

**Report on Ethanol Market Concentration**

December 1, 2005

Federal Trade Commission

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Section 1501(a)(2) of the Energy Policy Act of 2005, as codified at 42 U.S.C. § 7545(o)(10), requires the Federal Trade Commission (“Commission”) to “perform a market concentration analysis of the ethanol production industry using the Herfindahl-Hirschman Index to determine whether there is sufficient competition among industry participants to avoid price-setting and other anticompetitive behavior.” The Commission must report its findings annually to Congress and to the Administrator of the Environmental Protection Agency.

Staff with energy expertise from the Commission’s Bureau of Competition and Bureau of Economics jointly prepared this analysis. As instructed by statute, the Commission staff calculated the Herfindahl-Hirschman Index (“HHI”) and, in doing so, took into account marketing agreements among industry participants.<sup>1</sup> Staff prepared this analysis using publicly available sources, supplemented by voluntary interviews with industry participants and calculations from the Department of Energy’s Energy Information Administration (“EIA”).

Based on the HHIs and on qualitative considerations of the competitive dynamics of ethanol production, staff concluded that U.S. ethanol production currently is not unduly concentrated. Given current market conditions, and assuming that ethanol production in the United States is a relevant market for competition analysis, the best measurement of market concentration yields HHIs between 499 and 1259, depending on the degree to which individual producers’ shares can be attributed to their common marketers.<sup>2</sup> Under the Horizontal Merger

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<sup>1</sup> The HHI measures market concentration. It is calculated by adding the squared market share of each market participant. *See* Section II below.

<sup>2</sup> As discussed in more detail below, these concentration figures are based on capacity, including expansions and plants currently under construction.

Guidelines used by the Commission and the Department of Justice to assess the competitive effects of mergers, an HHI of 499 indicates an “unconcentrated” market and an HHI of 1259 indicates a “moderately concentrated” market.<sup>3</sup> Viewed in isolation, these concentration levels do not justify a presumption that one firm, or a small group of firms, could wield the market power necessary to set prices or coordinate on prices or output. Moreover, the concentration figures overstate the likelihood of anticompetitive behavior in light of significant new entry in ethanol production and marketing that will occur in the next year and is expected to continue for several more years. Furthermore, if ethanol is part of a larger antitrust product market including gasoline or certain gasoline blendstocks, the concentration figures would also overstate the likelihood of anticompetitive behavior.

The following analysis: (1) provides a brief background regarding ethanol production and factors affecting ethanol demand; (2) explains how staff calculated HHIs using the capacity of each producer; (3) explains how HHIs may be affected by marketing agreements between ethanol producers and the marketers who sell ethanol downstream on their behalf; (4) calculates HHIs based on production rather than capacity data; and (5) discusses the importance of entry in understanding the analytical significance of the HHIs.

#### I. Ethanol Production and Demand

Fuel ethanol production in the United States has grown substantially in recent years, both in volume and in number of participants. In 2004, the U.S. ethanol industry produced 3.4 billion

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<sup>3</sup> See U.S. Dep’t of Justice and Federal Trade Comm’n, *Horizontal Merger Guidelines* § 1.5 (1992, revised 1997) [hereinafter *Horizontal Merger Guidelines*].

gallons of fuel ethanol, more than double the volume produced in 2000.<sup>4</sup> More than 75 different firms operate more than 90 fuel ethanol production facilities in the United States, with a current capacity of more than 4.1 billion gallons per year.<sup>5</sup> This contrasts with 43 firms and just under 2 billion gallons per year of capacity in late 2000.<sup>6</sup> The largest producer's share of capacity is currently around 25 percent, down from over 40 percent in 2000. The industry continues to expand, as incumbent producers are currently expanding existing plants and 18 new entrants are constructing new plants. As a result, an additional 1.3 billion gallons per year of ethanol capacity are expected to be operational within the next year.<sup>7</sup>

Ethanol plants currently operate in 19 states, although production remains predominantly in the Midwest. Producers manufacture ethanol by processing and fermenting corn or other starchy grains.<sup>8</sup> Most current ethanol production and new plants under construction use a dry milling process, which yields as co-products carbon dioxide and a feed ingredient called distillers grain. The alternative wet milling process yields ethanol and a range of different co-products that can include corn oil and corn gluten meal. From the plant, producers and marketers

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<sup>4</sup> Compare EIA-819 Monthly Oxygenate Report (Dec. 2004), available at [http://www.eia.doe.gov/pub/oil\\_gas/petroleum/data\\_publications/monthly\\_oxygenate\\_report/historical/2005/2005\\_02/pdf/819mhilt.pdf](http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/monthly_oxygenate_report/historical/2005/2005_02/pdf/819mhilt.pdf), with EIA 819-M Monthly Oxygenate Telephone Report (Dec. 2000), available at [http://www.eia.doe.gov/pub/oil\\_gas/petroleum/data\\_publications/monthly\\_oxygenate\\_report/historical/2001/2001\\_01/pdf/819mhilt.pdf](http://www.eia.doe.gov/pub/oil_gas/petroleum/data_publications/monthly_oxygenate_report/historical/2001/2001_01/pdf/819mhilt.pdf).

<sup>5</sup> See Renewable Fuels Ass'n, *Homegrown for the Homeland: Ethanol Industry Outlook 2005*, at 8-9, available at <http://www.ethanolrfa.org/outlook2005.pdf>.

<sup>6</sup> See Renewable Fuels Ass'n, *Ethanol Industry Outlook 2001*, at 12-13.

<sup>7</sup> See Renewable Fuels Ass'n, *U.S. Fuel Ethanol Production Capacity*, at [http://www.ethanolrfa.org/eth\\_prod\\_fac.html](http://www.ethanolrfa.org/eth_prod_fac.html) (last updated Sept. 2005).

<sup>8</sup> A small amount of domestic ethanol production is produced from waste products, such as brewery waste, beverage waste, and cheese whey. Outside the United States, a large amount of ethanol is produced from sugar.

transport ethanol by rail or truck to product terminals, where they blend it with gasoline for further downstream sale.

Several factors account for the recent increase in ethanol production and demand. First, given current government subsidies, U.S. ethanol production can serve as an economical means of extending gasoline volumes. For example, firms can produce a blend of 90 percent gasoline and 10 percent ethanol by volume ("E-10") for use in automobiles, and sell E-10 at a price comparable to gasoline without ethanol. The price of ethanol itself reflects this fact, as spot ethanol prices appear more closely related to gasoline prices than to the price of corn or other inputs. Thus, rising gasoline prices have helped stimulate ethanol production and demand.

Second, ethanol has gained acceptance as a replacement for methyl tertiary butyl ether ("MTBE") as the preferred oxygenate in many markets that require reformulated or oxygenated gasoline. The 1990 Clean Air Act Amendments require the sale of oxygenated gasoline in areas that fail to meet certain air quality standards. Although MTBE remains a common oxygenate in some of those areas, environmental liability concerns regarding MTBE's storage and handling have led some oil companies to switch to ethanol use. In addition, several large states (such as California and New York, with additional states planning to follow) have banned the use of MTBE, leading to increased ethanol use.

Third, other laws and subsidies also have encouraged expansion of ethanol production. State government programs facilitated efforts to build ethanol plants. Federal tax credits created incentives for refiners and gasoline blenders to use ethanol. Most recently, the Energy Policy Act of 2005 instructs the Environmental Protection Agency to issue regulations that require a certain volume of renewable fuel to be included within the gasoline supply. For example, in 2006, the statute requires that gasoline sold or introduced into U.S. commerce by refiners,

blenders, and importers must contain 4 billion gallons of renewable fuel, such as ethanol or biodiesel. The volume requirement increases annually, reaching 7.5 billion gallons by 2012. Although ethanol sales will likely exceed these requirements in the short term, the Energy Policy Act's guarantee of certain renewable fuel sales provides additional incentives for producers to build new ethanol production capacity.

## II. Measuring Concentration Using Capacity

The Energy Policy Act requires the Commission to analyze ethanol production using the HHI measurement of market concentration. The HHI is a tool that the Commission and the Department of Justice use in reviewing the competitive effects of mergers. The HHI is calculated by summing the squares of the individual market shares of all market participants.<sup>9</sup> The Horizontal Merger Guidelines divide market concentration levels into three categories: markets are “unconcentrated” (HHI below 1000), “moderately concentrated” (HHI between 1000 and 1800), or “highly concentrated” (HHI over 1800).<sup>10</sup> The HHI provides a snapshot of market concentration and, in the context of merger review, the change in the HHI helps the agencies to evaluate the merger's effect on market concentration. It must be emphasized, however, that the Commission does not make enforcement decisions based solely on market share or HHIs. The HHI is only the starting point for competitive analysis. Its analytical significance depends on other market factors, such as ease of entry and likely competitive effects, that require further factual investigation and market analysis.

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<sup>9</sup> For example, a four-firm market with market shares of 30 percent, 30 percent, 20 percent, and 20 percent has an HHI of 2600  $[(30 * 30) + (30 * 30) + (20 * 20) + (20 * 20) = 2600]$ . The HHI ranges from 10,000 (pure monopoly) to a number approaching 0.

<sup>10</sup> See *Horizontal Merger Guidelines* § 1.5.

This analysis begins with the assumption, implicit in the Energy Policy Act's study requirement, that U.S. fuel ethanol production is a distinct relevant market for antitrust purposes. A relevant market has product and geographic dimensions. For the purpose of market definition, we delineate the product market to be a product or group of products such that a hypothetical firm that was the only seller of those products would find it profitable to impose at least a small but significant and nontransitory increase in price above the competitive level. A product or group of products would not be a product market if such a price increase would not be profitable because of the resulting loss of sales to other products. As long as fuel ethanol production is above the minimum levels mandated by the renewable fuels standard in the Energy Policy Act, there is a strong argument that ethanol is not a proper product market. Ethanol consumption above the mandatory minimum levels likely competes with other blendstocks that could possibly be used in gasoline. As the price of ethanol increases, refiners and blenders could choose to use other blendstocks in their gasoline. In areas with E-85, a blend of gasoline that is 85 percent ethanol, owners of flexible fuel vehicles will regularly make the decision to purchase E-85 or gasoline with no more than 10 percent ethanol. Compared to refinery capacity, ethanol capacity is minuscule. If ethanol is part of the overall gasoline product market, or even a smaller set of clean-burning blendstocks, the HHIs presented in this analysis could vastly overstate the concentration of the actual product market and the potential of ethanol sellers alone to engage profitably in anticompetitive behavior.<sup>11</sup>

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<sup>11</sup> Similarly, the HHIs do not account for the possibility that, in the event fuel ethanol prices increase, producers may switch production from other ethanol grades. In addition to fuel ethanol, some producers may manufacture beverage-grade ethanol (for alcoholic beverages) or industrial-grade ethanol (for industrial and consumer products, such as window-cleaning fluid). Volumes of beverage and industrial ethanol remain quite small in relation to fuel ethanol, and staff could not determine whether producers would switch grades if fuel ethanol prices rose. While staff does not believe significant volumes can be switched in this way, staff's analysis again tends to overstate concentration by assuming that such supply responses would not occur.

This analysis also is based on the assumption that the geographic market is the United States.<sup>12</sup> However, to the extent staff did not account for the effect of imported ethanol, the HHIs again overstate concentration in the industry. Many Western Hemisphere countries produce ethanol, and over 140 million gallons were imported into the United States in 2004. Imported volumes vary according to ethanol prices, and while imports are a small share of U.S. production, imported ethanol may become more significant in the event of a U.S. ethanol price increase. The federal tariff does not always make foreign ethanol uneconomic to import, because the Caribbean Basin Initiative, CAFTA, NAFTA, and other free trade agreements may affect the tariff's applicability.

Assuming that ethanol constitutes a product market, staff calculated HHIs in several different ways. First, staff calculated HHIs based on the ethanol productive capacity of each individual producing firm. The results are discussed in this section. Staff also calculated capacity-based HHIs that attributed producers' capacities to their common marketer. Those results are discussed in Section III. Finally, staff cross-checked these calculations by determining HHIs based on actual production, rather than capacity, the results of which are discussed in Section IV.

Staff first calculated market shares of firms based on their fuel ethanol productive capacity. Although market shares may be measured in other ways (such as total dollar sales), staff concluded that productive capacity provides a reliable and easily confirmable indicator of a producer's competitive significance in this industry. Because the product is not differentiated

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<sup>12</sup> Because marketers supply ethanol to both the East Coast and West Coast from plants in the Midwest, there do not appear to be regional markets smaller than the United States.



(producers manufacture chemically-identical ethanol), a firm's capacity likely is the best indication of its competitiveness.<sup>13</sup>

To determine the productive capacity of each ethanol plant, staff relied upon publicly available information supplemented by interviews with industry participants. The Renewable Fuels Association ("RFA") publishes and frequently updates data regarding ethanol capacity and announced expansions. Through websites and other sources, many producers also disclose existing plant capacity or plans for future construction. Marketers also may announce new marketing arrangements with producers. Staff conducted witness interviews of producers, marketers, and other industry participants to confirm the accuracy of the public data.

In attributing capacities to individual producers, staff included additional capacity expected to result from new plant construction or expansion of existing facilities, provided that the construction or expansion was sufficiently underway that the extra capacity should be able to produce marketable volumes within the next year. This is consistent with the approach taken by the antitrust enforcement agencies in the Horizontal Merger Guidelines. Staff attributed additional capacity to the firm only if the firm had finalized its expansion plans, received necessary financing for doing so, and begun the physical construction or expansion. Most industry participants believe that producers will likely undertake significant additional capacity expansion over the next several years. To the extent that such plans have not yet received financing or broken ground, however, future capacity expansions remain too speculative to include within this analysis.

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<sup>13</sup> See *Horizontal Merger Guidelines* § 1.41. Because some disparity may exist between a firm's stated and actual capacity, staff also calculated HHIs using actual production data. See Section IV below.

If each producer is allocated capacity based on this approach, staff determined that the HHI for U.S. fuel ethanol capacity would be 499, or “unconcentrated” under the Horizontal Merger Guidelines.

### III. Measuring Concentration Using Marketing Agreements

Marketing agreements add complexity to the competitive analysis of the ethanol industry. Producers must find ways to reach oil companies and others that ultimately blend the ethanol with gasoline for sale to consumers. A significant number of producers market their own ethanol by arranging for truck or rail transport to storage facilities and by entering sale agreements with oil companies, blenders, brokers, or others. However, many other producers rely on ethanol marketers to make these arrangements, for several reasons. Marketers can amalgamate volumes from multiple ethanol facilities to provide major oil companies and other ethanol purchasers with a single source for ethanol volumes that exceed what any one ethanol producer can provide. Marketers may also negotiate more favorable transportation or storage rates and can broaden the geographic reach of a producer’s volumes to enable nationwide distribution. Currently, seven major marketers provide these services for third-party ethanol producers. Several smaller marketers also provide these services, and other firms have made proposals to enter the ethanol marketing business.

There is no standard marketing agreement in the industry. A typical marketing agreement may have a three- to five-year term, though both longer and shorter agreements are also common. A marketer may have agreements of different lengths and terms with each of its producers. The marketer may be compensated based on a percentage of the dollar sales of ethanol or on a flat per-gallon basis. In some circumstances, the marketer may have an equity

ownership interest in the producer's facility. Despite the wide variety of marketing arrangements, in virtually all instances the ethanol producer determines its own output level, and the marketer is obligated to market 100 percent of the output from the ethanol plant.

Because marketers often represent more than one producer, staff carefully considered whether to attribute capacities to a single ethanol marketer rather than to each individual producer represented by the marketer. Each firm's ability to determine its own output in response to changing prices suggested that staff should consider each firm individually. The question was complicated by several factors, including the marketers that "pool" the sale and distribution of their producers' ethanol stocks. In pooling relationships, the marketer treats all of its producers' volumes in common, makes sales to accounts, and decides which plant would be the best situated to service the account. Each producer is allocated a pro-rated share from the common revenue pool, based on the volume it contributes. As a result, each producer within the marketing group will receive an identical netback (*e.g.*, the sale price less cost of transportation from the ethanol plant), regardless of where its production was actually delivered. The "pool" approach contrasts with the other main marketing model, in which the marketer sells its producers' volumes on a plant-specific basis. In the latter type of arrangement, the marketer regularly presents sales opportunities to each plant, and the plant's management must decide whether to accept the offer. A small amount of ethanol also is sold through firms acting essentially as brokers or resellers that take title to the ethanol and may assume the associated price risk.

Marketing agreements may affect competition in ethanol production in ways that are too speculative to resolve in this analysis. For example, because pooling agreements result in a customer's receiving an offer from a single marketer rather than from numerous producers, the

pooling agreement may be treated as reducing the number of bidders that could supply the customer. In this light, each of the producers' volumes might be attributed to the common marketer that acts as the sole "bidder" in their stead. On the other hand, because marketers have no control over a producer's output decision, a producer may have an incentive to boost production in the event of an increase in ethanol prices, and thereby may undercut the pool price as the marketer is forced to find additional buyers at potentially lower prices. This suggests that even in the pooling context producers might best be considered as independent firms.

Given the highly fact-specific nature of market analysis, staff cannot determine with certainty the effect of each marketing agreement in the industry. Staff therefore calculated HHIs by attributing all producers' shares to their marketer, regardless of whether the marketing agreement involves pooling volumes. This approach, which results in the highest level of concentration, yields an HHI of 1259, or "moderately concentrated" under the Horizontal Merger Guidelines. Staff alternatively calculated HHIs that attributed shares to marketers only when they had pooling arrangements with their producers. For producers using non-pooling arrangements, we attributed the market shares to the producers themselves. Using this approach, staff determined that the HHI was 813, or "unconcentrated" under the Horizontal Merger Guidelines.

#### IV. Measuring Concentration Using Production

As stated in § 1.5 of the Horizontal Merger Guidelines, the HHI analysis "suggest[s] greater precision than is possible with the available economic tools and information." Although staff believes capacity is a good indicator of concentration in this industry, staff also identified limitations on the capacity-based HHI analysis, which are outlined below. Thus, as a means of

cross-checking these conclusions, staff also performed an HHI analysis using ethanol production data.

Ethanol plant capacity is difficult to measure with absolute precision. Most industry participants report capacity based on “guaranteed” or name-plate capacity. Typically, a builder constructs an ethanol plant that is designed or guaranteed to produce a certain volume of ethanol. In this industry, the guaranteed amount often falls below the volume the plant can actually produce. Moreover, as the producer gains expertise in running the plant, adopts new technologies, and improves the production process, the plant’s actual capacity will tend to exceed its rated capacity. It is not uncommon for ethanol plants to run 10 to 15 percent higher than their stated capacities.

To test the conclusions of the capacity-based HHI analysis, staff performed a parallel analysis using ethanol production data. Every month, EIA collects confidential non-public information on production of oxygenates such as ethanol and MTBE. Oxygenate producers with production over 8 million gallons must report to EIA their monthly production volumes by product. EIA agreed to calculate the HHI data based on annual production from July 2004 through June 2005, following the same attribution methods outlined above. To maintain its confidentiality obligations, EIA reported only the final HHI numbers and did not disclose to us the volumes of ethanol attributed to each producer.

Figure 1 indicates that HHIs based on production are higher than HHIs based on capacity. Using the “all producer” model, in which volumes are attributed to each producer, the HHI for ethanol production is 929, which is still “unconcentrated.” Using the “all marketer” model, in

which producers' volumes are attributed to their common marketers, the HHI for ethanol production is 1613, or "moderately concentrated."<sup>14</sup>

**Figure 1: Domestic Fuel Ethanol Concentration**

Treatment of Marketing Agreements	HHI Based on Capacity	HHI Based on Production
Attribute capacity/production to the producer	499	929
Attribute capacity/production from members of pool marketing agreements to marketer, otherwise to producer	813	1221
Attribute capacity/production from members of all marketing agreements to marketer, otherwise to producer	1259	1613

Source: RFA, EIA

Note: Capacity includes new construction and expansions anticipated within one year. Production is from July 2004 to June 2005.

The production-based HHIs in Figure 1 present "worst case" market concentration scenarios for each method of treating marketing agreements. Because they are based on historical data, the production-based HHIs likely overstate the HHIs that will prevail in the near future. Production data do not fully account for entrants that may have begun ethanol production sometime during the period measured by EIA. Production data also do not account for capacity expansions that will produce marketable volumes within the next year. The ethanol industry is growing rapidly, with new entrants lowering concentration over time. The production-based HHIs help demonstrate the impact of entry. Indeed, if staff looked at concentration based solely on capacity of plants operating at the end of 2004, these figures would be very similar to the EIA production-based HHIs.<sup>15</sup>

<sup>14</sup> If producers' volumes are attributed only to marketers with pooling agreements, the HHI is 1221, or "moderately concentrated." See Section III, *supra*.

<sup>15</sup> For example, if we attribute all producers' shares to their marketers, the HHI based on capacity was 1634 at the end of 2004, halfway through the period covered by the production calculations. This HHI figure is very similar to the HHI based on production (1613) discussed above.

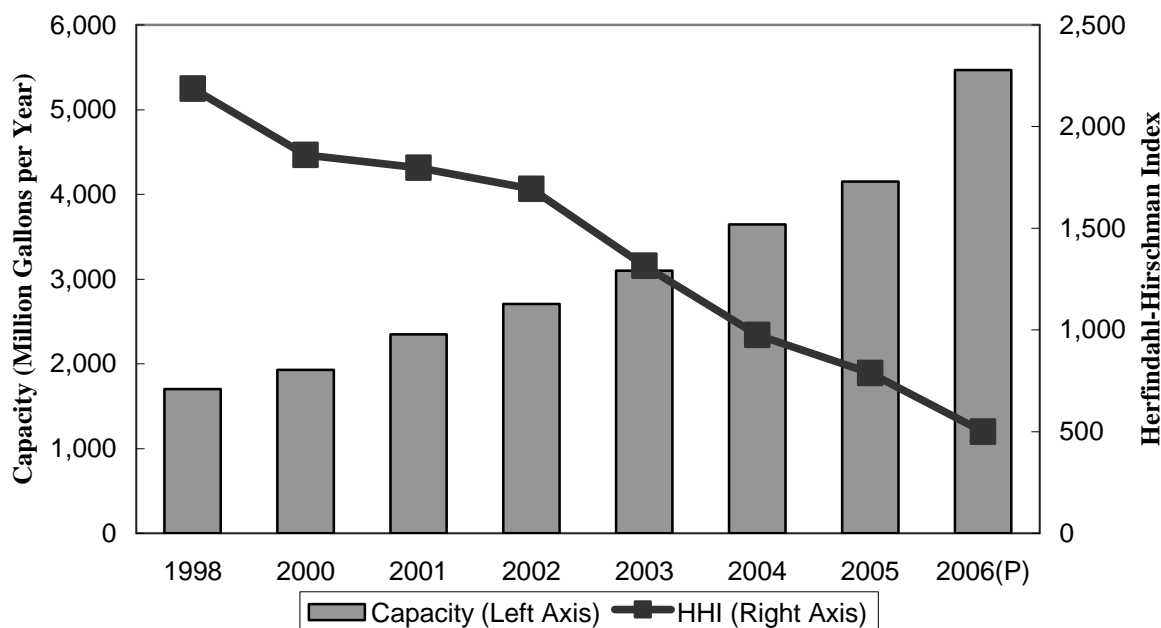
## V. The Effect of Entry

The likelihood and magnitude of entry into ethanol production and marketing further affect the potential for anticompetitive behavior in the ethanol industry. The threat of competitively significant entry can deter anticompetitive conduct by reducing the likelihood that one firm (or several firms acting in concert) could profitably raise prices above competitive levels. This is consistent with the approach in § 3.0 of the Horizontal Merger Guidelines, which instructs that “[a] merger is not likely to create or enhance market power or to facilitate its exercise, if entry into the market is so easy that market participants, after the merger, either collectively or unilaterally could not profitably maintain a price increase above premerger levels.” The Guidelines generally consider relevant only entry that can occur within a two-year window from initial planning to significant market impact.

Entry into ethanol production and marketing has been active and ongoing. Since late 1998, the number of ethanol producers has grown from 38 to 75. An additional 18 new firms are building new plants that should begin production within the next year. These firms collectively will add 937 million gallons to annual capacity. Incumbent firms are also expanding capacity, both at existing plants and by constructing new plants. As a result of entry and expansion, annual productive capacity has increased from 1.7 billion gallons at the end of 1998, to a projected 5.5 billion gallons by this time next year. Figure 2 shows the growth in U.S. fuel ethanol capacity since late 1998, as well as the impact that this growth has had on industry

concentration.

**Figure 2: Historical Fuel Ethanol Capacity and HHIs**



Source: RFA

Note: Annual figures are for year end for 1998 to 2004. 2005 is as of October. 2006(P) is projected capacity for late 2006, which adds current construction of new plants and expansions.

Facing apparently limited obstacles, new firms can enter into ethanol production at a small scale relative to overall ethanol production.<sup>16</sup> Designing, planning, and permitting a new ethanol plant may be difficult in some circumstances, but most new entrants have completed these processes within six to twelve months. Established firms provide design and construction services to new entrants, and ethanol's growth has expanded the availability of capital to finance new construction. Typically, a new ethanol plant with a capacity of 50 to 100 million barrels per year can produce marketable volumes within roughly one year of groundbreaking. Furthermore,

<sup>16</sup> The minimum viable scale of ethanol plants is small relative to overall domestic fuel ethanol production. Firms are constructing ethanol plants with a capacity of around 50 million gallons per year, which is roughly one percent of overall capacity. Therefore, a new entrant will likely have sales opportunities above its minimum viable scale after any anticompetitive price increase. Entry in this scale likely could be absorbed without significantly depressing ethanol prices.



a new entrant would not need to rely on current ethanol producers for any of the key inputs for building or operating a new plant.

Barriers to entry at the marketing level appear low as well, as new marketers have entered within the past several years and several more seem poised to do so. Entry seems particularly likely from former marketers of petroleum products or additives (such as MTBE) that can parlay their petroleum industry expertise into ethanol marketing. Some new ethanol plants that market their own ethanol production have entered recently as well.

As an indicator of the risk of anticompetitive conduct in the industry, the HHIs fail to account for the ease and rate of entry into ethanol production and marketing. Because it likely diminishes the incentives for market participants to engage in certain anticompetitive conduct such as cartel pricing, potential entry limits whatever competitive significance one might derive from a particular HHI figure.

## VI. Conclusions

The level of concentration in ethanol production would be unlikely to provide the opportunity or incentive for one or more firms to act anticompetitively. Various HHI calculations fell into the “unconcentrated” or “moderately concentrated” range, and new entry and other market factors reduce the significance of even these figures. Nevertheless, staff cannot exclude the possibility that future mergers may raise the potential for anticompetitive effects on segments or aspects of the industry. Given the highly fact-intensive nature of merger review, a merger may raise issues that warrant further investigation or enforcement action.