III. THE PRODUCTION AND MARKETING OF GASOLINE

A. Overview of Gasoline Production

Through the application of heat energy and a variety of chemical processes, crude oil can be transformed into many useful products, including motor fuels, heating oil, asphalt, lubricating oils, solvents, paraffin, petroleum jelly, petroleum coke, and feedstocks for the manufacture of chemicals, synthetic rubber, fibers, plastics, drugs, and detergents. (See Figure III.1 on page 80.) Fuel products, which include motor gasoline, jet fuel, diesel fuel, kerosene, and liquified petroleum gases, account for nearly 90 percent of the petroleum used in the United States.[39]

Locating crude oil, extracting it from the earth or seabeds, transporting it to refineries, transforming it into useful products, and transporting the refined products to the end-users is a complex, technologically sophisticated industrial operation that spans nearly the entire globe. By one measure, the oil industry is the most capital-intensive industry in the United States.[40] The oil industry is generally divided into two segments: "upstream," which includes exploration, production and transportation of crude oil to refineries; and "downstream," which includes the refining process and the distribution and marketing of the refined products.

1. Exploration and Production

Over the past 25 years, the proven reserves of crude oil in the United States have declined by one-third, from approximately 33 billion barrels of crude oil equivalent in 1978 to

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[39] Energy Information Administration, *Petroleum: An Energy Profile, 1999*, at 5-8. This document provides a more detailed description of the oil industry.

[40] The measure used here is assets per worker. By this measure the oil industry is significantly more capital-intensive than any other U.S. industry. Other measures of capital intensity, such as the capital-sales ratio, the capital-labor ratio, or the capital-value added ratio, do not yield significantly different results for analytic purposes such as this. William G. Shepherd, *The Economics of Industrial Organization*, 3rd ed., 1990, at 78-79.

23 billion barrels in 1999.[41] Today, the United States holds only about 2 percent of the world's proven crude oil reserves; almost two-thirds of the proven reserves are located in the Middle East. Nearly 50 percent of the crude oil consumed in the United States is imported; the EIA projects that by 2020 the percentage of imports will rise to nearly 70 percent.[42] It is considered unlikely that any major new reserves will be found in the United States.[43]

As proven reserves are consumed, exploration for additional reserves becomes more costly and requires increasingly sophisticated technologies to locate petroleum deposits. Just within the United States, the average cost of drilling a crude oil well has risen from about $250,000 in 1960 to over $850,000 in 1999.[44] Exploration is also financially risky: currently only about one-third of all exploratory wells are successful in finding deposits.[45] Because of the

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[41] Proven reserves are those quantities that geological and engineering data demonstrate with reasonable certainty to be recoverable in future years from known reserves under existing economic and operating conditions (British Petroleum Statistical Review of World Energy, Oil: Proved Reserves). The crude oil equivalent is composed of crude oil, dry natural gas, and natural gas liquids. The level of reserves in 1999 represented a significant increase over proven reserves as of 1998: a 3.5 percent increase in actual crude oil reserves, a 2.1 percent gain in dry natural gas reserves, and a 5.1 percent gain in natural gas liquids. Energy Information Administration, *Annual Energy Review 2000*, Table 4.2.

[42] *Petroleum: An Energy Profile, 1999*, at 45.

[43] *Petroleum: An Energy Profile, 1999*, at 14.

[44] In the U.S. in 1960, 45,620 wells were drilled in the search for oil and natural gas. Approximately 60 percent of those wells were successful. They were drilled to an average depth of 4,213 feet, and cost an average of $58.63 per foot ($247,008 per well). Over 95% of those wells were drilled on shore in the lower 48 states, and the average productivity per well was 11.9 barrels. In 1999 in the U.S., 25,140 wells, with an average success ratio of over 80% (a 20% increase in success over 1960), were drilled. They were drilled to an average depth of 5,944 feet at an average cost of $145.10 per foot ($862,474 per well). In 1999 87% of the wells were being drilled on shore and 20% of the wells drilled were drilled in Alaska. *Annual Energy Review 2000*, Table 4.4 & Table 5.2.

[45] *Petroleum: An Energy Profile, 1999*, at 21.

tremendous expense and risk involved, many downstream companies that refine and distribute gasoline do not engage in upstream exploration. Today, although successful exploration may be very profitable, out of the 63 companies that refine crude oil in the United States just 11 companies explore for crude oil.[46]

As domestic reserves have been depleted, average well productivity has declined too – from over 18 barrels per day in 1972 to just under 11 barrels per day in 2000.[47] Nonetheless, technological advances have increased the ability to access crude oil deposits and improved the efficiency of recovery of oil from identified deposits. Today, petroleum is being recovered from basins that would have been abandoned as unproductive in the past or that were beyond any technology to reach. For example, oil platforms in the Gulf of Mexico now can drill over 5 miles into the earth to capture crude oil deposits that just a few years ago were too deep to recover.

Throughout the history of the oil industry, the upstream sector has been subject to cycles of "boom" and "bust." When supplies are scarce and the price of crude oil rises, companies will invest in exploration and development. When supplies are plentiful, companies will reduce their upstream expenditures.

Crude oil is transported to the United States in tankers from Europe, Asia, the Middle-East and Alaska, in barges from Mexico and Canada, and through pipelines from Canada and Mexico. The major ports with capability to receive shipments of crude oil are located in New

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[46] Information provided by Energy Information Administration, March 4, 2002.

[47]Energy Information Administration, Annual Energy Review 2000, table 5.2; (http://www.eia.doe.gov/emeu/aer/txt/tab0502.htm)

York Harbor, the Gulf Coast, and on the West Coast.[48] Once in the U.S., crude oil is transported by barge or pipelines to refineries. A network of pipelines carries crude oil delivered to the Gulf Coast into the Midwest, and a lesser network carries crude oil produced in the continental United States across the various regions. (See Figure III. 2 on page 81.) There are 114,000 miles of crude oil pipelines in the United States.[49]

2. Refining

The first step in the refining process is atmospheric distillation, which consists of heating the crude oil to separate the different hydrocarbon components with differing boiling points. (See Figure III.3 on page 82.) Lighter products, such as gasoline, are recovered at the lowest temperatures; middle distillates, such as home heating oil and diesel fuel, come next; the heaviest products, such as residual fuel oil, are only recovered at the highest temperatures, sometimes over 1000 degrees Fahrenheit. Most refineries in the United States use additional refining technologies, such as vacuum distillation, coking, catalytic cracking, and hydrocracking, to improve efficiency, recover additional components, and improve product quality.

Every refinery has unique characteristics and capabilities for processing crude oil and for making refined products. Most refineries were initially built to process a specific slate of crude

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[48] The Port of Long Beach is the only U.S. port that is capable of handling "very large crude carriers," (capacity of up to 2 million barrels), and no U.S. port is capable of handling "ultra large crude carriers" (capacity greater than 2 million barrels). Crude oil must be transferred from these tankers into smaller vessels before it can be delivered to U.S. ports. The Louisiana Offshore Oil Port (LOOP) is a storage facility 18 miles offshore in the Gulf of Mexico where ultra large tankers can dock and load their cargo into pipelines that carry the crude oil into storage in salt caverns ashore in Louisiana. *Petroleum: An Energy Profile, 1999*, at 38.

[49] According to the Association of Oil Pipelines, there are also 86,500 miles of product pipelines. Together, the 200,500 miles of pipeline (crude and product) run through each of the 50 states. See http://www.aopl.org/pubs/facts.html.

oils, usually the crudes from the company's upstream division or from a nearby oil field. In the past two decades, many refiners have upgraded their refineries to be able to take advantage of the price differentials between the different grades of crude oil sold on the world market. In some cases, these capital improvements have cost hundreds of millions of dollars.

The economics of refinery operation is largely dependent on three variables: the cost of crude oil, the cost of operating the refinery, and the market price the seller can obtain for the product. In addition to the refinery's capabilities for processing crude oil, the "crack spread" – the difference between the price a refiner can obtain for a refined product and the cost of crude oil – will determine the types of crude oil a refiner will purchase and the products that the refiner will produce.

The United States has the largest refining capacity of any nation in the world – approximately 20 percent of the total global refining capacity.[50] Almost all of the gasoline consumed in the United States – approximately 96 percent – is produced in domestic refineries; the remainder is imported from locations such as the Caribbean and Europe.[51]

3. Storage and Distribution

Once crude oil is refined, the products are stored in tanks at the refinery or shipped to other distribution facilities, called wholesale terminals. It is estimated there are more than 1,300 wholesale terminals in service. A terminal may have as much as 2 million gallons of storage capacity.[52] Although major oil companies own a number of these terminals, about 75 percent

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[50] *Petroleum: An Energy Profile, 1999*, at 25.

[51] Energy Information Administration, *Petroleum Supply Annual 2000*, Volume 1, Table S4.

[52] Bureau of the Census, American Fact Finder, Economic Data Sets, Sector 42.

are owned by independent petroleum companies, distributors (jobbers), and terminal/supply service companies.[53]

Most of the volume of petroleum products is transported from refineries to wholesale terminals through pipelines.[54] (See Figure III.2 on page 81.) Most oil pipelines are operated as "common carriers," which means that the pipeline owner does not take title to the oil being shipped but simply provides the transportation service. As common carriers, pipelines must be accessible to all oil that meets the pipeline's shipping specifications, regardless of the ownership. Further, they are subject to government regulation concerning rates and operating practices. Some 184 companies operate pipelines that are regulated by the Federal Energy Regulatory Commission (FERC) for the purpose of rates.

A small percentage of pipelines are operated as proprietary pipelines. Proprietary pipelines transport crude oil or products for their owners or their affiliates. The owners of these pipelines can set their own rates; however, if they begin shipping substantial quantities of product for the use of third parties, the FERC can require that they become common carriers and be subject to the FERC's rate making authority.[55]

Petroleum products also are transported from refineries to wholesale terminals by barge. Barges generally have a capacity of 30,000 barrels or less, and are commonly used on the Mississippi and Ohio river systems. Most of the barges are owned by commercial transportation

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[53] Documents in Subcommittee files.

[54] Some 60 percent of the products move via approximately 87,000 miles of product pipelines. Generally, crude oil pipelines and product pipelines operate separately and do not carry the same commodities. Crude oil pipelines generally run from ports and production facilities to refineries and product pipelines generally run from refineries to distribution terminals.

[55] Information provided by the Association of Oil Pipelines on December 3, 2001.

companies, with some owned by the petroleum companies themselves. Less than six percent of petroleum products is moved from refineries by truck, and only half that amount, just over three percent, is moved by rail.[56]

Although different refineries have different operating characteristics, with limited exception the basic gasoline produced at any particular refinery will be chemically identical to the gasoline produced at any other refinery. A brand of gasoline is created when the refined gasoline is mixed with a company's proprietary blend of chemical additives at the terminal, which usually occurs as the tanker trucks are being filled for their deliveries to service stations. Because all gasoline must meet the applicable minimum federal standards, most gasoline is identical even after the proprietary chemical additives are mixed.[57] "Branded gasoline" is sold by the refiner with the understanding that it may be resold under the trademark or trade name owned by the refiner. "Unbranded gasoline" cannot be resold under the trade name.

Branded gasoline is distributed from refineries and terminals to retail outlets, either directly to the service station or through bulk plants. Bulk plants are like terminals, but they are used by jobbers to store product for distribution to retailers.[58] Jobbers purchase and transport gasoline from refiners and sell or distribute it to gasoline retailers or, in some cases, directly to

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[56] Association of Oil Pipe Lines, *Shifts in Petroleum Transportation*, August 4, 2000, Table 3.

[57] Some refiners contend that their gasoline contains unique constituents and/or additives. Documents in Subcommittee files.

[58] United States Census Bureau, Economics and Statistics Administration, *Summary 1997 Economic Census, Wholesale Trade, Subject Series*, March 2001, EC97W42S-SM, Table 1, Summary Statistics for the United States, p. 12.

the public through their own retail stations.[59] A jobber may distribute several brands of gasoline, and may own or lease several retail outlets selling different brands, including unbranded gasoline. Jobbers who contract with a company to distribute a particular brand of gasoline are often required to obtain that gasoline from a particular terminal. Refiners and jobbers distribute the gasoline to retail outlets by trucks that generally carry about 7,700 gallons of fuel each. Figure III.4 (page 83) shows the flow of gasoline from the refiner either directly to the dealer or indirectly through a jobber distribution system.

4. Retail Marketing

Service stations, which first appeared around 1910, remain the predominant retail establishments for marketing gasoline.[60] Currently there are over 175,000 retail gasoline outlets in the United States.[61] Today, there is an increasing variety of service station formats and ownership.

*A **company-owned, company-operated station*** is owned by a refining company and operated by salaried or commissioned personnel of the refining company. Although there are some company-operated stations that are supplied by a jobber on contract with a refining company, they are few-in-number and almost all of these stations are supplied by the refining companies directly.

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[59] The Petroleum Marketers Association of America (PMAA) estimates that the current number of petroleum distributors is 7,500, and that the number has declined by approximately 30 percent from 1989. PMAA states that the earlier estimates were "skewed" because they counted a number of small dealers with one or two trucks as distributors. There are very few of those small dealers still in business. (Interview with Bob Bassman, PMAA, 9/5/2001)

[60] *Petroleum: An Energy Profile 1999*, at 56.

[61] National Petroleum News, *Annual Market Facts*; data provided to the Subcommittee by EIA, 8/7/01.

*A **lessee-dealer*** is a person who leases the station and land**,** including tanks, pumps, signs, and other equipment, from a refiner and is supplied directly by the refiner or an affiliate or subsidiary company of the refiner. The lessee-dealer is required by contract to buy gasoline from the refiner at the price set by the refiner, the "dealer tank wagon" (DTW) price. This price will generally be higher than the rack price charged to jobbers (see below), as it will include a charge for promotional support provided by the refiner. The refiner also sets the lease rate and other operating standards and may also offer certain discounts, all of which affect operating costs and ultimately the retail price charged by the lessee dealer.

*An **open dealer*** is a person who owns (or leases from a third party who is not a refiner) the station or land of a retail outlet and has use of tanks, pumps, signs, and other equipment. An open dealer sells gasoline under the brand of a refiner. An open dealer may have a supply agreement with a refiner or may be supplied by a jobber under contract with a refiner. The open dealer may, upon expiration of a contract, switch to another source of supply, including a different brand.[62]

*A **jobber*** purchases branded or unbranded gasoline at a terminal owned or supplied by a refinery, commonly called the "rack," and distributes it to either his or her own service stations or to service stations owned by others or both. Many jobbers have term contracts with refiners for purchases of specific amounts of branded gasoline.

*An **independent dealer*** purchases unbranded gasoline, either on the spot market or at a refiner's rack. Independent dealers generally do not have long-term contracts with any particular

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[62] EIA, *Performance Profiles of Major Energy Producers 1999*, Glossary; http://www.eia.doe.gov/emeu/perfpro/glossary.html, at 2.

brand; they generally shop around for the lowest unbranded rack price.[63] They may also use a jobber to execute delivery of the gasoline purchased at the rack. Unbranded gasoline may be sold under a local retail chain name such as Sheetz, Wawa, or Freestate, or a local individual owner, such as "Joe's Gas."

As of 1999 there were approximately 117,250 branded stations and 57,750 unbranded stations in the U.S.[64] About half of the branded stations are open dealers, while the remaining stations are divided almost evenly between company-owned and lessee-dealer outlets.

In recent years, the retail marketing of gasoline has become increasingly linked with convenience shopping. For many years, the most common service station format consisted of several islands of gasoline pumps and two or three service bays. Today, gasoline is becoming just another offering at convenience outlets, such as Seven-Eleven and WaWa, supermarkets such as Safeway and Kroger, or hypermarkets such as Wal-Mart and Costco. This trend in retail marketing is discussed in Chapter D of this section.

B. <u>Trends in Refining</u>

The number of refineries in the United States reached a high of 324 in 1981 and then gradually declined to 155 by 2001. Several factors have contributed to this decline. First, the Crude Oil Entitlements Program[65] ended, and price controls on domestically produced crude oil

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[63] Jobbers may purchase branded gasoline and sell it to independent, unbranded stations. In those instances, the unbranded stations cannot identify the name of the brand they are selling. Such an arrangement only makes economic sense when the branded rack price is cheaper than the unbranded rack price.

[64] National Petroleum News, *Annual Market Facts*; Data supplied by EIA on 8/7/01.

[65] Until 1973 U.S. oil prices were generally above international prices. After the 1973 Arab oil embargo, however, most domestic oil was priced below imported oil due to U.S. price controls and the increase in OPEC oil prices. One result of this price disparity was to give refiners with greater access to less expensive domestic crude oil a substantial competitive edge

ended in 1981. Once the protections and price controls ended, it was no longer profitable to operate many of the small, simple refineries and a number of less efficient older refineries.

Crude oil and gasoline prices peaked in 1981, following the start of the war between Iran and Iraq and the decontrol of domestic crude prices[66]. Demand slackened as retail gasoline prices rose to unprecedented levels throughout the country. In addition to high prices, a number of conservation measures adopted during the 1970s took effect, further reducing demand. With declining demand and increasing OPEC production, crude oil and gasoline prices plummeted, putting further pressure on marginal refiners.[67] Figure III.5 (page 84) shows the trend in refining margins during and after this period.

The total amount of refining capacity during this period has been described as an "overcapacity bubble." In 1981, when the number of refineries was at its highest, capacity utilization was at its lowest. Just over 68 percent of refining capacity was being used, meaning that nearly one-third of all domestic capacity was idle. During most of the 1980s and into the early 1990s, total capacity remained high and utilization remained low, leading to low refining

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over refiners that relied on more expensive imported crude oil. To redress this inequity, the Crude Oil Entitlements Program was established in 1974. This program subsidized and protected the operation of small refineries. Refiners were able to buy and sell entitlements (permits) designed to minimize the disparity in their crude oil acquisition costs. U.S. General Accounting Office, *The United States Exerts Limited Influence on the International Crude Oil Spot Market*, August 21, 1980.

[66] The U.S. imposed price controls on domestically produced oil in 1973. Full decontrol of prices and supplies in the industry occurred in 1981. U.S. Department of Energy Office of Industrial Technologies, *Energy and Environmental Profile of the U.S. Petroleum Refining Industry*, December 1998.

[67] *Petroleum: An Energy Profile, 1999*, at 53-54.

margins.[68] In total, about 120 refineries closed during the 1980s, representing a loss of capacity of about 3 million barrels per day.[69]

Demand for petroleum products slowly began to increase after 1983.[70] Since that time, the annual gross input to domestic refineries has continued to increase as well.[71] Utilization rates have increased too. Many refiners made capital investments to "de-bottleneck" their refineries and add downstream processing equipment, such as catalytic cracking and reforming units, to increase their efficiency and capacity. Many of these investments also allowed refiners to process less expensive, heavier, crudes of lower quality.[72]

The Clean Air Act Amendments of 1990 also altered the refining landscape. To improve the air in a number of urban areas where the air quality did not meet federal standards, the Clean Air Act Amendments required the use of cleaner burning fuels, such as oxygenated gasolines by late 1992, lower sulfur diesel fuels by late 1993, and reformulated gasoline by January 1, 1995. According to the EIA, expenditures for pollution abatement rose from approximately 10 percent

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[68] Documents in Subcommittee files.

[69] *Petroleum: An Energy Profile, 1999*, at 30

[70] EIA, *Annual Energy Review 2000*, at Table 5.11.

[71] *Petroleum: An Energy Profile, 1999*, at 30.

[72] EIA, *The U.S. Petroleum Refining and Gasoline Marketing Industry*, updated September 25, 2001.

of refining capital expenditures in 1988 to approximately 40 percent in the mid-1990s.[73] Figure III.6 (page 85) shows the increase in environmental expenditures during this period.

As refiners were faced with the requirement to upgrade their facilities to produce cleaner gasoline, many refiners took the opportunity to de-bottleneck and upgrade their refineries. According to one trade publication, "As much as the environmental mandates were an economic burden to the oil industry, they did in an unintended way lead to a refinery capacity expansion. When certain capital investments were mandated, refiners took the opportunity to de-bottleneck and effectively add to capacity. The incremental cost of capacity addition was simply much less when combined with mandated investment than it would have been as a stand-alone project."[74] As a consequence, from 1989 to 1992 major energy companies doubled their capital expenditures for refining.[75]

Other refiners, however, chose not to make the necessary upgrades to produce the new, cleaner fuels. In the early 1990s, at the same time that refiners were faced with the new fuel requirements, refining margins continued to be depressed due to excess refining capacity. Figures III.5 and III.7 (pages 84 and 86) show the decline in refining margins and returns on investment, respectively, for the years 1990-1995. The combination of these and other factors in

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[73] The EIA study also concluded that although "the additional capital expenditures stemming from heightened pollution abatement requirements for the U.S. refining operations . . . have added to the capital intensity of U.S. refining in the late 1990s,...pollution abatement costs have been and continue to be a small part of overall operating costs." EIA also found "Although pollution abatement requirements clearly reduced the rate of return to refining/marketing assets, these requirements appear to account for only a small part of the steep decline in the rate of return to U.S. refining/marketing operations in the 1990s. . ." *The Impact of Environmental Compliance Costs on U.S. Refining Profitability*, October 1997, at 2, 5.

[74] Joe Petrowski, *Refining Concerns*, National Petroleum News, June, 2001.

[75] EIA, *The Impact of Environmental Compliance Costs on U.S. Refining Profitability*, October 1997, at 2.

the early 1990s led to another round of refinery closures beginning in the early part of the decade. Thirty-five refineries closed between 1991 and 1995, and another 15 closed between 1997 and 1999.[76] (See Figure II.6 on page 34.) In 2000, the National Petroleum Council projected that "the refinery shutdown trend is likely to continue into the future, regardless of the new fuels regulations, as the competitive landscape continues to evolve."[77]

With the closure of many small refineries and the addition of new capacity to existing refineries, the average capacity of a refinery in the United States has increased by nearly 50 percent since 1970. Thus, even though no new refinery has been built in the United States since the early 1980s, total capacity has increased by nearly 1 million barrels per day since 1986 – the equivalent of several new large refineries.[78]

In the United States today, 63 companies operate about 150 refineries with a combination distillation capacity of just over 16 million barrels per day.[79] These refineries range in size from small refineries with a capacity to process about 3,000 barrels of crude oil per day to the largest refinery, with a capacity to process just over than 500,000 barrels per day.[80] As demand has slowly grown, however, much of the industry is at its operable limit; the West Coast is even

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[76] National Petroleum Council, *U.S. Petroleum Refining, Assuring the Adequacy and Affordability of Cleaner Fuels*, June 2000, at 24-25. Only about half the closed refineries were able to produce finished gasoline. According to the NPC, the closures "have varied in size, complexity, and geography, with no apparent single physical factor responsible for the owner's decision to cease operation."

[77] *U.S. Petroleum Refining, Assuring the Adequacy and Affordability of Cleaner Fuels*, at 25.

[78] Cambridge Energy Research Associates, *Gasoline and the American People, July 2001 Update*, at 24-25.

[79] *Petroleum Supply Annual 2000*, Tables 36 & 40.

[80] EIA, Information provided to the Subcommittee, August 7, 2001.

short.[81] The annual average refinery utilization rate is now regularly greater than 90 percent.[82] (See Figure III.8 on page 87.)

The ownership of these refineries has changed in recent years. Within the last decade, as refining margins from downstream operations failed to provide as high a return as upstream operations for many of the major oil companies, a number of the oil companies divested several of their less profitable refineries. In 1990, fully integrated major oil companies (i.e. those with both upstream and downstream assets) owned 72 percent of domestic refining capacity, whereas the "independent" or non-integrated refiners (i.e. those without both upstream and downstream assets) owned only 8 percent. Included in this latter category were the "merchant" refiners such as Tosco Corporation, Valero Energy, and Tesoro Petroleum, which owned either no or relatively few retail outlets for the distribution of their refined products. By October 1998 the majors' share had fallen to 54 percent, and the independents owned 23 percent.[83]

These "independents," however, have themselves become increasingly vertically integrated refiners and marketers. During the mid-1990s Tosco, which at one point was mostly a merchant refiner, acquired all of Unocal's West Coast refining and marketing assets, all of BP's retail outlets on the West Coast, the Circle K convenience store chain, and all of the retail outlets on the East Coast the FTC required Exxon and Mobil to divest as a condition of approval for the Exxon-Mobil merger. Within the past year Phillips acquired Tosco, and Conoco is now seeking to merge with Phillips/Tosco. Valero merged with Ultramar Diamond Shamrock, which had

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[81] See Section IV.

[82] *Petroleum: An Energy Profile, 1999*, at 30; Petroleum Economist Limited, September 20, 2001.

[83] EIA, *The U.S. Petroleum Refining and Gasoline Marketing Industry*, September 25, 2001.

merged with Total. In 1990, independent refiners operated just over 13,000 retail outlets in 10 states; by 1999 these refiners were operating almost 22,000 outlets in 22 states.[84]

As a result of all of the mergers and acquisitions, even with the refinery divestitures by the majors that occurred in the 1990s, the refining business is now more concentrated than before and remains highly vertically integrated. The market share of the top 10 refiners has increased from about 55 to 62 percent over the past two decades. Seven of these ten refiners own one or more chains of retail outlets.[85]

C. Trends in Storage and Inventories

As the number of refineries has decreased, gasoline storage capacity and gasoline stockpiles at refineries also have decreased. In 1981, the aggregate storage capacity at the 324 refineries in the country was approximately 167 million barrels. By 2001, as the number of refineries was reduced by half, storage capacity for gasoline at refineries declined by 14 percent, to 143 million barrels.

As previously discussed, however, most of the terminal storage capacity is not located at refineries. Independents, jobbers, and terminal/supply service companies operate almost three times as many facilities as do the refiners. Of current stocks, approximately 40 percent is stored in bulk terminals, about one-third is stored at refineries, and the remainder, just over one-quarter (28 percent) is found in pipelines.[86] The Bureau of the Census reports that total storage capacity

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[84] EIA, *Restructuring: The Changing Face of Motor Gasoline Marketing*, October 30, 2001.

[85] See footnote 34, supra.

[86] *Petroleum: An Energy Profile, 1999*, at 41.

for refined petroleum products, including gasoline, declined almost 27 percent between 1987 and 1997,[87] while demand during the period increased almost 12 percent.[88]

In the Gulf Coast region (PADD 3)[89], which has the most refining capacity, gasoline storage is concentrated at the refineries. This is true as well for the Rocky Mountain (PADD 4) and West Coast (PADD 5) regions, neither of which are significant importers of gasoline. In the East Coast (PADD 1) and Midwest (PADD 2) regions, gasoline is stored primarily in bulk terminals closer to the market areas. In these regions, gasoline imports from other regions or nations are necessary to meet demand.

The costs of storing gasoline in inventory will vary, depending on market conditions, such as the type of storage required, the type of product being stored, and overall supply and demand considerations. Generally, long-term storage costs can become significant. On an average basis, it costs approximately $2 per barrel to hold gasoline in inventory at a refinery storage facility for a year and approximately $6 per barrel for a company to rent a storage facility for the same length of time. Thus, storing gasoline in rented tank space costs roughly 1 cent per gallon per month.[90]

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[87] Information provided to the Subcommittee by the Bureau of the Census, September 26, 2001.

[88]Energy Information Administration, *Annual Energy Review 2000,* Table 5.11.

[89] In 1950, the Petroleum Administration for Defense divided the country into five districts or Petroleum Administration for Defense Districts (PADDs). These districts were originally defined during World War II for purposes of administering oil allocation. See Figure III.9 (page 88) for a chart of the U.S. divided into PADDs.

[90] Energy Information Administration, *Oil Market Basics*, http://www.eia.doe.gov/pub/oil_gas.../oil_market_basics/Stocks_text.htm

In the past several years most refiners have aggressively reduced amounts of gasoline held in inventory. During the 1990s, a number of industries adopted "just-in-time" inventory practices to reduce operational costs and become more efficient. As the Wall Street Journal recently reported, "New software in use at most major energy companies allows employees to keep closer watch over how much oil or gas is sitting in tank farms, vast pipelines and neighborhood gas stations. By squeezing inventories to the minimum, the companies reduce storage costs and improve cash flow."[91] ExxonMobil, the largest oil company, has established a goal of reducing its crude oil and refined products in inventory by 15 percent. BP claims it has reduced its inventories by 7 percent since 1997. Prior to its merger with Texaco, Chevron had reduced its inventories of mid- and premium-grade gasoline by nearly two-thirds over the previous decade.[92]

Total gasoline stocks – meaning the total amount of gasoline and blending components in storage at refineries and terminals and in pipelines – have similarly fallen over the past two decades by about 20 percent, from approximately 250 million barrels in 1981 to around 200 million barrels at present. (See Figure III.10 on page 89.) In 1981 the amount of gasoline in storage equated to approximately 40 days of consumption; by 2001 the amount in storage had declined to around 25 days of consumption. Nationally, current stock levels represent only about 3 days worth of supply at the nation's current consumption rate of 8.5 million barrels of gasoline per day over the minimum amount of stocks considered necessary to effectively and efficiently distribute gasoline, which the EIA terms the "Lower Operational Inventory Level"

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[91] Alexei Barrionuevo, *Get Ready for Spikes In Gasoline Prices, As Supplies Tighten*, Wall Street Journal, January 24, 2002.

[92] *Id.*

("LOI").[93] According to the EIA, the LOI is the level of gasoline stocks at which "inventory related supply flexibility could be constrained or non-existent."[94]

The declines in inventory levels have been particularly severe in the Midwest and in California. In the Midwest, inventory levels have fallen about 22 percent over the past decade. In California, inventories have been reduced by about 20 percent over the same time period.[95]

Low inventories are widely regarded as a key factor contributing to the increased volatility of gasoline prices in recent years. The Federal Trade Commission, the Energy Information Administration, economists, and industry documents all attribute, in part, increasing volatility to reduced inventory levels.[96] In an analysis presented to the FTC, Philip Verleger relates the recent wave of mergers, the reduction in inventories, and increased price volatility:

> While proponents of the supermajors (including the author) have asserted that larger firms were necessary to maintain the diversified exploration programs required to stay in the business, the basic reason to merge has clearly been shareholder value. Every merged firm has sought to improve margins.

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[93] Energy Information Administration, *Petroleum 1996: Issues and Trends*, Figure 67.

[94] Energy Information Administration, *Weekly Petroleum Status Report*, July 6, 2001, p. 59.

[95] *Get Ready for Spikes In Gasoline Prices, As Supplies Tighten*, Wall Street Journal.

[96] See, e.g. EIA, *Petroleum 1996, Issues and Trends*; Final Report of the Federal Trade Commission, *Midwest Gasoline Price Investigation*, March 29, 2001 ; EIA, Testimony Before the Committee on Energy and Commerce, May 15, 2001 ("As EIA has pointed out on numerous occasions, very low gasoline stocks, combined with a market short on crude oil, generates an environment ripe for price volatility, both during the spring and peak summer periods."); Cooper, Consumer Federation of America, *Ending the Gasoline Price Spiral* at 10-11 ("Stocks are the key factor in policy responses to market power where supply is inelastic. Every investigation of every product spike in the past several years points to unusually low stock as a primary driver of price shocks."); P.K. Verleger, Jr., *World Oil Markets: Changing Structure and Greater Price Volatility Causing the Third Petro-Recession*, April 2001 Draft ("The recession will occur because the price of oil, like the price of any commodity, can achieve equilibrium over a wide range of identical level of supply and demand. The key determinant of the observed price is the amount of inventories held by processors and consumers.")

> Improving margins is synonymous with cutting costs. In most cases, the merged firms have sought to achieve these synergies by reducing inventories. In fact, one of the merged companies sought to lower its worldwide stocks by between 30 and 50 million barrels.
>
> The pursuit of minimum stocks by the merged companies must have increased the inelasticity of the supply-of-storage function. As companies chose to operate with lower stocks, they implicitly accepted the fact that they would be forced to pay a greater premium for incremental supplies. In the process, they abrogated a traditional role. In the past, integrated companies provided a pseudo price insurance program for consumers by holding stocks. Today, financial markets and responsibility to shareholders make it impossible for these firms to perform such a role.
>
> The effect of lower inventories on price volatility is discussed further in Section IV.

D. Trends in Marketing

The "hypermarket" is rapidly expanding as a highly competitive format for selling gasoline. (F-13)

The gasoline marketing techniques prevalent in America from the 1940s through the 1960s and early 1970s reflect not only a competitive landscape entirely different from today's, but also a culture in which the public placed much more trust and confidence in major institutions. "The Shell Answer Man" was an authoritative source for anything anyone wanted to know about gasoline and car performance. Every American during the 1960s knew the Texaco jingle that you could "trust your car to the man who wears the star." Oil companies often gave away handy household items for free following frequent fill-ups. Within the gasoline marketing industry the 1960s are characterized as "The Era of the Major Brands."

Prior to the oil embargo of 1973 gasoline was cheap and plentiful; not until 1974 did the retail price reach 40 cents per gallon. Cars, however, were less reliable than they are today. The local service station, which almost always sold a major brand, provided the full range of services a car owner needed - full-service gasoline islands; attendants to pump the gas, clean the

windshield, and check the oil; and two or three service bays for maintenance of tires, batteries, brakes, wipers, mufflers, and for oil changes. Gasoline had been sold this way since the 1920s, and most customers were loyal to the major brands.[97]

Independents in operation during this period offered a lower price for gasoline, but the price was offset by a lack of services and amenities. These stations offered minimal fueling facilities, no repair bays, did not accept credit cards, were frequently poorly maintained, were in less desirable locations, and the gasoline sold generally was of lower quality. These independents initially occupied a "low price niche."[98]

At first, the independents did not affect the majors' retail strategies. For many of the fully integrated major oil companies, service stations were not a major profit center but rather an outlet for those companies' refined products. The major profits were obtained from the upstream operations, especially the production and sale of crude oil, and retail strategies were often designed to maximize these upstream profits. With superior quality, customer brand loyalty, and different economic goals, many majors did not deem it necessary to compete with these independents on price.[99]

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[97] Presentation by ExxonMobil to the Subcommittee staff, July 23, 2001.

[98] Presentation by ExxonMobil to the Subcommittee staff, July 23, 2001.

[99] See F. M. Scherer, *Industry Structure, Strategy, and Public Policy*, 1996, at 134-5. Prof. Scherer states that a number of major oil companies deliberately pursued a strategy of developing many low-volume small outlets with high retail prices, some of which operated at a loss, as a result of "anomalies fostered by the percentage depletion tax break given domestic oil producers." The majors chose this strategy to maximize throughput of crude oil rather than sell additional products to independent marketers or gain additional volumes through lower retail prices because the multi-site low-volume strategy was "less likely to trigger price wars." *Id*.

At this point in time, the marketing of convenience items and the marketing of gasoline had not been linked. Convenience stores did not offer gasoline, and gasoline stations offered few, if any, convenience items.

The upheaval in the oil markets caused by the Arab oil embargo in 1973 and the formation of the OPEC cartel forever altered the marketing of gasoline. As gasoline prices skyrocketed in the mid-1970s, consumers became much more cost-conscious. Self-service stations proliferated, soaring from just 6 percent of all retail outlets in 1974 to 68 percent in 1978.[100] Major brands cut costs further by de-emphasizing advertising in an effort to move additional product through the system.[101]

By the mid-1970s the reliability of the automobile had improved significantly, so that car owners had less need for the routine repair and maintenance service that traditionally had been offered at the service station. With a high volume of focused service, specialty service shops, such as Midas Muffler, Jiffy Lube, and Aamco transmission services, could provide these specialized services at less cost than the full-service mechanic at a retail gasoline station, and therefore captured a major segment of the repair and maintenance market. The service station repair and maintenance business was eroded further by a new network of dealers and specialty repair shops that had arisen as a result of the influx of more fuel-efficient cars imported from Europe and Japan. As customers took their cars elsewhere for repair, they also realized that any gasoline would work in their cars. Brand loyalty and brand value began to decline.[102]

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[100] By 1985, 87 percent of all stations had self-service pumps, and 46 percent were exclusively self-service. Scherer, *Industry Structure, Strategy, and Public Policy*, at 136.

[101] Presentation by ExxonMobil to the Subcommittee staff, July 23, 2001.

[102] Presentation by ExxonMobil to the Subcommittee staff, July 23, 2001. According to one industry analysis, in 1986, the typical difference between the rack price of a major brand and

The loss of revenues from repair and maintenance work, combined with the more intensive competition in price, prompted many dealers and companies to look for replacement sources of revenues and attractions for customers. In the 1980s and 1990s, sometimes called "The Age of Marketing Diversity," the focus of gasoline marketing shifted from automotive needs to driver needs, from an emphasis on selling a product to providing a "retail experience" for the customer.[103] Many gasoline stations added convenience items, such as soft drinks, cigarettes, coffee, nuts, donuts, and candy to their offerings. Further, the de-emphasis on brands encouraged other types of retailers to begin selling gasoline. Existing convenience chains, such as 7-Eleven, Sheetz, and QuickTrip, enlarged their stores and formats and began selling gasoline. Independents added convenience stores to their lots as well.

Convenience stores have continued to grow in size and range of offerings. Correspondingly, the percentage of revenues obtained from gasoline sales at these outlets has decreased. One industry document notes that typical petroleum marketers depend on gasoline to provide 50 percent of total site margin, but "best of class retailers rely on gasoline margins for only 25 percent of the total site margin."[104]

Because companies are looking to increase their merchandise sales, companies are investing significant amounts of money to construct newer and bigger stores. The average

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the lowest rack price for a non-major brand (termed the brand "uplift") for unleaded gasoline was slightly over 6 cents per gallon. By the mid-1990s, that difference had declined to between 1 and 2 cents per gallon. The uplift for premium similarly declined from about 13 to 7 cents per gallon during this period. Demand for premium fuel has been steadily declining as well, further eroding a source of profits for the major brands. Documents in Subcommittee files.

[103] Presentation by ExxonMobil to the Subcommittee staff, July 23, 2001. One study reports a decline of 25,000 service bays since 1990. Tracy Cox, *Down, But Not Out*, National Petroleum News, November 2001.

[104] Document in Subcommittee files.

investment per new convenience store is now over $1.8 million in an urban area, and nearly $1.2 million in rural areas.[105] Figure III.11 (page 90) shows the growth in the number of convenience stores and corresponding decline in the number of conventional stores since the late 1970s.

Cigarettes and tobacco generate nearly one-third of all non-gasoline sales at convenience stores, accounting for nearly $9.4 billion in sales in 2000.[106] Soft drinks were the next most popular item, accounting for about one-sixth of all sales and providing nearly $4.8 billion in sales revenues in 2000. Beer and alcohol sales were almost 9 percent of sales and accounted for $2.6 billion in revenue. Although fast food accounted for only about 10 percent of sales, it provided the most sales revenue, approximately $10.2 billion.

A variety of marketing strategies has evolved to satisfy these and other consumer preferences in purchasing gasoline and convenience items. As different consumers attach different weights to factors such as store appearance, location, price, speed, type of food offering, safety, crowdedness, the availability of a car wash, or the ability to pay by cash or credit card, either at the pump or in the store, companies have sought to carve out distinct offerings and identities. Some have focused on sales of cigarettes, tobacco, beer and alcohol in order to satisfy the "time-sensitive," "urgent wants" of young adult males. Others have focused on "smart shopping," offering freshly made food and produce, or on "safety firsters," whose "primary concern is to avoid crime while buying gas," or on "simplicity seekers," who are "overburdened by increasing complexities of day-to-day life, dislike too many choices/hassles," and are "interested in a simple, streamlined gasoline purchasing experience."[107]

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[105] National Petroleum News, *Facts, Figures, Trends*, Mid-July 2001, at 126.

[106] *Id*., at 120.

[107] Documents in Subcommittee files.

The hypermarket, which the EIA defines as "a supermarket, other traditional retail store, or discounter (such as Wal-Mart or Costco in the United States) with a motor gasoline outlet in the parking lot," has rapidly become an extraordinarily competitive presence in the retail gasoline marketplace. [108] Hypermarkets have captured almost half of the gasoline market in France and approximately one-quarter of the market in the United Kingdom.[109] Although hypermarkets currently account for only about 3 percent of gasoline sales in the United States and are mostly located in the Gulf Coast, Midwest, and Southeast, many of the people interviewed by the Majority Staff believe that hypermarkets will continue to increase their gasoline business at the expense of major brand retail and convenience stores across the country, just as they have done in Europe. In Texas, hypermarkets have captured just over 11 percent of the gasoline market since first entering the marketplace in 1997; over this same period the branded marketers' share dropped from 94 to 82 percent.[110] Some believe that the hypermarket will most likely become the dominant format of the future.[111]

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[108] Energy Information Administration, Department of Energy, *Restructuring: The Changing Face of Motor Gasoline Marketing*, Footnote 18, http://www.eia.doe.gov/emeu/finance/sptopics/downstrm00/index.html

[109] Documents in Subcommittee files.

[110] OPIS, *Hypermarts Wrestle 11% of Market Share From Majors in Texas*, December 18, 2001.

[111] Documents in Subcommittee files.

Figure III.12 (page 91) presents a widely-quoted industry projection of the growth of hypermarket gasoline sales in the next several years.[112] Industry projections show that hypermarkets have the potential to capture over one-quarter of the gasoline market. [113]

Unlike the cost of building new convenience stores with gasoline islands, the cost of entry into the gasoline market for large retail or grocery chains can be relatively low. Many hypermarkets are simply adding gasoline islands onto their existing parking lots where there are sufficient excess parking spaces. Due to the potentially large volume of sales, these companies have been able to secure favorable long-term contracts with independent or merchant refiners seeking long term customers.

Hypermarkets are even less dependent on gasoline sales than convenience stores for their overall profit margins.[114] For many of the hypermarkets, gasoline is simply one more product in an array of offerings for the customer at a low price. The cost of operating several gasoline islands at a hypermarket is just another element in the overall overhead costs of the entire facility. Hypermarkets are thus much less dependent on gasoline margins for overall profitability than traditional gasoline stations or convenience stores. Unlike a traditional gasoline retailer, the primary goal of a hypermarket that decides to offer gasoline often is not

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[112] As of the end of 2000, about 1250 hypermarkets sold in total over 4 billion gallons, which was about 3.3 percent of the U.S. retail gasoline sales. Hypermarket gas sales were predicted to reach 11 billion gallons in 2002 and 22.7 billion gallons by 2005.

[113] Documents in Subcommittee files.

[114] One industry executive interviewed by the Majority Staff stated that some hypermarkets do not make any profits from retail sales – that retail products are priced just to cover the cost of operations, without any profit margin. According to this executive, these hypermarkets make their profits solely from the fees charged to the customers who purchase shopping memberships.

necessarily to make a large margin from the sale of gasoline, but rather to increase traffic to the store by offering gasoline at a very low price.

Hypermarkets have priced themselves below much of the competition. In Houston, Texas, for example, Wal-Mart sold gasoline at an average of under 5 cents per gallon more than the rack price. By contrast, majors such as Shell, Chevron, Texaco, and Mobil were selling gasoline at 12 to 13 cents more than the rack price.[115] Another industry analysis notes that hypermarkets generally price gasoline anywhere from 5 to 15 cents below major branded competitors in their area.[116] One hypermarket told Majority Staff that its policy is to price 2 cents below the lowest nearby competitor.[117]

As a result of these lower prices, the volume of gas sold at hypermarkets can be very high. For example, the average convenience store sells between 95,000 and 100,000 gallons per month. The supermarket-hypermarkets sell between 150,000 and 300,000 gallons per month. "Super-store" hypermarkets may sell between 200,000 to 700,000 gallons per month.[118]

If the anticipated growth in hypermarkets occurs, it will result in additional significant changes in the composition of the retail marketplace. Because demand for gasoline is projected to grow at only 1-2 percent per year, a significant growth in hypermarket sales volume would have to be at the expense of a number of retailers in the market today. In fact, a number of

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[115] OPIS, *Hypermarts Wrestle 11% Of Market Share From Majors in Texas*.

[116] Document in Subcommittee files.

[117] Document in Subcommittee files.

[118] Document in Subcommittee files.

retailers already have seen significant declines in margins and volumes as a result of nearby hypermarket competition.[119]

At this point, it is unclear, however, how current market participants will respond to the new competition from hypermarkets. A number of jobbers and small independent operations may be the most seriously threatened by the hypermarkets, as they tend to own or service smaller, older stations with fewer offerings which cannot compete either on price or on convenience with the hypermarkets. Already in San Diego, just seven hypermarket gasoline sites have captured 20 percent of the market share from jobbers and independents.[120] Even the most efficient stations with a traditional format may not be able to compete with the hypermarkets, as the traditional format requires a higher margin than a hypermarket just to break even. Moreover, these smaller operations may not have the resources – which can amount to more than $1 million per new convenience store – to move to a more competitive format. The extent to which major brands will themselves invest – either through discounts to their jobbers on wholesale purchases, or through site upgrades – to enable such sites to become competitive with new hypermarkets and convenience stores remains to be seen. [121]

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[119] Documents in Subcommittee files. Several industry case studies conclude that a hypermarket that sells gasoline can take over about 20 percent of the sales volume in a market and wipe out up to 40 percent of the margin that the other retailers previously enjoyed. Keith Reid, *The Wal-Mart Approach*, National Petroleum News, May 2001.

[120] James Naughton, *Stand By Your Brand?,* National Petroleum News, August 2001.

[121] One response has been for the large fuel marketers to seek to partner with hypermarketers for joint ventures. In seeking to link with hypermarketers, some oil companies have sought commitments from existing hypermarkets that they will not build gasoline facilities within a certain number of miles of the company's existing locations. Document in Subcommittee files.

One response of independents and jobbers has been to seek legislative protection against below-cost pricing tactics allegedly used by the hypermarkets. One Wal-Mart official recently told *The Washington Post* that, with certain discount plans, Wal-Mart's retail gasoline prices are below its cost.[122]

Even prior to the entry of hypermarkets, the number of retail outlets had been steadily declining. (See Figure III.13 on page 92.) Beginning in the mid- to late-1970s, as the majors grew more cost-conscious, retail outlets began to be judged as stand-alone businesses. The majors increased franchisee rents, imposed fees for credit card services, and sometimes left entire regions of the country that no longer were considered profitable.[123] In many instances, major oil companies also began to price their own company-operated stores and jobber-supplied stations lower than their lessee dealers selling the same brand, driving many of these dealers out of business.[124]

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[122] Wal-Mart shoppers who buy a shopping card get a 3-cent discount on gasoline, and Sam's Club members get a 5-cent discount. Dina ElBoghdady, *The High Price of Cheap Gas*, Washington Post, February 1, 2002.

[123] For example, Texaco, which had previously boasted that it was the only petroleum company in all 50 states, withdrew from six Midwestern states in 1978; Exxon left Kentucky, Ohio, Vermont and parts of other northeastern states in 1982; and Chevron abandoned Arkansas and adjacent territories in Tennessee and Kentucky in 1993 and sold all of its jobber outlets in 7 other states. *Industry Structure, Strategy, and Public Policy,* at 137.

[124] "New company outlets were typically located on heavily traveled urban traffic arteries, where they could satisfy two objectives: meeting the competition of independents head-to-head, and maintaining pressure on the refining company's smaller franchised dealers, who might otherwise be inclined to set relatively high prices and sacrifice volume. . . .

"There are at least two reasons why [conflicts with jobbers] arose. For one, when the gasoline industry was subject to thoroughgoing federal controls between 1974 and 1981, the regulations probably froze jobbers' wholesale margins at levels sufficiently generous to put retailers too small to buy directly from refiners at a significant disadvantage. . . . But second, even after federal regulation ended, dealer-jobber conflicts persisted. It seems probable that the refiners recognized the superior market retention potential of low-price jobber-owned stations. Therefore, they did little to discourage their jobbers from maintaining rack-to-tank wagon price

In the midst of this turmoil in the retail market, Congress enacted the Petroleum Marketing Practices Act in 1978, which specified the conditions under which a refiner could unilaterally terminate a lessee dealer and provided the dealer with the right of first refusal for a franchise the refiner intended to sell. A number of states, including Maryland and Connecticut, outlawed company-owned gasoline stations, and some, including New Jersey and Oregon, have prohibited self-service.

As Figure III.13 (page 92) indicates, the total number of retail outlets in the United States continues to decline. At the same time, as Figure III.14 (page 93) indicates, the volume per retail outlet continues to increase. If the past and current trends are a reasonably accurate guide to the future – and there is nothing apparent to suggest the contrary – the number of stations will continue to decline as the economies of scale of the convenience stores and hypermarkets continue to put pressure on the traditional formats remaining.

While convenience stores and hypermarkets are major competitive forces in the gasoline retail market, it is unclear what their impact will be in the long run if their growing presence drives out a significant number of smaller independents or smaller jobbers.

E. Impact of Environmental Requirements on Motor Gasoline

In addition to the three familiar grades of gasoline available at most gasoline pumps – regular, mid-grade, and premium – there are a number of federal, state and local specifications for gasoline, which has resulted in a variety of what are termed "boutique fuels."[125] This variety

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spreads that squeezed small franchised outlets – perhaps into oblivion." *Industry Structure, Strategy, and Public Policy,* at 138.

[125] There is some confusion about the definition of the term boutique fuels. President Bush's Energy Report of 2001 used the term to describe only the state and local fuel control programs. In the press, the term boutique fuels has been used more broadly, to mean any state or

of fuel specifications has arisen from federal, state and local efforts to improve air quality and public health in areas with air quality problems. The Environmental Protection Agency (EPA) lists 15 different fuel types in use today.[126]

In the Clean Air Act Amendments of 1990, Congress established a clean fuel program to reduce harmful emissions from motor vehicles. The reformulated gasoline (RFG) program was designed to primarily reduce ozone pollution, and the oxygenated gas program was intended to addresses carbon monoxide pollution. According to the EPA, "seventy five million Americans breathe cleaner air today due to this program.[127]

1. RFG Program

Under the Clean Air Act, the EPA is responsible for establishing minimum national standards for air quality. According to the 1990 Amendments, "severe" or "extreme" non-attainment areas – i.e. areas that did not meet EPA's national ambient air quality standards for ozone, carbon monoxide, particulate matter, sulfur dioxide, nitrogen dioxide and lead – were

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federal fuel program. Environmental Protection Agency, Staff White Paper, *Study of Unique Gasoline Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements*, October 2001, at 9. In this report, the term "boutique fuels" will be used in the same manner as in the EPA Staff White Paper, which includes any fuel that is developed pursuant to a state, local, or federal fuel program. See Figure III.15 (page 94) for a map of boutique fuels in the U.S.

[126] *Study of Unique Gasoline Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements*, Appendix D, at 100. Some estimates include different grades of these fuel types as a distinct type of gasoline, and thus conclude there are more than 40 different types of gasoline. See, e.g., Association of Oil Pipe Lines, *Answers to Common Questions*, http://www.aopl.org/about/questions.html.

[127] *Study of Unique Gasoline Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements*, at 1.

required to use RFG as of January 1, 1995.[128] Areas with less severe pollution were given the option of using RFG.[129]

Today, RFG is used in portions of 17 states and in the District of Columbia. It accounts for nearly 30 percent of the gasoline sold in the United States. The EPA estimates that since the RFG program began, it has resulted in annual reductions of smog-forming pollutants of at least 105,000 tons, and toxic air pollutants by at least 24,000 tons. EPA also estimates that compared to conventional gasoline, Phase II RFG, which has been in use since 2000, has cut air toxics by 22 percent and smog precursors by 27 percent, the latter of which is equivalent to taking 16 million vehicles off the road.[130]

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[128] RFG is gasoline that is blended in a manner such that, on average, it significantly reduces Volatile Organic Compounds (VOC) and air toxic emissions relative to conventional gasolines. Apart from the oxygenate requirement in the 1990 Amendments, RFG differs from conventional gasoline in that it has lower levels of certain compounds, such as benzene, sulfur, and aromatics, and will not evaporate as easily as conventional gasoline (lower Reid Vapor Pressure), particularly in the summer. RFG provides the same vehicle performance characteristics as conventional gasoline. EPA, Reformulated Gasoline and Vehicle Performance, at http://www.epa.gov/otaq/rfgvehpf. EPA estimates that it costs 4 to 8 cents per gallon more to produce RFG than conventional gas. EPA Briefing to Subcommittee Staff, September 2001.

[129] The areas where RFG is required are: Los Angeles, San Diego, and Sacramento in California; Milwaukee, Wisconsin, Hartford, Connecticut, New York City (including portions in the states of New York, New Jersey, and Connecticut), Greater Philadelphia (including portions in the states of Pennsylvania, New Jersey, Delaware, and Maryland), Chicago (including portions in the states of Illinois, Wisconsin, and Indiana), Baltimore, Maryland, and Houston, Texas.

The opt-in areas are: Connecticut, Delaware, Massachusetts, Rhode Island, New Jersey, District of Columbia, the Kentucky portion of the Cincinnati metro area, Louisville, Kentucky, portions of Maryland near the District of Columbia, the New Hampshire portion of Greater Boston, St. Louis, Missouri, New York counties near New York city, Dallas-Fort Worth, Texas, and portions of Virginia (DC suburbs, Richmond, Norfolk-Virginia Beach-Newport News). EPA Briefing to Subcommittee Staff, September 2001

[130] EPA Briefing to Subcommittee Staff, September 2001.

The 1990 Amendments require that RFG contain at least 2 percent oxygen by weight, but neither the Amendments nor the EPA requires the use of any specific oxygenate in RFG.[131] It is within the discretion of the refiner as to how the 2 percent requirement is met. The 2 percent requirement can be met by adding a number of ethers or alcohols to gasoline, any of which contains oxygen and other elements. The most common additives to RFG are ethanol and methyl tertiary butyl ether (MTBE). Presently, about 87 percent of the RFG contains MTBE as an oxygenate. In Chicago and Milwaukee, which are close to major ethanol production centers, ethanol is used in 100 percent of the RFG.[132] It takes approximately 6 percent of the nation's corn crop to produce the amount of ethanol currently used in gasoline.[133]

The use of MTBE has become controversial. Low levels of MTBE have been detected in numerous ground and surface waters, and these sites of contamination have been linked to MTBE's use as a fuel.[134] In July 1999, a Blue Ribbon Panel appointed by EPA Administrator Carol Browner to study the use of oxygenates in gasoline released its findings and recommendations regarding the use of MTBE, including the following findings:

- RFG provides considerable air quality improvements and benefits for millions of US citizens.

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[131] Office of Transportation and Air Quality, U.S. Environmental Protection Agency, *Study of Boutique Fuels and Issues Relating to Transition from Winter to Summer Gasoline,* October 24, 2001.

[132] Office of Transportation and Air Quality, U.S. Environmental Protection Agency, *Study of Boutique Fuels and Issues Relating to Transition from Winter to Summer Gasoline,* October 24, 2001.

[133] Congressional Research Service, James E. McCarthy, March 7, 2002, *Clean Air Act Issues in the 107th Congress.*

[134] Statement of Linda Fisher, Deputy Administrator, U.S. EPA, Before the Senate Committee on Energy and Natural Resources, June 21, 2001.

- . . . MTBE, due to its persistence and mobility in water, is more likely to contaminate ground and surface water than the other components of gasoline.
- MTBE has been found in a number of water supplies nationwide, primarily causing consumer odor and taste concerns that have led water suppliers to reduce use of those supplies. Incidents of MTBE in drinking water supplies at levels well above EPA and state guidelines and standards have occurred, but are rare. The Panel believes that the occurrence of MTBE in drinking water supplies can and should be substantially reduced.
- MTBE is currently an integral part of the U.S. gasoline supply both in terms of volume and octane. As such, changes in its use, with the attendant capital construction and infrastructure modifications, must be implemented with sufficient time, flexibility, certainty, and flexibility to maintain the stability of both the complex U.S. fuel supply system and gasoline prices.

The Panel recommended that the use of MTBE should be reduced substantially, Congress should remove the current 2 percent oxygen requirement "to ensure that adequate fuel supplies can be blended in a cost-effective manner while quickly reducing usage of MTBE," and EPA should take actions "to ensure that there is no loss of current air quality benefits."

In 2000 the EPA announced that it would begin to phase out MTBE under Section 6 of the Toxic Substances Control Act, a process that will take several years. However, it is unclear whether or not EPA has the authority to take steps to ban MTBE use in the absence of specific Congressional authorization.[135] Thirteen states have passed legislation to limit or phase out MTBE, the largest among these being California.[136]

There are a number of issues regarding the availability of ethanol in the event that large quantities are needed as a gasoline additive as a result of the elimination of MTBE. If MTBE

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[135] Congressional Research Service, James E. McCarthy and Mary Tiemann, *MTBE in Gasoline: Clean Air and Drinking Water Issues*, Update February 7, 2002.

[136] These states are: Arizona, California, Colorado, Connecticut, Illinois, Iowa, Kansas, Michigan, Minnesota, Nebraska, New York, South Dakota, and Washington. Congressional Research Service, James E. McCarthy, March 7, 2002, *Clean Air Act Issues in the 107th Congress.*

use is reduced or phased out, but the 2 percent oxygenate requirement remains in effect for RFG, the demand for ethanol would soar.[137] Ethanol is more difficult to distribute than MTBE; it absorbs water and would separate from gasoline if transported long distances by pipeline, so it must be mixed with non-oxygenated gasoline blendstock close to the market in which it is to be sold.[138] At present, the infrastructure to transport and store significantly more quantities of ethanol for blending into gasoline has not yet been developed. In the short term, ethanol is unlikely to be available in sufficient quantity at a reasonable cost to replace MTBE nationwide.[139] In addition, replacing MTBE with ethanol as an oxygenate would result in a decline in the volume of gasoline produced by at least 5 percent.[140]

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[137] Current ethanol production is approximately 1.7 billion gallons per year. Nominal production capacity is projected to be approximately 2.7 billion gallons per year. Renewable Fuels Association, Ethanol Industry Outlook 2002. Approximately 2.7 billion gallons of gasoline or approximately 4.1 billion gallons of ethanol per year would be required to replace the consumption of approximately 3.3 billion gallons of MTBE per year. Congressional Research Service, Brent Yacobucci, *Energy Content of Ethanol vs. MTBE*, April 1, 2002.

[138] Because ethanol increases the evaporation rate of RFG, refiners must produce a unique blendstock with a very low evaporation rate (RVP) to which the ethanol will be added. This blendstock is slightly more expensive to produce and must be segregated from other RFG blends. At the same time, ethanol reduces tailpipe emissions of carbon monoxide and dilutes the more toxic components in gasoline. EPA Briefing to Subcommittee Staff, September 2001.

[139] Congressional Research Service, James E. McCarthy and Mary Tiemann, *MTBE in Gasoline: Clean Air and Drinking Water Issues*, Updated February 7, 2002.

[140] This is because in a given gallon of RFG, to meet the 2 percent (by weight) oxygen requirement for RFG, 11 percent MTBE must be used by volume. To meet the same requirement, only 5.7 percent (by volume) ethanol must be used, because of its higher oxygen content. Therefore, to replace MTBE with ethanol for purposes of meeting the oxygen requirement, another 5.3 percent volume must also be replaced. This could come in the form of additional ethanol, gasoline, or other additives. Memo to the Permanent Subcommittee on Investigations, *Energy Content of Ethanol vs. MTBE*, Brent Yacobucci, Congressional Research Service, April 1, 2002.

The American Petroleum Institute, the Renewable Fuels Association, the National Farmers Union, the National Corn Growers Association, and the American Farm Bureau Federation, support the provision in the energy bill currently before the Senate that provides for a nation-wide phase-out of MTBE over 4 years, the elimination of the 2 percent oxygenate requirement, and a "renewable fuels standard" (RFS), in which part of the nation's fuel supply, growing to 5 billion gallons by 2012, would be provided by renewable domestic fuels, such as ethanol.[141]

California Governor Gray Davis recently issued a state executive order providing an additional 12 months for California refiners to transition from MTBE to ethanol. Initially, under California law, MTBE was to be phased out by December 31, 2002. The California Energy Commission estimates that because the EPA has denied California's application for a waiver from the 2 percent oxygenate requirement, California will need to import between 750 and 900 million gallons of ethanol each year once the MTBE ban becomes effective.[142] A study sponsored by the California Energy Commission concluded that the MTBE phase-out could lead to a 5 to 10 percent reduction in gasoline supplies, which could result in a doubling of gasoline prices in California – meaning consumers would be paying up to $3 per gallon of gasoline.[143]

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[141] S. 517, Introduced in the 107th Congress.

[142] Statement of Governor Gray Davis, *Governor Davis Allows More Time for Ethanol Solution*, May 15, 2002.

[143] Consultant Report, California Energy Commission, *MTBE Phase-Out in California*, March 2002, at 1-2.

2. Oxygenated Gasoline Program

During the winter months, increased carbon monoxide emissions from cold vehicles have elevated carbon monoxide levels in a number of urban areas.[144] These carbon monoxide concentrations can be reduced by adding oxygen to gasoline.[145] The oxygenated gasoline program requires that gasoline in certain non-attainment areas of the country that have a large amount of carbon monoxide contain at least 2.7 percent oxygen by weight during the winter months.[146] The EPA originally designated 39 areas of the country as having levels of carbon monoxide that were too high.[147] Today 16 areas of the country are using oxygenated fuel.[148] The oxygenated gasoline program is administered and enforced by the individual states (in contrast to the RFG program, which is administered by the EPA). [149]

3. State Fuel Programs

States with areas that are in "non-attainment" of the standards of the Clean Air Act must submit plans to EPA – referred to as State Implementation Plans (SIP) – that outline the state's

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[144] Tancred Lidderdale, U. S. Department of Energy, *Areas Participating in the Oxygenated Gasoline Program*, at http://www.eia.doe.gov/emeu/steo/pub/special/oxy2.html.

[145] While serving different purposes, the same additives (i.e. ethanol, MTBE) can be used in both the RFG program and the oxygenated program.

[146] The RFG program is year-round.

[147] Energy Information Administration, *Demand, Supply, and Price Outlook for Oxygenated Gasoline, Winter 1992-1993,* Monthly Energy Review, August 1992, by Tancred Lidderdale.

[148] Thirteen of these areas are in non-attainment, and three are using the oxygenated gas program pursuant to a State Implementation Program. Oral Interview of Brent Yacobucci, Congressional Research Service Analyst, March 26, 2002.

[149] Tancred Lidderdale, U.S. Department of Energy, *Areas Participating in the Oxygenated Gasoline Program*, at http://www.eia.doe.gov/emeu/steo/pub/special/oxy2.html.

strategy for attaining and/or maintaining air quality standards in those areas. The EPA is authorized to approve a state fuel control program in a SIP if the EPA finds the state fuel control is necessary to achieve the air quality standards which the SIP implements.[150]

Generally, state fuel controls have not been as stringent as the federal RFG standards but have imposed lower volatility requirements, caps on sulfur content, limits on the use of MTBE, or requirements for minimum oxygen or ethanol content. The most notable exception is California, which requires a unique clean-burning gasoline ("CARB") across the entire state, and requires RFG that is cleaner than federal RFG in ozone non-attainment areas. There are also SIP fuel requirements for parts of Alabama, Arizona, Florida, Georgia, Illinois, Kansas, Louisiana, Maine, Minnesota, Missouri, Nevada, North Carolina, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, and Virginia.[151] The SIP fuel controls usually apply only in the more urban parts of the state, which tend to be the most polluted areas.

The EPA has identified a variety of reasons why states and localities have either adopted a fuel controls program in a SIP or opted into the RFG program. First, noted the EPA, fuel controls "can provide significant, cost effective emission reduction of VOCs and NOx."[152] Another reason, according to the EPA, some refiners have sought to encourage states to develop

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[150] Generally, the Clean Air Act preempts states from regulating motor vehicle fuels for emission control purposes if the EPA already has established controls for those fuels. In addition to the exception for EPA-approved SIPs, California is statutorily exempted from this preemption.

[151] Information provided by Congressional Research Service.

[152] *Study of Unique Gasoline Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements*, at 14.

unique fuel requirements in order to create distinct fuel markets with limited competition while simultaneously telling federal officials to reduce the number of fuels:[153]

> Discussions with refiners and marketers suggested that another possible reason refiners promoted state fuel programs over RFG related to the effect on competition. A state-specific program generally leads to the secondary effect of limiting competition for the gasoline supplied to the affected market since the market for a state fuel is often small compared to the market for federal RFG. As a result, the number of refiners likely to devote production to this small state fuel market is often limited. This has been perceived as a benefit to the refiners that produce the gasoline for a state fuel market.[154]

4. Impacts of Boutique Fuels on Fuel Supply

The variety of fuels in use today in different areas of the country is often cited, particularly by gasoline marketers and refiners, as one of the prime causes of the recent price volatility. The mix of state and federal standards in effect today has resulted in a situation where adjacent areas may be using gasoline with significantly different properties.[155] In the event of a supply disruption or shortage, it may be more difficult to bring in additional supply to an area that requires a boutique fuel rather than a conventional fuel, because fewer refiners may be readily capable of producing the required gasoline.[156]

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[153] Document in Subcommittee files.

[154] *Study of Unique Gasoline Fuel Blends ("Boutique Fuels"), Effects on Fuel Supply and Distribution and Potential Improvements*, at 14.

[155] The petroleum industry, however, opposes providing states with authority to require RFG in areas that are not currently non-attainment areas, which could help reduce such geographic disparities. See, e.g., *American Petroleum Institute v. EPA*, F.2d (D.C. Cir. 2000).

[156] EPA emergency provisions provide for a refiner to apply to EPA for a waiver of the RFG requirement until alternative RFG supplies can be obtained. U.S. Department of Energy, Tancred Lidderdale and Aileen Bohn, *Demand and Price Outlook for Phase 2 Reformulated Gasoline, 2000*, at http://www.eia.doe.gov/emeu/steo/pub/special/rfg4.html.

The EPA has found that the current gasoline production and distribution system is able to provide adequate quantities of boutique fuels, as long as there are no supply disruptions. If there is a disruption, however, the EPA determined that it becomes more difficult to provide gasoline supplies to affected areas because of boutique fuel requirements.[157] One common proposal to improve fuel availability is to reduce the number of boutique fuels in use. Proponents of fewer fuels contend it would be easier to mitigate price spikes and easier and more economical for foreign refiners to ship gasoline to the United States if there were not so many micro-markets within the United States.[158]

In developing its Staff White Paper on boutique fuels, the EPA considered a variety of comments from persons interested in this issue. The EPA reported that a majority of the stakeholders it consulted "although not all in agreement on the magnitude of the problems caused by boutique fuels today or the need to make significant changes, saw merit in having fewer fuel specifications across the country as long as it did not negatively impact supply, air quality benefits, or cost, and as long as sufficient time was provided to allow for an orderly transition." According to the EPA, refiners were concerned about a continued proliferation of state-mandated boutique fuel. "[The refiners] wanted a strong federal program that would not cause states to adopt their own fuel programs but not so strong as to significantly impact refinery operations and cost of production." The states "argued for a strong national program," one that

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[157] EPA, *Study of Boutique Fuels and Issues Relating to Transition from Winter to Summer Gasoline,* October 24, 2001.

[158] Brent Yacobucci, Congressional Research Service, *Harmonization of Gasoline Standards.*

would minimize the need for state programs, yet still provide the flexibility for states to set their own unique fuel specifications to address their concerns, such as the use of MTBE.[159]

The EPA paper proposed for consideration four basic fuel program options: a three-fuel option, a two fuel option, a 49-state Federal fuel, and California fuel available nationwide. The EPA is currently seeking public comments on the extent to which these options improve the fungibility and movement of gasoline across the country, maintain or improve air quality, maintain or improve production capacity, and minimize cost.[160]

Although fewer fuels fosters fungibility, a reduction in the number of fuels required would not necessarily lead to greater availability of gasoline. Since each refinery has been configured to meet the specific standards and requirements of the current marketplace, changing these standards could substantially affect refinery economics.[161] These economic effects would not necessarily be equitably distributed across the refining industry. Accordingly, there is no consensus within the industry on many boutique fuels issues. An official at one company has noted that the company had made a considerable investment in its refineries to be able to provide boutique fuels in certain markets and would object to any reduction to less than four gasoline types because "it could lead to reduced supplies and higher prices with no corresponding benefits to the environment." [162] Another company document states, "a national or even regional

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[159] *Study of Unique Gasoline Fuel Blends (Boutique Fuels), Effects on Fuel Supply and Distribution and Potential Improvements*, at 16.

[160] *Id.* at 16 ff.

[161] See, e.g., Brent Yacobucci, Congressional Research Service, *Harmonization of Gasoline Standards.*

[162] Document in Subcommittee files.

gasoline plan would mean huge investments in refineries...while stranding much of the industry's current investment in small refineries, pipeline tankage and terminals...it is not coincidental that the parties currently tending to support this approach have very deep pockets with little current investment in product infrastructure, and have or are in the process of shedding any 'small' refineries."[163]

If the past is any guide, new fuel standards that impose additional capital requirements on the refining industry will likely result in the loss of some marginal refining capacity. The extent to which the benefits of such standards in terms of air quality, fuel flexibility, cost, and fungibility outweigh the costs and the decrease in refining capacity must be carefully considered.

Last summer the Department of Energy testified to Congress about boutique fuels:

> [It] is important to understand that the current situation of using different fuels to meet the differing air quality needs of various urban areas has economic benefits, at least at this time. Under this approach, areas that do not need the more expensive clean fuel do not have to bear the cost of that fuel. Problems arise with this localized fuel approach when there is an upset in the supply system and fuel supplies need to be brought in from alternative sources that may not normally store or make the particular fuel needed. In the past, such as last summer in St. Louis, EPA and the Department have dealt with these supply disruption situations by considering fuel supplier or state government requests to allow the sale of non conforming gasoline on an as needed basis. This system has worked well and continuing it is certainly one option...some have suggested a move to a federal reformulated gasoline, or regional fuels instead of the current mix of clean and conventional gas. While this might help make for a simpler distribution system, it would reduce the total volume of gasoline that today's refineries could produce and place significant additional investment requirements on refineries. If a sufficient number of states were to restrict use of MTBE, refiners and distributors might choose to remove MTBE from all gasoline to protect the fungibility of the gasoline distribution system and avoid even more boutique fuels. MTBE's contribution to gasoline suppliers nationally is equivalent to about 400,00

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[163] Document in Subcommittee files.

> barrels a day of gasoline production capacity or the gasoline output or the gasoline output of four to five large refineries.[164]

5. Seasonal Transition Issues Involving RFG

Because summer-grade gasoline must have lower evaporation rates than winter-grade gasoline, each spring winter-grade gasoline in storage tanks must be completely drained to make room for the summer-grade gasoline.[165] This can lead to supply disruptions since the changeover occurs at the same time as gasoline demand is approaching its yearly peak.[166] In both 2000 and 2001, gasoline prices rose sharply during the transition period, particularly in the Midwest. [167] Many fuel marketers have stated they need greater flexibility in the transition from winter to summer grade RFG so that sufficient inventories are available during this period.

The EPA has described the effects of low spring inventories on price:

> Although gasoline prices generally rise around Memorial Day, the start of the summer driving season, for the past two years spikes have occurred in various parts of the United States. These price spikes occur when gasoline inventories have become unusually low. Low gasoline inventories have occurred for a

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[164] Statement of Robert Card, Under Secretary of Energy before the Senate Committee on Energy and Natural Resources, June 21, 2001.

[165] EPA regulations require that gasoline retailers must be selling summer-grade conventional gasoline and RFG by June 1 of each year. To ensure that sufficient retail supplies are available by this date, EPA also requires that by May 1 terminals and all other facilities upstream from the retailer must have only summer-grade gasoline. Typically, refiners will begin producing summer-grade gasoline in March or April in order for terminals to meet the May 1 deadline. *Study of Boutique Fuels and Issues Relating to Transition From Winter to Summer Gasoline*, at 3.

[166] Gasoline production typically peaks in May and June in order to meet peak demand in July and August. EIA, *Petroleum Supply Monthly*, March 2002.

[167] For a more detailed discussion of Midwest gas prices, see Section IV.

> variety of reasons, including a recent trend in the petroleum industry towards reducing inventories to near the minimum operating levels. This has been particularly the case recently during the winter to summer transition. Additionally, because it costs refiners more to make summer grade fuel than winter grade fuel, competitive economic pressures lead refiners to delay this expense as long as possible.

Following the two recent spring price spikes and the concerns refiners have raised regarding the winter-to-summer transition, EPA has taken the following actions to provide refiners and marketers with more flexibility during this transition: [168]

- Eliminated the existing blend stock accounting;[169]
- Allowed gasoline terminal operators a broader testing tolerance than currently permitted for the initial tank turnover from winter to summer fuel; and [170]
- Adjustment of VOC standard for Chicago and Milwaukee RFG. [171]

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[168] *Study of Boutique Fuels and Issues Relating to Transition From Winter to Summer Gasoline.*

[169] *Regulation of Fuel and Fuel Additives RFG-Transition,* 67 C.F.R., 8729, February 26, 2001.

[170] This guidance outlined the EPA's policy on allowing a 2 percent testing tolerance for the volatile organic compound (VOC) standard. The 2 percent enforcement tolerance will apply at terminal locations at the time the terminal first classifies the tank as complying with summer standards for federal RFG. This means that the EPA is removing the so called "no tolerance for the first turn" condition from use of the 2 percent VOC tolerance at terminals. *Reformulated Gasoline Transition Fact Sheet*.

[171] *Adjustment to RFG VOC Standard*, 66 C.F.R. 37156, July 17, 2001.