Gasoline Type Proliferation and Price Volatility

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Contacts

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On June 17, 2002, Senator Jeff Bingaman, Chairman of the Senate Committee on Energy and Natural Resources, requested that the Energy Information Administration (EIA) provide analyses of eight factors related to the Senate-passed fuels provisions of H.R. 4, the Energy Policy Act of 2002 (Appendix A). In response, EIA has prepared a series of analyses discussing the market impacts of each of these factors. This paper addresses factor 8 of the Senator's request.

Because of the rapid delivery time requested by Sen. Bingaman, each requested factor related to the Senate-passed bill was analyzed separately, that is, without analyzing the interactions among the various provisions. In addition, assumptions about State actions, such as their implementation and timing of MTBE bans, influence the results. Discussions about some of these interactions have been included in order to explain the interconnected nature of such issues.

EIA's projections are not statements of what will happen but what might happen, given known technologies, technological and demographic trends, and current laws and regulations. EIA's *Annual Energy Outlook 2002 (AEO2002*) is used in these analyses to provide a policy-neutral Reference Case that can be used to analyze energy policy initiatives. EIA does not propose, advocate or speculate on future legislative or regulatory changes. Laws and regulations are assumed to remain as currently enacted or in force in the Reference Case; however, the impacts of emerging regulatory changes, when clearly defined, are reflected.

The analyses involve simplified representations of reality because of the complexity of both the issues examined and the environment in which they would occur. Projections are highly dependent on the data, methodologies, and assumptions used to develop them. Because many of the events that shape energy markets (including severe weather, technological breakthroughs, and geopolitical disruptions) are random and cannot be anticipated, energy market projections are subject to significant uncertainty. Further, future developments in technologies, demographics, and resources cannot be foreseen with any degree of certainty. These uncertainties are addressed through analysis of alternative cases in the *AEO2002*.

Introduction

This paper is in response to Sen. Bingaman's request for analysis of "the potential effect/role of implementation of a national menu of fuels to address the proliferation of boutique fuels." The purpose of the question was to better understand if there are means of reducing the probability of price volatility by reducing the number of gasoline types in use today. This is a complex problem, and there does not seem to be a simple solution in the near term.

As described in more detail below, there does not seem to be a means of reducing price volatility in the short term by reducing the number of fuel types. First, the potential for price volatility stems from several factors, including the international petroleum market. Eliminating multiple fuel types will not eliminate volatility, but should reduce the size and duration of price surges when they occur. Second, not all petroleum fuel types have the same impact on price volatility, and the measures needed to reduce price volatility could cost the nation more than they would save a particular region.

The paper begins with a discussion of how the "boutique fuel" issue developed, followed by a section on price volatility and the role that the growing number of fuel types have played in exacerbating volatility. The third section looks to the future and notes that both existing and proposed legislation will result in even more fuel types. With this context, the fourth section reviews options for reducing the number of fuels, and explores whether those options might be effective in reducing price volatility and the tradeoffs being made. The final section summarizes EIA's conclusions, and the main points of the discussion.

Background: How Fuel Types Evolved

Since the passage of the Clean Air Act Amendments in 1990, a growing number of distinct types of gasoline have entered the system. Prior to that time, gasoline types fell into three grades (regular, midgrade, and premium) and volatility distinctions between gasolines sold in the North and those sold in the South. Also, gasoline's tendency to evaporate, as measured by Reid Vapor Pressure (RVP), shifted between summer and winter seasons for driveability and control over evaporative emissions that lead to ozone pollution. Apart from some local adjustments that were sometimes needed (e.g. for altitude or extreme desert conditions), few distinct types of gasoline were being used.

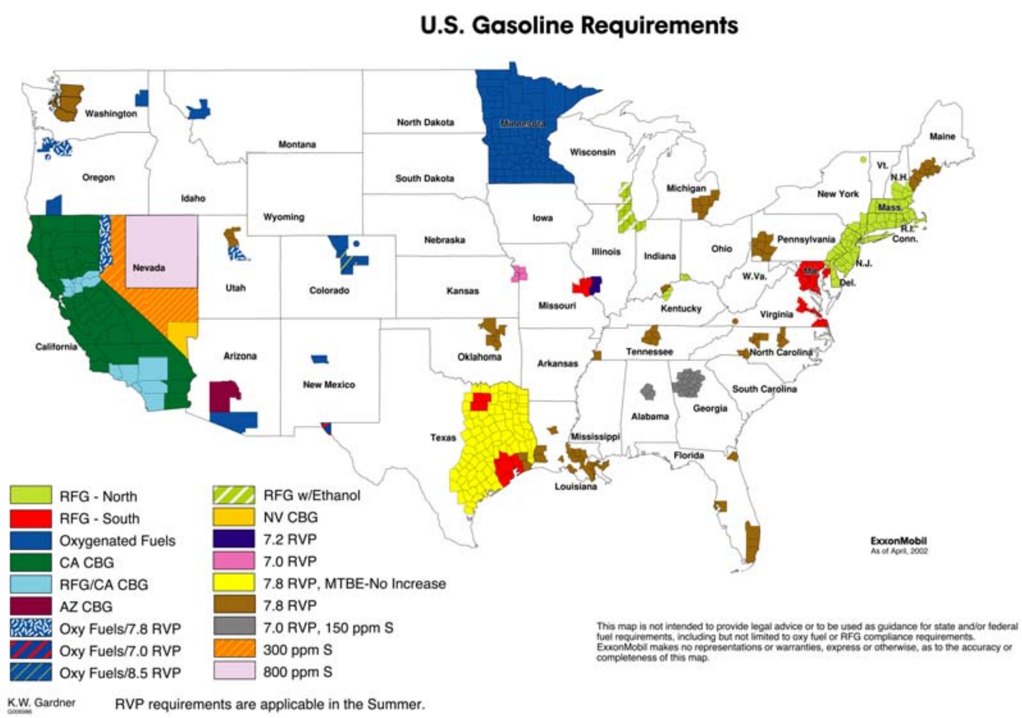
The Clean Air Act Amendments created oxygenated gasoline and reformulated gasoline (RFG) blends, moving the system to three formulations of gasoline (conventional, oxygenated and reformulated), each of which is available in three grades, with volatility distinctions between Northern/Southern and summer/winter blends.

When the RFG program first began in 1995, concerns arose over both production capability and the distribution system's ability to handle the additional gasoline types. Pipelines had to carry more distinct types of products, which affected the number of breakout tanks required and availability of tanks for each gasoline type. The increased number of products even affected the speed with which the products move through the line, because of the need to inject and draw off smaller batches. The industry responded by partially eliminating the need to ship and store midgrade gasoline through the addition of in-line blending at terminals. Premium grade and regular grades were blended in appropriate ratios to create midgrade product as the material was loaded into trucks, and in some cases at the retail pump. Product exchanges between suppliers were also used to eliminate the need for all terminals to store all products.[1]

[1] For example, where terminals service areas with both RFG and conventional sales, one supplier might

In parallel with the Federal gasoline changes, States have added gasoline types as well.[2] As States developed their State Implementation Plans (SIPS) to improve air quality, many found they could achieve significant reductions in air emissions by requiring a low-RVP conventional gasoline. When refiners only have to produce a few gasolines of different quality, production costs for low-RVP conventional fuels can be less than for RFG. In addition, California found it needed to use a cleaner fuel than Federal RFG (California RFG, or CaRFG), and the Midwest created a unique ethanol-blended RFG (see Appendix C, "Using Ethanol in Gasoline," in EIA's answer to Sen. Bingaman's question regarding "Timing for Startup of the Renewable Fuel Standard"). Now, in addition to RFG, oxygenated, and conventional gasolines, the system needed to accommodate several low-RVP conventional gasolines, CaRFG and ethanol-blended RFG. The net result of the increase in gasoline fuel types in today's market is shown in Figure 1.

Figure 1. Different Fuel Locations (Islands) and Types, 2002



Source: ExxonMobil

While the number of gasoline fuel types grew, the number of distillate fuel types also

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agree to carry conventional gasoline, and another RFG, supplying each other's customers as needed. Such an arrangement reduces the need for duplicate tankage.

[2] For an overview of Federal and State fuel requirements, see Appendix B, Environmental Protection Agency, *Staff White Paper, Study of Unique Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements* (Washington, DC, October 2001) EPA420-P-01-004, http://www.epa.gov/otaq/regs/fuels/p01004.pdf .

increased. On-road diesel fuel had to have lower sulfur levels than heating oil, resulting in segregation of distillate fuel oil into low-sulfur and other sulfur levels. In the Northeast, which uses much heating oil, States have added further sulfur distinctions for heating oil to meet their specific State environmental needs. Because distillate fuels use the same distribution system as gasoline, traveling through pipelines batched with gasoline fuels and being stored at the same terminals, the increasing number of distillate fuels also contributed to logistical complexity.

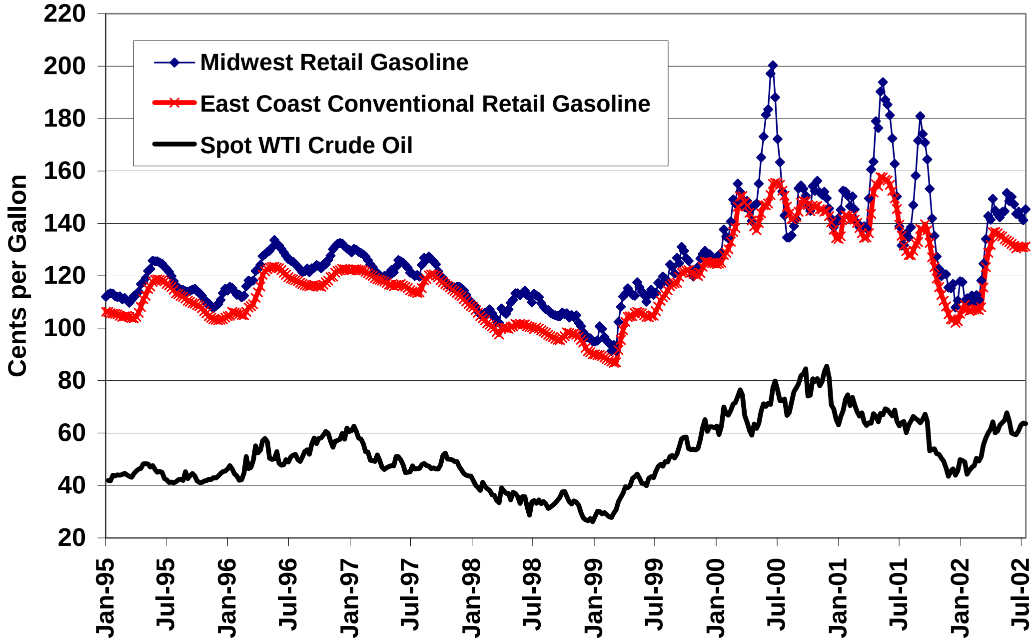
Looking just at gasoline, the general impact of an increasing number of distinct gasoline fuels with smaller demands and, in some cases, served by fewer suppliers has been to reduce the flexibility of the supply and distribution system to respond to unexpected supply/demand shifts. Thus, while some States were trying to contain gasoline prices by choosing various low-RVP types instead of RFG, they inadvertently traded potential production cost savings for distribution system strain, which translated to more potential for price volatility. When the market tightens in a distinct fuel area, which can occur from a supply disruption, a winter-to-summer transition, or unusual demand, the system has less ability to respond than when fuels were more fungible. Regions with specialized gasolines cannot borrow from their neighbors if they run short without a special waiver, and with a limited number of suppliers for a specialized fuel, supply response may take several weeks. This, in turn, has led to unintended price volatility in some areas.

Historical Price Volatility and Role of Increasing Number of Fuel Types

Eliminating the boutique fuel problem would not remove price volatility entirely, but would most likely diminish the frequency and magnitude of price surges, though at the cost of a higher average price to meet a more stringent average environmental requirement. Price volatility historically has begun with the state of the international petroleum markets, as reflected in world crude oil prices. When petroleum markets tighten globally, prices rise as demand exceeds production for some time and inventories diminish. When gasoline inventories are low, little cushion is available to absorb mismatches in local supply and demand. Under these conditions, the stage is set for price volatility. The use of many different fuels in different locations, called the boutique fuel factor, increases the chances that one of these locations will experience faster inventory depletion than other regions, leading to a local price surge. Volatility in retail gasoline prices in a given region represents the combination of the underlying crude oil price volatility and fluctuations in gasoline margins over crude oil, including those attributable to the boutique fuel factor (Figure 2).

Tight petroleum markets existed during 2000 and 2001. With low inventories, other factors such as the change to cleaner Phase II gasoline (as required under the Clean Air Act Amendments) and refinery outages resulted in large price swings, particularly in the Midwest and California. During 2002, world petroleum markets loosened, and inventories returned to more normal levels during the first half of the year, due in part to slowing economic growth and demand falloff immediately following the September 11

Figure 2. Midwest and East Coast Gasoline Prices



Source: Retail prices, EIA; spot prices, Reuters Ltd.

terrorist attacks. However, while normal markets with higher inventory cushions reduce the probability of rapid price runups, California has had some problems even during normal market conditions, due to its unique gasoline specifications (CaRFG), limited refining capacity, and geographic isolation from other refining centers.

Generally, the impact of boutique fuels on price varies with volumes, distance from supply sources, and number of supply sources, which in turn, depend on the degree of product differentiation (Appendix B). The size and duration of a price runup is influenced by the size of the supply/demand imbalance and the speed with which the imbalance can be resolved. The speed of resolution depends on the availability of nearby supply such as inventories or refiners able to provide the product. The geographic "island" nature of distinct fuel types means they can't borrow from their neighbors when supplies run short. They must wait for supplies to arrive from more distant supply sources, delaying response time. If the fuel is difficult to produce, fewer suppliers will be available to respond when a problem occurs. More fuel types generally also mean lower inventories for a given number of tanks, and inventories can run low on one fuel type, but not appear low in total across all fuel types.

Not all boutique fuels are equal in their propensity to lead to price volatility. As will be explained in the following paragraphs, the fuel regions that have been subject to the most severe price surges and that are most likely to impact surrounding areas are California and Chicago-Milwaukee. These regions have fuels that are unique and that few suppliers outside of their regular supply sources can produce. Furthermore, both regions are a long distance from the major marginal supply center of the Gulf Coast. The loss of volumes from a regular supply source can mean the market waits until the supply source is back online.

The Chicago-Milwaukee area uses ethanol-blended RFG. With the start of the more stringent Phase II emission requirements from the Clean Air Act Amendments, this gasoline has become very difficult to produce. As a result, few suppliers outside of those refiners serving the area can produce the fuel. Refineries supplying ethanol-blended RFG to the Chicago-Milwaukee area made investments to produce the low-RVP reformulated gasoline blendstock for oxygenate blending (RBOB). In addition, extra supply generally comes from the Gulf Coast, and requires at least several weeks to travel by pipeline or barge. Thus, a temporary shortfall in Chicago-Milwaukee supply can last for weeks, causing prices to rise quickly and stay high during this time. Furthermore, during supply problems such as occurred during 2000 and 2001 in the Midwest, RBOB prices have tended to rise more than conventional gasoline prices, which in turn creates incentives for the few suppliers available to focus on RBOB at the expense of conventional gasoline, and creates a cascading problem in the region for all gasolines.

California reformulated gasoline (CaRFG) is another classic boutique fuel. Yet in this case, the volumes and area involved are large. California refineries run close to production capacity. When one refinery is down for an extended period, other nearby refineries may not be able to increase production adequately to fill the gap. Furthermore, since CaRFG is unique and requires significant refinery investments to produce the fuel, few refineries outside of the region can provide the product. As in the case of Chicago-Milwaukee, the distance of that “island” from other supply sources (typically the Gulf Coast or Europe) delays response even if supply is available from the few refineries that can produce the product. The combination creates higher price volatility in California than in most other parts of the country.

In both of these boutique fuel cases, refiners must make capital investments to serve these markets. A refiner that might serve the California or Chicago-Milwaukee markets periodically on an opportunistic basis, or that has an opportunity to serve a very small market share would likely not make the additional investment, thereby giving up its ability to serve either of these markets.

The isolation of these two regions even affects distant refiners that can make either CaRFG or RBOB. Such refiners may decide not to produce because of the time that it would take both to make the product and to ship it to the region. Neither potential buyers of that product nor the marginal supplier may want to take the risk that the cause of the price surge will be resolved before the additional product arrives. Should that occur, the extra transportation and production expense might not be recoverable.

The regions that have different RVPs are also subject to price volatility, but these fuels are relatively easy to produce. In a situation where a major supplier loses its ability to supply a low-RVP region for some time, other suppliers can adjust, and the severity of price response would generally be less than price surges in California or Chicago-

Milwaukee. Price volatility has not been as much an issue with low-RVP fuels as it has with CaRFG and Chicago-Milwaukee ethanol-blended RFG. The price volatility in low-RVP regions seems to be more due to their geographic isolation from suppliers ("island" nature) than to the difficulty of producing the fuel. This implies that simply reducing the number of low-RVP fuels, without reducing the number of islands, may not necessarily do much to reduce price volatility.

Number of Fuel Types Likely to Increase In Future

Factors are evolving that, on balance, could increase the number of distinct fuel types and/or number of islands, including: ether bans, removal of the oxygenate waiver, low-sulfur fuels, renewable fuel standard, and the 8-hour air quality standards for ozone.

8-Hour Quality Standards for Ozone

EPA's change from a 1-hour standard for measuring ozone air quality to an 8-hour standard has raised questions regarding the number of regions needing specialized fuels. This issue is covered more fully in EIA's response to Sen. Bingaman's question regarding "Reformulated Gasoline Use Under the 8-Hour Ozone Rule." Nitrogen oxides (NO_x) and volatile organic compounds (VOCs) are the two emissions of concern under these standards. In areas where NO_x is the limiting factor, gasoline would likely not be affected, since Tier 2 low-sulfur gasoline has achieved about as much NO_x control as possible. However, a change in diesel fuel requirements might be made to further reduce NO_x. In areas where VOCs are the limiting factor, if the area is not currently using the lowest-RVP gasoline practical, they may need to move to a lower-RVP blend. While uncertainty exists regarding the impacts of the 8-hour standard, it could lead to an increase in the number of gasoline and diesel fuel "islands," but it is not expected to lead to more gasoline types.

Ether Bans & Oxygenate Waivers

The public's concern over MTBE water contamination has led some States to ban MTBE, has caused Congress to consider a Federal MTBE ban, and has resulted in oil companies voluntarily moving away from ethers in gasoline. In addition, consideration is being given to removing the oxygenate requirement on Federal RFG. Both ether bans and the removal of the oxygenate requirements could increase the number of distinct fuel types.

MTBE is the primary oxygenate used in RFG today. In 2000, MTBE supplied about 300,000 barrels per day of gasoline volume, including volumes used in imported gasoline. MTBE burns cleanly, and has no toxics, good evaporative properties (not much different than the remaining gasoline components), good distillation properties (affecting both emissions and driveability), and high octane. When MTBE is removed from reformulated gasoline, refiners have to find another clean-burning, high-octane replacement material. If oxygenates are required, ethanol is the most practical alternative. Without oxygenates, RFG can be produced using extra alkylates or iso-octane materials. Yet, even in this case, many refiners may choose ethanol as an economic solution because of its fuel quality characteristics (primarily octane rating and ability to dilute toxics).

Ethanol, however, has some properties that would increase fuel type proliferation. Ethanol cannot be moved effectively through today's pipeline system, as it tends to get pulled into the water that usually exists in petroleum pipelines and tanks. Instead, it is blended at terminals near the end users. Splash blending, in which ethanol is added directly to a tanker truck along with the base gasoline, is commonly used. Ethanol-blended product must be kept separate from non-ethanol blends. This includes separation through to the gasoline pump. The separation is needed because adding a small amount of ethanol (from the ethanol-blended mixture) to gasoline without ethanol can increase the vapor pressure of the mixture substantially, potentially pushing it above required VOC limits. Thus, ethanol will need to be moved through an independent distribution system until it is close to the end user, where it is added before being delivered to retail stations.

The Midwest is the region where most ethanol is used in gasoline today.[3] California is now increasing its ethanol use as the State moves towards its January 2004 MTBE ban deadline. As State MTBE bans in regions outside of the Midwest, such as those in New York and Connecticut, are implemented, many RFG suppliers will turn to ethanol. These companies will have to establish a means of delivering large volumes of ethanol to the region (mainly by rail) and tankage to hold the material prior to splash blending in the trucks that deliver it to the retail stations. As this occurs, RFG supply will depend both on production and delivery of the very low-RVP blendstock to mix with ethanol, and on the supply/distribution system for ethanol. Interruptions in either supply chain will contribute to price volatility. The size of the areas moving to ethanol could counter the probability for price spikes to some extent. As more areas need the unique ethanol-blended RFG, more suppliers will have to invest to produce the product. Thus, when one supplier has production problems, more suppliers may be available to fill the gap. We would expect regions like Chicago-Milwaukee to benefit from this change, while regions like the Northeast could see more volatility than they have previously, because of the greater difficulty to suppliers of refining the low-RVP blendstock and handling the ethanol oxygenate, in comparison to the existing MTBE RFG used there currently.

MTBE bans, regardless of the oxygenate waiver, may add increased volumes of alkylate and similar products to the distribution system. Even with ethanol, some refiners will find it beneficial to use more alkylate or iso-octane to counter some of the blending properties of ethanol (e.g., high RVP as discussed further in EIA's response to the Committee's question regarding "Supply Impacts of an MTBE Ban"). It is likely that the Gulf Coast will be a large supplier of alkylate and iso-octane. Those additional products

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[3] Small volumes of ethanol-blended conventional gasoline have been produced in the Northeast. The Federal Highway Administration estimates of ethanol-blended gasoline use in 2000 indicate States in the Northeast represented less than 3 percent of ethanol blended into gasoline in the United States that year.

potentially could move to refineries in California, the Midwest, and the East Coast, adding to product movement complications.

Some have proposed the removal of the oxygenate requirement from RFG. If a region has both ethanol-blended RFG and non-oxygenated RFG, these fuels must be delivered and handled separately through the supply system to the retail stations. In some cases, a region's distribution and storage infrastructure may not be able to handle the extra complexity, and companies may choose one fuel to supply, even though individual refinery production economics might imply two fuels would be cheaper. In this case the economics of the distribution system could outweigh those of production.

Integrating these issues leads to a patchwork containing the various islands and gasoline types we have today, along with fuels with and without MTBE, fuels with and without ethanol, and increased movement of unfinished products like alkylate and iso-octane.

Renewable Fuel Standard

The renewable standard alone could result in some increase in the number of boutique fuels. Most of the required ethanol, at least in the early years of the program, could be used in the Midwest, with credits sold to suppliers serving other areas. Currently much gasohol in the Midwest is created by splash-blending ethanol with finished conventional gasoline (i.e., gasoline that could be sold as is to consumers). Adding ethanol to finished gasoline results in a product that has more octane than needed, sometimes referred to as "octane giveaway." Octane could become more valuable as State MTBE bans evolve. MTBE is a high-octane material, and as substitute materials with octane lower than MTBE are used to fill in for the MTBE loss, the value of octane could increase. This will create economic incentives for companies to produce conventional gasoline blendstocks for oxygenate blending (CBOB). Also, if States remove the 1-pound RVP waiver for adding 10-percent ethanol to gasoline, CBOBs will be created if ethanol is blended in those States. The CBOB in this case would have a low RVP and would not be ready to sell to consumers until blended with the ethanol. This could lead to the evolution of various types of RVP CBOBs to create different RVP gasolines. In this case, CBOBs, along with RBOBs and finished gasolines would be traveling through the distribution system.

Low-Sulfur Fuels

Tier 2 requirements for low-sulfur gasoline create a conventional fuel that is closer to RFG in quality. This could reduce the incentive for States to design specialized fuels different from the standard Tier 2 conventional gasoline. However, it is not clear if the number of fuels will diminish.

While low-sulfur gasoline may encourage a diminishing number of specialized fuels, some States are considering moving to low-sulfur gasoline early, before Federal regulations fully take effect. This would add more fuel types to the system for a time, affecting not only the regions opting to move early to these fuels, but also the ability of other regions to act quickly in the event of any supply/demand imbalances.

Low-sulfur diesel fuel types may also increase. Consideration is being given to a separate low-sulfur off-road diesel fuel from ultra-low-sulfur on-road diesel fuel, which could add to fuel proliferation. (Also, it is still not clear how ultra-low-sulfur diesel fuel will impact the distribution system, apart from the potential addition of an off-road diesel fuel.) In addition, the transition to ultra-low-sulfur on-road diesel fuel is structured to increase diesel fuel types in the system, allowing both 500-ppm and 15-ppm fuel for a time. Allowing 500-ppm fuel to be used for some time relieves production constraints at the “cost” of more fuels having to be handled in the distribution system. The ultra-low-sulfur diesel fuel and the proposed diesel fuel transition could add increased complexity to the distribution system that must deal with gasoline and other light fuels.

Both early adoption of low-sulfur gasoline and ultra-low-sulfur diesel fuel by some States[4] and the transition period to ultra-low-sulfur diesel fuel under the current Federal regulations are temporary situations. As a result, terminal operators and others dealing with the increased number of fuels will not want to invest in more tankage or other means of handling the fuels since the situation will only exist for several years. As such, the transition periods could see more volatility than will occur after the transition times. Again, the boutique fuel issue is not the only matter of concern with these decisions. If the ultra-low-sulfur diesel fuel transition period were eliminated and all diesel fuel was to be 15 ppm instead, the effect of production problems on prices could exceed boutique fuel effects in the short run.

Future Number of Fuel Types (An Illustration)

While the future size and location of different fuel “islands” is difficult to assess, the current and proposed changes to petroleum fuels will create more types of fuels. Different regions will be affected differently. The Midwest may only see an increase in CBOBs, but the East Coast, for example, could see significant changes.

Currently the East Coast has:
- Conventional gasoline
- Several low-RVP conventional gasolines
- Reformulated gasoline.

With some States looking at early adoption of low-sulfur fuels and State MTBE bans on top of other Federal changes, for a period of time, the East Coast could need to deal with the following fuel types:
- Conventional gasoline

[4] Texas, for example, held a conference June 25, 2002, to explore a plan for moving early to ultra-low-sulfur diesel fuel.

- Conventional low-sulfur gasoline
- Several low-RVP conventional gasolines
- Reformulated gasoline with MTBE
- Reformulated gasoline with no oxygenates
- RBOB
- Several CBOBs with different RVPs
- Ethanol-blended RFG
- Ethanol
- Alkylate or iso-octane products.

Options to Reduce Price Volatility: Will Reduction in Number of Fuels Help?

This section explores several options that have been raised to reduce the number of distinct gasoline types in the system.

Moving to One or Two Fuels

This option would mean moving to CaRFG or to RFG and CaRFG, since the areas using these fuels would not likely accept a move to a dirtier fuel. This option offers the consumer higher average costs because of the higher production costs of these fuels, in exchange for reduced price volatility due to improved flexibility for distribution and storage. The transition to such a situation between now and 2007 would be extremely difficult and disruptive. The high investment costs required would likely lead to an accelerated loss of marginal refineries, and the high gasoline quality would result in a loss of some import suppliers able to produce such gasoline. The remaining refiners would not only have to make the process changes to produce all RFG, but would probably need to expand capacity to make up for the supply losses just mentioned. Furthermore, it is more difficult for refiners to produce all RFG[5] than to produce a combination of RFG and conventional gasoline. A transition to this one- or two-fuel world would be difficult, and given the other changes being undertaken by the industry today, a transition of this magnitude could be disruptive in the short term.

Another option would be where every State but California moves to RFG.[6] From 1995 through 2000, RFG spot prices (outside of California) averaged 2 to 3 cents per gallon higher than those for conventional gasoline (Figure 3). Since this differential is less than

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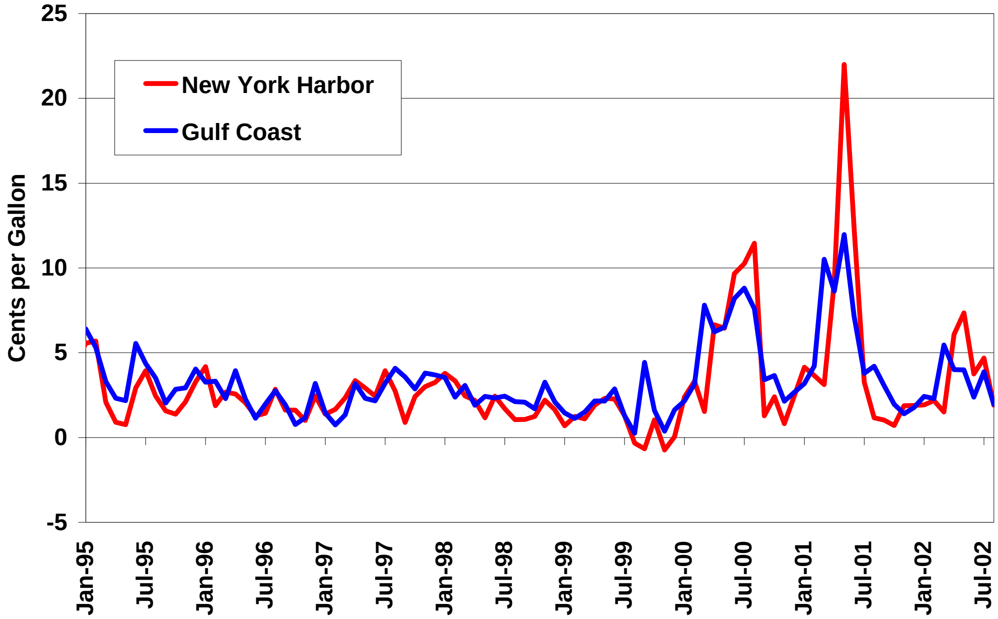
[5] It is easier for a refinery to produce conventional gasoline than RFG. Also, refineries producing at least some conventional gasoline have more flexibility and can be expected to run at higher utilizations. For example, when a specification problem occurs with RFG, the refinery can divert streams to conventional gasoline for a time and keep producing gasoline. If the refinery only produces RFG, it might have to cease gasoline production until the problem is resolved.
[6] The RFG case is being used for expediency. The case for moving to CaRFG is more complicated to review historically and to use for illustrative purposes.

most estimates of the higher cost of producing RFG,[7] these prices would be inadequate for refiners to earn returns on the additional investment required. This implies that, if nothing else changes, RFG might have migrated higher, perhaps to 4 or 5 cents per gallon or so above conventional gasoline prices. Would consumers be willing to pay that much more to reduce volatility?

Figure 3. RFG-Conventional Gasoline Spot Price Differentials



Source: Reuters Ltd.

Since the East Coast uses about 40 percent RFG, many of those consumers would see little impact of moving to a single fuel. It is not clear if conventional gasoline consumers in the Southeast and other parts of the country would find a 5-cent-per-gallon increase acceptable. Some consumers might accept a premium of 5 cents per gallon in view of the cleaner-burning qualities of the fuel.

There are a number of large uncertainties not covered by this analysis. For example,

- The difficulty and potential volatility surrounding a transition may not be tolerable. The loss of supply from marginal refinery shutdowns and reduced import sources could tighten the market considerably for some time and create more volatility before settling into the desired less volatile situation.
- The volatility seen in the Midwest and other areas recently may diminish. If the Midwest market calms down, as 2002 indicates, the enthusiasm for embracing a more expensive fuel may dwindle.
- The cost of RFG, as a single fuel, is uncertain. Most indications are that it would cost

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[7] Energy Information Administration, "1995 Reformulated Gasoline Market Affected Refiners Differently," *Petroleum Marketing Monthly*, DOE/EIA-0380(1996/01) (Washington, DC, January 1996).

more relative to conventional gasoline than is the case today. For example, a refinery can produce RFG more cheaply when it is produced in conjunction with conventional gasoline.

- Refiners also lose some flexibility when the quality of the gasoline pool becomes more constrained, as it would if refiners produced only RFG. This can result in larger reductions in output when a refinery experiences an outage on a single unit.
- MTBE bans in the future would likely increase the cost of RFG, and thus the differential between RFG and conventional gasoline, due to the loss of volume, the need to replace the oxygen content of MTBE, and other changes to refinery operations required to make RFG without MTBE.
- Low-sulfur gasoline requirements will tend to increase the cost of conventional gasolines, which will require a more significant change in quality than RFG, thus reducing the cost difference between RFG and conventional gasoline. Also, distribution and storage costs would decline. But these factors would probably not overcome the factors increasing the relative RFG cost.

While little consideration has been given to the idea of moving to one or two fuels due to the impracticality of doing it in the short term, the topic merits some consideration for the longer term from an economic and environmental perspective.

Reducing the RVP Fuel Slate

Reducing the patchwork nature of gasoline supply through a limited slate of allowed gasolines (e.g., limiting the number of low-RVP gasoline types that can be used) may do little to reduce price volatility. While the number of low-RVP gasoline types decreases, the number of “islands” using these low-RVP fuels may not decline. In fact, production of most of the low-RVP gasolines can be less problematic than delivering the specialized blends to selected areas or “islands.” That is, the “island” dimension may be a larger price-volatility factor in some low-RVP areas than the fuel specification itself. Reducing the number of low-RVP fuels also does not address the main regions of recent price volatility – California and Chicago-Milwaukee.

Introducing A Federal MTBE Ban to Reduce State Patchwork of MTBE-Ban Fuels

State MTBE bans, some of which begin as early as 2004, will produce a patchwork of MTBE areas that increases the boutique fuel problem, particularly in areas like the Northeast. A Federal MTBE ban, currently proposed to start in 2007, could eliminate the fuel type proliferation stemming from the patchwork of State MTBE bans at that time. MTBE bans, whether State or Federal, have a number of other implications for gasoline supply, as described in EIA’s response to Sen. Bingaman’s questions regarding MTBE bans and the Renewable Fuel Standard.

Other Options

Reducing the number of fuels is one means of reducing volatility due to strains on the infrastructure. Other options may also exist. An expansion of infrastructure (e.g., more tanks) could help relieve the price volatility. However, incentives for holding inventories in those tanks would also have to exist. There could be ways to cushion consumers from price surges. For example, heating oil consumers in some areas pay a slight premium to have guaranteed price caps. Perhaps programs such as these might be developed for the gasoline markets.

Conclusion

It would be difficult to devise a Federal menu of fuels in the near term that would have much impact on gasoline price volatility. In the longer term, while reducing fuel types to one or two fuels would remove the fuel-type strain on the system, the solution could be costly, depending on the fuel type(s) selected. This conclusion stems from the factors summarized below.

Reducing the number of boutique fuels will not totally eliminate volatility, but would likely reduce its frequency and magnitude. International petroleum market cycles play a large role in setting the stage for price volatility. The proliferation of fuel types has exacerbated the problem. The international petroleum market, like other commodity markets, swings between tight and loose market conditions. When the market tightens, prices rise as demand exceeds production for some time, and inventories are drawn down to low levels. Low inventories mean less cushion for unexpected changes in demand or supply. With little inventory supply cushion, the chances of price runups increase compared to loose market conditions with high inventories. The presence of many distinct fuels in such circumstances further increases the probability that some specific fuel region may run low enough to cause a price surge locally.

Generally, the impact of boutique fuels on price volatility varies with volumes, distance from supply sources, and number of supply sources, which in turn, depend on the degree of product differentiation. Not all boutique fuels are equal in their propensity to lead to price volatility. The size and duration of a price runup is influenced by the size of the supply/demand imbalance and the speed with which the imbalance can be resolved. The speed of resolution depends on the availability of nearby supply, such as inventories or refiners able to provide the product. **The two fuel types that have experienced the most volatility are California RFG (CaRFG) and Chicago-Milwaukee's ethanol-blended RFG. These two fuels are unique and difficult to make**. Not many refiners outside of those supplying theses areas can regularly make these fuels. In addition, the few marginal suppliers that may be able to supply extra fuel are a long distance away from these regions (Europe and the Gulf Coast).

Moving to one or two fuels means moving to the highest-quality clean fuels such as

CaRFG and Federal RFG, since the public will not likely tolerate a degradation in clean air in areas already using reformulated gasolines. These fuels are more difficult and expensive to produce than conventional gasoline. Moving to one or two fuels means **some consumers would be trading less volatility as a result of less strain on the distribution system for higher average prices in many regions now served by lower quality gasolines because of the higher cost of production of a single, cleaner fuel.** In the short-term (between now and 2007), such a transition would be extremely difficult to implement on top of the other changes already approved. Under any circumstances, such a transition would be disruptive due to the high investment costs and difficulty in producing all RFG. It could lead to a loss of marginal refineries, loss of import suppliers, and a reduction of production capacity at existing refineries, which would require expansion on top of process investments. However, in the longer term, ignoring the disruptive nature of a transition, there may be merit in looking at such an option.

Proposals have been made to reduce the national slate of fuels by reducing the number of low-RVP blends. This likely will do little to reduce price volatility. Low-RVP fuels are generally not difficult to produce and have not resulted in the magnitude of price volatility seen with CaRFG and ethanol-blended RFG. Reducing the number of low-RVP gasolines would help simplify refinery and transportation logistics, but not necessarily reduce the number of distinct isolated geographic areas or "islands" that use low-RVP fuels. It would only mean that more of these "islands" would be getting the same kind of fuel. Price runups associated with low-RVP areas have been due more to the "island" effect, i.e., the distance from supply, rather than from the difficulty of producing the fuel. When an "island" runs low on fuel, it cannot borrow from its neighbors, but has to wait until the next shipment arrives. In actual practice, the price volatility of low-RVP gasoline areas has been much less than in California or Chicago-Milwaukee.

Over the next few years, both existing and proposed regulations will likely increase the number of fuels. In every case, there is a tradeoff among price volatility associated with an increasing number of fuels, production costs (and thus prices), and environmental impacts. For example, State MTBE bans would produce a patchwork of fuels with and without MTBE. A Federal MTBE ban, proposed for 2007, would remove the patchwork, but only after some proposed State bans would have already been in effect since as early as 2004.

Appendix A. Request from Committee

United States Senate

COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, DC 20510-6150

ENERGY.SENATE.GOV

June 17, 2002

Dr. Mary Hutzler
Acting Administrator
Energy Information Administration
1000 Independence Avenue SW
Washington, DC 20585

Dear Acting Administrator Hutzler:

The Senate passed version of H.R.4 contains a number of provisions affecting fuels markets that require additional analysis prior to final conference decisions. First, the oxygenate requirement for RFG would be eliminated and the states would be allowed to ban the use of MTBE beginning in 2004, a national phase out would follow. Also beginning in 2004, a certain portion of all gasoline sold in the U.S. will have to be from "renewable fuels", this requirement will affect all refiners and gasoline markets. The combination of these two factors alone has the potential to significantly impact US motor fuels markets.

As we all know too well, every previous significant change to fuel formulations has resulted in severe price volatility in various US motor fuels markets. Each time, the Committee on Energy & Natural Resources has held hearings to review the problems in an effort to avoid or at least mitigate future recurrence of such dislocations. The Energy Information Administration (EIA) has also investigated and reported on these various transitions. We should be able to apply what we have learned from these past market transition experiences to ease the implementation of these various changes that will start to take effect in 2004.

Therefore, I am requesting that the EIA analyze the potential market implications of the Senate-passed fuels provisions in H.R.4 combined with known and anticipated regulatory changes. This should include specific analysis of the following factors:

1. The expected volumetric shortfall in fuels supplies with an effective MTBE ban in 2004;
2. Actual renewable fuels production capacity, supply, and constraints and the effect on price;
3. Inter-regional transportation issues and associated costs for renewable fuels;

4. The potential effect of operating the mandate on a fiscal year, (i.e. beginning in October) vs. calendar year basis;
5. The environmental impact of the simultaneous implementation of the low sulfur and Mobile Source Air Toxic (MSAT) gasoline regulations and a national ethanol mandate;
6. The impact on gasoline price and supply when many additional ozone non-attainment areas come under the new 8-hour ozone standard;
7. The potential cost and supply impacts associated with individual states seeking to protect air quality through the removal of the one-pound vapor pressure waiver for gasoline blended with ethanol;
8. The potential effect/role of implementation of a national menu of fuels to address the proliferation of boutique fuels.

As earlier requests have noted, it would be helpful to have this study completed as soon as possible. Should you have any questions, regarding this request, please contact Jennifer Michael at the Committee, at (202)224-7143. I thank you in advance for your assistance.

Sincerely,

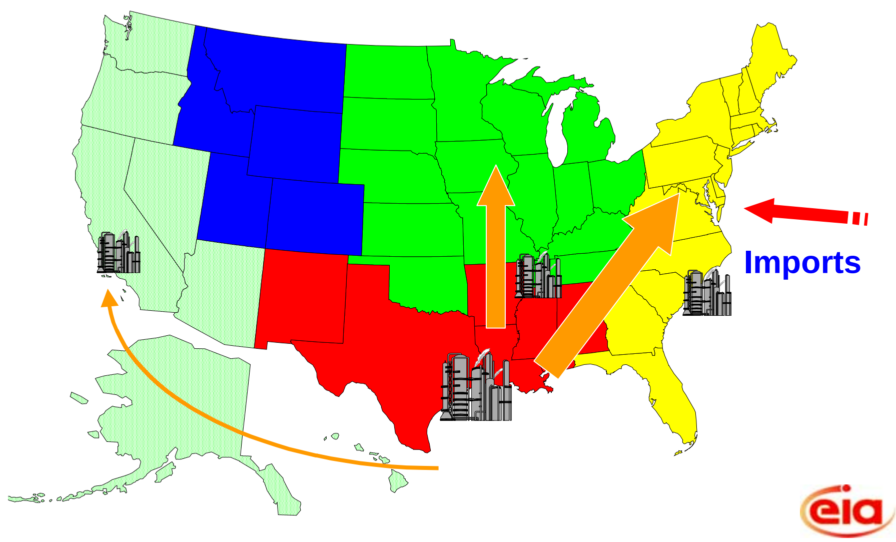
Jeff Bingaman
Chairman, Senate Committee on
Energy & Natural Resources

cc: file

Appendix B. Supply and Distribution of Light Products

The size and duration of price surges are determined by the size of the imbalance and the time it takes to resolve the problem. One factor that influences the time to fill a gap between supply and demand is the distance that new supply must travel. Both the East Coast and the Midwest are dependent on products made on the Gulf Coast, which can take several weeks to travel by pipeline or barge (Figure 4). In addition, the East Coast depends on imports, some of which also come from some distance, such as Europe. A small amount of material even moves from the Gulf Coast to the West Coast through the Panama Canal.

Figure 4. Major Petroleum Product Flows in the U.S.

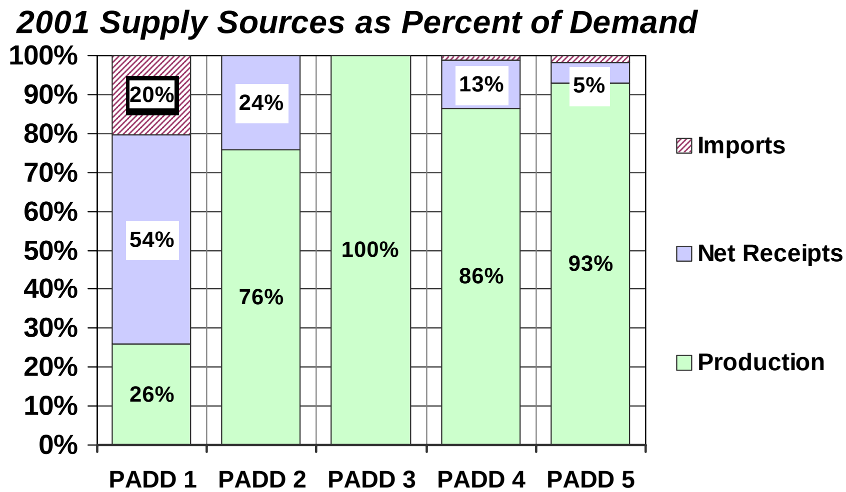


Source: EIA

The East Coast (PADD 1) is most dependent on distant production (Figure 5). More than half of its light product needs come by pipeline or barge. Of that product moving from other PADDs, almost 80 percent comes by pipeline. The Midwest is also dependent on distant light product production – mainly from the Gulf Coast. About 86 percent of the Midwest light products from other PADDs comes via pipeline.

The Gulf Coast (PADD 3), which is the source of most of the East Coast's and Midwest's domestic net receipts, is not dependent on external supply sources. Today, the Rocky Mountain area (PADD 4) and the West Coast (PADD 5) receive some products from other PADDs, but to a much smaller extent than PADDs 1 and 2.

Figure 5. Pipeline and Barge Movements of Light Products Critical to Regional Supply



Note: Light products are gasoline, distillate and jet fuel.
Source: EIA, Petroleum Supply Monthly, 2001

The future need for inter-PADD product flows will depend on how demand in each PADD is growing relative to its own refinery capacity. As MTBE is phased out of gasoline, either through State or Federal actions, both West and East Coast refineries are expected to experience the largest loss of production capability because of the high percentage of RFG they produce. As a result, the Gulf Coast could be sending more volumes to these coastal regions. The net result could be an increase in the percentage of product flowing over long distances, which could increase the potential for price volatility.