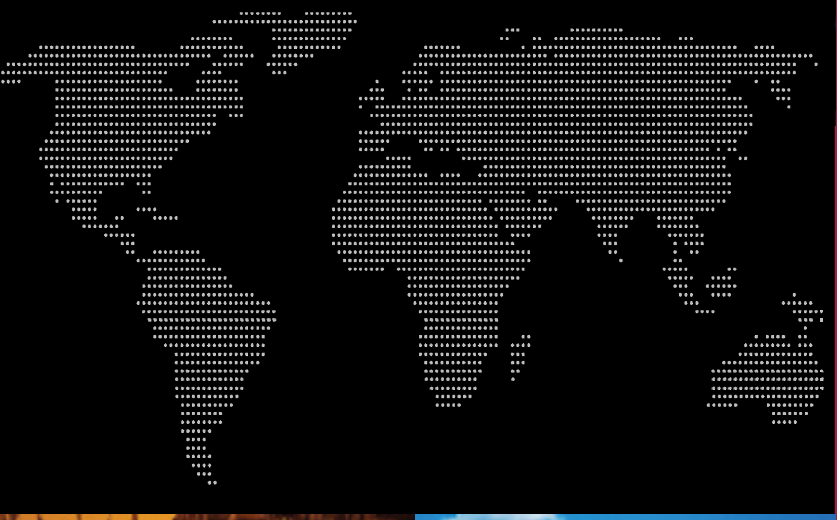
BAKER & O'BRIEN
INCORPORATED



Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline

Prepared for
The American Petroleum Institute

Prepared by:
David C. Tamm
Kevin P. Milburn

March 2012

Baker & O'Brien, Inc.
1333 West Loop South
Suite 1350
Houston, Texas 77027

TABLE OF CONTENTS

TABLES

INTRODUCTION

In July 2011, Baker & O'Brien, Inc. (Baker & O'Brien) completed a report titled, "The Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline" (the Original Report). The Original Report included a Base Case, a Study Case, and three Sensitivity Cases. The Study and Sensitivity Cases addressed a range of potential regulatory scenarios reducing both gasoline sulfur and Reid vapor pressure (RVP). The American Petroleum Institute (API) has engaged Baker & O'Brien to analyze an additional case (Sensitivity Case 4) in which only gasoline sulfur regulations are changed.

General industry conditions, corporate profiles, geographic considerations, and unique refinery characteristics can influence potential responses to regulatory requirements. Therefore, Baker & O'Brien undertook a refinery-by-refinery approach in evaluating the potential impacts of lowering the specifications for sulfur and RVP in gasoline. Compliance options were evaluated and production estimates calculated for each refinery using Baker & O'Brien's *PRISM*™ Refining and Marketing Industry Analysis System. The *PRISM* model is based on publicly-available information, and incorporates Baker & O'Brien's industry experience and knowledge.

Baker & O'Brien conducted this analysis and prepared this report with reasonable care and skill, utilizing methods we believe to be consistent with normal industry practice. No other representations or warranties, expressed or implied, are made by Baker & O'Brien. All results and observations are based on information available at the time of this report. To the extent that additional information becomes available or the factors upon which our analysis is based change, our opinions could be subsequently affected.

REGULATORY ASSUMPTIONS

The gasoline sulfur specifications in Sensitivity Case 4 are the same as the Study Case and Sensitivity Cases 2 and 3, 10 parts per million (ppm) company annual average, with an individual batch limit of 20 ppm. All other gasoline properties are the same as in the Base Case. Gasoline specifications for the original cases and Sensitivity Case 4 are summarized below in Figure 1.

FIGURE 1

GASOLINE SPECIFICATIONS

<table>
<tr><th colspan="3" rowspan="2">Property</th><th rowspan="2">Base Case</th><th rowspan="2">Study Case</th><th colspan="4">Sensitivity Cases</th></tr>
<tr><th>Case 1</th><th>Case 2</th><th>Case 3</th><th>Case 4</th></tr>
<tr><td colspan="2" rowspan="2">Sulfur, maximum ppm</td><td>Company annual average</td><td>30</td><td>10</td><td>5</td><td colspan="3">10</td></tr>
<tr><td>Individual batch</td><td>80</td><td>20</td><td>10</td><td colspan="3">20</td></tr>
<tr><td rowspan="4">Maximum RVP, pounds per square inch absolute (psia)</td><td rowspan="2">Summer</td><td>Base</td><td rowspan="2">Varies regionally</td><td colspan="2">7.0</td><td colspan="2">7.0 to 7.8**</td><td rowspan="2">Varies regionally</td></tr>
<tr><td>1 psia Waiver</td><td colspan="2">No</td><td>Varies</td></tr>
<tr><td rowspan="2">Winter</td><td>Base</td><td colspan="6" rowspan="2">Varies regionally</td></tr>
<tr><td>1 psia Waiver</td></tr>
<tr><td rowspan="2">Benzene, maximum volume percent (Vol.%)</td><td colspan="2">Company annual average</td><td colspan="6">0.62</td></tr>
<tr><td colspan="2">Refinery annual average</td><td colspan="6">1.3</td></tr>
<tr><td colspan="2" rowspan="2">Octane, minimum (R+M)/2</td><td>Regular</td><td colspan="6" rowspan="2">Varies regionally</td></tr>
<tr><td>Premium</td></tr>
<tr><td colspan="2" rowspan="2">ASTM Drivability Index (DI), maximum***</td><td>Summer</td><td colspan="6" rowspan="2">Varies regionally</td></tr>
<tr><td>Winter</td></tr>
<tr><td colspan="3">Ethanol, fixed Vol.%</td><td colspan="6">10</td></tr>
</table>

OTHER ASSUMPTIONS AND ANALYTICAL BASIS

Technology, capital investment, and other input costs in Sensitivity Case 4 are consistent with the Original Report. The gasoline consumption forecast, analytical basis and methodology for forecasting individual refinery compliance responses are the same as in the Original Report.

STUDY RESULTS

COMPLIANCE RESPONSE

Applying the methodology and criteria described in the Original Report, an estimate of the most likely compliance response decisions was made for each refinery in Sensitivity Case 4. Twenty-three refineries would need to upgrade fluid catalytic cracker (FCC) feed hydrotreaters, one refinery would require installation of a new FCC feed hydrotreater, thirteen refineries would need to install new FCC gasoline hydrotreaters, and thirty-three refineries would need to expand or upgrade their existing FCC gasoline hydrotreaters.[1]

In the Original Report Study Case and Sensitivity Cases 1 – 3, the removal of light hydrocarbons from the gasoline pool necessitated a reduction in naphtha and FCC gasoline endpoints to meet the summer Drivability Index (DI) specification. Sensitivity Case 4 FCC gasoline endpoints are the same as the Base Case. As a result, Sensitivity Case 4 required more hydrotreating than the Study Case and Sensitivity Cases 2 and 3.

In the Original Report, as well as the new Sensitivity Case 4, compliance investment requirements were calculated for all refineries, and as discussed in Section 8.8 of the Original Report, these investment requirements were compared to each refinery's "value as an ongoing concern."[2] If the investment requirement exceeded this value, it was assumed that the refiner would not make the compliance investment. This led to decisions to close four to seven refineries in the various Original Report cases. By themselves, none of the compliance investment requirements for Sensitivity Case 4 exceeds the "value as an ongoing concern" threshold, and no refinery shutdowns are projected. It must be noted that if individual refineries face investment requirements due to other regulatory changes, "consent decrees," or other constraints not included in the Base Case, the combination of those costs with the Sensitivity Case 4 requirements might change this conclusion. Also, reductions in petroleum product consumption or other market conditions could change this conclusion.

[1] Individual refineries may appear in multiple categories.
[2] Assumed to be five times the future annual net cash flow.

While total capital investment requirements in Sensitivity Case 4 are similar to Sensitivity Cases 2 and 3, the breakdown of the investments is different. The expected compliance investments are shown below in Figure 2.

FIGURE 2

EXPECTED REFINERY COMPLIANCE INVESTMENTS

	Study Case	Sensitivity Case 1	Sensitivity Case 2	Sensitivity Case 3	Sensitivity Case 4
Refinery Shutdowns	4	7	4	4	0
Number of New Units					
Naphtha Depentanizer	45	43	27	16	0
FCC Depentanizer	40	38	9	9	0
Hydrocracker Depentanizer	23	22	2	2	0
FCC Feed Hydrotreater	1	8	1	1	1
FCC Gasoline Hydrotreater	9	20	9	9	13
Number of Revamps and Expansions					
FCC Feed Hydrotreater	30	28	27	27	23
FCC Gasoline Hydrotreater	32	38	30	30	33
Desulfurization, $MM	9,456	15,112	8,873	8,873	9,766
Logistics/Tankage, $MM	1,187	1,353	740	445	0
Other, $MM	845	878	344	259	0
Total Investment Cost, $MM	11,488	17,343	9,957	9,577	9,766

Note: Individual refineries may appear in multiple categories for each case. Logistics/Tankage, Desulfurization, and Other all include contingency. The Original Report Logistics/Tankage data did not include contingency.

GASOLINE SUPPLY BALANCE AND REFINERY OPERATIONS

In the Original Report Base Case, United States (U.S.) refineries were projected to produce 7,296 MB/CD of hydrocarbon gasoline[3] annually. Hydrocarbon gasoline from other domestic sources was estimated at 200 MB/CD. The combination of domestic production was less than the projected consumption, resulting in a need for annual imports of 885 MB/CD. During the summer season, gasoline imports of 923 MB/CD were required.

The reductions in summer RVP in the Original Report Study and Sensitivity Cases, combined with projected refinery closures, resulted in significant reductions in domestic gasoline production. The summer season reductions ranged from 622 to 1,377 MB/CD. Because RVP specifications were held constant with the Base Case and because no shutdowns are projected, total gasoline production in Sensitivity Case 4 is the same as the Base Case. Details of the gasoline quality and supply balance for Sensitivity Case 4 summer season are reported in Tables 1 through 4.

REFINERY HYDROGEN REQUIREMENTS

In the Original Report cases, the previously-discussed reductions in naphtha end points to meet the DI specification resulted in lower reformer utilization and a reduction in refinery hydrogen production relative to the Base Case. Reformer hydrogen production in Sensitivity Case 4 is the same as the Base Case. In the Original Report cases, the combination of reduced reformer hydrogen production and increased desulfurization resulted in an annualized increase in net hydrogen purchases of 164 to 293 million standard cubic feet per calendar day (MMscf/CD) at refineries that continued to operate in the respective cases. The annualized increase in net hydrogen purchases for Sensitivity Case 4, 129 MMscf/CD, is lower due to the additional reformer hydrogen production. These numbers assume that existing refinery hydrogen plants produce at capacity where needed. It was assumed that the incremental hydrogen purchases would be available from third-party steam methane reformers.

[3] Changes in gasoline production and imports throughout the report are hydrocarbon only. It was assumed that domestic ethanol production and consumption remain constant at Base Case levels.

FIGURE 3

HYDROGEN PURCHASES, MMSCF/CD

	Total U.S.	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5
Base Case*	1,629.7	20.1	36.5	1,326.7	0.8	245.5
Study Case Purchases	1,793.6	28.4	64.8	1,424.5	1.5	274.5
Delta vs. Base Case**	**163.9**	**8.2**	**28.3**	**97.7**	**0.6**	**29.0**
Delta, %	**10%**	**41%**	**77%**	**7%**	**72%**	**12%**
Base Case*	1,618.4	20.1	36.5	1,315.4	0.8	245.5
Sensitivity Case 1	1,911.2	46.3	93.5	1,469.3	1.5	300.5
Delta vs. Base Case**	**292.8**	**26.2**	**57.0**	**153.9**	**0.6**	**55.0**
Delta, %	**18%**	**130%**	**156%**	**12%**	**74%**	**22%**
Base Case*	1,629.7	20.1	36.5	1,326.7	0.8	245.5
Sensitivity Case 2	1,814.4	28.3	64.5	1,416.6	0.8	304.1
Delta vs. Base Case**	**184.7**	**8.2**	**28.0**	**89.9**	**0.0**	**58.6**
Delta, %	**11%**	**41%**	**77%**	**7%**	**0%**	**24%**
Base Case*	1,629.7	20.1	36.5	1,326.7	0.8	245.5
Sensitivity Case 3	1,814.6	28.3	64.5	1,416.5	0.8	304.4
Delta vs. Base Case**	**184.9**	**8.2**	**28.0**	**89.8**	**0.0**	**58.9**
Delta, %	**11%**	**41%**	**77%**	**7%**	**0%**	**24%**
Base Case*	1,662.6	20.1	69.3	1,326.7	0.8	245.5
Sensitivity Case 4	1,791.3	20.9	91.6	1,382.1	0.8	295.8
Delta vs. Base Case**	**128.7**	**0.8**	**22.3**	**55.4**	**0.0**	**50.3**
Delta, %	**8%**	**4%**	**32%**	**4%**	**0%**	**20%**

* The hydrogen purchases are based on the refineries operating in the respective Study or Sensitivity Case relative to Base Case purchases.

** Difference in reported delta values are due to rounding.

GREENHOUSE GAS EMISSIONS

The additional hydrotreating required in Sensitivity Case 4 would result in an increase in carbon dioxide (CO_2) emissions versus the Base Case. The increase in CO_2 emissions in Sensitivity Case 4 versus the Study and Sensitivity Cases in the Original Report is attributed to the number of refineries running and severity of hydrotreating operations.

FIGURE 4

INCREMENTAL CO_2 EMISSIONS, TONNES/CD

CO_2 Emissions	TOTAL U.S.	PADD 1	PADD 2	PADD 3	PADD 4	PADD 5
Base Case*	717,811	48,248	137,968	375,030	24,241	132,323
Study Case	727,748	48,667	140,932	380,321	24,892	132,935
Delta	**9,936**	**419**	**2,964**	**5,292**	**650**	**612**
Base Case*	708,840	48,248	135,811	368,215	24,241	132,323
Sensitivity Case 1	724,976	49,245	139,793	376,141	25,276	134,521
Delta	**16,136**	**997**	**3,982**	**7,926**	**1,035**	**2,197**
Base Case*	717,811	48,248	137,968	375,030	24,241	132,323
Sensitivity Case 2	725,411	48,502	139,524	379,316	24,583	133,486
Delta	**7,599**	**253**	**1,555**	**4,286**	**342**	**1,163**
Base Case*	717,811	48,248	137,968	375,030	24,241	132,323
Sensitivity Case 3	724,951	48,502	139,429	379,135	24,506	133,379
Delta	**7,140**	**253**	**1,461**	**4,105**	**264**	**1,056**
Base Case*	729,459	48,248	146,147	375,030	24,241	135,793
Sensitivity Case 4	733,404	48,339	146,769	377,371	24,353	136,572
Delta	**3,944**	**90**	**622**	**2,342**	**112**	**778**

* The CO_2 values are based on the refineries operating in the respective Study or Sensitivity Case relative to Base Case emissions for those refineries.

Assuming foreign refineries experience a proportional increase, the combined increase in CO_2 emissions would be 1.7 million tonnes per year for Sensitivity Case 4 versus 2.9 to 7.4 million tonnes per year from the cases in the Original Report.

TOTAL COMPLIANCE COSTS

In the cases from the Original Report, the downgrading of light hydrocarbons was the most significant compliance cost. In Sensitivity Case 4, this cost is eliminated, resulting in significantly lower annual compliance costs. Total annual compliance costs are shown below in Figure 5.

FIGURE 5
TOTAL ANNUAL COMPLIANCE COST
2009 $MM PER YEAR

	Study Case	Sensitivity Case 1	Sensitivity Case 2	Sensitivity Case 3	Sensitivity Case 4
Purchased Hydrogen	305	546	354	354	246
Other Variable Operating Expenses	498	749	342	303	455
Fixed Operating Expenses	269	404	37	35	23
Capital Recovery	1,953	2,949	1,693	1,628	1,666
Light Hydrocarbon Downgrading	7,368	8,572	4,363	2,528	0
Total Cost	10,393	13,220	6,789	4,848	2,390

In Figures 6 through 10, the annualized and summer individual refinery compliance costs are plotted in cents per gallon (¢/Gal.) of gasoline for the Study and Sensitivity Cases vs. cumulative barrels of gasoline supplied by U.S. refiners.

FIGURE 6

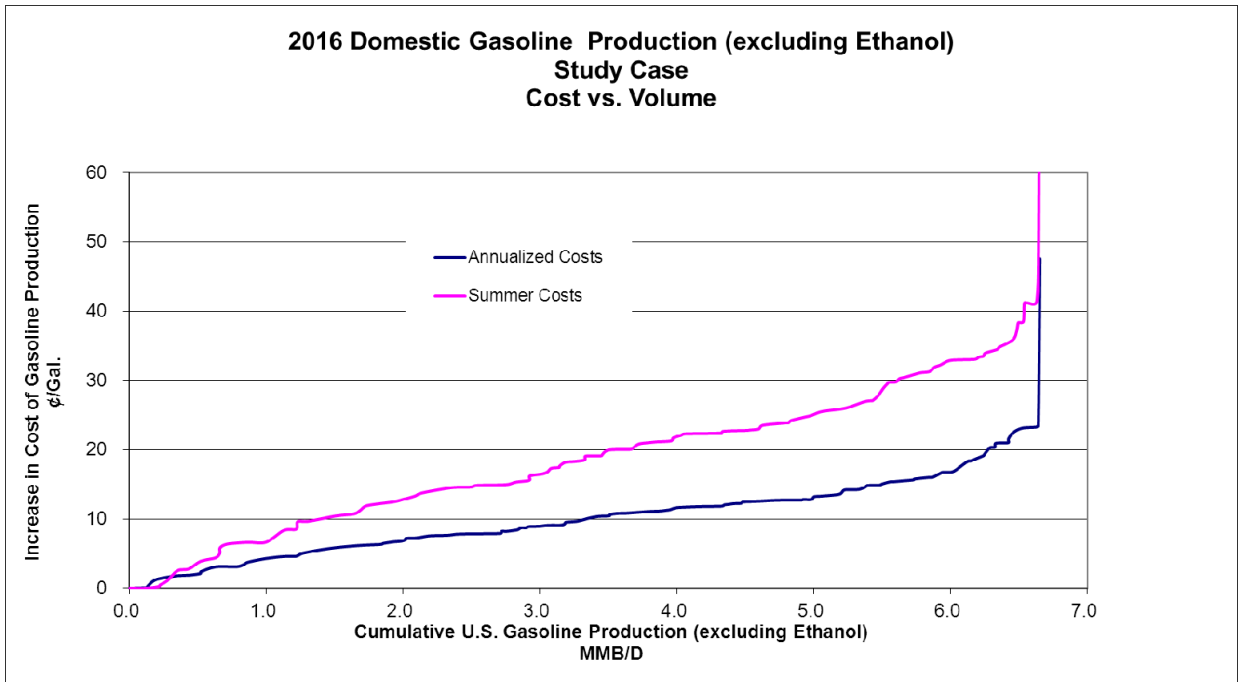


FIGURE 7

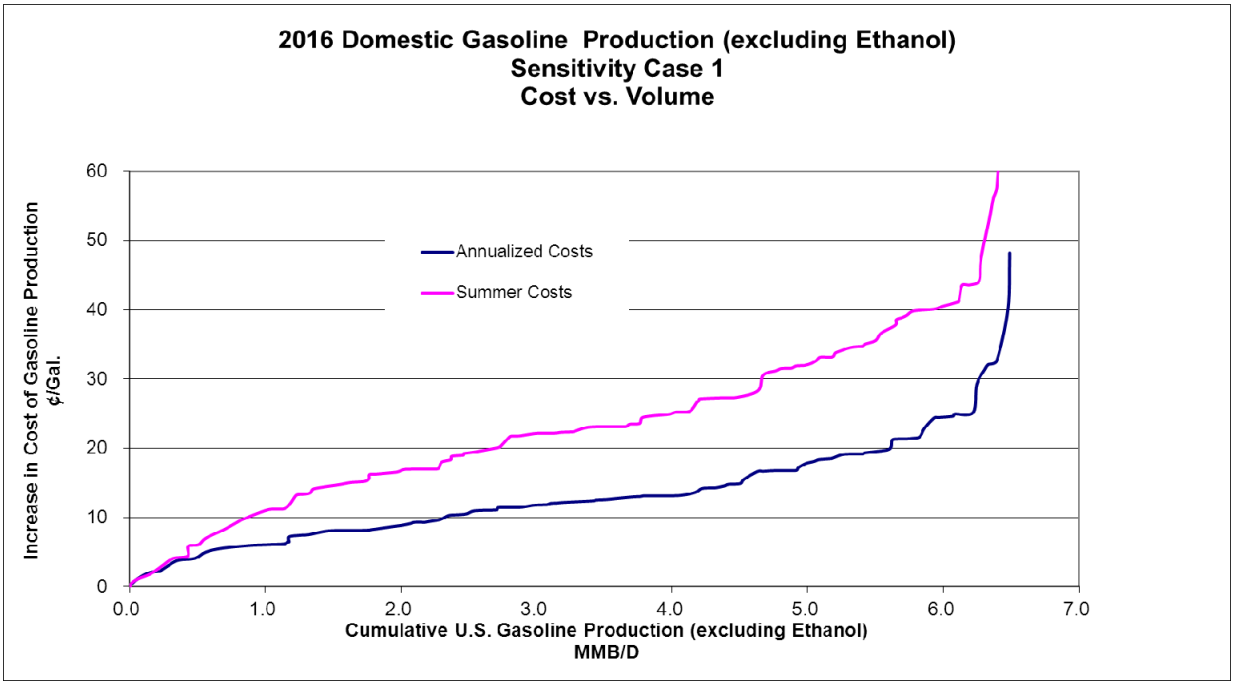


FIGURE 8

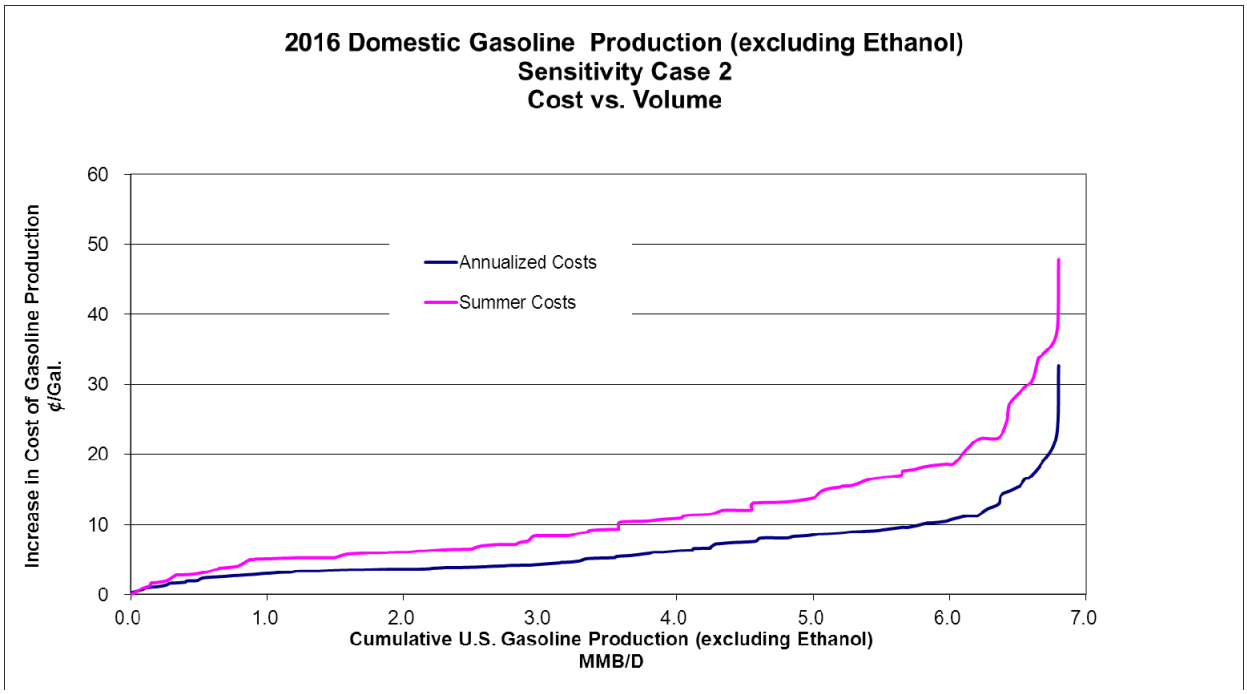


FIGURE 9

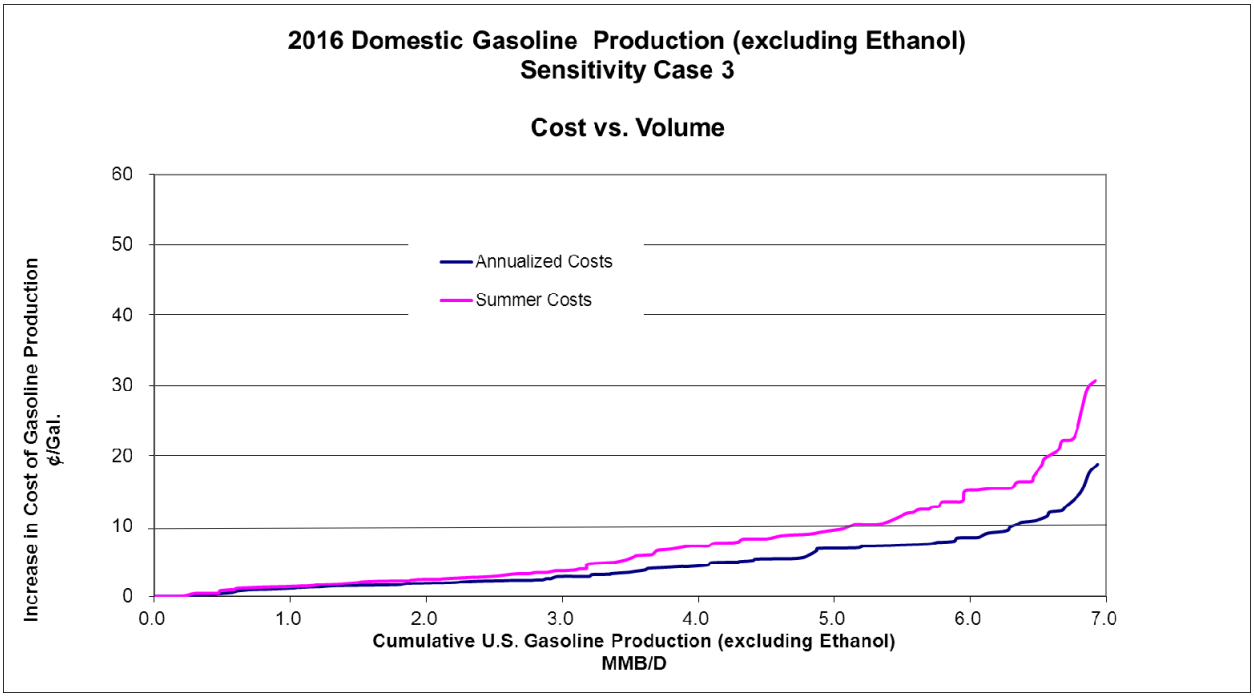
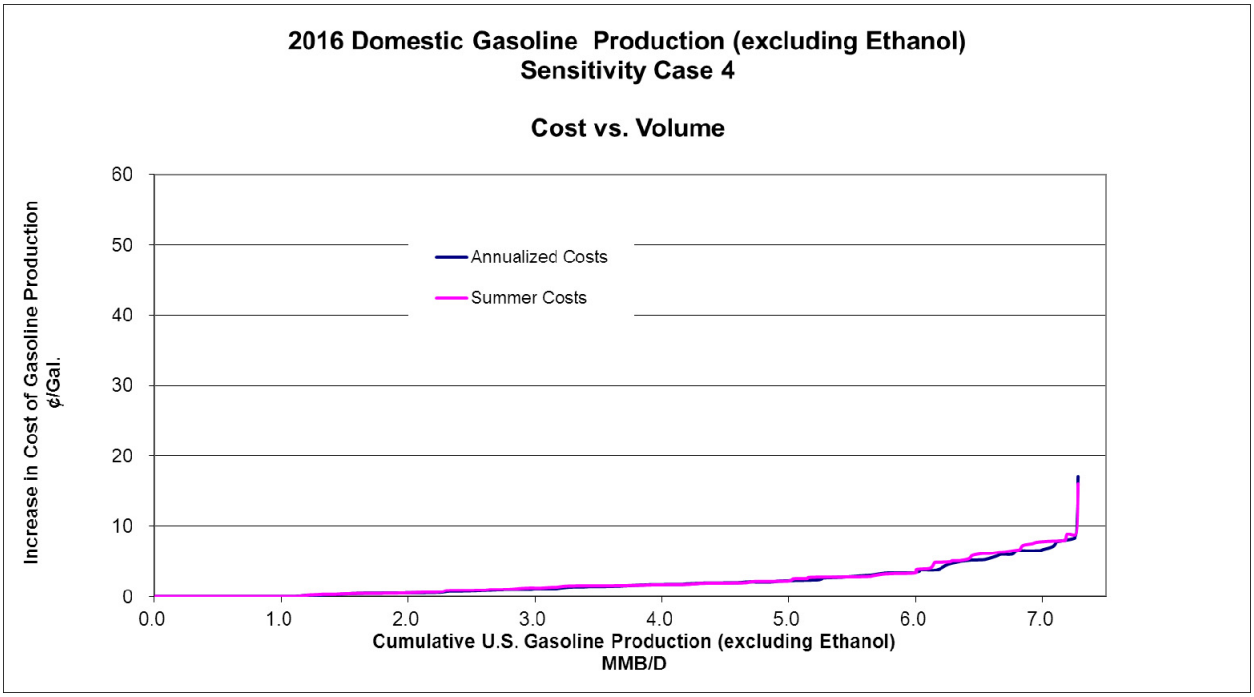


FIGURE 10



CONCLUSIONS

Compliance costs in Sensitivity Case 4 are significant, but the elimination of the RVP changes included in the Original Report removes the substantial costs associated with removing light hydrocarbons from the gasoline pool. The results indicate no change in gasoline supply relative to the Base Case.

Total capital investment costs are projected at just under $10 billion, in the same range as three of the previous cases. Ongoing annual compliance costs, including capital recovery, are estimated at $2.4 billion in Sensitivity Case 4. Allocating these annualized costs to gasoline produced results in a marginal cost of 6¢ to 9¢/Gal. in most markets.

TABLE 1

Sensitivity Case 4 2016 Summer Supply Balance[1,2]

(Thousands of Barrels Per Day - Including Ethanol)

	Ethanol [3]	*Hydrocarbon*	*TOTAL U.S.*	*PADD 1*	*PADD 2*	*PADD 3*	*PADD 4*	*PADD 5*
Domestic Refinery Gasoline Production[4]								
E85	48.4	17.0	65.4	0.4	64.7	0.1	0.0	0.2
Lower Sulfur Gasoline - C	547.1	4,924	5,471	318	1,570	2,842	344	397
Lower Sulfur Gasoline - R	180.6	1,626	1,806	358	345	1,068	-	35
CARB	96.4	868	964	-	-	-	-	964
TOTAL	**873**	**7,435**	**8,307**	**677**	**1,980**	**3,910**	**344**	**1,396**
Gasoline Consumption[5]								
E85	48.4	17.0	65.4	0.4	64.7	0.1	0.0	0.2
Lower Sulfur Gasoline - C	627.0	5,643	6,270	2,132	2,080	1,172	369	517
Lower Sulfur Gasoline - R	210.1	1,891	2,101	1,307	358	345	-	91
CARB	111.8	1,006	1,118	-	-	-	-	1,118
TOTAL	**997**	**8,558**	**9,555**	**3,440**	**2,503**	**1,517**	**369**	**1,726**
Domestic Refinery Over/(Under) Supply[6]								
E85		-	-	-	-	-	-	-
Lower Sulfur Gasoline - C		(719)	(799)	(1,814)	(510)	1,670	(25)	(119)
Lower Sulfur Gasoline - R		(266)	(295)	(949)	(13)	723	-	(56)
CARB		(138)	(154)	-	-	-	-	(154)
TOTAL		**(1,123)**	**(1,248)**	**(2,763)**	**(523)**	**2,393**	**(25)**	**(330)**

NOTES:

(1) "Summer" is defined as April through September. Annual average consumption from the EIA 2010 Annual Energy Outlook Early Release was seasonally adjusted using actual 2005/2006 consumption as reported by the EIA in Petroleum Marketing Monthly.

(2) As described in the main body of the report "Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline".

(3) The difference between the ethanol in Domestic Refinery Gasoline Production and Gasoline Consumption is the ethanol blended into the imported gasoline blendstocks.

(4) Totals represent finished gasoline produced from refinery CBOB, RBOB, and CARBOB as determined by *PRISM* simulations and include 10 Vol.% ethanol added to domestic refinery production. Gasoline blender production, based on blendstock sources other than from domestic refiners, is not included.

(5) Total U.S. gasoline consumption is based on the full year 2016 forecast contained in the EIA 2010 Annual Energy Outlook Early Release. PADD level allocations are based on annual 2005/2006 vehicle miles traveled as reported by the U.S. Department of Transportation. Grade allocations are based on 2005/2006 average annual share of sales as reported in the Petroleum Marketing Annual.

(6) Net supply requirements are from finished gasoline and gasoline blendstocks, excluding oxygenates, either from foreign imports or non-refinery supply.

TABLE 2

Sensitivity Case 4 2016 Summer Regional Finished Gasoline Qualities[1,2]
At Refinery Gate (Before Ethanol is Added)

	TOTAL U.S.	*PADD 1*	*PADD 2*	*PADD 3*	*PADD 4*	*PADD 5*
Domestic Production by Crude Oil Refiners[3]						
Total Pool						
RVP, psi	7.4	7.0	8.1	7.3	8.5	6.8
Olefins, Vol.%	9.7%	12.0%	10.1%	10.6%	9.9%	5.8%
Aromatics, Vol.%	29.1%	28.6%	30.2%	29.4%	27.6%	27.3%
Benzene, Vol.%	0.56%	0.65%	0.61%	0.51%	0.71%	0.54%
Sulfur, wppm	10.2	11.8	11.0	11.3	11.5	4.8
Lower Sulfur Gasoline - C						
RVP, psi	8.4	8.9	8.7	8.0	8.5	8.9
Olefins, Vol.%	11.7%	18.3%	10.2%	12.2%	9.9%	10.3%
Aromatics, Vol.%	32.2%	37.6%	32.1%	32.4%	27.6%	30.7%
Benzene, Vol.%	0.60%	0.67%	0.67%	0.53%	0.71%	0.69%
Sulfur, wppm	11.0	10.4	10.7	11.5	11.5	8.4
Lower Sulfur Gasoline - R						
RVP, psi	5.3	5.3	5.3	5.3	-	5.2
Olefins, Vol.%	6.8%	6.3%	9.8%	6.2%	-	4.5%
Aromatics, Vol.%	21.1%	20.5%	21.7%	21.4%	-	10.4%
Benzene, Vol.%	0.48%	0.63%	0.36%	0.46%	-	0.66%
Sulfur, wppm	11.4	13.2	12.3	10.7	-	7.5
CARBOB						
RVP, psi	5.9	-	-	-	-	5.9
Olefins, Vol.%	4.0%	-	-	-	-	4.0%
Aromatics, Vol.%	26.5%	-	-	-	-	26.5%
Benzene, Vol.%	0.48%	-	-	-	-	0.48%
Sulfur, wppm	3.3	-	-	-	-	3.3

NOTES:

(1) "Summer" is defined as April through September.

(2) As described in the main body of the report "Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline".

(3) *PRISM* simulation results.

TABLE 3

Sensitivity Case 4 2016 Summer Regional Finished Gasoline Qualities[1,2]
(includes Ethanol)

	TOTAL U.S.	*PADD 1*	*PADD 2*	*PADD 3*	*PADD 4*	*PADD 5*
Domestic Production by Crude Oil Refiners[3]						
Total Pool						
RVP, psi	8.6	8.2	9.2	8.5	9.5	8.0
Olefins, Vol.%	8.8%	10.8%	9.1%	9.5%	8.9%	5.2%
Aromatics, Vol.%	26.2%	25.7%	27.2%	26.5%	24.8%	24.6%
Benzene, Vol.%	0.51%	0.59%	0.56%	0.46%	0.65%	0.49%
Sulfur, wppm	10.2	11.6	10.9	11.2	11.3	5.4
Lower Sulfur Gasoline - C						
RVP, psi	9.4	9.9	9.7	9.1	9.5	9.9
Olefins, Vol.%	10.5%	16.5%	9.2%	11.0%	8.9%	9.3%
Aromatics, Vol.%	29.0%	33.8%	28.9%	29.2%	24.8%	27.6%
Benzene, Vol.%	0.55%	0.61%	0.61%	0.48%	0.65%	0.62%
Sulfur, wppm	10.9	10.4	10.6	11.4	11.3	8.6
Lower Sulfur Gasoline - R						
RVP, psi	6.7	6.7	6.8	6.7	-	6.7
Olefins, Vol.%	6.2%	5.7%	8.8%	5.5%	-	4.0%
Aromatics, Vol.%	19.0%	18.4%	19.6%	19.3%	-	9.4%
Benzene, Vol.%	0.43%	0.57%	0.33%	0.42%	-	0.60%
Sulfur, wppm	11.3	12.8	12.1	10.7	-	7.8
CARBOB						
RVP, psi	7.3	-	-	-	-	7.3
Olefins, Vol.%	3.6%	-	-	-	-	3.6%
Aromatics, Vol.%	23.9%	-	-	-	-	23.9%
Benzene, Vol.%	0.44%	-	-	-	-	0.44%
Sulfur, wppm	4.0	-	-	-	-	4.0

NOTES:

(1) "Summer" is defined as April through September.

(2) As described in the main body of the report "Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline".

(3) *PRISM* simulation results.

TABLE 4

Sensitivity Case 4 2016 Summer Production[1,2]

(Thousands of Barrels Per Day - Including Ethanol)

	TOTAL U.S.	*PADD 1*	*PADD 2*	*PADD 3*	*PADD 4*	*PADD 5*
Domestic Production by Crude Oil Refiners[3]						
E85 Gasoline	65.4	0.4	64.7	0.1	0.0	0.2
Lower Sulfur Gasoline - C	5,471	318	1,570	2,842	344	397
Lower Sulfur Gasoline - R	1,806	358	345	1,068	-	35
CARB Gasoline	964	-	-	-	-	964
Jet Fuel	1,488	79	263	666	41	439
Distillates	4,244	331	893	2,345	170	505
Pentanes	92	2	0	30	-	60
Other[4]	4,126	306	722	2,184	128	786
TOTAL	**18,257**	**1,395**	**3,858**	**9,135**	**682**	**3,186**

NOTES:

(1) "Summer" is defined as April through September. Annual average consumption from the EIA 2010 Annual Energy Outlook Early Release was seasonally adjusted using actual 2005/2006 consumption as reported by the EIA in Petroleum Marketing Monthly.

(2) As described in the main body of the report "Addendum to Potential Supply and Cost Impacts of Lower Sulfur, Lower RVP Gasoline".

(3) Totals represent finished gasoline produced from refinery CBOB, RBOB, and CARBOB as determined by *PRISM* simulations and include 10 Vol.% ethanol added to refinery production. Gasoline blender production, based on blendstock sources other than from domestic refiners, is not included.

(4) Includes LPG, residual fuel oil, aviation gasoline, petrochemical feedstocks, lubricants, waxes, asphalt, road oil, still gas, special naphthas, petroleum coke, and miscellaneous petroleum products.