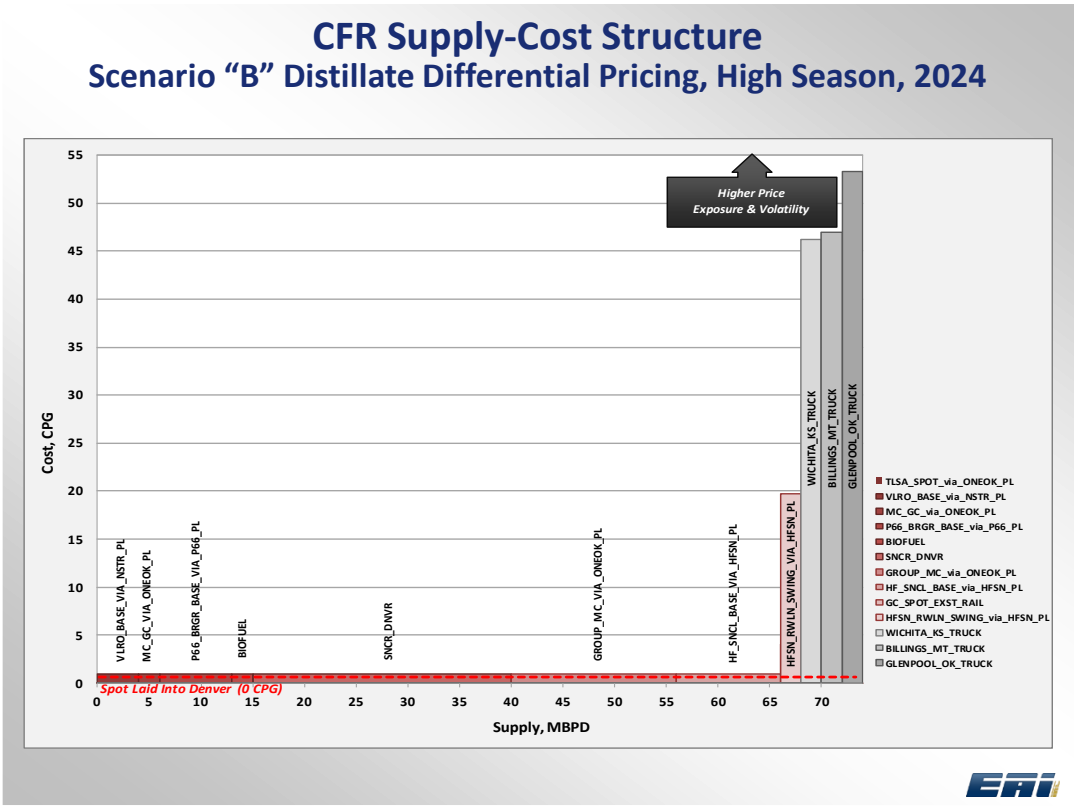
CFR Supply-Cost Structure
Scenario "B" Distillate Differential Pricing, High Season, 2024
Higher Price Exposure & Volatility
Cost, CPG
Supply, MBPD
Spot Laid Into Denver (0 CPG)
VLRO_BASE_VIA_NSTR_PL
MC_GC_VIA_ONEOK_PL
P66_BRGR_BASE_VIA_P66_PL
BIOFUEL
SNCR_DNVR
GROUP_MC_VIA_ONEOK_PL
HF_SNCL_BASE_VIA_HFSN_PL
HFSN_RWLN_SWING_VIA_HFSN_PL
WICHITA_KS_TRUCK
BILLINGS_MT_TRUCK
GLENPOOL_OK_TRUCK
TLSA_SPOT_via_ONEOK_PL
VLRO_BASE_via_NSTR_PL
MC_GC_via_ONEOK_PL
P66_BRGR_BASE_via_P66_PL
BIOFUEL
SNCR_DNVR
GROUP_MC_via_ONEOK_PL
HF_SNCL_BASE_via_HFSN_PL
GC_SPOT_EXST_RAIL
HFSN_RWLN_SWING_via_HFSN_PL
WICHITA_KS_TRUCK
BILLINGS_MT_TRUCK
GLENPOOL_OK_TRUCK

Figure 22