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Eliminating MTBE in Gasoline in 2006

Summary

In 2005, a number of petroleum companies announced their intent to remove methyl tertiary-butyl ether (MTBE) from their gasoline in 2006. Companies' decisions to eliminate MTBE have been driven by State bans due to water contamination concerns, continuing liability exposure from adding MTBE to gasoline, and perceived potential for increased liability exposure due to the elimination of the oxygen content requirement for reformulated gasoline (RFG) included in the Energy Policy Act of 2005. EIA's informal discussions with a number of suppliers indicate that most of the industry is trying to move away from MTBE before the 2006 summer driving season.

Currently, the largest use of MTBE is in RFG consumed on the East Coast outside of New York and Connecticut (Figure 1) and in Texas.[1] The other RFG areas in the Midwest and California have already moved from MTBE to ethanol. Most companies eliminating MTBE in the short-run will blend ethanol into the gasoline to help replace the octane and clean-burning properties of MTBE. The rapid switch from MTBE to ethanol could have several impacts on the market that serve to increase the potential for supply dislocations and subsequent price volatility on a local basis. These impacts stem mainly from:

- Net loss of gasoline production capacity
- Tight ethanol market, limited in the short-run by ethanol-production capacity and transportation capability to move increased volumes to areas of demand
- Limited resources and permitting issues hampering gasoline suppliers abilities to quickly get terminal facilities in place to store and blend ethanol
- Loss of import supply sources that cannot deliver MTBE-free product, or that cannot produce the high-quality blendstock needed to combine with ethanol

The different properties between MTBE and ethanol affect not only production, but distribution and storage of gasoline as well. Ethanol-blended gasoline cannot be intermingled with other gasolines during the summer months,[2] and ethanol, unlike MTBE, must be transported and stored separately from the base gasoline mixture to which it is added until the last step in the distribution chain.[3] Many areas of the distribution system cannot handle additional products without further investments.

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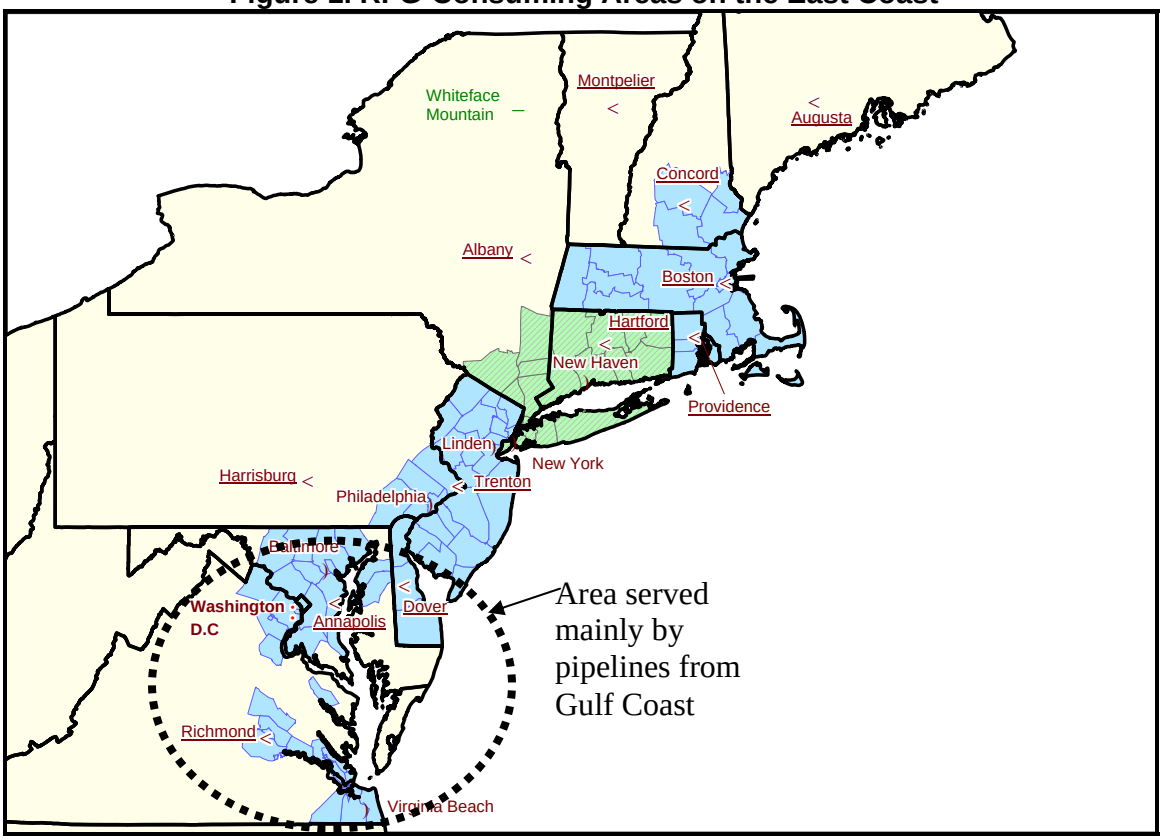
[1] Areas using reformulated gasoline either by Federal requirement or by States opting into the program to meet their specific air quality needs can be found at: http://www.epa.gov/otaq/rfg/whereyoulive.htm

[2] EPACT 2005 (Section 1513) allows retail stations to switch summer-grade ethanol gasoline with non-ethanol blended gasoline 2 times, which provides an increase in future flexibility during the summer months. EPA expects to issue a ruling on this provision in late January or February.

[3] The petroleum distribution and storage system contains water. Petroleum remains separate from the water, but ethanol has an affinity for water. If ethanol-blended gasoline interfaces with water, the ethanol is pulled from the gasoline into the water. As a result, ethanol is delivered and stored separately until delivery to retail stations.

A large number of changes are required to the supply and distribution system to make the transition from MTBE-blended RFG to ethanol-blended RFG: contracting for and moving more ethanol to the East Coast and Texas, converting terminal tanks from petroleum to ethanol, adding blending equipment at many terminals, and finding new sources of supply – both ethanol and RFG blending components. In general, areas on the East Coast served by imports into the Northeast and East Coast refineries will likely need more gasoline supply from imports and from the Gulf Coast than previously used. The areas further south in Maryland, Delaware, Washington DC and Virginia will still receive the reformulated gasoline blendstocks for oxygenate blending (RBOB) for their RFG from the Gulf Coast, but ethanol must be brought in by rail car to major terminals serving those areas.

Figure 1. RFG-Consuming Areas on the East Coast



Legend: Green and blue shaded areas represent areas using RFG. New York and Connecticut RFG areas are in green to highlight regions already banning MTBE.
Source: Environmental Protection Agency http://www.epa.gov/otaq/regs/fuels/rfg/rfgarea.pdf
Note: EPA lists as an RFG opt-in region the area of Whiteface Mountain that lies above 4,500 feet in elevation. This area is in Essex County, but is not shaded on the map.

The largest challenge in the transition may be supply availability and transportation of ethanol. Ethanol capacity in the United States is running near capacity and therefore is

not adequate to replace the MTBE lost at this time, although the additional capacity under construction should eventually be able to meet demand. As a result, gasoline suppliers will likely remove some ethanol from conventional gasoline in the Midwest[4] and increase ethanol imports from places like Brazil.

RFG Production Capacity Losses

As companies move to ethanol-blended RFG, they experience some loss in production capability in the summer months (about 5-6 percent outside of California), due to changes necessary to accommodate ethanol's higher evaporative properties, as measured by Reid vapor pressure (RVP), and to counter ethanol-blended gasoline's higher toxic emissions and distillation characteristics. When New York and Connecticut moved away from MTBE, the ethanol-blended volumes were small enough that refiners had some flexibility to keep from experiencing much volume loss.[5] But when a refiner producing mainly RFG-type gasoline eliminates all MTBE-blended RFG, volume loss is unavoidable in the short run without capacity investments.

While individual refineries vary, and companies are still working through their ability to bring in outside blending components to counter some of this loss, a sizeable net decline is expected. Extra components and imports must be brought in to make up the difference.

At this time, little RFG is expected to be produced without ethanol, although oxygenates like ethanol are no longer required. Replacing the octane previously provided by MTBE is difficult, and, while ethanol is not as clean-burning as MTBE, it is a cleaner component than most petroleum components, so it helps refiners to meet their fuel emission requirements.

In general, companies strive to assure their firm contractual commitments to supply fuel and fuel components are met. However, some fuel buyers cover all or part of their needs with opportunistic purchases on the open market, which can sometimes offer savings over firm contract prices. Volumes available to such opportunistic buyers could initially fall short of typical supply levels if companies that have historically provided short-term volumes of finished gasoline or blending components do not have those volumes available.

RFG Imports

Table 1 shows sources of RFG imports than can be identified. RBOB imports have been increased by the addition of 10-percent ethanol or 11.4-percent MTBE in this table to

[4] Minnesota has mandated 10-percent ethanol use in gasoline, which would limit moving product from this State (*Minn. Stat*. 239.791, Subd. 1)..

[5] See http://www.eia.doe.gov/pub/oil_gas/petroleum/analysis_publications/mtbebans/mtbebans.pdf

represent finished gasoline volumes. Canada is the largest supplier with Europe and the Virgin Islands being the next largest. Venezuela, which used to supply more RFG to the United States, only provided 17 thousand barrels per day in 2004. As we move away from MTBE, we expect that we will lose volumes from some areas, but Western Europe, Canada, and the Virgin Islands all have some potential to provide more volume to help fill the gap.

Table 1. 2004 East Coast Imports of Finished RFG and RFG Blending Components*
(Thousand Barrels Per Day)

Country/Region	Thousand Barrels Per Day
Canada	125
Virgin Islands	62
Venezuela	17
Western Europe	67
Eastern Europe	6
Other Countries	3
Blending Components Used to Produce RFG (All Countries)**	160
Total Imported Volumes	440

*The RBOB imports were increased by volumes to represent an 11.4-percent MTBE or 10-percent ethanol finished gasoline mixture. All but about 15 thousand barrels per day of imports flow into the States north of Maryland and Delaware.
** Motor gasoline blending components such as alkylate are used in the production of both conventional gasoline and RFG. This line represents an estimate of the volume of these components used in the production of RFG, but it is not possible to determine the country of origin.

Source: Form EIA-814, Petroleum Supply Annual 2004, and EIA estimates.

Preparations at Pipelines and Terminals

The distribution chain presents another challenge when moving from MTBE to ethanol. Because ethanol-blended gasoline cannot be intermingled with other gasolines during the summer months, and ethanol must be transported and stored separately, terminals will need to carry both RBOB and ethanol. Many areas of the distribution system cannot handle additional products without further investments, creating the need to restrict how many gasoline types a given terminal can carry.

Based on their customers' requirements, the two pipelines moving product from the Gulf Coast into the East Coast RFG areas (Colonial and Plantation Pipelines) have announced they will not be carrying MTBE-blended gasolines beginning with their delivery cycles in March.

The current transition and associated changes in distribution caught some companies that were planning on eliminating MTBE at a later date off guard. Not only do these companies have to change their refinery operations earlier than anticipated, they must add blending facilities at their terminals, convert some tanks to ethanol, convert their retail outlets, and obtain ethanol contracts sooner than expected. The hurricanes and the equipment changes needed to meet this summer's ultra-low sulfur diesel fuel program have created shortages of both contract labor and hardware, and permitting of new facilities takes time.

Currently only about 1/3 of the RFG used on the East Coast is blended at terminals. The remainder is produced or delivered as finished product. Terminal facilities, including those handling imports, will have to add capability to accommodate blending an additional 850 thousand barrels per day of gasoline.

Ethanol Supply and Distribution

Both capacity and transportation issues imply a very tight ethanol market for at least the first part of the year. Table 1 shows that about 130 thousand barrels per day of additional ethanol may be needed to replace the MTBE currently used in RFG. The East Coast will need an additional 90 thousand barrels per day of ethanol, and Texas will need most of the remaining 40 thousand barrels per day. Table 2 shows that today's ethanol production of 275 thousand barrels per day is fully utilizing the available capacity of 283 thousand barrels per day. Although planned ethanol capacity could fill the additional 130 thousand barrel per day requirement, these new facilities will not start soon enough to meet 2006 demand needs as companies are making changes during the first quarter 2006.

Table 2. PADDs 1 and 3 RFG in 2004 (Thousand Barrels per Day)

Regions	RFG Demand	Estimated Ethanol	Estimated MTBE	Ethanol Needed to Replace MTBE
PADD I RFG	**1255**	**36**	**102**	**90**
- NY & CT	360	36		0
- MA, NH, RI, PA, NJ	595		68	60
- MD,DE, DC, VA	300		34	30
PADD 3 MTBE-Blended RFG *	**390**		**44**	**39**
Total Ethanol to Replace MTBE				**129**

* PADD 3 MTBE-Blended RFG includes a small volume of RFG produced for PADD 2. Most of this production is used in Texas.
Sources: Energy Information Administration Petroleum Supply Annual 2004 and EIA estimates.

Table 3. Ethanol Demand and Capacity

	Thousand Barrels Per Day	Billion Gallons
Production November 2005	275	4.22
Capacity February 2006	282	4.32
Additional Demand in 2006	129	1.98
Planned Capacity	133	2.04

Sources: Volumes – Form EIA-819 for 2005, EIA Estimates for 2006. Capacity – Renewable Fuels Association Capacity as of 2/4/2006 at http://www.ethanolrfa.org/industry/locations/

The availability of ethanol storage and transportation infrastructure may be an even greater challenge than finding additional ethanol supply during the first half of 2006. The 90 thousand barrel per day increase in ethanol to the East Coast represents 2.5 times the quantity of ethanol moved to the East Coast in 2005. Rail cars and barges may not be available.

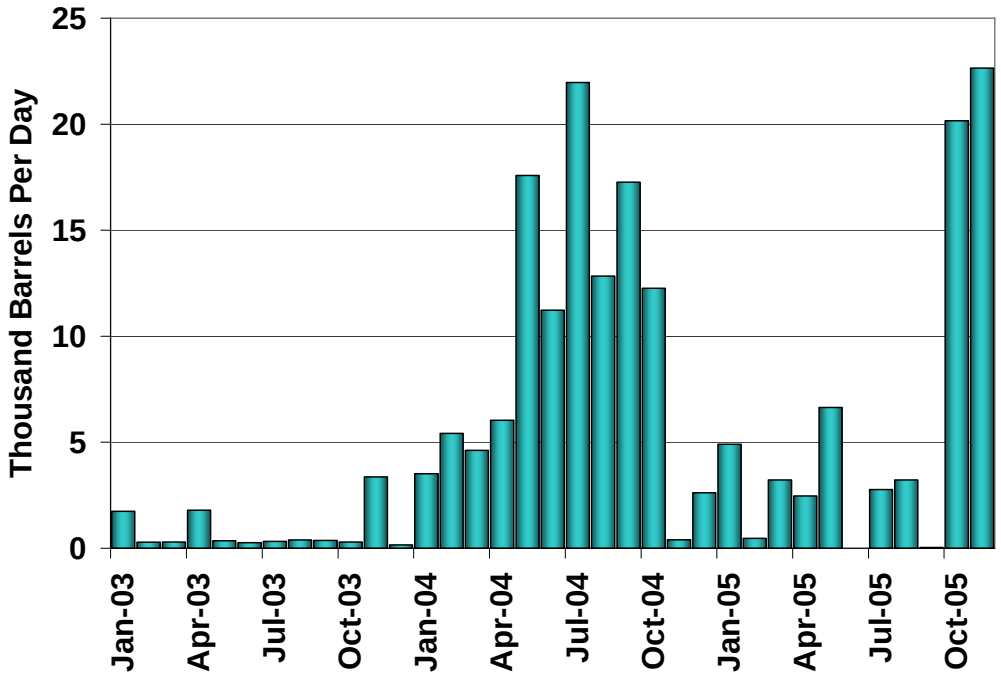
The increased volumes of ethanol to be used in RFG during the first half of 2006, and perhaps for the entire year, will not be met by increased domestic ethanol production alone. Some of the increased use of ethanol in RFG will be met by increased domestic production, some by increased imports from areas like Brazil, and the remainder by taking ethanol currently used in conventional gasoline in the Midwest and shipping it to the East Coast and Texas for RFG blending. Removing ethanol from conventional gasoline reduces conventional gasoline volumes, but replacing lost conventional gasoline is easier than replacing lost RFG volumes.

Fuel ethanol imports have not been large historically, although they have surged in recent years to average over 20 thousand barrels per day in some months, including recently in October and November 2005 (Figure 2). Ethanol imports are generally less attractive than domestic production because imports are subject to an ad valorem tariff of 2.5 percent and a second duty of 54 cents per gallon, which offsets the 51-cent-per-gallon tax credit for blending 10-percent ethanol into gasoline. However, under the Caribbean Basin Initiative (CBI), a limited volume[6] of ethanol from selected Caribbean countries

[6] Up to 7 percent of the previous year's domestic ethanol production can be brought into the United States duty free from 24 countries covered under the Caribbean Basin Initiative. Some additional volumes can

can be brought in duty free. Still, in 2004 and 2005, some volumes of fuel ethanol came to the East Coast with full duty. The growth in ethanol demand has generally kept the U.S. ethanol market tight. Furthermore, East Coast facilities were better suited to bringing in product by water rather than rail (the preferred path for ethanol from the Midwest). The combination made it more economic for some buyers to import ethanol with the full import duty than to bring supplies from the Midwest. Given the increase in ethanol demand expected from the elimination of MTBE and expected transportation bottlenecks delivering material from the Midwest, imports of ethanol could rise significantly in 2006.

Figure 2. Fuel Ethanol Imports



Source: Form EIA-814

If ethanol experiences large price increases, some gasoline suppliers will find it economic to reduce the quantity of ethanol being blended from 10 to 5.7 percent.[7] The RBOB to

come from these countries duty free if they have some defined local sugarcane content. Although Brazil is not on the list, Brazilian ethanol can be reprocessed in the CBI countries and then be delivered duty free to the United States.

[7] Different base reformulated gasoline blendstocks for oxygenate blending (RBOBs) are designed to have defined amounts of ethanol to assure proper emission control and engine performance. The 10- and 5.7-percent RBOBs derived from when RFG required a minimum of 2-percent-by- weight oxygen content, which required a minimum of about 5.7-percent volume of ethanol, and the maximum tax break for using ethanol, which occurred at 10 percent. As a result, pipelines defined 5.7-percent and 10- percent RBOB's for shipment. While the oxygen content and tax credit constraint no longer exist, pipelines will still have to define RBOB qualities for their product batches.

which the ethanol is added is more expensive to produce for 5.7-percent ethanol blends than for 10-percent blends, the tax credit is proportionally less, and suppliers experience an even greater loss of total RFG volume than when using the 10-percent blends. Also, such changes may not be the decision of individual companies. The 5.7-percent RBOB must be kept separate from the 10-percent RBOB, and terminals and pipelines may not be able to handle both products. In these cases, substantial time may be needed to implement such a change. In many areas, such as those served by pipeline, it can take 30 days to move from one RBOB type to another due to travel time for new base gasolines and tank turnovers.

Putting Together the Balance for the East Coast

RFG markets on the East Coast are supplied differently. The Northeastern RFG markets in New York, Connecticut, Massachusetts, New Hampshire, Rhode Island, Pennsylvania and New Jersey receive most of their supplies from East Coast refineries and imports via New York Harbor. A small amount comes from Gulf Coast refineries. By contrast, about 90 percent of the supply for RFG markets in Maryland, Delaware, District of Columbia and Virginia comes from Gulf Coast refineries via the Colonial and Plantation Pipelines.

The Northeastern market described above received about 51 percent of its RFG supply from East Coast Refineries (including ethanol additions), and about 43 percent of its supply from imports. Less than 10 percent came from the Gulf Coast. Table 3 summarizes the flows in 2004 and compares them to two illustrative supply variations in 2006. With a reduction in production capacity for RFG on the East Coast as a result of the change from MTBE to ethanol, supply volumes into the Northeast are expected to increase from the Gulf Coast and imports, as shown in Table 4.

Table 4. RFG Supply Sources for Northeast States
(Thousand Barrels Per Day)

	2004	2006 Estimate
East Coast Refiners	470	425
Gulf Coast Supplies	60	100
Imports (Blending & Finished)	425	435

Note: Northeast RFG States include Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, and Rhode Island.
Source: Form EIA-810, Petroleum Supply Annual, Estimates

Although we may very well see increased import volumes into the Northeast in 2006, foreign supply sources are also being affected by the removal of MTBE. Some foreign refiners are not now capable of providing MTBE-free finished gasoline to U.S. markets. Fewer suppliers will be able to produce the high-quality, low-RVP blending components needed for ethanol-blended RFG. How much extra volume will be needed will not be known until the change from MTBE to ethanol is nearing completion. If planned

volumes begin to run short, additional volumes from abroad can be obtained, but such volumes take time to be produced and delivered. Consumers could see some price surges while the market rebalances.

The East Coast RFG areas in Maryland, Delaware, District of Columbia, and Virginia may experience the most difficulty in changing from MTBE-blended RFG to ethanol-blended RFG due to difficulty in obtaining and delivering ethanol to terminals that are primarily located at inland locations. These areas have historically relied on petroleum product supply from the Gulf Coast via pipelines. Any companies having trouble getting ethanol supplies or getting terminals ready for ethanol receipts and blending will have to arrange for other sources to meet their customers' needs.

In the event that ethanol supplies or blending facilities fall short, companies are considering contingency plans. For example, non-oxygenated RFG, referred to as clear RFG, is an option. This is a finished product that does not have to be blended at the terminal. However, in most cases refiners have not structured their refineries to produce clear RFG. Also, due to the difficulty of replacing octane from either MTBE or ethanol and the loss of the MTBE and ethanol volumes, the quantity of clear RFG that can be produced would be even less than ethanol-blended RFG. Furthermore, as the system downstream of the refinery gates will already be stretched distributing and storing ethanol and RBOB, the ability to ship and store clear RFG is likely to be limited.

Texas RFG

Texas uses about 356 thousand barrels per day of RFG in the Houston and Dallas-Fort Worth areas. These areas also are experiencing logistical challenges in making the transition. Getting ethanol to the major terminals is difficult, due to limited rail access. Pipeline deliveries of petroleum products are also still being worked out. Still, the industry is planning on providing RFG without MTBE by this summer.

Conclusion

As highlighted in the summary, the rapid change from MTBE-blended RFG to ethanol-blended RFG on the East Coast and in Texas will likely occur before the summer driving season begins. The many changes that must take place to convert production from finished RFG to RBOB and to add equipment to terminals not now equipped for blending is a large challenge by itself. In addition, supplies of ethanol will be tight, and the need to move increased volumes of ethanol from the Midwest to the East Coast will strain transportation capabilities. Overall, the complexity of the transition away from MTBE-blended RFG may give rise to local imbalances between supply and demand and associated price surges during the change. As the summer progresses and demand grows, the tight supply situation is not likely to ease significantly, leaving the market exposed to the increased potential for price volatility in the East Coast and Texas RFG regions.