

No Free Lunch -  
Understanding ALL Impacts of an MTBE Ban

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## BACKGROUND

In November, 1998, U.S. Environmental Protection Agency Administrator appointed Blue Ribbon Panel to investigate air quality benefits/water quality concerns for gasoline oxygenates. Panel -

Agreed broadly, but not unanimously, that less MTBE should be used in reformulated gasoline (RFG).

Urged removal of legal requirement for 2 wt% oxygen in RFG.

Given Panel recommendations, EPA Administrator announced that "We must begin to significantly reduce the use of MTBE in gasoline as quickly as possible without sacrificing the gains we've made in achieving cleaner air."

## CLINTON ADMINISTRATION PRINCIPLES

Given Blue Ribbon recommendations, Clinton Administration proposed legislative principles:

#1: Amend Clean Air Act to provide authority to reduce or eliminate use of MTBE.

#2: As MTBE use is reduced or eliminated, ensure that air quality gains are not diminished.

#3: Replace existing oxygen requirement of Clean Air Act with renewable fuel standard for all gasoline.

ARE STAKEHOLDERS PAYING ATTENTION  
TO ALL IMPACTS OF MTBE BAN?

MTBE ban would be equivalent to loss of substantial premium blendstock volume, requiring significant increase in refinery capacity.

MTBE BAN EXAMPLE

**PREMISES: No spare alkylation capacity; no RVP headroom; replace MTBE with petroleum blendstocks.**

REPLACE VOLUME AND ENERGY: Drop out MTBE and replace with naphtha.

REPLACE OCTANE: Restore octane loss by increasing reformat octane, with associated yield losses.

OUTCOME:

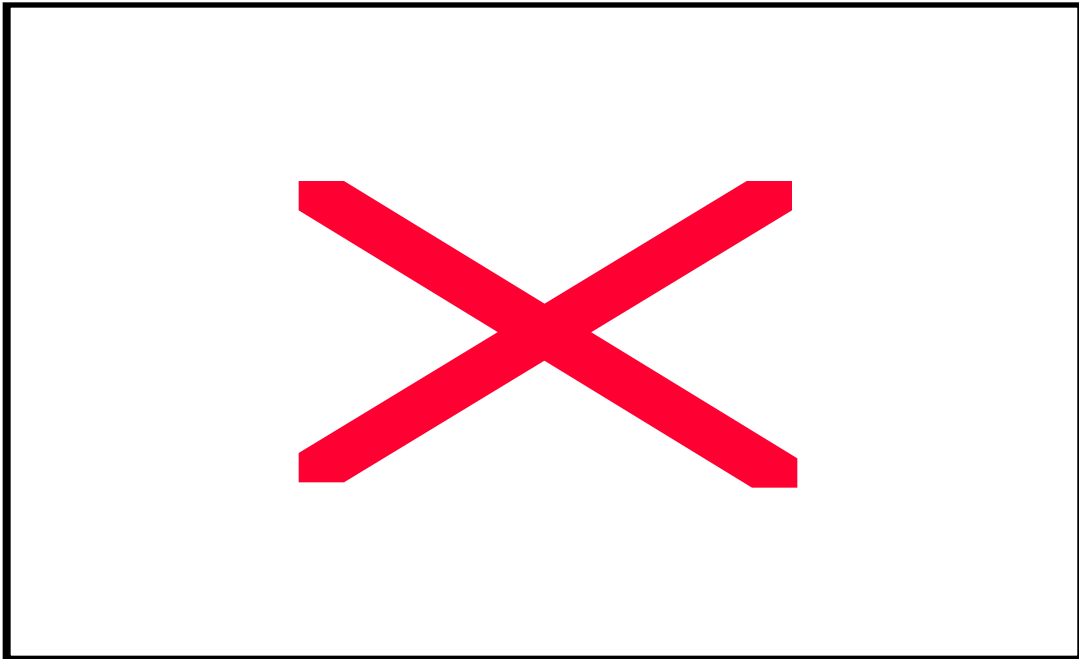
MTBE ban is equivalent to **loss of 300 thousand barrels per day of premium blendstock.**

MTBE removal needs to be compensated by crude processing capacity equivalent to **5 average US refineries.**

CONTEXT FOR LOSING A PREMIUM BLENDSTOCK

US is experiencing ...

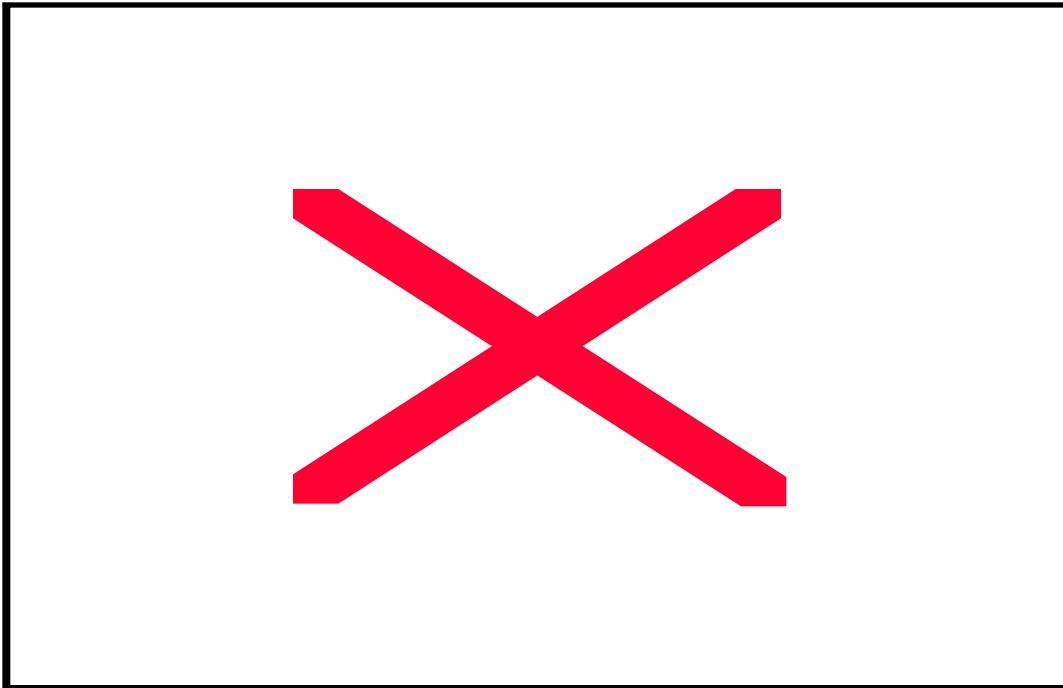
High gasoline demand and demand growth.



## CONTEXT FOR LOSING A PREMIUM BLENDSTOCK

US is experiencing ...

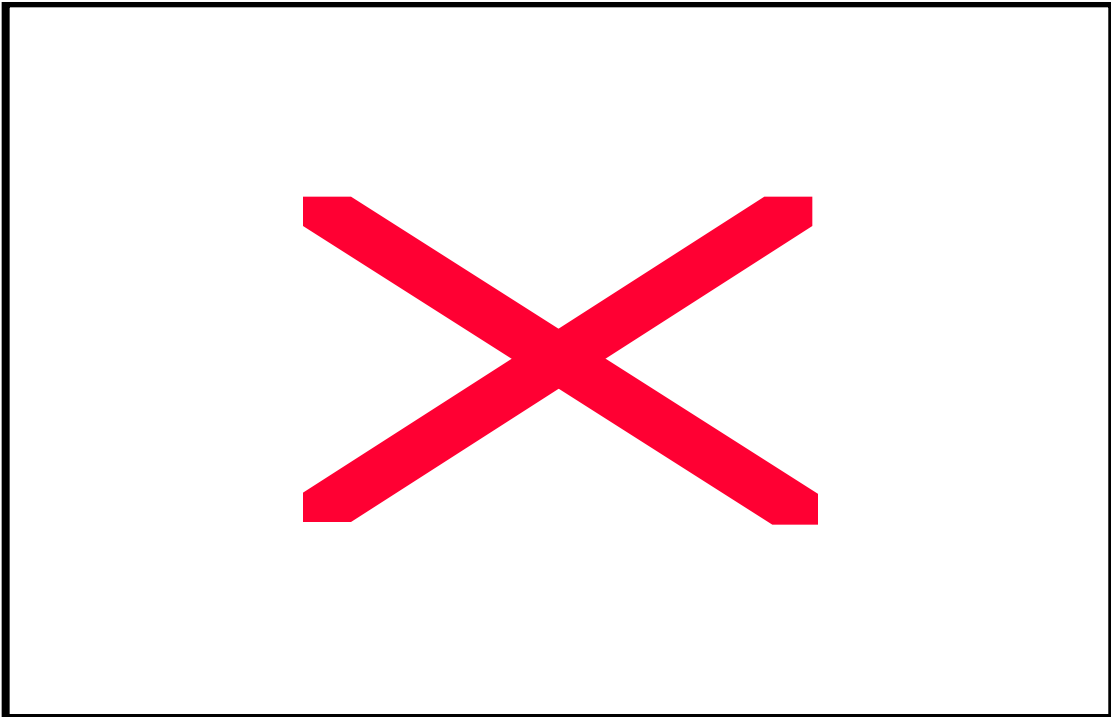
Increasing import dependence and import dependence growth.



## CONTEXT FOR LOSING A PREMIUM BLENDSTOCK

US is experiencing ...

High refinery utilization and gasoline season utilization increase.



## CONTEXT FOR LOSING A PREMIUM BLENDSTOCK

US is experiencing ...

Multiple requirements for product quality changes -

Low sulfur gasoline

Ultra-low sulfur diesel fuel

Gasoline toxics control (Anti-backsliding rule)

High refinery investment requirements for product quality changes...

Low sulfur gasoline: \$8 billion (National Petroleum Council)

Ultra-low sulfur diesel fuel: \$8 billion to \$13 billion (DOE)

MTBE reduction: > \$1.8 billion (NPC)

Loss of flexibility in gasoline production and supply system, with market difficulties already experienced for ...

CARB diesel and reformulated gasoline

St. Louis Phase II reformulated gasoline

Chicago Phase II reformulated gasoline

WHAT ARE LIKELY IMPACTS OF REDUCED MTBE USE?



We used Oak Ridge National Laboratory Refinery Yield Model to develop understanding of impacts of Clinton Administration Principles:

Factor variation in summer scenarios:

MTBE Content (0% to 3%)

Oxygen Requirement (Yes or No)

Toxics Backsliding Limitations (Yes or No)

Renewable Standard(No, 2X, or 3X)

MTBE Plant Conversion (Yes or No)

## ADVERSE COST AND IMPORT IMPACTS

Banning MTBE increases average production costs for gasoline.

Banning MTBE increases gasoline imports.

Scenario	MTBE Content	Oxygen Requirement	Toxics Limits	Renewable Standard	MTBE Plant Conversion
2	0%	No	No	2X	No

Region	Gasoline output, % of required	EtOH, BGY	EtOH cost increase, cpg	Gasoline cost increase, cpg	Investment, \$B
1+3	<b>89</b>	0.09	40	<b>1.2</b>	0
4		0.09	40		
CA		0.83	40		
2	<b>97</b>	1.89	30	<b>1.1</b>	0

**National ethanol demand: 2.9 BGY (2X)**

Production Regions -

1+3: US East and Gulf Coasts

4: US Rocky Mountain

CA: California

2: US Midwest

EtOH: Ethanol

BGY: Billion gallons per year

cpg: Cents per gallon

\$B: Billion dollars

## ADVERSE PRICE IMPACTS

Price impacts will be greater than cost impacts, if price is determined by marginal costs of production.

For example, with a reduction of MTBE, the price increase appears to be several times greater than the average cost increase.

Scenario	MTBE Content	Oxygen Requirement	Toxics Limits	Renewable Standard	MTBE Plant Conversion
1	<3%	No	No	NA	No

Region	Source*	Gasoline cost increase, cpg	Gasoline price increase, cpg
1+3	ORNL	0.0-0.3	
National	EIA		1.9-2.4

ORNL: Oak Ridge National Laboratory

EIA: Energy Information Administration, *MTBE Analysis for the National Economic Council*

## INVESTMENT - IMPORT DILEMMA

With MTBE ban, high refinery investment is required to keep gasoline imports from increasing.

Scenario	MTBE Content	Oxygen Requirement	Toxics Limits	<b>Renewable Standard</b>	MTBE Plant Conversion
2	0%	No	No	<b>2X</b>	No

<b>Region</b>	<b>Gasoline output, % of required</b>	EtOH, BGY	EtOH cost increase, cpg	Gasoline cost increase, cpg	<b>Investment, \$B</b>
<b>1+3</b>	<b>100</b>	2.17	40	2.0	<b>4.7</b>
<b>1+3</b>	<b>89</b>	0.09	40	1.2	<b>0</b>

## HIGH RENEWABLE MANDATE - RFG PRODUCTION DECLINE

For our premises - *without gasoline value response* - MTBE ban/high ethanol mandate could significantly depress summer RFG production.

Scenario	MTBE Content	Oxygen Requirement	Toxics Limits	Renewable Standard	MTBE Plant Conversion
3	0%	No	No	3X	No

Region	Gasoline output, % of required	EtOH, BGY	EtOH cost increase, cpg	Gasoline cost increase, cpg	Investment, \$B
<b>1+3</b>	89	0.00	70	<b>1.0 (No RFG)</b>	0
4		0.09	70		
CA		0.83	70		
2	<b>104</b>	<b>3.33</b>	60	6.9	0.2
<b>National ethanol demand: 4.25 BGY (3X)</b>					

## OXYGEN MANDATE - RFG PRODUCTION DECLINE

For our premises - *without gasoline value response* - MTBE ban/oxygen mandate could significantly depress summer RFG production, compared to MTBE ban/oxygen waiver.

Scenario	MTBE Content	Oxygen Requirement	Toxics Limits	Renewable Standard	MTBE Plant Conversion
5	0%	No	No	No	No
6	0%	Yes	No	No	No

Region 1+ 3				
Scenario	Oxygen Requirement	Gasoline output, % of required	Conventional gasoline output, % of required	RFG output, % of required
5	No	90	100	61
6	Yes	88	119	3

**COMPLEX INTERACTIONS:  
ENERGY USE, INVESTMENT, ETHANOL ECONOMICS,  
GASOLINE PRODUCTION**

Refinery energy use (and pollutant emissions) increase with MTBE ban.

Scenario 5 (no oxygen or renewable requirements) illustrates importance of ethanol in refiner economic response to compensate for volume and octane loss due to MTBE ban.

Scenario	MTBE Content	Oxygen Requirement	Toxics Limits	Renewable Standard	MTBE Plant Conversion
5	0%	No	No	No	No

<b>Region 1+ 3</b>					
<b>Gasoline output, % of required</b>	<b>EtOH, BGY</b>	<b>EtOH cost increase, cpg</b>	<b>Gasoline cost increase, cpg</b>	<b>Investment, \$B</b>	<b>Refinery fuel and power index*</b>
<b>Reference with MTBE</b>					<b>1.00</b>
<b>90</b>	<b>0.73</b>	30	1.1	0	<b>1.10</b>
<b>100</b>	3.35	30	1.7	2.3	<b>1.02</b>
*Refinery fuel and power per unit of gasoline energy, relative to Reference					

## BAN COMPLICATIONS ARE RELATED TO MTBE PROPERTIES

MTBE has high octane - policies that cause octane loss can aggravate impacts of MTBE ban:

Low sulfur gasoline

Toxics control

Benzene content control

MTBE has attractive Reid vapor pressure - policies that change vapor pressure requirements can alleviate or aggravate impacts of MTBE ban:

Oxygenate RVP credit

Low sulfur gasoline RVP tradeoffs through Complex Model

Mandated ethanol use

Lower RVP standards

Elimination of conventional gasoline RVP waiver



## BAN COMPLICATIONS ARE RELATED TO MTBE PROPERTIES

(Continued)

MTBE tends to lower distillation curve - policies that require downward shift of distillation curve can aggravate impacts of MTBE ban:

Driveability index reduction. MTBE ban will increase DI by 45 to 90 degrees.

## IMPACTS VERSUS BENEFITS

In times of tight supply and price volatility, an MTBE ban invites market problems by virtue of impacts/costs we have discussed:

Loss of gasoline blendstock volume

Increased gasoline production costs

Increased marginal costs of production (price)

Increased reliance on gasoline imports

Increased refinery investments

Increased refinery fuel/power/pollutant emissions

Policies with adverse impacts on octane, vapor pressure, and distillation properties.

WHAT BENEFITS ARE WE PURCHASING AT THESE COSTS?