

Status and Impact of State MTBE Bans

Background

As a result of the Clean Air Act Amendments of 1990 (CAAA90), the year-round use of reformulated gasoline (RFG) has been required in cities with the worst smog problems since 1995 (Figure 1). One of the requirements of RFG specified by CAAA90 is a 2-percent oxygen requirement, which is met by blending “oxygenates,”¹ including methyl tertiary butyl ether (MTBE) and ethanol, into the gasoline. MTBE is the oxygenate used in almost all RFG outside of the Midwest. Ethanol is currently used in the Midwest as an oxygenate in RFG and as an octane booster and volume extender in conventional gasoline.

Several years ago, MTBE was detected in water supplies scattered throughout the country, but predominantly in areas using RFG. MTBE from RFG was apparently making its way through leaking pipelines and underground storage tanks into ground water. The discovery of MTBE in ground water and concerns for water quality touched off a debate about the use of MTBE in gasoline, and subsequently the oxygen requirement itself. Discussions of removing the oxygen requirement on RFG have often been linked to the concept of a renewable fuels standard that would assure a certain level of ethanol blending.

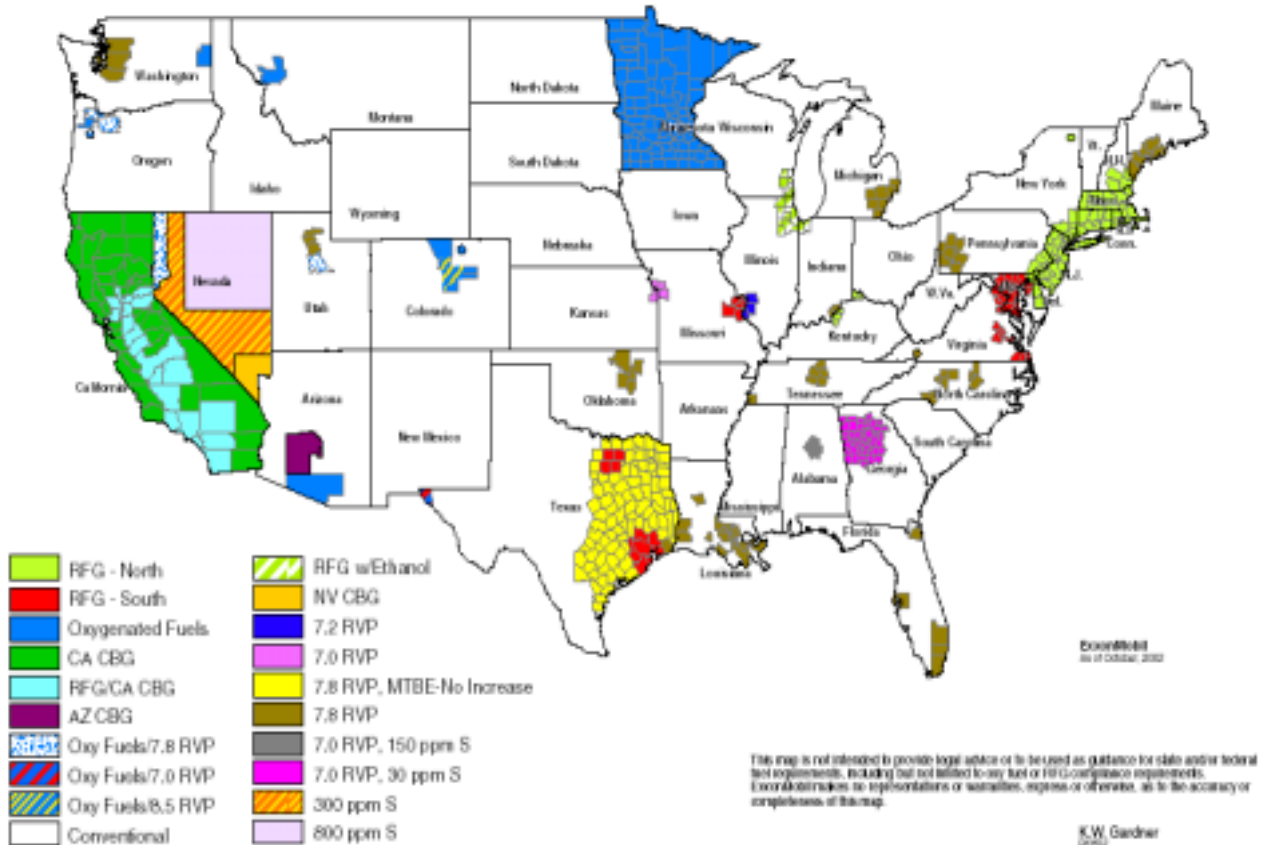
MTBE blended into RFG adds oxygen, extends the volume of the gasoline and boosts octane, all at the same time. In order to meet the 2-percent oxygen requirement (by weight), MTBE is blended into RFG at approximately 11 percent by volume. If the use of MTBE is reduced or banned, refiners must find other measures (e.g., blending ethanol and/or other petroleum-based products such as alkylate) to maintain the octane level of gasoline and still meet all Federal requirements.

Ethanol currently receives a Federal excise tax exemption of 52 cents per gallon, which is scheduled to decline to 51 cents in 2005. Legal authority for the Federal tax exemption expires in 2007, but this exemption has been renewed several times since it was initiated in 1978. Blending with ethanol, which is primarily produced from corn, is also encouraged by tax incentives in 17 States to help bolster agricultural markets. Some of the characteristics of ethanol have made it less attractive to refiners than MTBE as an oxygenate, primarily higher volatility which makes it more difficult to meet emissions standards. On the other hand, ethanol contains more oxygen so only about half as much ethanol (by volume) is needed for RFG. EIA recently published a study, *Supply Impacts of an MTBE Ban*,² which analyzed refineries’ options to supply MTBE-free gasoline, including the likely use of ethanol.

¹ An oxygenate is typically referred to as a hydrocarbon compound with some oxygen content that, when blended with gasoline, will facilitate burning of gasoline and reduce carbon monoxide emissions.

² Requested by Sen. Jeff Bingaman and published in September 2002, <http://tonto.eia.doe.gov/FTP/ROOT/service/question1.pdf>

Figure 1. U.S. Gasoline Requirements, 2002



Key: RFG = reformulated gasoline; CBG = California Air Resources Board gasoline (required for all California except the Federal RFG areas in that State); RVP = Reid vapor pressure in pounds per square-inch; S = sulfur

Status of State MTBE Bans

Legislation that would ban or restrict the use of MTBE in gasoline has already been passed in 16 States: California, Colorado, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Nebraska, New York, Ohio, South Dakota, and Washington. In addition, Maine has passed legislation that contains a goal of phasing out MTBE. Of these States, only five currently rely on MTBE (California, Connecticut, Kentucky, Missouri, and New York); together, they account for approximately 45 percent of the Nation’s MTBE consumption. Table 1 provides a summary of these State MTBE bans.

Table 1. Overview of State MTBE Bans

State	MTBE Ban Schedule	MTBE Consumption^a (% of U.S. total)
California	MTBE ban starting January 1, 2004	31.7
Colorado	MTBE ban started April 30, 2002	0
Connecticut	MTBE ban starting October 1, 2003	3.4
Illinois	MTBE prohibited by July 2004	0
Indiana	MTBE limited to 0.5% by volume, starting July 23, 2004	0
Iowa	0.5% MTBE by volume cap, already in effect	0
Kansas	MTBE limited to 0.5% by volume, starting July 1, 2004	0
Kentucky	MTBE ban starting January 1, 2006; beginning in January 1, 2004, ethanol encouraged to be used in place of MTBE	0.8
Maine	Law merely expresses state's "goal" to ban MTBE; it's not an actual ban. The "goal" is to phase out gasoline or fuel products treated with MTBE by January 1, 2003	0
Michigan	MTBE prohibited by June 1, 2003	0
Minnesota	All ethers (MTBE, ETBE, TAME) limited to 1/3 of 1.0% by weight after July 1, 2000; after July 1, 2005, total ether ban	0
Missouri	MTBE limited to 0.5% by volume, starting July 1, 2005	1.1
Nebraska	MTBE limited to 1.0% by volume, starting July 13, 2000	0
New York	MTBE ban starting January 1, 2004	7.5
Ohio	MTBE ban starting July 1, 2005	0
S. Dakota	0.5% MTBE by volume cap, already in effect	0
Washington	MTBE ban starting December 31, 2003	0

^aData include MTBE blended into RFG and oxygenated gasoline only. MTBE may also be found in conventional gasoline, but not in significant amounts.

Source: MTBE consumption estimates are based on EIA data as of December 2002.

Some other States either have introduced or are likely to introduce bills limiting or banning MTBE. For example, Rhode Island Sen. Leo Blais introduced a bill (S.B. 31) that would phase out MTBE starting July 2004.³ Rhode Island consumes approximately 1.0 percent of the total MTBE in the Nation. However, it is unclear if any new State MTBE ban(s) in addition to the States listed in Table 1 would be enacted soon enough to have a significant near-term impact on the market, since approximately 43 percent of the MTBE would be phased out of the market in about a year.

³ *World Fuels Today*, January 22, 2003

Most of the attention concerning State MTBE bans has been focused on California, which consumes approximately 32 percent of the Nation's MTBE. Originally California was set to ban all ethers (including MTBE) by January 1, 2003. That deadline has been postponed for a year until January 1, 2004, out of concerns for potential supply disruptions. Even though several major refiners announced their intention to phase out MTBE by January 1, 2003, only ConocoPhillips has already completed the switch. Shell, BP, and ExxonMobil indicated their intention to switch out of MTBE blended gasoline in California markets by the first quarter of 2003. Valero, ChevronTexaco, and Tesoro do not intend to produce MTBE-free gasoline until California's MTBE ban comes into effect next January.⁴

In April 1999, California petitioned the U.S. Environmental Protection Agency (EPA) to waive the Federal oxygen requirement for areas of the State required by CAAA90 to use RFG,⁵ but the waiver request was denied by EPA in June 2001. An oxygen waiver would allow the State flexibility of using oxygenate-free RFG in case of unexpected ethanol supply disruptions. EPA also recently rejected a request from several trade groups for the California market, which would have allowed refiners and distributors to mix ethanol and MTBE-blended gasoline during the transition.⁶ Commingling of ethanol and MTBE-blended gasoline is believed to increase VOC (volatile organic compounds) emissions, although the magnitude and importance, in terms of its contribution to ozone, could vary depending on the season or geographical region in focus.⁷

New York is currently scheduled to phase out MTBE at the same time as California. While California has been largely self-sufficient in RFG supplies in the past, New York (and in general New England states) traditionally imported some RFG to supplement the production by domestic refiners (both from foreign sources and from other refining regions). In 2001, approximately 18 percent of the RFG consumed in New England and Mid Atlantic States was imported.⁸ When MTBE is banned in New York and Connecticut, the RFG imports could decline as some foreign suppliers may not be able to provide MTBE-free RFG or RBOB⁹ in the short term. The reduced RFG and RBOB imports would need to be made up by additional supply from the domestic refiners, likely from the Gulf Coast refineries and at additional costs.

New York would also be affected by the new EPA Mobile Source Air Toxics (MSAT) rule. Refineries traditionally supplying RFG to the New England and Mid Atlantic states, where RFG represents approximately two-thirds of the gasoline sales in those markets,

⁴ *World Fuels Today*, January 8, 2003

⁵ San Diego, Los Angeles, Sacramento, and San Joaquin Valley

⁶ *World Fuels Today*, January 7, 2003

⁷ NOx and VOC react with air to form ozone in the lower atmosphere, especially under sunlight and at high summer temperatures.

⁸ *Petroleum Supply Annual 2001, Vol. 1*, June 2002,

http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/petroleum_supply_annual/psa_volume1/current/pdf/volume1_all.pdf

⁹ RBOB stands for Reformulated Gasoline Blendstock for Oxygenate Blending, a motor gasoline blending component which, when blended with a specified type and percentage of oxygenate, meets the definition of RFG. Under an MTBE ban, RBOB would need to be "reformulated" to resemble those used in the Midwest in order to blend ethanol, primarily to offset the vapor "penalty" incurred by blending ethanol.

have relatively “clean” baselines for toxic emissions accounting.¹⁰ Blending with ethanol results in a slight increase in the emissions of toxics, which must be compensated by other blending changes in order to comply with “anti-backsliding” regulations under MSAT. In order to comply with MSAT, some refineries might opt for reducing the production of RFG, which might result in a temporary supply shortage.

In anticipating the State MTBE bans, the U.S. MTBE consumption has been declining since 2000. Table 2 shows annual MTBE consumption since 1993.¹¹ It is important to monitor the declining trend of MTBE as the 17 States start making the transition to MTBE-free gasoline in 2003 and 2004.

Table 2. U.S. MTBE Consumption (thousand barrels per day)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Domestic Supply^a	134.2	130.5	177.4	181.5	202.0	201.6	220.4	213.7	205.6	214.9
Net Imports^b	20.1	31.4	51.9	56.8	64.3	59.9	73.1	72.5	77.3	58.5
Total	154.3	161.9	229.3	238.3	266.3	261.5	293.5	286.2	282.9	273.4

^aDomestic supply includes MTBE production and stock changes. Stock change for 1993 was from January 31 to December 31, 1993.

^bNet imports include gross imports and MTBE blended in RFG and oxygenated imports, minus gross exports.

Source: EIA, *Petroleum Supply Annual 1993-2001*, DOE/EIA-0340; *Petroleum Supply Monthly 2002*; *EIA-819M Monthly Oxygenate Telephone Report*

Supply of Ethanol

One key factor for transition out of the MTBE-blended RFG is the availability of ethanol, the likely oxygenate alternative.¹² A recent EIA study, *Renewable Motor Fuel Production Capacity Under H.R. 4*,¹³ concluded that the ethanol industry is able to supply the volumes of ethanol required to phase out the use of MTBE under the State MTBE bans. According to the study, the Nation will have about an annual 2.86 billion-gallon (187,000 barrels per day) ethanol production capacity (2.4 billion gallons of existing capacity and 0.46 billion gallons of capacity under construction) available by the end of 2003. The State MTBE bans require a projected demand for ethanol of 2.73 billion gallons (178,000 barrels) in 2004.¹⁴

¹⁰ RFG is cleaner than conventional gasoline in terms of air toxic emissions. Thus, a refinery producing mostly RFG would have a cleaner (and stricter) baseline than a refinery producing mostly conventional gasoline.

¹¹ Winter oxygenated gasoline programs began at retail in November 1992, followed by the Federal RFG program in January 1995.

¹² Even if the oxygen requirement for RFG is waived, ethanol is still likely to be used in lieu of MTBE to make up the volume loss and to serve as an octane booster.

¹³ Requested by Sen. Jeff Bingaman and published in September 2002, <http://tonto.eia.doe.gov/FTP/ROOT/service/question2.pdf>

¹⁴ *Annual Energy Outlook 2003*, January 2003. This projection includes ethanol blended into both conventional gasoline and RFG.

In a recent, separate EIA study, *Review of Transportation Issues and Comparison of Infrastructure Costs for a Renewable Fuels Standard*,¹⁵ several inter-regional ethanol transportation issues were raised, even though most logistical issues could be overcome with proper planning. A few major items in the ethanol delivery infrastructure will be required. Rail terminals able to spot more than a few cars, constraints on the Inland Waterway System,¹⁶ and a possible shortage of OPA90 compliant Jones Act Vessels¹⁷ are some of the issues that must be dealt with to ensure adequacy of gasoline supplies, particularly in California.

Impact on Gasoline Prices

From the EIA study, *Renewable Motor Fuel Production Capacity Under H.R. 4*,¹⁸ the State MTBE bans are projected to increase average national motor gasoline prices by 1.8 cents per gallon in 2004, compared to a reference case with no State MTBE bans. In addition, the State MTBE bans would have a larger impact on national average RFG prices – 3.6 cents per gallon in 2004. Although State-level projections are not available, it is generally expected that the increase in RFG prices in California, New York, and Connecticut would be significantly higher than the national average as a result of the MTBE bans. Table 3 shows the impact on RFG prices and the associated ethanol supply and RFG consumption at PADD¹⁹ levels.

¹⁵ Requested by Sen. Jeff Bingaman and published in September 2002, <http://tonto.eia.doe.gov/FTPROOT/service/question3.pdf>

¹⁶ Near record drought condition this winter in the upper Midwest has affected the Mississippi River barge traffic, which provides a vital transportation link to ship ethanol from the Midwest to California.

¹⁷ The Merchant Marine Act of 1920, otherwise known as the Jones Act, requires that products shipped between U.S. ports must be transported in ships that were built in the United States, U.S. flagged, and manned by U.S. personnel. The Oil Pollution Act of 1990 (OPA90) requires the use of double-hulled vessels and further requires the retirement of single-hulled vessels from petroleum product service by certain dates based on their manufacture or rebuild date.

¹⁸ In 2002, EIA performed three major studies relating to the supply and price impacts on gasoline from a possible RFS and/or MTBE ban: A) *Impact of Renewable Fuels Standard/MTBE Provisions of S. 1766 – Requested by the Senate Energy Committee*, March 2002

([http://www.eia.doe.gov/oiaf/servicerpt/mtbe/pdf/sroiaf\(2002\)06.pdf](http://www.eia.doe.gov/oiaf/servicerpt/mtbe/pdf/sroiaf(2002)06.pdf) and errata

http://www.eia.doe.gov/oiaf/servicerpt/mtbe/pdf/errata_rfs.pdf); B) *Impact of Renewable Fuels*

Standard/MTBE Provisions of S. 517 – Requested by Senators Daschle and Murkowski, April 2002

(<http://www.eia.doe.gov/oiaf/servicerpt/mtbe/pdf/addendum06.pdf>); and C) *Renewable Motor Fuel*

Production Capacity Under H.R.4, September 2002

(<http://tonto.eia.doe.gov/FTPROOT/service/question2.pdf>). These studies were performed as the Senate

Energy Bill evolved in 2002, with various assumptions and data updates. *Renewable Motor Fuel Production Capacity Under H.R.4* is the latest study and contains the most update-to-date information.

¹⁹ PADDs are Petroleum Administration for Defense Districts, which have been used in EIA's analyses within the same framework as the petroleum industry uses.

Table 3. Projections for 2004

	Ethanol Supply (million barrels/day)	RFG Consumption (million barrels/day)	RFG Price Increase (in 2000 dollars)
PADD I	0.019	1.295	\$0.025/gallon ^a
PADDs II-IV	0.094	0.807	\$0.001/gallon
PADD V	0.065	0.818	\$0.090/gallon
U.S.	0.178	2.920	\$0.036/gallon

a. The average RFG price increase in PADD I is projected to be less than the national average because New York and Connecticut only account for approximately 27 percent of the MTBE use in PADD I. Other primary PADD I States, such as New Jersey, Massachusetts, Pennsylvania, Maryland, Virginia (jointly accounting for approximately 56 percent of the MTBE use in PADD I), have not passed legislation to formally phase out MTBE. Thus, projections for PADD I (in lieu of individual States) may not represent the possible gasoline price impact on the New York and Connecticut consumers.

Source: National Energy Modeling System date codes ENsXmXoX.d082302a, ENs1mXoX.d082302b.

The long-term equilibrium analysis of the EIA studies is based on an assumption of sufficient lead-time for investments and assumption of perfect foresight for investors. In reality, some market participants may respond to uncertainty by delaying investment decisions, creating the possibility of supply imbalance and price spikes during the MTBE phase-out.

[Revised March 27, 2003. Updates were made to Tables 1 and 2 with associated text revisions.]