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I am planting energy, not corn. For the committed portion of my crop I don't care about the price of corn, I care about ethanol prices.

—Farmer/Owner, Mid-Missouri Energy

On a beautiful clear morning in October 2005, Ryland Utlaut ran his combine across part of his 700 acres of corn on his western Missouri farm. He was about halfway through his corn harvest and was thinking about leaving enough time in his day to check in at his second job as president of Mid-Missouri Energy (MME). MME purchased corn and turned it into ethanol at its 40 million gallon per year plant in Malta Bend, Missouri. Utlaut had been instrumental in organizing the farmers' cooperative a few years earlier to take advantage of the growing interest in ethanol as an automotive fuel and to provide local farmers with a value-added market for their corn. The plant began production in February 2005 and from the beginning it had met or exceeded all performance expectations. (See **Exhibits 1** and **2** for MME's financial data.) However, despite being in operation for only a few months, Utlaut and the cooperative faced a difficult decision: should they expand, perhaps double, the output capacity of the plant?

Utlaut, who farmed with his brother, had been a farmer for most of his life as had his father before him. Like most farmers in the area, Utlaut primarily ran a grain operation raising corn and soybeans. While specialization made him more efficient, it also left him dependent on producing a single harvest and on the commodity grain market for good prices for his crops. Owning a stake in an ethanol plant that used corn as a feedstock helped Utlaut manage the risks of his farming business. When corn prices were high, he made money on corn. When corn prices were low, he was potentially able to offset this with higher profits from the sale of ethanol.

The market's interest in ethanol had grown significantly in the previous few years. Record high oil prices on the world market, a desire by the United States and other countries to increase energy self-sufficiency, environmental concerns related to a gasoline additive (MTBE), and technological advances that lowered ethanol production costs combined to produce an industry boom. Between 2001 and 2005, ethanol production in the United States doubled to four billion gallons per year. Several factors led industry supporters to believe that this growth would continue. In August 2005, the United States passed new legislation requiring the use of 7.5 billion gallons per year of renewable fuels (primarily ethanol) by 2012. Back-to-back hurricanes in early September damaged U.S. oil

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Professor Forest Reinhardt and Senior Researchers James Weber and Mary Shelman, Global Research Group, prepared this case. HBS cases are developed solely as the basis for class discussion. Cases are not intended to serve as endorsements, sources of primary data, or illustrations of effective or ineffective management.

refiners, pushed gasoline prices over $3 per gallon, and further highlighted the vulnerability of the existing U.S. energy supply.

Despite the expected growth in ethanol demand and the early success of MME, expanding the plant carried significant risk for Utlaut and his fellow farmer-owners. Many small ethanol plants from a decade or two earlier had failed due to low oil prices and/or high feedstock prices. Expanding now would put more of his capital at risk before he had recouped his original investment. Further, other new ethanol plants were opening rapidly throughout the Midwestern states, and Utlaut had recently learned that a local grain handler was evaluating a new ethanol facility within a few miles of the MME facility. Should the industry expand too fast, overcapacity could drive down ethanol prices and make it impossible to turn a profit. Closer to home, increased demand for local corn could drive up the price of feedstock and thus the cost of production. Yet should MME decide to wait, other new cooperatives or private ventures could form in the area.

Ethanol

Ethanol, also known as grain alcohol or ethyl alcohol, was a clear, colorless, flammable liquid that could be used as a fuel or in various industrial uses.[1] Ethanol was typically blended with gasoline in order to expand the gasoline supply, increase the octane rating of gasoline, and make gasoline a less polluting, cleaner burning fuel. Marketers sold ethanol-gasoline blends in various concentrations. Two common blends were E10, also called gasohol, which was a mixture of 10% ethanol and 90% gasoline, and E85, which was 85% ethanol. E10 could be used in almost any motor vehicle interchangeably with gasoline and automobile manufacturers provided full warranties for the use of E10 blends in the United States and Canada. Relatively inexpensive modifications to the engine and fuel system were required to use higher concentrations such as E85. The U.S. government considered E85, or higher concentration blends, to be an "alternative fuel," and it called vehicles that could use E85 "flexible fuel vehicles" because such vehicles could also use gasoline (and perhaps other fuels as well). It was possible to use higher concentrations than E85, but because of various technical and safety reasons such use was rare.

Blending ethanol and gasoline was an inexpensive process often called "splash blending." The desired quantities of gasoline and ethanol were simply pumped into a delivery truck and the two chemicals blended by driving to the delivery site. Because ethanol absorbed water, and when it did it would no longer blend with gasoline, it could not be transported through pipelines. This raised ethanol's transportation costs relative to other fuels. In most instances, ethanol was blended with gasoline near the point of end use.

One gallon of ethanol contained approximately 83,000 Btu's of energy, less than gasoline's 124,000 Btu's per gallon. (See **Exhibit 3** for energy conversion factors.) While no major study had compared ethanol and gasoline in vehicle mileage tests, mileage differences in practice appeared to indicate that gasoline provided only a few percent more miles per gallon than ethanol. This modest difference in mileage resulted from the practice of blending ethanol and gasoline, and perhaps also because the ethanol in an ethanol-gasoline blend caused gasoline to burn more completely, therefore releasing more energy.

Ethanol had been used as a motor fuel for automobiles since the days of Henry Ford. The development of the oil industry, which historically could produce gasoline at lower costs than

[1] Ethanol was also the alcohol found in beer, wine and spirits. Federal regulations required that fuel ethanol producers add between 2% and 5% of a denaturant to fuel ethanol to ensure it was not consumed.

ethanol, pushed ethanol almost completely out of the fuel market for most of the 20th century. Following the oil shocks of the 1970s, which saw gasoline supply shortages and price increases, ethanol began to make small inroads back into the fuel market. When governments mandated the removal of lead in gasoline for environmental reasons, the petroleum industry substituted ethanol or other chemicals to maintain the octane rating of gasoline to prevent engine knock. For this use, ethanol could be used in blends as low as 2% to 3%.

In 1979, the U.S. government passed legislation that provided loan guarantees for small new ethanol plants, provided tax benefits for producers, and provided per gallon subsidies designed to help develop an ethanol industry. By 1984, nearly 150 small new plants had been built in addition to the dozen or so prior existing plants. By the end of 1985, however, approximately half of these plants had gone out of business because even with subsidies they were unable to compete with the low price of gasoline. Despite this setback, ethanol production and use continued to grow at a modest rate through the end of the 1990s.

A Renewed Interest

In the later years of the 1990s and into 2005, several factors combined to stimulate a renewed interest in ethanol. These included technological improvements in ethanol production, environmental concerns (primarily over the use of MTBE), rising gasoline prices, low corn prices, and concerns over the supply of gasoline (capacity and reliability of supply). (See **Exhibit 4** for ethanol production levels in the United States.) While growth had been most rapid in the United States, other countries, including Brazil, Canada, Argentina, the United Kingdom, and China all had developing ethanol industries. Several countries around the world had mandated, or were considering mandating, ethanol use. (See **Exhibit 5** for ethanol production by country and **Exhibit 6** for U.S. ethanol imports.)

Ethanol Production

Ethanol was produced by fermenting sugars. Brazil, the world's largest ethanol producer, used sugarcane as did most other countries where sugarcane was available. In parts of the world where sugarcane could not be easily grown, sugarbeets were the preferred substitute. In the United States, the world's second largest producer, ethanol manufacturers primarily used corn. To use corn, manufacturers first needed to convert the corn's starch into sugar. This step in the process made corn less efficient than sugarcane in producing ethanol. Certain other types of biomass, such as switch grass, potatoes, wheat, sorghum, and agricultural and forestry wastes, held promise in ethanol manufacturing; however, further research was required before these methods would be economically feasible.

U.S. manufacturers produced fuel ethanol by one of two methods: dry milling and wet milling. Dry milling was a simpler and less expensive process with scale economies that allowed the construction of plants that typically produced between 15 million and 80 million gallons of ethanol per year with newer plants tending to be larger than older plants. (A dry mill might be built for roughly $1 per gallon of ethanol output per year.) The basic process involved grinding the corn, using water, enzymes and heat to turn the corn's starch into sugar, adding yeast and fermenting the sugar into a mixture of ethanol, water and solids, distilling the mixture to remove most of the water, and using molecular sieves to remove the remaining water. The dry milling process also produced distillers dried grain with solubles (DDGS, a high protein animal feed with established markets) and carbon dioxide (a gas used in carbonated beverages and other applications) as coproducts. (See **Exhibit 7** for a process flow diagram of a dry mill plant.) Corn represented the largest cost to produce ethanol, accounting for approximately 60% of total costs. This was followed by energy costs (natural gas and electricity) of about 15% of total costs and chemicals, yeasts, enzymes, and denaturants at about 10% of total costs.

Wet mill plants broke the corn down into more of its component parts before making ethanol. These extra steps made wet mills significantly more expensive to build and operate than dry mill plants. The higher cost of the wet mill process required that plants be built larger, with capacities in excess of 100 million gallons per year, to be cost efficient. (Construction costs for a wet mill might be over $2 per gallon of ethanol output per year.) The advantage of the wet mill process, however, was that it produced more coproducts that, depending on commodity prices, could be quite valuable. These coproducts included high fructose corn syrup (a sweetener used in processed foods), corn oil, corn gluten (a high protein animal feed), corn germ, and carbon dioxide. The wet mill plants also had a degree of flexibility that enabled them to produce more of one coproduct at the expense of another in an attempt to obtain the most profitable mix of outputs.

Both dry and wet mills produced about 2.7 gallons of ethanol per input bushel of corn. Newer plants might get a bit more, but the theoretical limit[2] was approximately 3 gallons per bushel.[3] In a dry mill, a standard 56 pound bushel of corn produced by weight roughly 1/3 ethanol, 1/3 DDGS, and 1/3 carbon dioxide.

Energy Balance In the 1970s, the process of producing ethanol from corn likely had a negative "energy balance," meaning that the energy required to produce a gallon of ethanol exceeded the amount of energy obtained when burning a gallon of ethanol. The energy required to produce ethanol included the energy used to produce fertilizers, power farm equipment, transport corn, and manufacture ethanol. In the ensuing decades, technological advances in ethanol production plants greatly reduced the amount of energy required to produce ethanol and increased the amount of ethanol that could be obtained from corn. For example, between 1995 and 2005 the amount of ethanol that could be obtained from a bushel of corn in a new plant increased from approximately 2.3 gallons to 2.8 gallons. Over the same period, corn yields had increased by approximately three bushels per acre and corn farming efficiencies increased. By 2005, ethanol supporters strongly argued that these efficiency gains enabled the corn-to-ethanol energy balance to turn positive. Other scientists, however, were unsure of the energy balance while industry critics argued that the energy balance remained negative. Despite the uncertainty around the energy balance question, the ethanol industry continued to conduct research aimed at improving the efficiencies of all steps in the ethanol production process.

The United States Department of Agriculture (USDA) listed corn-based ethanol as yielding 1.67 Btu's of energy for every one Btu of energy used in ethanol production. (In contrast, sugarcane-based ethanol production yielded approximately nine Btu's of energy for every one Btu used in production.) The USDA listed gasoline, electricity, and coal as yielding 0.84, 0.34, and 0.98 Btu's respectively for each Btu input.[4]

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[2] The theoretical limit was determined by the starch content of the corn. The seed industry was developing new higher-starch corn hybrids.

[3] Michael S. Graboski, Fossil Energy Use in the Manufacture of Corn Ethanol, August 2002.

[4] Mikkel Pates, Ethanol Industry Forges Forward, Agweek, August 23, 2005.

The U.S. Ethanol Industry

In 2005, Archer Daniels Midland (ADM), a $36 billion multinational corporation, was the industry's largest ethanol producer with a market share between 25% and 30%, down from roughly 70% in the early 1990s. ADM had historically been involved in agriculture and food-related businesses. As such, its ethanol plants largely consisted of wet mills and it operated the largest wet mills in the world. In recent years, however, ADM was taking a greater interest in, and investing in, the energy sector. For example, ADM was the largest producer of biodiesel[5] in Europe. In late 2005, ADM announced that it would build its third biodiesel plant in Germany as well as its first biodiesel plant in the United States in 2006. For ethanol, ADM announced that it would build two new dry mill plants by early 2008 with a combined capacity of 500 million gallons per year. This seemed to be part of its strategy to maintain an ethanol market share in the United States of at least 25%.[6] ADM was a major financial supporter of industry organizations, such as the Renewable Fuels Association, which lobbied the government for regulations that supported ethanol.

The remainder of the U.S. ethanol industry was highly fragmented with nearly 100 producers in 2005, up from approximately 60 producers in 2002. An additional 20 plants were being constructed or undergoing major expansions. The industry's second largest producer held a market share of less than 4%. Most U.S. ethanol plants were located in Midwestern states where corn was plentiful. (See **Exhibit 8** for ethanol production by state.)

In the early 1990s, wet mills produced roughly 75% of U.S. ethanol with the remainder coming from dry mills. In the decade since, nearly all new plants used the dry mill technology and by 2005 approximately 75% of output came from dry mills. A key reason that the industry was not building new wet mill plants was because the wet mills' primary coproduct, high fructose corn syrup, had seen falling prices over the past decade.

An Industry Boom While ethanol production had been growing for over two decades, in 2005 many observers felt that the industry was in the midst of a boom; production was growing in excess of 20% a year, new plants were being built or existing ones expanded throughout the Midwest, politicians were expanding production incentives and usage mandates, farmers were clamoring for the opportunity to invest in new ethanol ventures, and small towns were offering tax breaks and other inducements in the hopes of luring ethanol plants to their communities. A director of an economic development council in Iowa stated, "I've never seen people so excited," while an ethanol plant builder from South Dakota called it "a bit like a gold rush."[7] Ethanol had given hope to small towns struggling with declining populations and few economic opportunities for its residents. It had also given hope to farmers facing falling corn prices.

Concerns There were concerns as to whether the boom could turn bust. Few ethanol producers were publicly traded companies, which limited oversight by sophisticated investors. In late 2004, a Standard & Poor's report rated the ethanol industry as highly speculative due to price volatility of ethanol and feedstock inputs and other factors beyond the industry's control. The report also noted that the industry could not survive without government subsidies. A further concern was the possibility of an oversupply of ethanol that would drive down prices. A spokesman for the Renewable Fuels Association countered the oversupply concern: "We are 2-3 percent of the gasoline

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[5] Biodiesel was another plant-based fuel that used oilseeds such as soybeans and rapeseed as a feedstock.

[6] David Driscoll, Archer Daniels Midland analyst report, Citigroup Global Markets, September 14, 2005.

[7] Scott Kilman, "Home Grown: In Midwest Investment Boom, Corn-to-Fuel Plants Multiply," *The Wall Street Journal*, March 9, 2005.

supply for this country and somehow we are over-producing? That doesn't make sense. Oil companies are not using it enough."[8]

Cooperatives Independent farmers cooperatives were building the large majority of new ethanol plants. Such farmer-owned operations accounted for half of U.S. ethanol production. Farmers had a long history of forming cooperatives. Traditional cooperatives, such as farm supply cooperatives and grain elevator cooperatives, tended to either help farmers acquire farm inputs (seed, fertilizers, etc.) or help farmers market raw outputs (largely grains). Such cooperatives typically had low start-up costs, had open membership policies, and benefited a member based on the volume the member chose to purchase through or sell through the cooperative over the course of the year. It was generally easy to become a member of a traditional cooperative and easy to dissolve one's membership in one.

In the past decade, and in a few instances longer, farmers had gotten more involved in the processing of their outputs into high value-added products, such as producing ethanol from corn. Building an ethanol plant, however, required a larger capital investment up front, and a more assured supply of raw material (corn) inputs, than a traditional cooperative could reliably provide.

To be able to build capital intensive production facilities, farmers had entered into what were called New Generation Cooperatives (NGCs) that differed from traditional cooperatives in several key respects. Most NGCs had defined membership requirements. Members were required to put a set amount of equity into the cooperative to build the plant. This member equity was required both to build the plant and to obtain any necessary loans. Members were also required to provide a set amount of production inputs at specified quality levels (corn in the case of ethanol plants) to keep the plant running at efficient capacity. Members typically had to join the cooperative at the time of its founding and the number of members was a function of the quantity of raw material needed by the plant. Once the founding membership was determined, NGCs might close to additional new members. Further, members could not remove easily their equity from the NGC once invested; instead, they received a return from the operation of the plant. Various tax and securities laws required that members be actual agricultural producers with "production at risk" and not simply interested investors. This further limited a member's ability to exit an NGC. Thus, transfers of membership typically were rare and required the approval of the NGC's board.[9]

Cooperative members typically received one vote on matters put to the membership. (This was different from corporations where voting rights were based on the number of shares owned.) Members voted to select board directors and to change bylaws while the board directors ran the business.

Brazil Brazil began producing ethanol from sugarcane to cut petroleum imports after petroleum prices rose in 1973. Between 1980 and 1985, Brazilian ethanol production increased from less than one billion gallons to three billion gallons per year in response to government mandates that its vehicles use ethanol. In the two decades since, its production fluctuated between three billion and four billion gallons per year, accounting for around 50% of Brazil's sugarcane crop (2.66 million hectares out of 5.34 million hectares). Brazil had far fewer motor vehicles than the United States and it was able to supply over 30% of vehicle fuel demand from ethanol compared to the United States where approximately 3% of fuel demand came from ethanol. By law, all gasoline sold in Brazil in 2005 was required to contain a minimum of 25% ethanol.

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[8] Jeremy Grant, "Ethanol Processing Slows for ADM," *Financial Times*, May 2, 2005.

[9] Deanne Hackman, "What is a New Generation Cooperative?" Ag Decision Maker, Iowa State University, December 2001.

Brazil produced ethanol from sugarcane at far lower costs than U.S. producers could with corn. There was an import duty of $0.51 per gallon (matching the blender tax credit received by U.S. producers of ethanol for fuel) to ship ethanol from Brazil to the United States. If, however, part of the processing of the Brazilian ethanol was done in the Caribbean, this duty could be avoided. It was possible that future free trade agreements could impact ethanol prices in the United States.

Environmental Concerns Help Ethanol

Through amendments to the Clean Air Act of 1990, the federal government required the use of cleaner burning gasoline in motor vehicles in certain parts of the United States. (See **Exhibit 9** for the locations that had clean fuel requirements.) One amendment, the Federal Oxygen Program, called for the use of oxygenated fuel during winter months in regions of the country that exceeded federal air quality standards on carbon dioxide. A second amendment, the Reformulated Gasoline Program, required the use of oxygenates in gasoline in areas that had high ground level ozone (smog). By adding oxygenates to gasoline, the levels of carbon dioxide, benzene, and other pollutants released from vehicles could be substantially reduced.

The petroleum industry had used a chemical it produced called methyl tertiary butyl ether (MTBE) in gasoline in small quantities since lead was removed from gasoline in the early 1980s. In the 1990s, the industry chose to use MTBE to meet the new oxygenate regulations and it greatly increased production. MTBE was cost effective, blended well with gasoline, and could be transported by pipeline. One major concern with the use of MTBE, however, was that when it leaked from storage tanks it contaminated ground water and drinking water more readily than gasoline. Beginning in the late 1990s, some states began banning the use of MTBE.

Ethanol was the primary alternative to MTBE as a fuel oxygenate. Ethanol, however was not produced by the petroleum industry, had not historically been produced in sufficient quantities to meet the need, and could not be transported by pipeline. Many farmers and farmer cooperatives saw the opportunity to expand ethanol production to meet this need and believed that the marketing and transportation challenges could be overcome.

Ethanol was a generally considered to be an environmentally safe fuel. It was biodegradable, not highly toxic, and when blended with gasoline caused the blend to burn more completely with less toxic emissions. One environmental downside to ethanol was that it increased the volatility of gasoline. When gasoline evaporated it increased ground level ozone pollution. Gasoline volatility was particularly a concern in warmer months.

U.S. Government Support for Ethanol

Both federal and state governments supported the development of the ethanol industry through numerous grants, subsidies, and tax credits aimed at producers and resellers of fuel ethanol.[10] These incentives included:

The Energy Policy Act of 2005 The federal government's energy bill of 2005 included a mandate that petroleum refiners blend into gasoline at least 7.5 billion gallons per year of a

[10] Biodiesel enjoyed the support of government policies similar to those of ethanol.

renewable fuel by 2012, nearly double the 2005 rate.[11] Over the time duration of this legislation, the only renewable fuel that would likely be both widely available and cost effective was ethanol. Projected growth rates indicated that the actual amount blended would be larger than 7.5 billion gallons, but the mandate gave confidence to investors and producers in the ethanol industry. This mandate, when combined with the various government financial supports given to the ethanol industry, was expected to cost the federal government over $3 billion per year by 2012. In addition to mandating renewable fuels, this act eliminated in 2006 the Reformulated Gasoline Program's oxygenate requirement put in place as part of the Clean Air Act amendments. The act also called for the use of a minimum of 250 million gallons of ethanol made from cellulose[12] in 2013. The act supported cellulose ethanol by requiring the U.S. Secretary of Agriculture to create a per gallon subsidy for cellulose ethanol, and offer loan guarantees and grants for the construction of facilities to produce cellulose ethanol.

Federal Tax Credit (VEETC) The American Jobs Creation Act of 2004 created a tax credit for ethanol. Effective January 1, 2005, U.S. ethanol blenders were eligible for a new Volumetric Ethanol Excise Tax Credit[13] (VEETC) of $0.51 for every gallon of ethanol used in gasoline. This meant that E10 blends effectively received a credit of $0.051 per gallon and E85 blends received a credit of $0.434 per gallon. VEETC for ethanol was set to expire at the end of 2010.

Federal Small Producers Credit To support new ethanol plants, in 1990 the federal government implemented a $0.10 per gallon income tax credit to new producers on up to 15 million gallons of ethanol annually. The credit was capped at $1.5 million per producer and was only given to plants of less than 30 million gallon capacity. In 2004, this credit was allowed to be passed through cooperatives to their farmer-owners and the Energy Policy Act of 2005 increased the plant size capacity cap to 60 million gallons.

Commodity Credit Corporation Bioenergy Program The federal government paid up to $7.5 million a year to ethanol producers for increasing the amount of corn inputs purchased for increasing ethanol production over the previous year. The payment criteria were designed to help new plants, or plants expanding their capacities, through the difficult first years of operations. The payments reimbursed producers at a rate of one bushel of corn (or other bio-matter input) for each additional 2.5 bushels used over the previous year for ethanol manufacturing plants that produced less than 65 million gallons per year. For larger plants the ratio was one bushel for 3.5 bushels. The total program was capped at $150 million per year and set to expire in late 2006. If eligible payments would exceed $150 million, payments would be spread across qualified producers. (MME estimated it would receive a total of between $4.5 million and $6 million from this program over two years.)

Member State Tax Credit To encourage the formation of New Generation Cooperatives that added value to agricultural products grown in the state, Missouri offered a tax credit to producers (farmers) who invested in a NGC. The tax credit was equal to 50% of the producer's investment with

[11] The renewable fuel part of the 2005 energy bill was designed to decrease the consumption of petroleum, increase energy security, and increase rural growth across America. The bill was signed into law on August 8, 2005.

[12] Cellulose was found in nearly all plant matter, typically in the non-food portion of plants such as stems and stocks, and was often a residue left over from grain processes. Cellulose was a very inexpensive input for ethanol; however, with current technology it was more energy intensive to turn into ethanol than corn. As the conversion technology improved, cellulose could become a strong competitor to corn in ethanol production.

[13] VEETC replaced a federal excise tax exemption for gasoline marketers and oil companies who blended 10% ethanol into gasoline. The federal government imposed a $0.183 per gallon federal excise tax on gasoline fuel. Under the ethanol excise tax exemption, gasoline marketers and oil companies received a $0.051 per gallon reduction in this excise tax for blending 10% ethanol into the gasoline. (This essentially meant that the ethanol itself received a $0.51 per gallon subsidy.)

a cap on the credit of $15,000 per member and $1.5 million per cooperative. To keep within the cap levels, the tax credit would be allocated across eligible members and MME estimated that members might actually receive only 20% to 25% of what they would receive without the caps.

State Producer Payment Missouri also provided incentive payments to new ethanol producers for their first five years of operations. The payments consisted of $0.20 per gallon for the first 12.5 million gallons produced and another $0.05 per gallon for the next 12.5 million gallons each year. The maximum yearly payment, therefore, could be as high as $3.125 million for a plant producing 25 million gallons or more. While the state had not always fully funded this program in the past, it was fully funded in 2005 and the Missouri governor had promised continued support for full funding.

Other State Programs Individual states were showing a growing interest in ethanol and other renewable fuels. Minnesota mandated that gasoline sold in the state contain 10% ethanol. In 2005, Minnesota passed legislation that could increase the amount of ethanol in gasoline to 20% by 2013. (Minnesota also had the nation's largest number of gas stations selling E85 – approximately 130 locations.) In 2004, Hawaii, and in 2005, Montana, enacted legislation similar to Minnesota's 10% mandate. Other states, including Missouri, were considering ethanol mandates of their own.

Prices and Markets

Corn Corn was one of the leading crops in the United States. It was used primarily as an animal feed (75% of production), but it was also used to produce corn oil, high fructose corn syrup, glucose, dextrose, corn starch, and cereal. Approximately 13% of the corn was used to produce fuel ethanol in 2005. (See **Exhibit 10** for historical corn production and usage.) In 2005, U.S. farmers grew nearly 11 billion bushels of corn, 2 billion of which was exported, on 74 million acres. While corn yields nationwide ranged between 50 and 200 bushels per acre, most corn was grown in areas that had yields between 150 and 180 bushels per acre. (See **Exhibit 11** for corn yields and production by state.) A typical corn farmer in Missouri had between 800 and 1,000 acres, about half of which were dedicated to corn. Average corn yields in the state were between 140 and 180 bushels per acre but could vary depending upon quality and location of cropland, fertilization regime, and weather.

Corn prices were roughly $2 per bushel, but ranged significantly from state to state and year to year. Record corn crops in 2004 and 2005 kept prices lower than the historical average. (See **Exhibit 12** for historical corn prices.) High corn prices would be the most likely cause of an ethanol plant losing money. Corn was by far the largest single cost component in the production of ethanol, representing two-thirds of production costs. The cost of corn was driven primarily by local and regional corn prices, and secondarily by the cost of transporting corn to the facility, both of which were influenced by the location and operation of the ethanol facility itself.

Grains such as corn were actively traded on the futures market (e.g., CBOT or Chicago Board of Trade) to hedge risk for buyers and sellers of grain. However, farmers usually sold their corn on the local "cash market" to a direct user such as a livestock producer or ethanol facility, or to a country elevator. The difference between the CBOT futures price for a bushel of corn and the local "cash" price was called the "basis." Basis was impacted by transportation cost and the availability of transportation services (trucks, rail cars, barges, etc.), along with the amount of free grain storage space at the farm and/or grain elevators. Basis was often negative and wider during fall harvest but narrowed later in the crop market year.

Although there were many complicating factors, there appeared to be a directional relationship between corn demand for ethanol production measured as the percent of corn production within a 50-mile radius of the ethanol facility, and the level of impact on the local basis. Generally, new ethanol facilities located in regions with sufficient available corn production impacted local basis between $0.05 and $0.10 per bushel.[14] This impact to local basis existed on top of the national lift in corn pricing estimated for overall ethanol production.

Historically, the area where MME was located had experienced a local basis of -$0.28 to -$0.32 to CBOT (or approximately $0.15 below the basis in Kansas City). A feasibility study prepared for MME in 2002 estimated that it would be able to purchase corn for approximately $0.03 to $0.05 per bushel below Kansas City prices.

Nearly all corn used in ethanol production was a standard variety – No. 2 Yellow. Breeders had developed a "high fermentable" hybrid corn that produced ethanol more efficiently than standard corn, but there was no way to differentiate one corn variety from another in the existing supply chain. This meant that currently there was no incentive for a farmer to grow such corn because there was no way for a buyer to compensate the farmer for producing it.

Natural Gas and Electricity Ethanol production was energy intensive and most plants relied on natural gas and electricity to meet their needs. The majority of the natural gas used in the United States was produced domestically while most imported natural gas came from Canada. Natural gas prices had fluctuated throughout most of the 1990s between $2 and $4 per million Btu's (MMBtu). From 2002 to early 2005, gas prices averaged closer to $6. The increase was due in part to declining production from natural gas wells. In late summer 2005, prices jumped to nearly $15 following the hurricane damage to the Gulf Coast. Electricity prices, meanwhile, where significantly higher than historical natural gas prices on a per Btu basis. Electricity prices, however, had been more stable than gas prices in part due to the variety of fuels (coal, natural gas, hydropower, nuclear) used to produce electricity.

Ethanol Ethanol was sold into the gasoline blending market where it competed with other oxygenates and octane components, as well as with gasoline itself. Historically, ethanol prices had been highly correlated with the price of gasoline and gas blending components, and the difference between the price of ethanol and the price of gasoline had often exceeded the Federal Blenders Credit of $0.51 per gallon. While the cost to produce ethanol was highly correlated with the price of corn and other inputs, the cost to produce ethanol had almost no impact on the price ethanol could command in the marketplace. (See **Exhibits 13** and **14** for historical ethanol and gasoline prices.) However, the greatest effect on the price of ethanol was the supply and demand factor in specific markets. For example, the ethanol to gasoline price spread dropped dramatically in the first few months of 2005 as new ethanol production facilities came on line before blending infrastructure was in place to absorb the additional supply.

DDGS Dried Distillers Grain with Solubles (DDGS) was a high protein animal feed produced as a coproduct to ethanol production from corn. In 2004, U.S. dry mills produced eight million tons of DDGS (17 pounds per bushel of corn used to produce ethanol), up from 3.2 million tons in 2002. Approximately 85% of the DDGS was used for beef and dairy cattle feed, and the rest for hogs and poultry.

DDGS sold for approximately $100 per ton, but prices had been declining in recent years as the supply had increased. (See **Exhibit 15** for historical DDGS prices.) The market price for DDGS and

[14] Mid-Missouri Energy Feasibility Report, SJH & Co., December 15, 2002, p. 24.

the cost to ship varied depending on the destination market and volume. Producers in the upper Midwest often shipped to California and other western markets while facilities in the lower Midwest often shipped to locations in Texas and New Mexico. The market price for DDGS was influenced more by the price of corn and other grains which could be used as feed without being converted to DDGS.

DDGS was actually wet when produced at the ethanol plant. Although a valuable animal feed when wet, it had to be used within three days or it would develop mold. Thus any buyer of wet distillers grain must be located nearby (typically within 100 miles) the ethanol plant and have sufficient need to use the feed quickly. (Because it was more difficult to site livestock operations than ethanol plants it was more likely to build an ethanol plant near a livestock operation than have a livestock operation look to build near an ethanol plant.) In Missouri, both beef cattle and dairy cattle inventory had been declining. Between 20% and 25% of the industry's DDGS was used as wet feed near where it was produced.

DDGS dried also made a good feed, could be stored indefinitely, and shipped well, but the drying process was energy intensive making this feed more costly to produce. Approximately 50% of the natural gas used at dry mill ethanol plants went into drying the DDGS. Thus the cost to produce DDGS was highly influenced by the cost of energy.

It was possible to burn DDGS to produce energy. Some ethanol industry researchers were investigating the technology and the economics behind ethanol plants burning their DDGS for their own energy needs rather than sell it as feed. A few ethanol plants were under construction incorporating DDGS as an energy source.

Petroleum

Total U.S. gasoline demand was approximately 140 billion gallons in 2004, up from 100 billion gallons in 1985. The primary use of gasoline was for the country's 200 million motor vehicles (automobiles and light trucks). Ninety percent of gasoline was produced by the refining of crude oil in the country's 149 refineries (down from 212 in 1985) and 10% was imported. U.S. refinery capacity utilization was very high (running over 92% in 2005) and the effects were evident in September 2005 when two hurricanes shut down Gulf Coast refining operations. Gas prices went over $3.00 per gallon and shortages occurred in some areas of the country.

The majority of gasoline was shipped by pipeline to storage terminals near consumer areas and then loaded into trucks (typically holding 10,000 gallons) for delivery to approximately 167,000 individual gas stations. Some gas stations were owned by refiners and some were independents that purchased gas on the open market for resale.

Although the United States was the world's third largest crude oil producer,[15] less than 40% of the crude oil used in U.S. refineries was produced domestically. In 2004, the U.S. imported over 4.8 billion barrels of oil.[16] Approximately half of petroleum imports were from countries in the Western Hemisphere (Canada, Mexico and Venezuela), with 20% from the Persian Gulf, 15% from Africa, and

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[15] OPEC (Organization of Petroleum Exporting Countries) was the main player in the crude oil market, accounting for 40% of world oil supply and holding about 70% of proven reserves. OPEC members included Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates, and Venezuela.

[16] One 42 U.S. gallon barrel of crude oil yielded approximately 19.7 gallons of gasoline, along with other products including diesel fuel, heating oil, and jet fuel.

15% from other regions. The U.S. import price for a barrel of crude oil increased from $28 a barrel in January 2004 to more than $60 a barrel in August 2005. Crude oil accounted for around 44% of the cost of a gallon of regular gasoline.[17]

The U.S. was the largest user of petroleum products, accounting for 25% of world demand. Over 60% of U.S. demand came from the transportation sector, up from 50% in 1978. Global oil demand had been increasing and this growth was expected to continue as emerging markets developed. For example, per capita oil consumption in China was only one-quarter of U.S. consumption yet strong growth was expected as its transportation sector expanded. There were 24 million vehicles in China in 2004, but this number was projected to increase to between 90 million and 140 million vehicles by 2020. Forecasts put Chinese petroleum demand in 2030 at 14 million barrels per day and, since China did not have large oil reserves, China was expected to import much of this amount.

Mid-Missouri Energy

The roots of MME began in the fall of 2001 when a private investor came to the Malta Bend area looking to work with farmers to build a $40 million ethanol plant. (Malta Bend was a farming community of approximately 250 people located 80 miles east of Kansas City.) A number of farmers, including Utlaut, met with the investor, but the farmers ultimately decided that the proposed deal was not in their best interest. The farmers, however, were intrigued with the idea of building an ethanol plant and continued to meet on their own in 2002. Ultimately 11 farmers formed themselves as Mid-Missouri Energy and as a group invested approximately $25,000 as seed money to move the idea forward.

These 11 farmers became MME's original board of directors. The board had significant experience beyond farming. Utlaut, who was elected president, held a degree in agricultural business and had long been active in the farming community. For several years he served as president and chairman of the National Corn Growers Association. Don Arth, MME's vice president, had been a board member of the Missouri Corn Growers Association and Merchandising Council, a board member for a local bank, and was a director of the local fire department. Patty Kinder, MME's board secretary and the cooperative's first employee, had previously served as director of the Carollton (County) Area Chamber of Commerce and Economic Development for 18 years in addition to holding several other economic development positions.

After the initial seed money, MME was able to find other financial support. Catholic Charities provided a $25,000 grant as a form of local economic development, the Missouri Agriculture and Small Business Development Authority provided another $180,000 grant, and $28,000 was raised from private local donors interested in seeing a local plant. MME used part of this early money for a feasibility study. Completed in December 2002, the study indicated that a 40 million gallon ethanol plant at an initial cost between $55 million and $60 million could be economically viable.

Next MME hired Fagen, Inc., first to provide advice on raising the necessary equity from farmer-investors and later to design and build the plant. Fagen was a highly experienced heavy industrial contractor that had built more ethanol plants than any other builder.[18] Fagen worked closely with and used technology from ICM, an engineering, manufacturing, and grain merchandising company that had been designing and building ethanol plants for 25 years. Fagan had been involved with

[17] There were three main grades of gasoline that varied by octane. Gasoline prices varied by grade.

[18] Broin was the other major builder of ethanol plants in the United States. Unlike Fagen, Broin required an ownership stake in the plant, along with an on-going contract to manage the plant operations.

numerous efforts to raise farmer equity for building ethanol plants and all such efforts had been a success. (Utlaut credited much of MME's success in raising capital, building the plant, and producing ethanol to the experience of Fagen-ICM.)

MME - A Missouri New Generation Cooperative In January 2003, MME completed a confidential disclosure statement that described the new business, the equity it was trying to raise, its financial expectations, and the obligations of the members of the cooperative. (This document was similar to what a company would use for a public offering of stock.) It also described MME as a New Generation Cooperative and provided details on what this meant for members.

The MME founders determined that they needed to raise approximately $58 million to build their 40 million gallon per year ethanol plant and begin operations. They set out to raise between $12 million and $28 million in member equity investments with the remainder to come from debt financing. If MME could not raise $12 million the cooperative would dissolve and funds would be returned to investors. If MME raised $12 million in equity, or perhaps a bit more, it would form as a limited liability corporation through which they would raise the additional funds needed to build the plant. If MME could raise closer to the $28 million, it could be 100% farmer-owned.

In the spring of 2003, the MME board members, in groups of three to four, traveled within a 75 mile radius and held 82 meetings with groups of farmers (2,500 farmers in all) who might be interested in joining the cooperative. MME also invited the local banks and grain dealers to these meetings. Utlaut recalled that members of the local financial community supported MME's efforts by speaking about the significant economic opportunity they felt the plant brought to the area. Raising the first $12 million came easier than expected and this led MME to continue its equity drive until it raised approximately $26 million by July 2003. MME obtained the remaining funds it needed through bank loans.

After the equity drive, MME had 729 members. While the minimum investment was two units (units were priced at $10,000 each and required annual delivery of 5,000 bushels of corn), the average member held three or four units. The largest investors were a couple of members who purchased approximately 50 units each. Some farmers bought more than one membership (for example a husband and wife each bought one in their own name), which enabled them to obtain larger tax benefits.

Member Requirements MME's board set the investment requirements by weighing the amount of capital it needed to raise against what a typical farmer might be able to afford to invest, how much corn such a farmer could commit to providing, and how many farmers existed within a reasonable distance from the plant site.

MME would buy corn from its members according to the number of units each member owned and a daily delivery schedule set up by MME.[19] MME would not buy corn from nonmembers. If MME needed more corn than its members could provide, it would buy that corn from grain storage companies only. This helped reduce the competitive threat posed by the ethanol plant to local grain elevators. (Note – most ethanol plants were LLC, which meant they tended to have fewer corn farmers as members. This forced these plants to purchase a larger portion of their corn on the open market, including from commercial grain handlers or direct from nonmember farmers.)

For members who could not (or chose not to) deliver their corn, MME also operated a "corn pool," charging $0.10 per bushel to a member who used the pool. Thus a member that owned the minimum two units, which required an annual delivery of 10,000 bushels of corn, could choose to pay $1,000

[19] Members either stored corn on-farm until their assigned delivery dates or paid for commercial storage at a local elevator.

instead of delivering corn. Some members might choose to use the pool for a portion of their delivery requirements rather than pay for corn storage until their delivery date. In addition, MME paid a premium to members based on their distance from the plant to cover the cost of additional freight. The premium reached $0.15 per bushel for members 70 miles away from Malta Bend.

Site Selection Site selection was important to any ethanol plant with access to a sufficient corn supply being the critical factor. For a 40 million gallon plant, MME needed nearly 15 million bushels of corn per year and corn was expensive to ship long distances. In 2001, the 12 counties within a 50-mile radius of the proposed plant site produced 75 million bushels of corn. (See **Exhibit 16** for Missouri corn production by county.) There were, however, several other major corn buyers in that area. MME believed that despite these other buyers, the delivery commitments made by its members assured it a reliable supply of corn.

Additional site selection issues included access to trucking routes to bring in the corn, access to railways to ship ethanol, and access to significant and reliable supplies of water, natural gas, and electricity. MME also needed to obtain any necessary permits to build and it hoped to be welcomed by its neighbors. (MME eliminated one site from consideration because one neighbor threatened a lawsuit that could delay construction.) MME needed approximately six acres for its plant. It ultimately acquired a suitable site with 65 buildable acres in Malta Bend. Though the plant was in the town of Malta Bend, for tax purposes it was considered to be on county land. The county offered MME 30 years of no property taxes.

Plant Construction MME broke ground on its plant in late 2003 and completed construction in February 2005. The ethanol plants built by Fagen were almost "cookie cutter" in that one plant was pretty much like another. The plants tended to be built quickly with few surprises or major problems along the way. Each plant, however, was able to incorporate the lessons learned and efficiency gains discovered from previous plants. For MME, part of the construction included building a $1.9 million, 14 mile long natural gas pipeline which it had to maintain.

Plant Operation MME's plant ran 24 hours a day 353 days of the year. The remaining time was for scheduled maintenance. Corn was delivered daily by truck typically carrying 900 bushels each. Its busiest day saw 180 trucks of corn unloaded in an eight hour day. Most of this corn was grown within 60 miles of the plant. About 60% of the ethanol was shipped out by rail, the remainder by truck. A railcar held 28,000 gallons while a truck held 8,000 gallons. Dried distillers grain was shipped by rail and truck. MME had a blender's license meaning it could mix and sell its own E10 or E85, but it had not chosen to do so.

The plant could store onsite approximately 10 days worth of corn and 10 days worth of denatured ethanol. (A lack of ethanol storage industry-wide had hurt ethanol prices because the petroleum industry knew the ethanol producers must sell quickly.) Local farmers and grain elevators had greatly increased their capacity to store corn, perhaps three-fold, between 2003 and 2005 because more corn would be used locally at the ethanol plant rather than shipped out.

MME employed 33 employees but really needed about 37. When MME advertised for these positions it received over 500 applications, mostly from local people. The workforce in the area was highly qualified and the MME positions paid above average wages and benefits compared with typical jobs in the area. Most employees started work at MME a couple of months before the plant began operations to go through extensive training and become familiar with the plant. Utlaut believed that MME's commitment to training made the start up go quite smoothly and brought the plant up to capacity more quickly than some other plants had managed.

Energy price increases, primarily for natural gas, had doubled MME's monthly energy costs from roughly $0.5 million per month to $1 million per month since the plant opened. Approximately one-half of the natural gas used by MME was used to produce ethanol and the remainder was for drying the DDGS. Approximately 90% of the electricity usage was for ethanol production.

MME found the plant to operate more effectively than initially believed (this was common in the industry). By October 2005, the plant ethanol capacity was closer to 48 million gallons per year and it used about 10% less energy. (See **Exhibit 17** for MME plant input data and **Exhibit 18** for plant output data and prices.)

MME's plant output (and also the energy used) was based in part on the moisture content of the corn.[20] If the moisture exceeded 15% it was more difficult to grind, which slowed the production process. To compensate, MME paid full price for corn with a moisture content of up to 16%, but paid a discounted rate for higher moisture corn. Corn higher than 17% moisture was rejected. Farmers could bring the corn to an elevator for drying at their own expense. The plant also rejected corn with aflatoxin, a mold that made the distillers dried grain coproduct unsuitable for animal feed.

MME divided the year into three periods and estimated an average corn price for the period. Farmers received 80% of the estimated price at the time of delivery and the balance was paid at the end of the period based on the actual price of the corn.

Corn had a defined standard weight of 56 pounds per bushel. Actual weight per bushel varied from approximately 50 pounds per bushel in a bad year to 60 pounds in a good year. MME weighed a truckload of corn on arrival, divided the weight by 56 pounds per bushel, and paid for the number of bushels. Thus heavier weight corn was measured as more bushels.

MME estimated that it would lose money if corn prices hit $4 per bushel assuming no major change in ethanol prices. Such a price would not be unprecedented. In the mid 1990s, corn prices had briefly reached $5 per bushel.

Ethanol Sales To sell its ethanol, MME joined an association of 12 ethanol plants that operated similarly to a cooperative to jointly market their ethanol. This association brought greater selling power to MME as well as a level of expertise in the ethanol market. There were also efficiency gains as any ethanol contracts entered into by the association could be met with production from the nearest ethanol plant.

DDGS Sales MME contracted with a marketing company to sell its DDGS feed. MME had initially priced its DDGS a bit lower than it might have in order to get its start in the business. The majority of its distillers grain was sold as DDGS because there were few buyers of wet distillers grain near the MME plant. A major local producer of poultry and hogs could potentially buy a significant amount of dry DDGS. It had been MME's policy to limit the amount of production sold to any one customer unless there was a long-term contract for fear that this would leave MME too dependent on one major buyer.

MME Members' Risks and Rewards Membership in the MME cooperative carried both risks and potential rewards. Members would share in any profits generated by the plant and they were not liable for any debts beyond their initial investment. Further, the plant provided them with an additional market for their corn. Some research indicated that the presence of an ethanol plant raised local corn prices between $0.05 and $0.10 per bushel. Members, however, might not be fully paid for their corn. In the event that the plant experienced a disastrous financial situation, lenders

[20] To a large extent, moisture content of the corn was controllable at the farm level.

would be paid first, and members, who were contractually committed to the delivery schedule, might receive only partial payment on the corn they delivered. (Some early ethanol plants had lost money and during the previous ethanol boom, many failed. In recent years, very few plants had failed and Fagen maintained that it had never built a plant that lost money.)

The Decision

Utlaut looked with satisfaction on what MME had accomplished so far. One MME manager commented that the only surprise encountered was how smoothly everything had gone. The biggest factors in MME's success were favorable prices for corn and ethanol. During its equity drive, MME estimated it would pay $2.30 a bushel for corn and sell ethanol for $1.15 per gallon. Actual prices had been more favorable to MME since the start of production. Most recently, MME was buying corn for $2.06 and selling ethanol at $1.79.

This success made it tempting to grow the company by doubling the plant size. Several other factors also pushed Utlaut towards doubling the plant. First, the existing plant had been designed and built with an eye towards future expansion; not much of what existed would have to change to add capacity. Utlaut felt the plant could double in size for between $30 million and $40 million, far less than the original plant cost. Second, the expansion would come with additional economies of scale. For example, while the initial plant employed 33 people, doubling the capacity would require only three to four additional plant-level employees. No additional management or administrative staff would be needed. Third, Utlaut and many of MME's members believed that the ethanol boom was still in full swing. One month ago, Fagen went into South Dakota on an equity drive and raised $50 million in two nights.

There were also factors that led Utlaut to proceed with caution as he thought about the decision. Foremost among them was whether there was enough corn in the area to supply the plant in a price range that made ethanol profitable, and whether MME's access to corn at favorable prices was limited by its policy to only buy from MME members and commercial grain elevators. Most of MME's members could not double the amount of corn they were providing to the plant. This meant that more corn would have to come from local grain dealers or from new members. MME already purchased corn from each of the four local grain dealers, though it was possible these dealers might be willing to increase the amount they sold to MME. New members committed to supplying MME was another possible source for corn, but MME had promised its existing members that they would receive the first rights to any new shares sold to increase plant capacity. In the area around MME, farmers practiced a normal corn-soybean crop rotation – they planted corn one year and soybeans the next year. This normal rotation would continue at MME's current capacity, but if the plant expanded farmers might choose to increase their corn production.

MME's distribution policy was to pay its members as much as possible for the first few years once any loan covenants had been met. In November 2005, MME decided to pay out everything it could to its members. Members received a return of over 30% on their initial investment. Utlaut knew many members had taken loans in order to buy shares and that they were depending on payment from MME in order to pay these loans. This policy might make it difficult to hold money to reinvest in the plant beyond necessary upkeep.

Utlaut liked the idea of expanding, but he was not yet convinced that this was the right course of action. MME might have to invest in another feasibility study before making a decision. While there was little doubt that ethanol was a growing commodity, the industry had gone through a bust period in the past. Utlaut wondered if that could happen again and what could cause it. He further wondered what would happen to MME if such a bust occurred just as MME was opening new capacity. What would happen to his fellow cooperative members? At the same time, Utlaut was concerned that if MME delayed its decision, another competitor could build a plant in the area, obtain corn commitments from local farmers, and effectively preempt MME from expanding its plant.

Exhibit 1 Income Statement for the Fiscal Year Ended September 30, 2005

	Year to Date	Per Gallon
Revenues		
Ethanol Sales	$38,831	$1.38
Ethanol Marketing Fees	(278)	(0.01)
Distillers Dried Grains Sales	5,814	0.21
Distillers Wet Grains Sales	132	0.00
Distillers Grain Marketing Fee	(114)	(0.00)
Corn Pool Fee Revenue	264	0.01
Total Operating Revenues	**$44,649**	**$1.59**
Cost of Goods Sold		
Corn	$20,357	$0.72
Corn—Tri-period Price Adjustment	1,059	0.04
Denaturant	1,233	0.04
Chemical Costs	1,602	0.06
Electricity	804	0.03
Natural Gas	6,534	0.23
Salaries and Labor—Production	1,184	0.04
Depreciation – Plant	2,250	0.08
Other	218	0.01
Total Cost of Goods Sold	**$35,241**	**$1.25**
Gross Profit	**$ 9,409**	**0.33**
General and Administrative Expenses	$ 2,731	0.10
Income from Continuing Operations	**$ 6,678**	**$0.24**
Other Revenues and Expenses		
CCC—Bioenergy Program	$ 3,326	$0.12
State Incentive Income	4,787	0.17
Grant Income	500	0.02
Railroad Industrial Development	88	0.00
Other	210	(0.01)
Net Income	$15,169	$0.54

Source: Company Document.

Exhibit 2 Balance Sheet for the 12 Months Ending September 30, 2005

ASSETS	
Current Assets	
Cash	$ 8,982
Accounts Receivable	
Accounts Receivable	$ 428
Accounts Receivable Ethanol	3,143
Accounts Receivable Distillers	619
Accounts Receivable Bioenergy Program	1,333
Accounts Receivable State Producer Payment	3,521
Accounts Receivable RR Industrial Development	88
Accounts Receivable Miscellaneous Receivables	1
Total Accounts Receivable	$ 9,133
Prepaids and Hedge	$ 1,423
Inventory	
Ethanol	$ 302
DDGS	47
Corn	510
Denaturant	275
Other	232
Work in Process	418
Total Inventory	$ 1,784
Property and Equipment	56,646
Property and Equipment (net of depreciation)	$54,293
Other Assets	$ 452
Total Assets	**$76,067**
LIABILITIES AND CAPITAL	
Current Liabilities	$ 3,032
Long-term Liabilities	$36,154
Capital	
Contributed Capital	$22,480
Additional Paid-in Capital	(54)
Retained Earnings	(714)
Net Income (Loss)	15,169
Total Capital	$36,881
Total Liabilities and Capital	**$76,067**

Source: Company Document.

Exhibit 3 Energy Conversion Factors

1 gallon ethanol = 6.59 pounds = 83,333 Btu

1 gallon gasoline = 124,400 Btu

1 kilowatt hour electricity = 3,412 Btu

1 cubic foot natural gas = 1,021 Btu

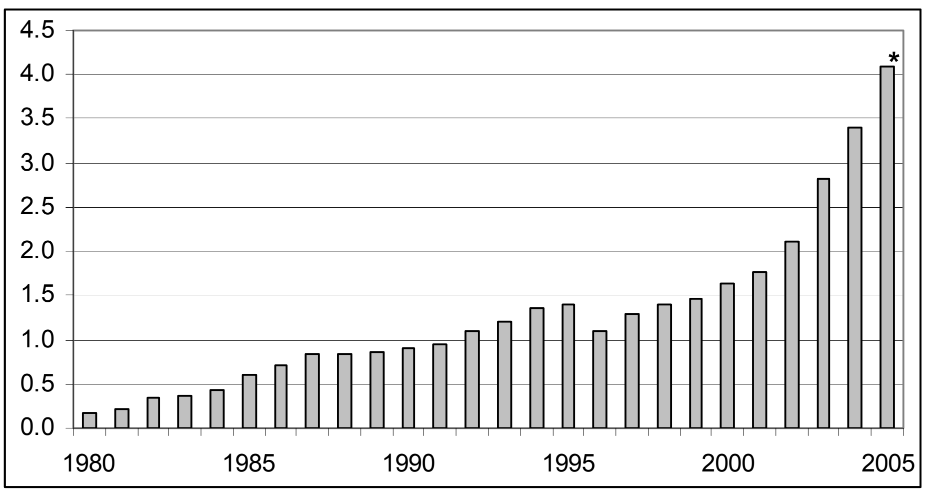
1 pound coal = 10,000 btu

1 barrel = 42 gallons

1 therm = 100,000 Btu

Source: U.S. Energy Information Administration, http://www.eia.doe.gov, accessed October 24, 2005.

Exhibit 4 U.S. Ethanol Production, 1980-2005 (billion gallons)



Source: American Coalition for Ethanol, website http://www.ethanol.org/production.html, accessed October 24, 2005.
* 2005 projected.

Exhibit 5 Ethanol Production by Country (2004, gallons millions)

Brazil	3,989	Germany	71	Philippines	22
United States	3,535	Ukraine	66	South Korea	22
China	964	Canada	61	Guatemala	17
India	462	Poland	53	Cuba	16
France	219	Indonesia	44	Ecuador	12
Russia	198	Argentina	42	Mexico	9
South Africa	110	Italy	40	Nicaragua	8
United Kingdom	106	Australia	33	Mauritius	6
Saudi Arabia	79	Japan	31	Zimbabwe	6
Spain	79	Pakistan	26	Kenya	3
Thailand	74	Sweden	26	Swaziland	3
				others	338
				World total	10,770

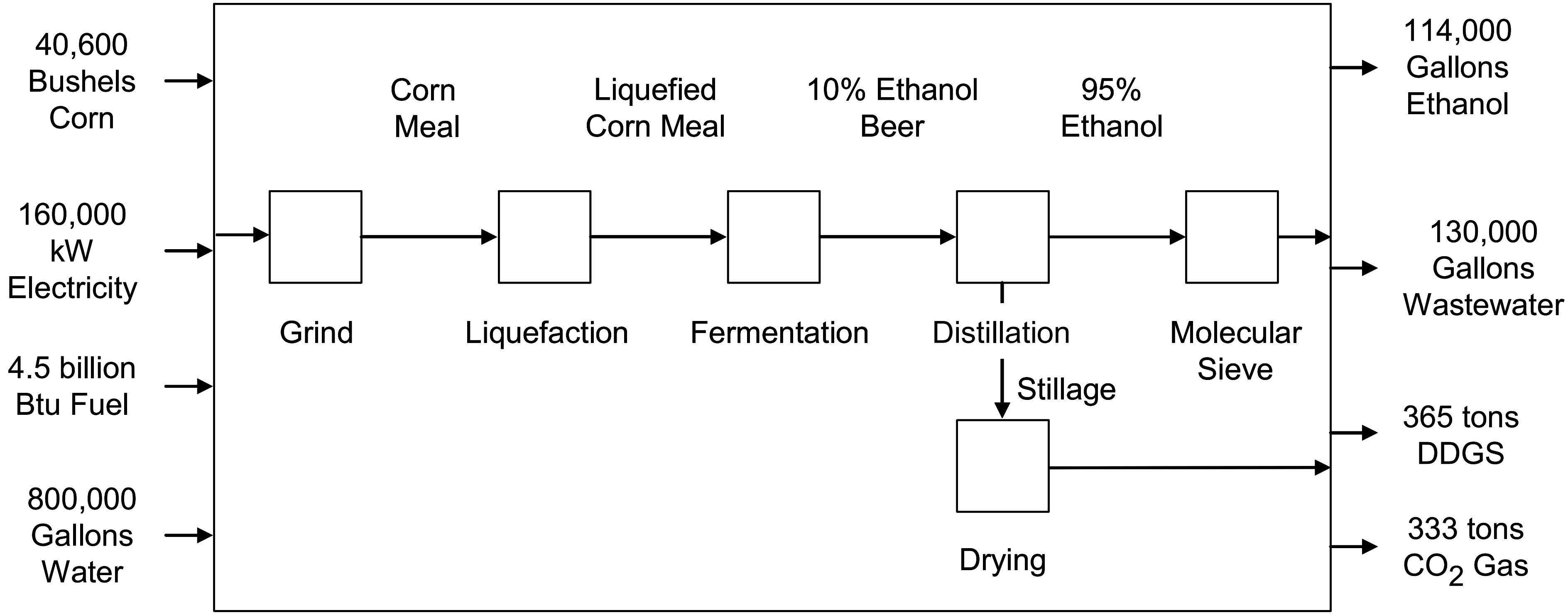
Source: "Homegrown for the Homeland, Ethanol Industry Outlook 2005," Renewable Fuels Association, website http://www.ethanolrfa.org/industry/outlook, accessed October 24, 2005. (F.O. Licht).

Exhibit 6 U.S. Ethanol Production Imports and Demand (gallons millions)

	2002	2003	2004
U.S. Production	2,130	2,800	3,400
Imports			
Brazil	0	0	90
Costa Rica	12	15	25
El Salvador	5	7	6
Jamaica	29	39	37
Total Imports	46	61	161
Exports	Na	na	na
Stock Change	-91	39	-31
Demand	2,085	2,900	3,530

Source: Adapted from Industry Statistics, Renewable Fuels Association, website http://www.ethanolrfa.org/industry/statistics, accessed October 24, 2005.

Exhibit 7 Daily Consumption and Output Data for a 40 Million Gallon Dry Mill Ethanol Plant[a]



Source: Company Document.

[a] Data from MME's pre-production estimates. Actual production data differs.

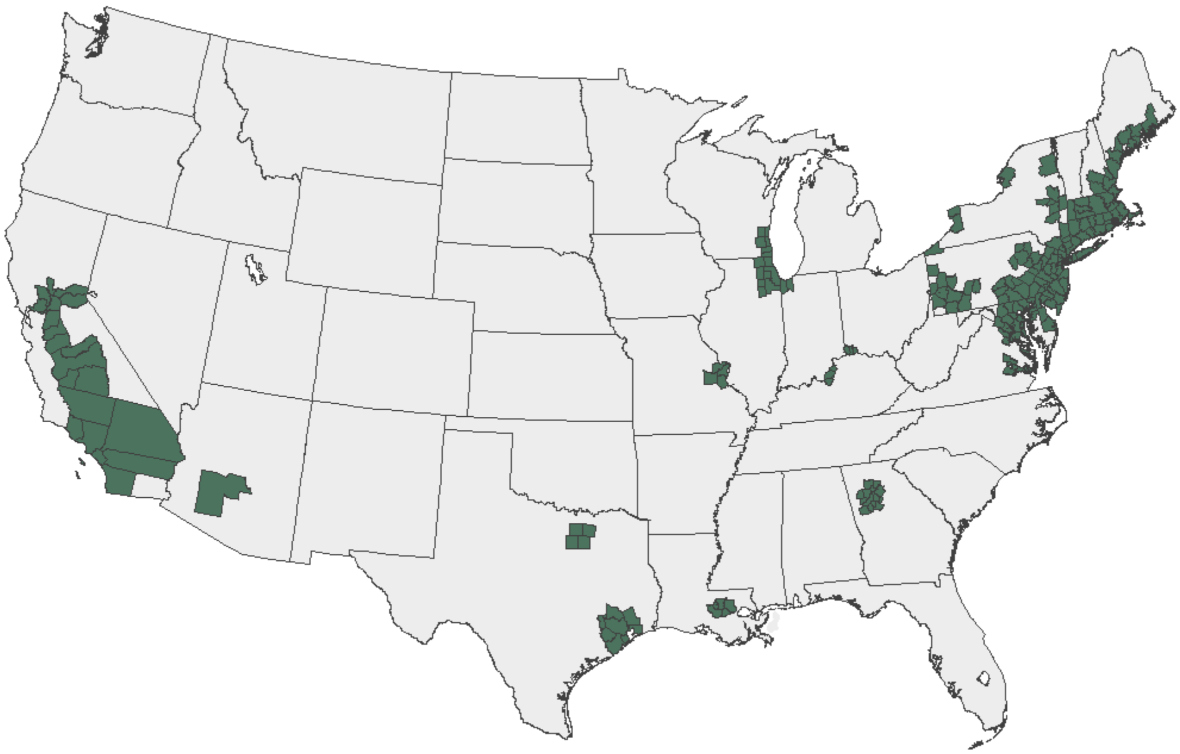
Exhibit 8 Ethanol Production by State[a]

State	Number of Plants in Operation	Capacity (million gallons per year)	Number of Plants under Construction	Capacity (million gallons per year)
California	3	34		
Colorado	1	2	2	82
Iowa	17	707	7	460
Illinois	4	248	1	50
Indiana	1	95		
Kansas	7	179	1	40
Kentucky	2	24		
Michigan	1	40	3	155
Minnesota	13	393	2	99
Missouri	3	105		
North Dakota	1	11	1	50
Nebraska	10	427	1	42
New Mexico	1	15		
Ohio	1	4		
South Dakota	11	424		
Tennessee	1	60		
Texas			1	30
Washington	1	1		
Wisconsin	5	107	1	40
Wyoming	1	5		

Source: Adapted from American Coalition for Ethanol, http://www.ethanol.org/productionlist.html, accessed October 24, 2005.

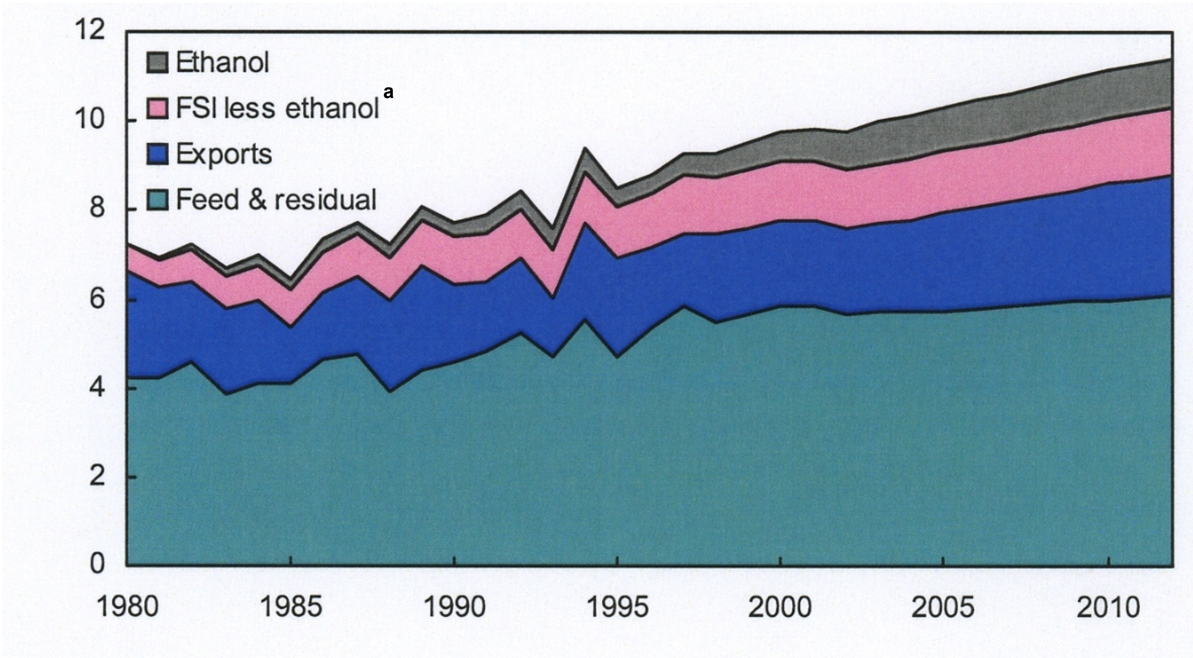
[a.] Does not include Archer Daniels Midland which has seven plants (Iowa(2), Illinois(2), Minnesota(1), North Dakota(1), and Nebraska(1)) producing a combined 1,070 million gallons per year.

Exhibit 9 U.S. Counties with Reformulated or Clean Burning Gasoline Requirements



Source: Adapted from U.S. Environmental Protection Agency, Reformulated Gasoline, Where You Live, http://www.epa.gov/otaq/rfg/whereyoulive.htm, accessed December 5, 2005.

Exhibit 10 Historical Corn Use and Projections (billions of bushels)



Source: USDA Agricultural Baseline Projections to 2012, http://www.ers.usda.gov, accessed October 24, 2005.

[a] FSI = Food, seed and industrial.

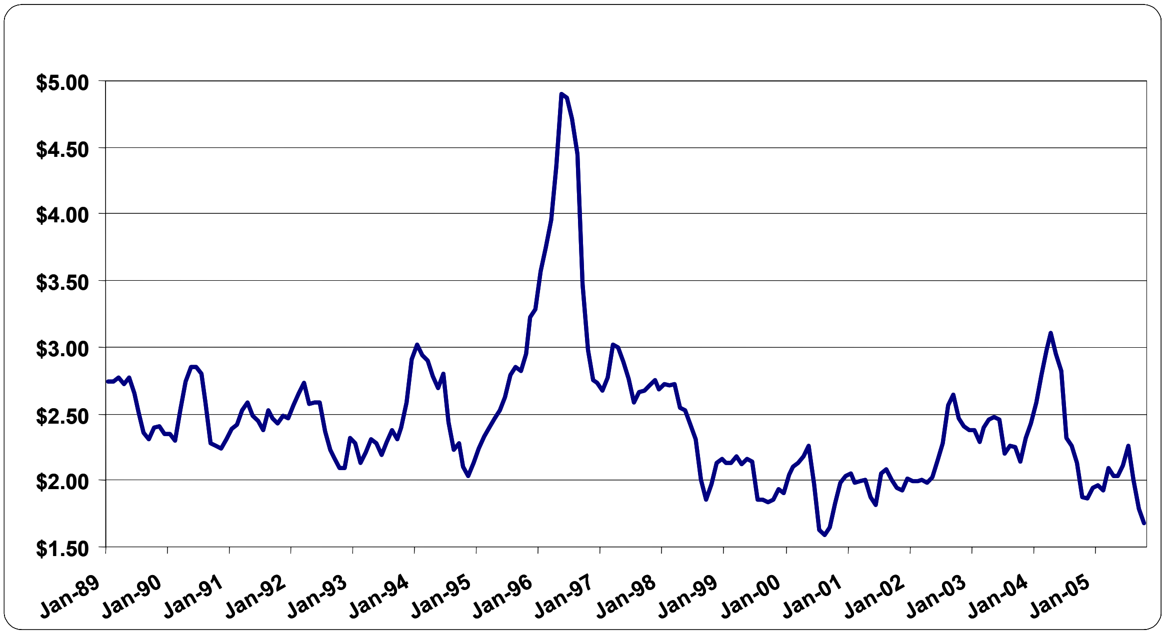
Exhibit 11 Corn Yield and Production by State, 2002-2004

State	Yield (Bushels per acre)			Production (1,000 Bushels)		
	2002	2003	2004	2002	2003	2004
AL	88	122	123	15,840	23,180	23,985
AZ	185	190	180	5,180	4,180	4,860
AR	134	140	140	34,170	49,000	42,700
CA	170	160	175	25,500	22,400	26,250
CO	150	135	135	108,000	120,150	140,400
CT[a]	- -	- -	- -	- -	- -	- -
DE	84	123	152	14,028	19,926	23,256
FL	96	82	90	3,552	3,198	2,880
GA	110	129	130	31,900	37,410	36,400
ID	155	140	170	6,975	7,000	12,750
IL	135	164	180	1,471,500	1,812,200	2,088,000
IN	121	146	168	631,620	786,940	929,040
IA	163	157	181	1,931,550	1,868,300	2,244,400
KS	116	120	150	301,600	300,000	432,000
KY	104	137	152	111,280	147,960	173,280
LA	121	134	135	65,340	67,000	55,350
ME[a]	- -	- -	- -	- -	- -	- -
MD	74	123	153	31,450	50,430	65,025
MA[a]	- -	- -	- -	- -	- -	- -
MI	117	128	134	234,000	259,840	257,280
MN	157	146	159	1,051,900	970,900	1,120,950
MS	120	135	136	63,600	71,550	59,840
MO	105	108	162	283,500	302,400	466,560
MT	140	140	143	1,820	2,380	2,145
NE	128	146	166	940,800	1,124,200	1,319,700
NV[a]	- -	- -	- -	- -	- -	- -
NH[a]	- -	- -	- -	- -	- -	- -
NJ	61	113	143	4,270	6,893	10,296
NM	175	180	180	8,575	8,640	10,440
NY	97	121	122	44,620	53,240	61,000
NC	83	106	117	56,440	72,080	86,580
ND	114	112	105	113,430	131,040	120,750
OH	89	156	158	264,330	478,920	491,380
OK	130	125	150	24,700	23,750	30,000
OR	160	170	170	3,200	5,100	4,760
PA	68	115	140	57,120	102,350	137,200
RI[a]	- -	- -	- -	- -	- -	- -
SC	47	105	100	12,220	22,575	29,500
SD	95	111	130	308,750	427,350	539,500
TN	107	131	140	65,270	81,220	86,100
TX	113	118	139	202,270	194,700	233,520
UT	142	155	155	2,272	2,015	1,860
VT[a]	- -	- -	- -	- -	- -	- -
VA	68	115	145	22,100	37,950	52,200
WA	190	195	200	13,300	13,650	21,000
WV	105	115	131	3,150	3,105	3,799
WI	135	129	136	391,500	367,650	353,600
WY	119	129	131	4,165	6,450	6,681
US	129.3	142.2	160.4	8,966,787	10,089,222	11,807,217

Source: Crop Production 2004 Summary, Agricultural Statistics Board, National Agricultural Statistics Service, USDA, January 2005. Available at www.usda.gov, accessed December 7, 2005.

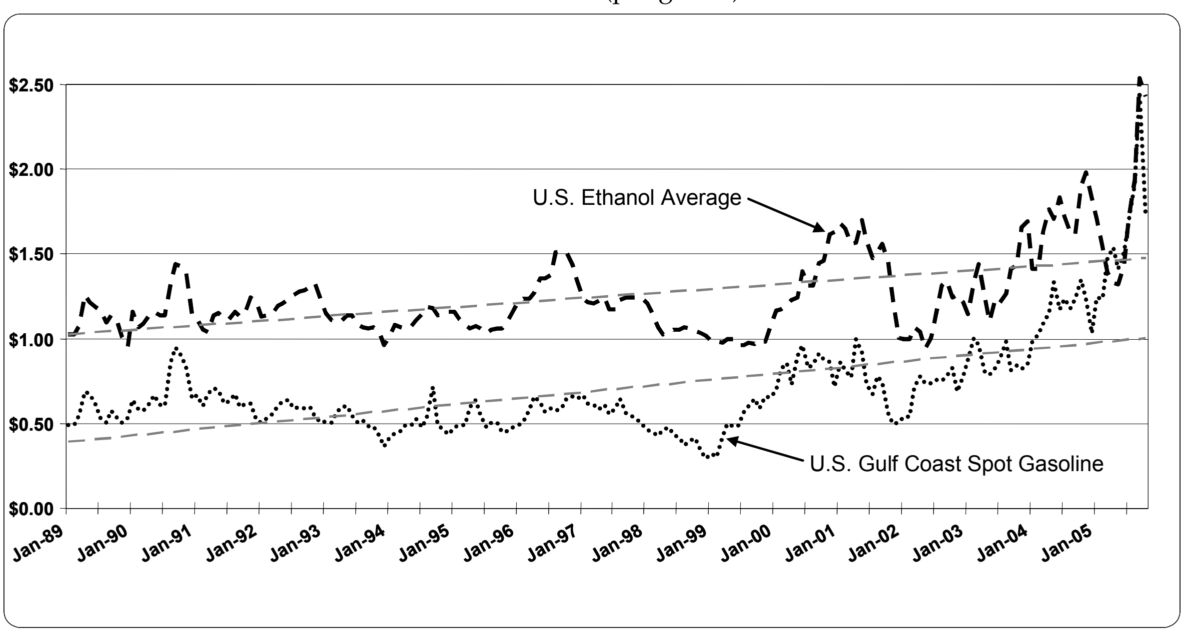
[a] Corn production not estimated for these states.

Exhibit 12 Historical Chicago Board of Trade Cash Corn Price (per bushel)



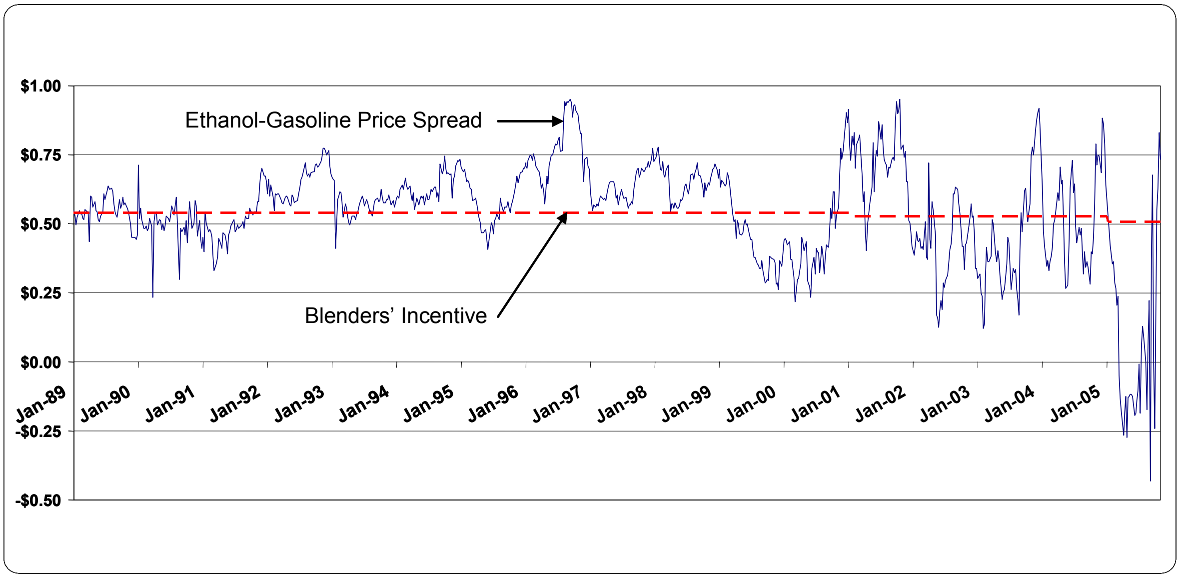
Source: SJH and Company, 2005.

Exhibit 13 Historical Ethanol and Gasoline Prices (per gallon)



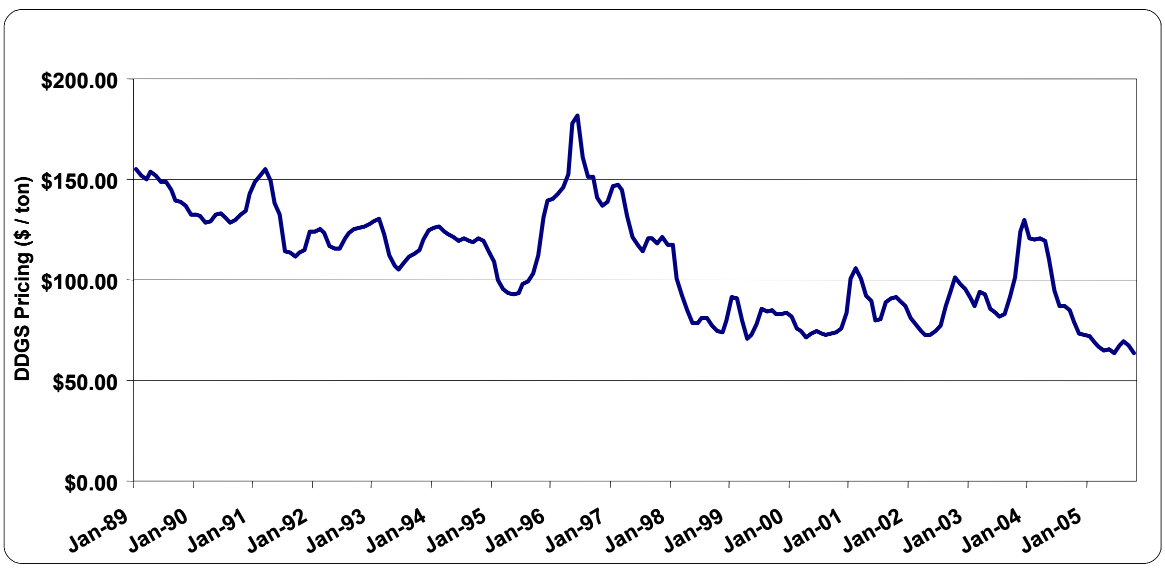
Source: SJH and Company, 2005.

Exhibit 14 Historical Ethanol-Gasoline Price Spread versus Blenders' Incentive (per gallon)



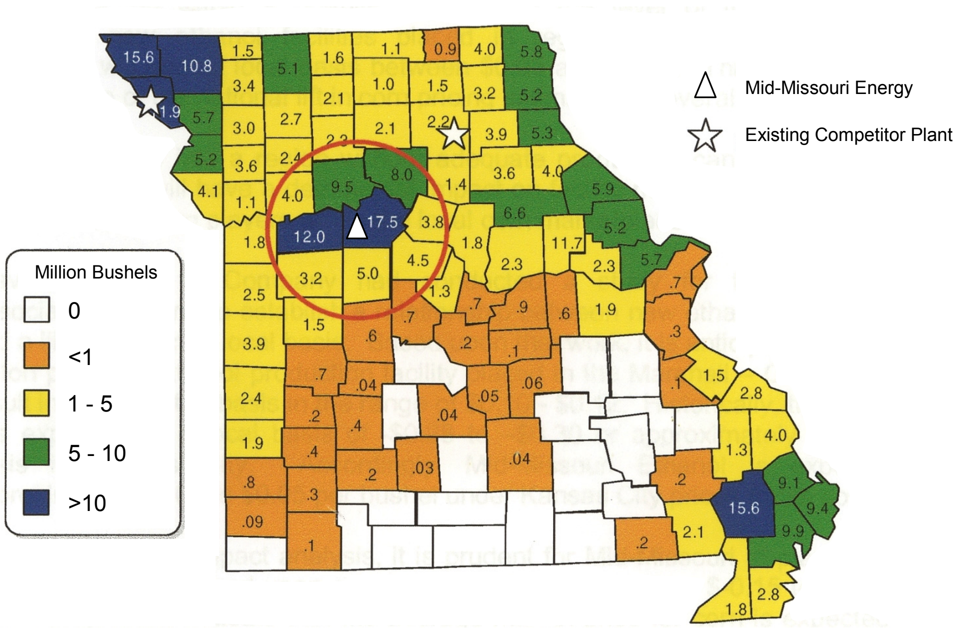
Source: SJH and Company, 2005.

Exhibit 15 Historical Dried Distillers Grain with Solubles Price (Mid-Illinois Markets)



Source: SJH and Company, 2005.

Exhibit 16 Missouri Corn Production by County (million bushels)



Source: Company Document.

Exhibit 17 MME Plant Inputs (2005)

	Corn (Bushels)	Natural Gas (MMBtu's)[a]	Electricity (Kilowatt Hours)	Water (gallons)	Denaturant (gallons)
March	1,347,538	115,104	2,226,840	10,968,005	135,,982
April	1,313,904	112,599	unknown	12,812,937	95,257
May	1,275,793	115,881	unknown	13,998,902	116,983
June	1,393,599	109,420	2,485,298	20,149,936	87,339
July	1,340,535	115,095	2,615,362	15,102,372	98,858
August	1,444,797	121,152	2,722,596	16,167,848	143,701
September	1,392,622	114,855	2,471,003	15,016,892	86,336

Source: Company Document

[a.] MMBTU = millions of British Thermal Units

Exhibit 18 MME Plant Outputs and Prices[a]

	Ethanol (gallons)	Price per Gallon	DDGS[b] (tons)	Price per Ton	Wet Feed (tons)	Price per Ton
March	3,741,480	$1.33	11,364	$55.35	338	$34.05
April	3,591,366	1.22	9,061	75.06	685	35.97
May	3,726,369	1.19	10,985	72.53	635	33.53
June	3,736,019	1.24	10,837	64.03	571	21.82
July	3,573,397	1.35	9,574	82.21	623	44.06
August	4,076,210	1.54	11,708	78.42	473	33.91
September	3,863,162	1.76	12,451	82.16	673	28.04

Source: Company Document

[a.] The price indicated reflects the average amount MME was paid that month.

[b.] DDGS = Dried Distillers Grain with Solubles (feed)