



**EAI, INC.**  
**( ENERGY ANALYSTS INTERNATIONAL )**

**WESTMINSTER, COLORADO**



# Denver/North Front Range Fuel Supply Costs and Impacts

**Executive Summary Presentation**  
for  
**Denver Regional Air Quality Council (RAQC)**  
by  
**EAI, Inc.**  
**(Energy Analysts International)**  
**March 4, 2011**

# Impact of Ozone Reduction Fuel Strategies

## *Fuels Scenarios and Scope of Work Conducted*

The gasoline specification options to be considered include the following:

- Retain the current 7.8 RVP summertime standard, but eliminate the one psi ethanol waiver
- Adopt a 7.0 RVP summertime standard and retain the one psi ethanol waiver
- Adopt a 7.0 RVP summertime standard and eliminate the one psi ethanol waiver
- Opt-into the federal Reformulated Gasoline Program (RFG).

This assessment was achieved through a combination of survey work, analysis and modeling by EAI, Inc.

**Task 1: Summarize the Colorado and Front Range Fuels Market**

**Task 2: Describe the capabilities of the refineries**

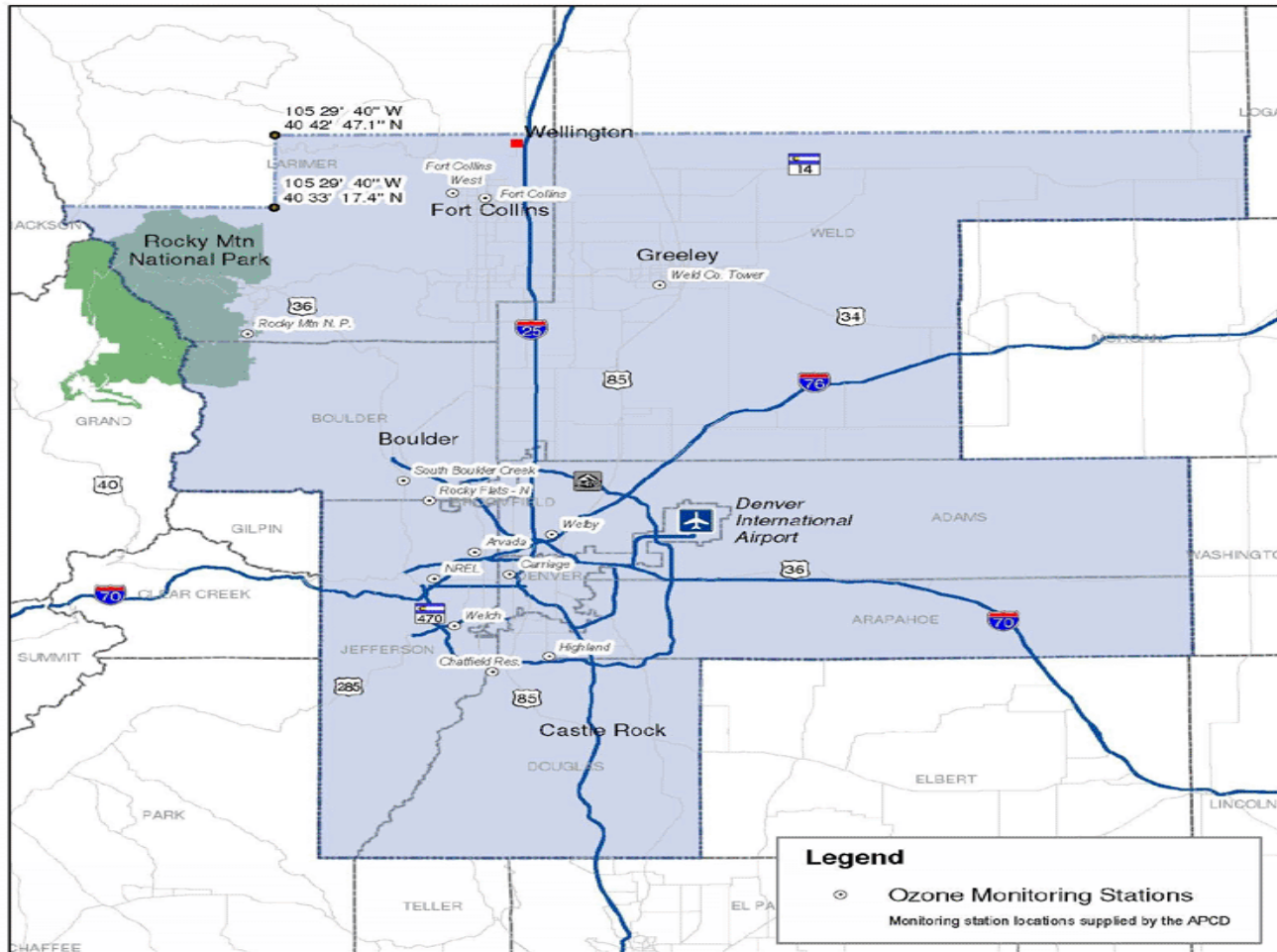
**Task 3: Quantify cost impacts**

**Task 4: Quantify distribution impacts**

**Task 5: Quantify ethanol and biofuel impacts**

**Task 6: Describe impacts of current and proposed Federal rules**

# Denver-Boulder-Greeley-Fort Collins Eight-Hour Ozone Control Area: Primary Non-Attainment Area



Denver-Boulder-Greeley-Fort Collins, Colorado  
Eight-Hour Ozone Control Area



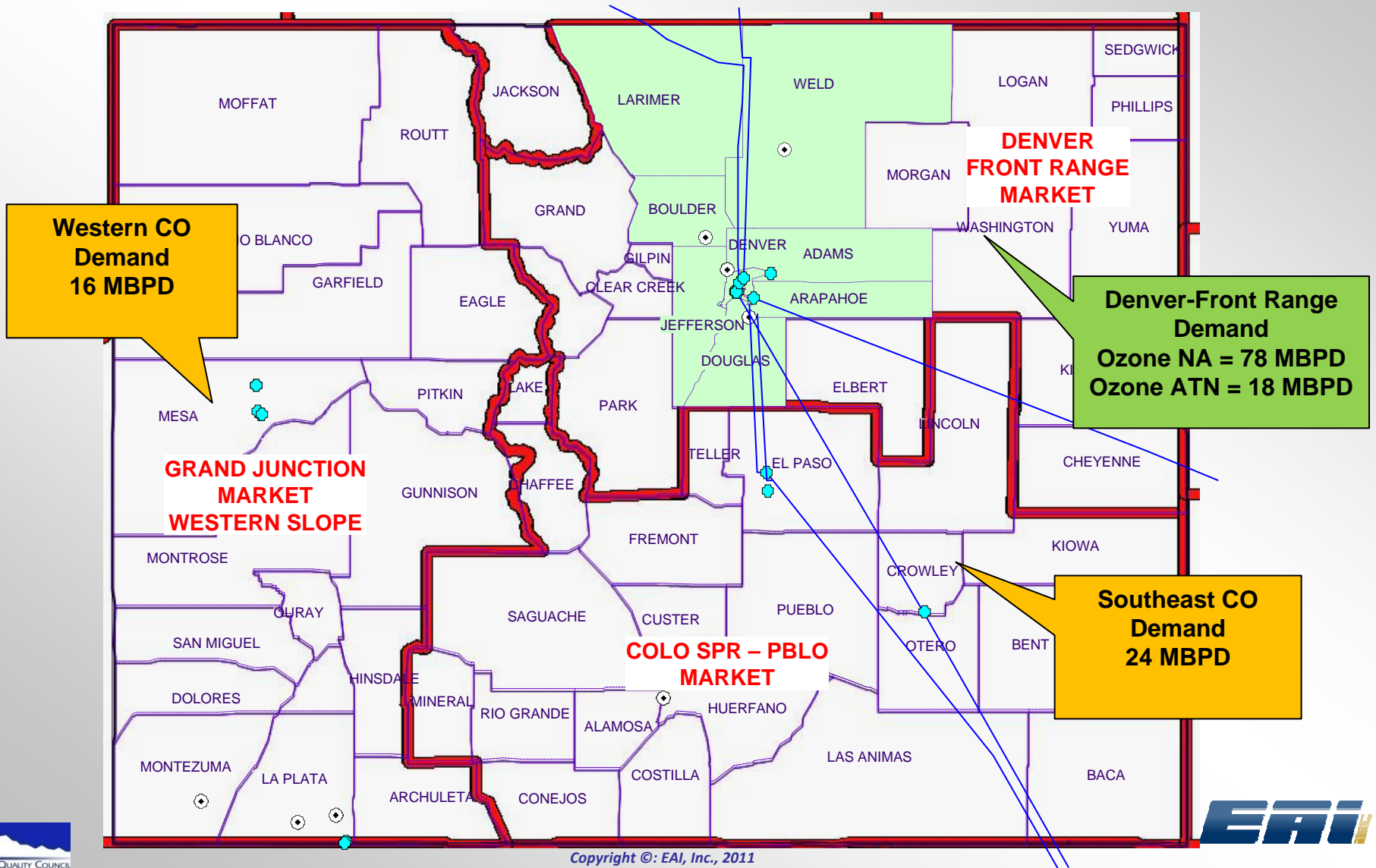
# Gasoline Demand Distribution

## Colorado Markets & Ozone Non-Attainment Area

- ❑ **Why is this Important ?:** A significant amount of product is supplied through the Denver product supply hub that services both the designated non-attainment market area as well as a relatively large attainment market area. Higher incremental special fuel costs relative to conventional fuel costs will require extra tankage and handling to support segregation. This also reduces supply flexibility.
- ❑ **Colorado Demand Distribution:**
  - **Total Colorado:** **136 MBPD (1000 BPD)**
  - **Front Range:** **96 MBPD**
    - **Non-Attainment Area:** **78 MBPD**
    - **Attainment Area:** **18 MBPD**
  - **Other Attainment Area Demands**
    - **SE Colorado (CO Springs-Pueblo)** **24 MBPD**
    - **Western Slope:** **16 MBPD**

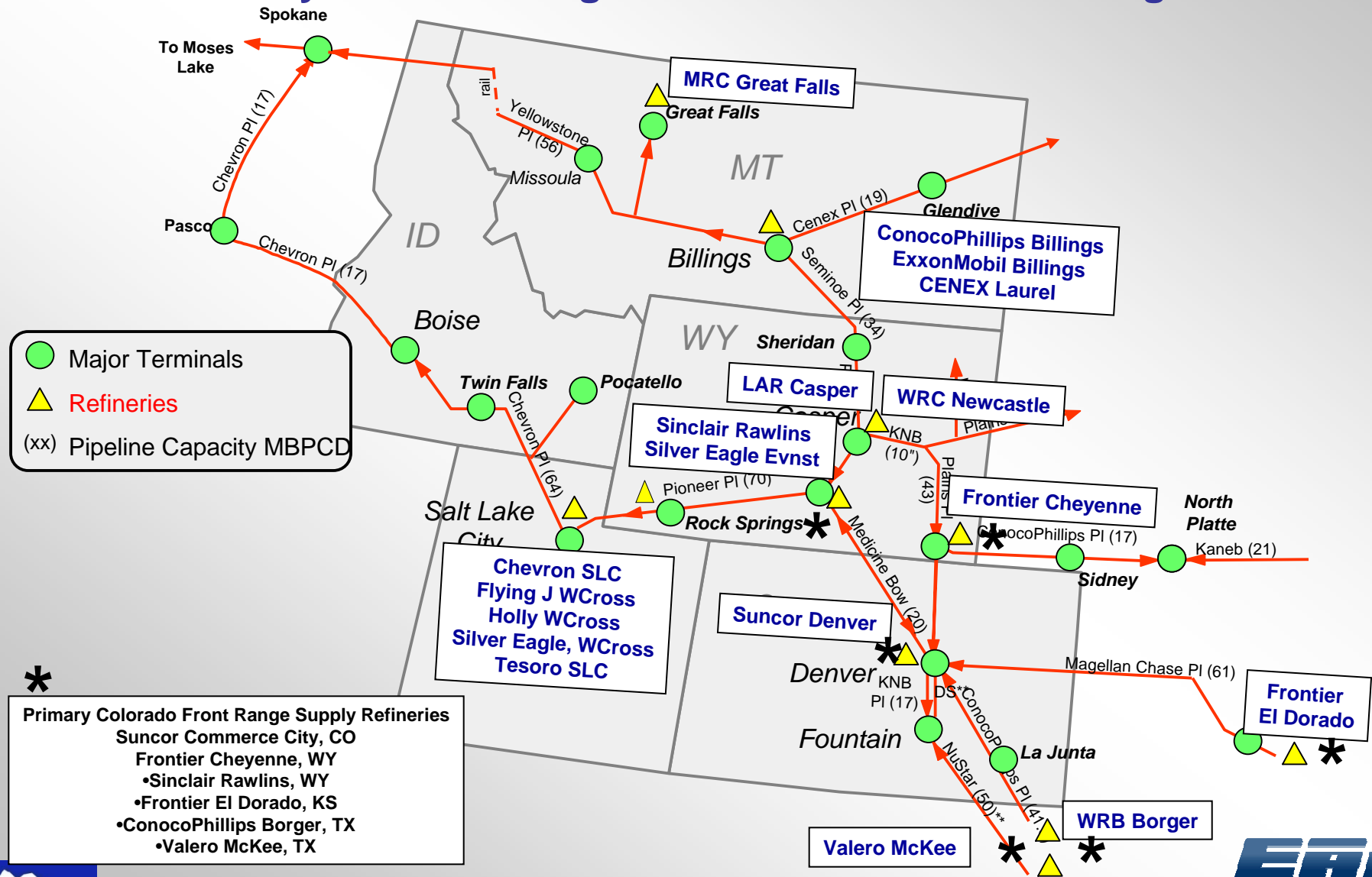
# Gasoline Demand Distribution

## Colorado by Geography and Ozone Attainment Status, 2009 Total Gasoline Demand at 136 MBPD



# Refined Product Supply – Pipelines and Refineries

## Rocky Mountain Region and Colorado Front Range



# Colorado Light Product Supply Chain and Capacities, 2009 MBPD

*There is not a lot of slack in the Denver/Front Range supply chain with 9 refineries that can access the area but effectively only 6 that regularly supply the market and have significant capacity that can be drawn upon. The effective summer open pipeline capacity that can access the Denver Front Range market is approximately 40 to 45 MBPD.*

## Refining Access & Capacities

**CHS Laurel, MT**  
**ConocoPhillips Billings, MT**  
**Little America Casper, WY**  
**Frontier Cheyenne, WY\***  
**Frontier El Dorado, KS\***  
**Sinclair Rawlins, WY\***  
**Suncor Denver, CO\***  
**Valero McKee, TX\***  
**WRB Borger, TX\***

9 Refineries can and have accessed the Denver market and \*6 on a regular basis  
 Total Capacity 775 MBPD  
 Effective Refining Capacity accessing the Colorado Front Range Market = 673 MBPD

Refining Capacity Serves Other Markets in other Rocky Mountain states, Midcontinent, Texas and Midwest markets.

## Terminal Network has Limited Excess Capacity

**Total Pipeline Capacity = 214 MBPD; 58% Utilized**  
**Effective Pipeline Open Capacity**  
 Avg Annual = 90 MBPD  
 Summer = 77 MBPD  
**Five Pipeline Systems (COP, Magellan, NuStar, Plains and Sinclair)**

Upstream pipeline bottlenecks  
 Seminole pipeline from Billings to Casper  
 Magellan Chase – El Dorado tankage

**Colorado Consumption**  
 Total Light Product = 211 MBPD  
 Total Gasoline = 136 MBPD

Limited amount of effective refining capacity that can access the Denver Front Range Market directly via pipeline; on the order of 100 MBPD total product or 50 MBPD of gasoline

# Summary of Key Findings

## Incremental Non-Attainment Area Fuel Costs

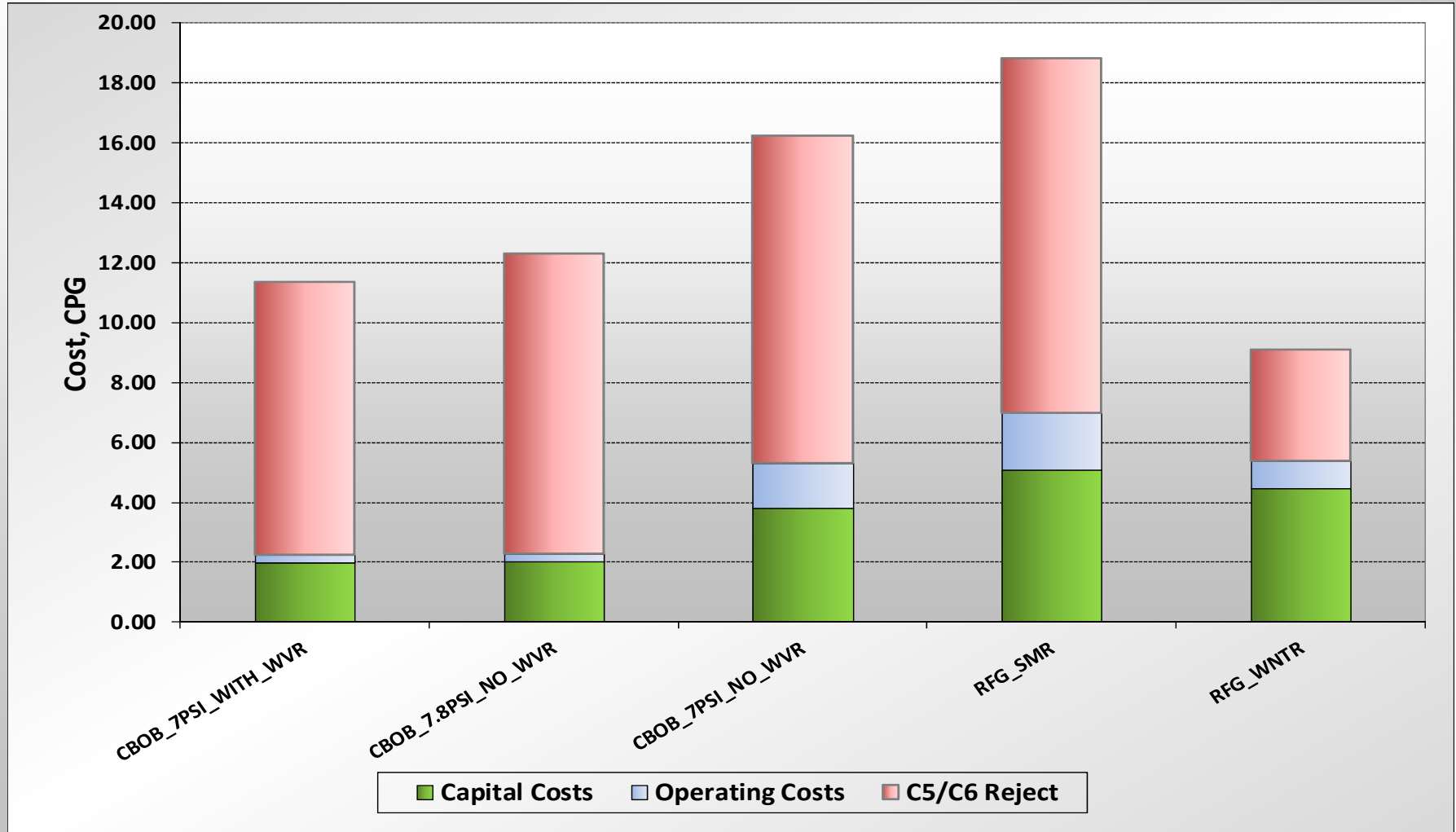
- Cost Components:** Total estimated program cost burden for the primary refineries supplying the Colorado Front Range market area consists of incremental operating costs, incremental capital investments to produce the special grades of fuel and lost light end values.
- Total Refinery Production Costs:** Total industry capital costs range from 250 to 710 MM dollars. Estimated total refinery costs per barrel of non-attainment fuel produced ranges from 11.4 CPG to 18.8 CPG. The largest single cost is the lost light end value representing the difference between getting gasoline value for lost pentanes vs extracted pentane value.

OZONE FUEL STRATEGY	CBOB	CBOB	CBOB	RFG
COST COMPONENTS	CBOB/7 PSI WITH WVR	7.8 PSI / NO WVR	7PSI / NO WVR	SUMMER
<b>INCREMENTAL OPERATING COSTS, CPG</b>				
Highest Op Costs	2.00	2.00	2.80	4.00
Lowest Op Costs	0.04	0.00	0.05	0.05
Weighted Average	0.25	0.25	1.48	1.90
<b>CAPITAL COSTS (1)</b>				
Total Industry (MM \$)	250	250	560	710
\$ Per Daily NATN BBL	3131	3160	7014	9696
Highest for Reporting Companies (MM\$)	110	110	350	400
Lowest for Reporting Companies (MM\$)	10	10	10	10
Allocated Capital Costs (20 Year, CPG)	2.02	2.04	3.81	5.09
<b>LOST LIGHT END COSTS(2), CPG</b>				
Highest Light End Costs	9.4	10.3	17.4	17.4
Lowest Light End Costs	8.2	9.0	0.9	3.6
Weighted Average	9.1	10.0	10.9	11.8
Total Estimated Costs (3)	11.4	12.3	16.2	18.8
(1) Based on Survey plus EAI, Inc. estimates, total capital likely under actual required				
(2) Based on light end losses being all pentane plus material; if butane would increase costs				
(3) Capital, Operating and Lost Light End Total Cost				

# Manufacturing Cost Increases to Produce Fuel Options: Production Weighted Cost Composite for Primary Refineries Supplying CO Front Range

*Lowest cost fuel option is 7 psi CBOB with Waiver & 7.8 psi CBOB fuel costs very close.*

*RFG gasoline production represents the highest cost option at 18.8 CPG and 7 psi CBOB slightly less.*



# Summary of Key Findings

## Rejected Light Ends and Gasoline Market Shift

- Light End Rejection:** Light end rejection represents removal of light hydrocarbons from the gasoline pool having relatively high RVP levels. The cost to the refiners is either lost stream value (gasoline vs pentane/butane values) and/or additional capital and operating costs to convert these streams to lower RVP streams via isomerization or other similar processes. Some value will be realized by the refiners in doing this but not necessary in a declining octane-barrel demand environment.
- Gasoline Market Shift:** Some refiners serving the market are likely to shift gasoline to alternative markets to avoid the investment requirements and risk. This response was very prevalent among all refiners for the RFG and 7 PSI / no waiver cases and for those refiners having the least volume in the market. The shifted volume would have to be replaced by the other Front Range suppliers.

REJECTED LIGHT ENDS & SHIFTED GASOLINE VOLUME				
STREAM CATEGORY	CBOB 7PSI / NO WVR	CBOB 7 PSI / WITH WVR	CBOB 7.8 PSI / NO WVR	RFG SUMMER
VOLUME, MBPD				
Light End Rejection	13.1	11.4	12.7	13
Gasoline Mrkt Shift	15.9	12.1	12.1	24.9
<b>Total Volume</b>	<b>29</b>	<b>23.5</b>	<b>24.8</b>	<b>37.9</b>
VOLUME AS PERCENT OF NON-ATTAINMENT PRODUCTION				
Light End Rejection	16.40%	14.30%	16.00%	17.70%
Gasoline Mrkt Shift	19.90%	15.10%	15.30%	34.00%

# Summary of Key Findings

## Refinery Investment Risk and Consumer Cost Exposure

☐ **Supply Availability and Impact on Market Prices:** There have often been **2 to 21 CPG market premiums paid for similar low RVP (7 psi/no waiver) fuels** (Detroit and Kansas City) relative to conventional fuels. Denver can expect to experience similar price upsets given its expected fuel source option reduction. These price increases can:

- Exceed incremental production costs when supply is constrained which is likely during the early stages of the program (**This represents additional consumer cost exposure and less investment risk to the refiner**), or
- Be less than the highest incremental production costs when the market is oversupplied and the special fuels are pushed into the lower cost attainment fuel markets (**this represents major investment risk for those refiners having the highest special fuel costs and lower cost exposure for the consumer**).

# Summary of Key Findings

## Other Factors and Considerations

- ❑ ***Boutique Gasoline Products and Fungibility:*** As additional ozone non-attainment markets adopt low RVP gasoline “standards”, this product will be in greater supply and accessible to markets from more refinery options. Low RVP gasoline sounds generic but 7.8 psi (with waiver-no waiver) gasoline is a much easier product to make than 7.0 psi gasoline with no waiver. There are very few markets using 7.0 psi no waiver gasoline currently being supplied by refineries servicing Colorado.
- ❑ ***Lost Ethanol Related Costs:*** Refinery revenue could decline due to the lost uplift from blending ethanol plus lost blender tax credit. Additional costs could be incurred with refiners-suppliers purchasing RINS in lieu of being able to blend ethanol. It is likely that ethanol blending will be limited for the non-RFG fuel-no waiver cases. These costs are likely to increase each year as the required ethanol blended volume increases with the RFS.
- ❑ ***Potential Opportunity Crude Costs:*** There is a growing supply of light crude and condensate that can access a number of the refineries serving the Colorado market. This supply growth coupled with sustained logistical constraints has resulted in these crudes being discounted by 10 to 15 dollars per barrel representing a significant cost savings for Front Range supply refineries. These crudes will be more difficult to use with the fuel options proposed without significant investments that could exceed what is presented in this report.

# Ozone Fuel Scenario Impact Matrix

## Colorado Ozone Attainment Strategy Support

<b>OZONE FUEL STRATEGY</b>	<b>CBOB</b>	<b>CBOB</b>	<b>CBOB</b>	<b>RFG</b>
<b>EAI, INC. EVALUATION FOR RAQC</b>	<b>7PSI / NO WVR</b>	<b>CBOB/7 PSI WITH WVR</b>	<b>7.8 PSI / NO WVR</b>	<b>SUMMER</b>
<b>Time to Implement (Max(W Contingency)) Months</b> (For all mjr splrs to accommodate)	60	60	60	60
<b>Incremental Operating Costs (CPG)</b>				
Weighted Average	1.48	0.25	0.25	1.90
Highest Cost	2.80	2.00	2.00	4.00
Lowest Cost	0.05	0.04	0.00	0.05
(Average Industry Per NATN BBL)				
<b>Capital Costs (MM \$) (1)</b>				
Total Industry	\$560	\$250	\$250	\$710
Per Daily NATN BBL	\$7,014	\$3,131	\$3,160	\$9,696
Highest Cost	\$350	\$110	\$110	\$400
Lowest Cost	\$10	\$10	\$10	\$10
Allocated Capital Costs (20 Year, CPG)	3.81	2.02	2.04	5.09
<b>Supply Reduction &amp; Shift (MBPD)</b>				
Light End Rejection	13.1	11.4	12.7	13.0
Gasoline Mrkt Shift	15.9	12.1	12.1	24.9
<b>Supply Reduction (Percent of NATN Market)</b>				
Light End Rejection	16.4%	14.3%	16.0%	17.7%
Gasoline Mrkt Shift	19.9%	15.1%	15.3%	34.0%
<b>Lost Light End Value (CPG of ATNM Supply) (2)</b>				
Highest Cost	10.9	9.1	10.0	11.8
Lowest Cost	17.4	9.4	10.3	17.4
	0.9	8.2	9.0	3.6
<b>Total Estimated Costs (CPG) (3)</b>	<b>16.2</b>	<b>11.4</b>	<b>12.3</b>	<b>18.8</b>
(1) Based on Survey plus EAI, Inc. estimates total capital likely to be under actual required				
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