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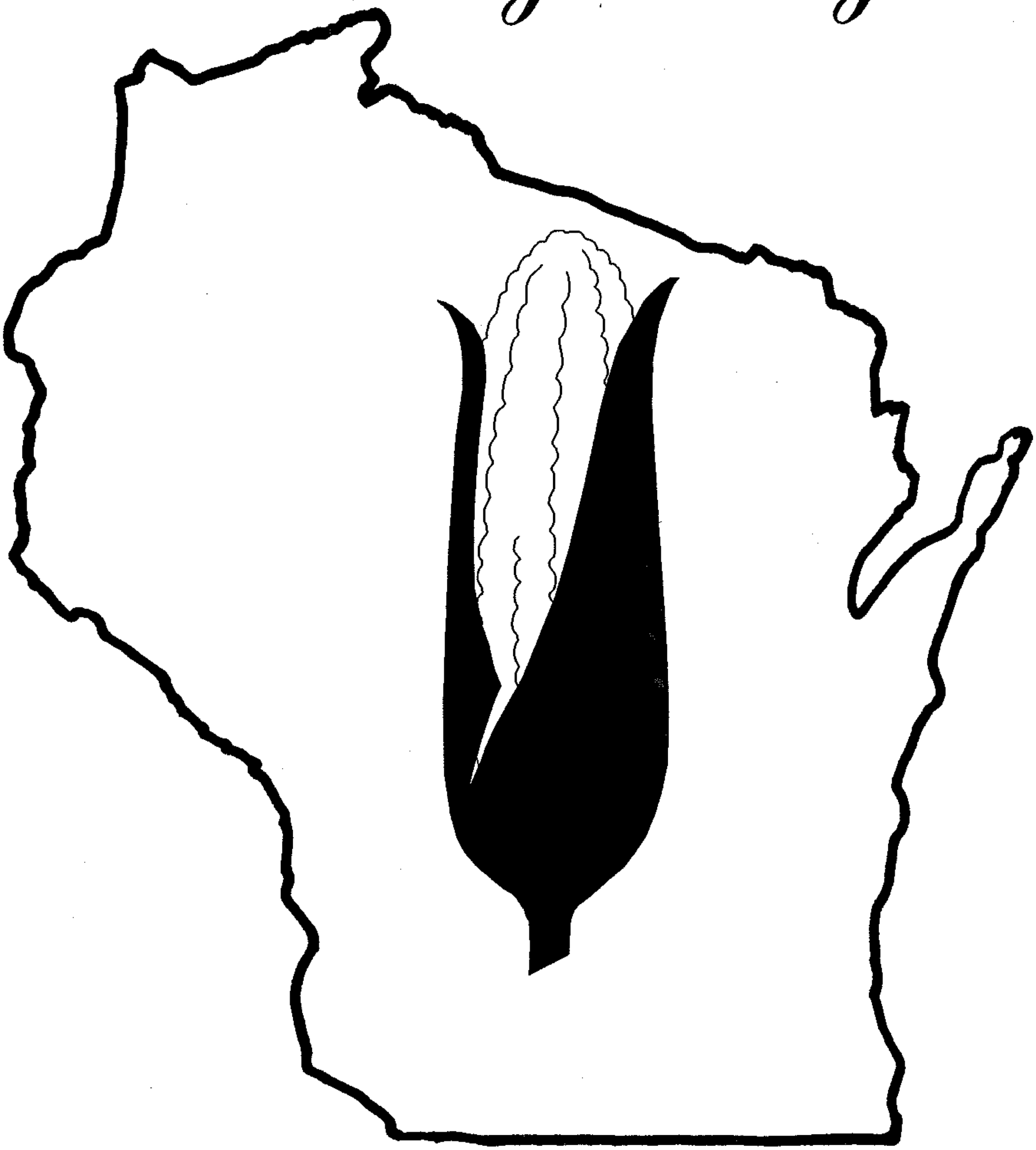
Ethanol Feasibility Study



July 1994

State of Wisconsin
Tommy G. Thompson, Governor

Department of Agriculture, Trade and Consumer Protection
Alan T. Tracy, Secretary

801 West Badger Road • PO Box 8911
Madison, Wisconsin 53708-8911

FOREWORD

The Wisconsin Department of Agriculture, Trade and Consumer Protection (WDATCP) is pleased to have assisted the Wisconsin corn farmers and the Wisconsin Corn Promotion Board in conducting this Wisconsin Ethanol Feasibility Study.

The study finds that Wisconsin can support the production of 100 million gallons of ethanol annually which would require about 40 million bushels of corn. The value-added income and increased employment from ethanol production would be of great benefit to Wisconsin. The Wisconsin Department of Agriculture, Trade and Consumer Protection is committed to encourage the development of this industry in Wisconsin.

Sincerely,

Alan T. Tracy
Secretary

AN ETHANOL FEASIBILITY STUDY

prepared for

THE CORN FARMERS OF WISCONSIN

with the support of the

WISCONSIN DEPARTMENT of AGRICULTURE,
TRADE and CONSUMER PROTECTION

by

Dr. J. Robert Burull

July 1994

EXECUTIVE SUMMARY

Dr. J. Robert Burull

Under the supervision of the Wisconsin Department of Agriculture, Trade, and Consumer Protection -- Marketing Division, and The Wisconsin Corn Promotion Board Executive Committee.

This study was conducted from July 1993 through June 1994. Its basic objectives were to determine feasibility for an ethanol plant(s) construction and operation in Wisconsin, and to locate optimum sites for those plants. Foundation for this study included a broad review of literature and existing feasibility determinations from ethanol activities both within and outside Wisconsin. Expertise and experiences from scientific researchers, owner-manager practioners, and professional consultants and advisors were solicited and included as part of this study's findings.

Research information and data gathered from Wisconsin's multiple resources to support this study's findings include: (1) corn grain growth areas and production (2) livestock and poultry population densities and locations, (3) annual state fuel importation volume and consumption, (4) gasoline and natural gas pipeline distribution locations and capacity, (5) ozone non-attainment area identification, (6) transportation networks, vehicle registration and regional population densities, (7) annual corn grain exports and grain/elevator facilities, (8) water and electrical energy, (9) splash blending terminal locations, (10) corn-to-ethanol energy comparisons, gains, and conversion efficiency, (11) biomass feedstock potential, (12) related business and industry economic impact prognosis, (13) related environmental impacts, and (14) labor and education characteristics for Wisconsin regions.

From the national and state data gathered and the ensuing analysis, all economic, environmental, and personnel resources and experiences point toward Wisconsin's ability to develop a vigorous ethanol industry. Wisconsin has all of the

requisite people and natural resources to produce ethanol, effectively and economically, as a major economic contributor to the State without hindering current corn grain or silage usage and consumption. Further, if Wisconsin does not develop this industry and utilize its vast agricultural resources for an in-state ethanol activity, a likely capturing of those resources by out-of-state growing ethanol businesses will deprive Wisconsin of this potential economic windfall.

Corn is currently, and projected to remain, the ethanol refining industry's major feedstock. Biomass products, however, will become a more competitive feedstock if a comparable production/delivery/commercial infrastructure can be developed. Energy conversions and costs from corn to ethanol versus biomass to ethanol show a positive energy conversion in both cases. Certain biomass elements, such as cellulose, can be more efficient energy conversions.

Wisconsin, although ranked eighth in corn production, and with excellent related resources, is the only midwestern state not to have an ethanol industry or operation dimension. The study concludes that should Wisconsin's legislature decide to create incentives to encourage ethanol production, as all other ethanol producting states have done, investors probably would be forth-coming and willing to risk capital in amounts of $100 to 400 million for either a dry- or wet-mill plant operation(s). Since most operations and analysts suggest that "bigger is better," and more profitable, a Wisconsin plant of 100 million gallon annual capacity is a suggested first target consideration--and entirely feasible. This plant, to capitalize on market diversity, should be a wet-mill operation capable of producing sweeteners as well as ethanol, corn gluten meal (CGM) as well as corn gluten feed (CGF), and technically be able to rapidly "swing" between both ethanol and sweetener conversions to match market opportunities.

The study further identifies four prime location sites. They are the Beloit Industrial Park, the Janesville Industrial Park, Beloit Township, and the Whitewater Industrial Park. All four--because they are located within the heart of Wisconsin's corn production area, population and vehicle density center, transportation networks, great water and electrical reserves, and near splash blending facilities for adding ethanol to gasoline--appear to be the most feasible Wisconsin ethanol sites. Of the four, Beloit is a priority site with Janesville a close second.

ACKNOWLEDGMENTS

This feasibility study is a "value-added" composition with the value coming from a diversity of talented professionals. First, without the invitation from the Wisconsin Corn Promotion Board, to write a funding grant for this study, I would never have been involved. The assistance of Erwin Sholts and Jim Smith of Wisconsin's Department of Agriculture, Trade and Consumer Protection (WDATCP) Marketing Division provided direction and important "first contacts" to help me become acquainted with a list of top qualified people. I was also provided valuable assistance by the Wisconsin Corn Promotion Board of Directors and members of the executive committee Bob Hodge, Joe Henry, Criss Davis, and Bob Karls (Executive Director).

The first two names given to me to contact were Dr. Steve Eckhoff, University of Illinois College of Agriculture Engineering, and Bruce Jordan, Vice President and General Manager for Morris-Energy, Inc., of Morris, Minnesota. I cannot give enough credit for their openness and generosity for providing information and encouragement. Bruce Jordan, many times, graciously gave of his expertise, helping me understand critical industry issues and practical production questions. Two other corn industry leaders, Roger Krejchik and Jerry Franz, who have spent many years working towards an ethanol industry in Wisconsin, gave generously of their knowledge for this study.

Most gratifying was the ready help from industry professionals and pioneers like Mike Bryan, Phil Lampert, and Ralph Groshan. Complimenting the above were dozens of very responsive and helpful people from Wisconsin utilities, grain facilities, community development offices, Federal and State offices, i.e., Wisconsin's Departments of Administration, Transportation and Industry, Labor, and Human Relations. Special thanks to Jeanne R. Burull, Ph. D., my spouse who graciously gave of her time to advise on format, for helping in the editing, and for encouraging me.

I ask that all those people who have helped and whose names do not appear here do not feel their contribution has been any the less, but each a significant piece of the whole. To each and everyone, thank you.

CONTENTS

CONTENTS (cont.)

CONTENT (cont.)

List of Exhibits

List of Tables

Chart I

I. INTRODUCTION -- Genesis of Study

A. Role of WDATCP and Wisconsin Corn Promotions Board

The genesis of this study began through the Wisconsin Department of Agriculture, Trade, and Consumer Protection (WDATCP), whose Secretary is Alan T. Tracy. In April 1993, the Marketing Division approved a study grant to determine feasibility of building an ethanol plant and operation in Wisconsin, and the most appropriate location for that operation. The Wisconsin Corn Promotion Board wanted definitive findings, regarding short- and long-term operational feasibility, which went beyond earlier studies. (See Appendix I, p. 34) The Board, in a February 24 letter, stated the information parameters of such a study's objectives:

* A publication that could be provided to investors.
* Market profile, i.e., demands for ethanol and its by-products
* Co-market demands for corn gluten
* Necessary infrastructures for feasible construction and operations
* Economic feasibility on a state-wide basis
* Available tax credits or requirements
* Required endorsements to build credibility
* Plant location

To take advantage of WDATCP's grant funding for such a study, the Corn Promotion Board contacted and hired Dr. Robert Burull to be the study's project director and main researcher-writer in cooperation with the Board and WDATCP. The grant was awarded to the Wisconsin Corn Promotion Board on July 1, 1993.

The application's objectives and content have been expanded, insofar as possible given the changing nature of corn and ethanol, to confirm feasibility or infeasibility of building, developing, and operating an ethanol plant in Wisconsin. According to the application's "need" section, the study will, among other considerations: (1) "directly reflect environmental realities as they relate to an ethanol plant operation;" (2) "include criteria such as possible site locations, and rate-of-return on investment projections;" (3) "show specific economic impacts on the Wisconsin farmer as well as on the overall

Wisconsin economy;" and (4) "illustrate short- and long-range investment viability." This study will provide a feasibility assessment and produce a final document which can be used as a credible investment guide, or as a financing proposal component.

B. Current Economic and Technology Reasons for Studying Feasibility in Wisconsin

1. Wisconsin Rankings in Corn Production – A National Corn Growers Association publication with 1993 figures, shows Wisconsin ranking 8th among all corn producing states with 216,200,000 bushels of corn produced out of a nation-wide total of 6,344,045,000 bushels. In average-size corn farms, Wisconsin ranked 4th behind Minnesota, Illinois, and Iowa with 48,665 farms as compared to Iowa's leading 83,301 corn farms. In corn acres planted, Wisconsin ranked 7th with 3,400,000 acres produced as compared to Iowa's first ranking of 12,000,000 acres. Because of the 1993 unseasonable weather and related weather stresses, Wisconsin corn production fell from the 1992, 306.8 million bushels to 216.2 million bushels. However, overall national corn production also saw significant declines from 7.475 billion bushels in 1991 to 6.344 billion bushels in 1993 *(Ethanol Work Group, Midwest Regulator, Jefferson, MO.p.1.)*

2. Biomass and Alternative Feedstocks – Corn remains the number one feedstock for ethanol production; but future feedstocks may be lower-cost and with improvement in membrane technology, bacterial fermentation, and coproduct development can eventually emerge. Such feedstocks include short-rotation woody crops like hybrid poplar, and herbaceous energy crops such as switchgrass which can be grown on a wide range of lands and in a variety of climates. Herbaceous crops can be harvested several times yearly.

Cellulose and hemicellulose in wood and grass can be converted to sugars and then fermented to ethanol. The Wisconsin Department of Agriculture and USDA personnel are intensively pursuing joint research activities in feedstock development, conversion techniques, and coproduct development. Some early cost development, for example, has reduced the estimated cost of using cellulosic feedstock from $2 per gallon to about $1.22 *(Industrial Uses of Agricultural Materials: Situation and Outlook Report,* USDA, ERS. Bulletin 663,P. 5. June, 1993). (For further biomass feedstock information, please see Appendix I, B. p. 34)

3. State Importation of Ethanol – In 1993, Wisconsin imported 2.1 billion gallons of gasoline and 125.21 million gallons of gasohol (10% ethanol blend); in 1992 the amount imported was 1.98 billion gallons of gasoline, and 157.65 million gallons of gasohol; in 1991, 1.897 billion gallons of gas and 201.9 million gallons of gasohol were imported; while in 1990, Wisconsin imported 2.009 billions of gasoline and 81.72 million gallons of gasohol. (See Exhibit 1, p. 59)

4. Potential Economy and Environmental Effects

a. National Gain – "Ethanol is an attractive supplement to gasoline for the key reason that increased ethanol use reduces carbon monoxide levels and carbon dioxide emissions. These environmental benefits could lead to increased demand of 2 billion gallons produced per year, and 5 billion gallons by the year 2000. Its increased production improves energy security by reducing reliance on oil imports improving the U.S. export-over-import debt load *(USDA Report No. 667, May 1993)*."

b. County-Municipal Gain – The Corn Refiners Association, Inc., notes in their 1993 *The Corn Annual*, (p.12) that cities like Cedar Rapids, Iowa, and Decatur, Illinois, receive over $6 million in local property taxes, and that corn producing farmers in other communities such as McLean County, Ill., Phelps County, Nebraska, or Kossuth County, Iowa, receive increased corn prices which contribute as much as $9 million annually to county income. All told, according to *Corn Refineries: Benefiting Local, Regional Economics* from *The Corn Annual*, corn refiners purchased $2.5 billion worth of corn last year and affected the sales price of the entire crop by an estimated $2 billion.

c. Multiple Regional Gains – The Minnesota Department of Agriculture shows, in a preliminary report *(Total Economic Impact Analysis of the Ethanol Industry in Minnesota,* 1994) (See Exhibit 2, p. 60)),a distinct economic gain in employee income, property income, total place of work income, total value added, overall employment, total industry output (the sum of all purchases by an industry in its production process), and final demand (the sum of all purchases for final use or consumption).

d. Rural Economy Gain –A recurring argument in support of the U.S. EPA's renewable oxygenate standard (ROS) is that developing the ethanol industry will stimulate the rural economy. That argument is supported by several new dry mill plants being built or designed for Minnesota, Nebraska, and Kansas. North Carolina, according to *OXY-FUEL NEWS,* March 21, l994. p.3, "is taking that argument to a new level by developing three 60 million gallon per year (gpy) facilities with cogeneration capacity. Two of the plants will be wet-milling operations, and the third will be a dry-milling plant." According to Bill Horton, president of DFI, the production "from the plant will be used partly for fuel ethanol and partly for chemical feedstocks such as amino acids." The plants will use natural gas as a fuel for the cogeneration plant to comply with the Clean Air Act requirements. (For other ethanol economic effects and activities. see Appendix I,C, p. 36)

5. Conclusion -- Generally, from a review of literature and observation of current market, legislative, and technological activities and trends, the ethanol industry (based on corn feedstock) has made substantial growth in the past ten years, accelerating that growth and production capacity in the last two years. The EPA proposed rule-making for oxygenates, the inclusion of ethanol as part of the 10% blend as well as the federal incentives, its continuing increasing demand, its net positive economic and energy effect within the state economies, and its promise as a self-sustaining, friendlier environmental fuel over that of traditional fossil fuels continue to spur investment in ethanol as a solid alternative fuel. Despite its critics and risk as a product, still dependent upon incentives for its success, new ethanol facilities at investment values of over $1 billion continue to enter the market. Wisconsin meanwhile, although ranked 8th in corn production, importing 2.07 billion gallons of gas, and/or blending 125 million gallons of gasohol per year, remains the only midwestern state that does not have an ethanol plant operation in place.

II. TECHNOLOGY and PRODUCTION

A. Technology

The conversion of corn into ethanol is accomplished through two standard processes: wet and dry milling. Wet milling accounts for about 60 percent of total ethanol production. Dry-milling plants cost less to build and produce higher ethanol yields (2.6 gallons per bushel versus 2.5 gallons for wet mills). Dry mills, however, produce less value and have less product flexibility to counter market feedstock and coproduct variables. Feedstocks (mostly corn) are the prime source for conversion into ethanol. While the coproducts generated from the dry-mill processes include ethanol, dry distilled gluten (DDGs) and CO2', the wet mill process produces ethanol or sweeteners, corn oil, corn gluten feed, corn gluten meal, and CO2. Other emerging technologies will provide more marketable coproducts over the next few years. (For a more detailed explanation of the wet- and dry-mill processes, please see Appendix II, A, p. 39. Note that each of the steps described offer opportunities to increase or reduce both capital as well as production costs.)

1 Capital Costs -- Technology, processing, feedstock quality, available energy, site location, and size of plant are all part of "capital cost," that is the cost of building the ethanol production facility and its ancilliary components. Costs include building a new plant, modifying existing plants, replacing worn or depreciated equipment, or replacing with more feasibly effective equipment, and rate of return on the initial investment.

a Technology Decision -- The single most important decision made in building a new facility is" what technology to use to fractionate the corn kernel--i.e., dry- versus wet-milling?" (U. of Ill., Ag Engineering. Wet Milling Notes, No. 4, January l991; Emerging Technology in Ethanol Production. USDA, ERA, Ag. Info. Bul. No.663. January 1993). Several "average capital cost" per gallon capacity facilities have been determined by field experiences and quoted by consultants (D. Nichols, Minnesota; USDA researchers; operating owners (ADM); National Corn Growers Association; and private "turn-key" equipment and construction vendors [Delta-T]).

b. Size -- Generally, larger facilities are more profitable than smaller facilities just from an "economy-of-scale" function. Standard dry-milling has less capital investment since (a) there is less equipment involved for preparing the corn for fermentation, (b) the process is less time consuming, (c) it uses less energy and (d) it requires less water than the standard wet-mill process. Total value of capital equipment in a wet-milling plant is higher than in a dry-milling plant because of the added wet-milling recovery equipment needed for removing the germ, oil, and fiber from the corn kernel. In a dry-milling plant, nearly half its capital expenditures are for coproduct processing equipment *(Emerging Technology, USDA. Bul. 663.)*.

c. By-product Value -- As earlier mentioned, dry-milling's major drawback is lack of by-product value. A 2-year study by Eckhoff shows that net feedstock cost (corn minus by-product value) is $0.10-$.15 more per gallon of ethanol produced for a dry ethanol process than for a wet-milling process. This suggests that the conventional dry process must be able to produce ethanol $0.10 - $0.15 per gallon cheaper than the wet-mill process.

d. Cost Parameters -- Cost estimates for wet- and dry-milling capital intensive requirements range from $2.50 to $3.00 per gallon capacity versus $1.50 to $1.60 per gallon capacity for a dry-milling plant. Jim Nichols, an ethanol consultant and advisor to the ethanol industry in Minnesota, states that a rule of thumb for wet-mill versus dry-mill is 2.5 more than dry-mill capital costs. A l988 study by LeBlanc and others puts a general wet mill construction figure of $200 to $300 million for an annual production capacity of 100 million gallons per year; or a general figure of $2 - $3 per gallon of annual capacity. Citing a figure which closely compares to that given by Nichols, Martin Andreas, Archer Daniels Midland (ADM), said at the March l994 International Sweetener Colloquium at Orlando (Milling & Baking News, March 22, l994 p. 24.), that "the cost of new capacity (wet-mill) has increased to $4,100 per day per bushel capacity from $1,000 over the past several years. . . corn milling involves considerable capital intensity . . . a new corn processing plant could be built for $50 million in l970 . . . this sum now would barely cover limited plant modifications."

Andreas noted that construction methods have radically changed with corn plants designed for a daily grind capacity of 60,000 to 100,000 bushels, but with a "set-aside" for up to 300,000 bushels. As a result, he stated, these plants can expand very rapidly. Echoing earlier quoted USDA information, Andreas said ADM has found the "larger the plant, the lower the cost and the more efficient (economy-of-scale) the unit becomes." He also noted that to date, "efficiency has never peaked as plant size increased."

The advantages of wet milling over dry milling are the value of the byproducts and the flexibility to produce finished products other than ethanol. This flexibility is characterized by the HFCS/ethanol "swing capability." In other words, when the market anticipates a higher demand for sweeteners and lower demand for ethanol, a "swing capable" facility can quickly change or modify its production from ethanol to sweeteners. This additional "swing" capacity also means increased capital costs (almost double) for this ability to produce both sweeteners and ethanol at the same time. (For further discussion on production and operating costs please see Appendix II, B. p. 41)

B. Facility/Site Location

A key cost item, not mentioned in the table above, for both feedstock delivery, and end-product(s) distribution, is site location. Siting a Wisconsin facility or optional site location(s) will be discussed later in this study, but site requirements as related to production and operating costs include:

1. An availabile, high quality, reliable feedstock supply which can be purchased directly from the producer. Direct contact with the producer rather than purchasing through a commercial seller usually ensures higher quality corn, and consequently less cost for corn conversion into ethanol and other corn byproducts. An area with a history of stable, high quality corn supply, normally free from insect damage, toxin production, or drought is a high premium location.

2. Transportation--good secondary roads, nearby interstate highway systems, near-by available rail and/or barge facilities, and private or publicly owned pipeline distribution facilities are all necessities for assuring break-even and profitable operations through supply and delivery efficiency.

3. Markets--closeness to markets, i.e., area refineries, shipping ports for direct least expensive carriage to long distance buyers including out-of-state or international export deliveries can make the difference between a successful and unsuccessful operation.

Developing a well organized marketing program according to Bryan and Bryan, Ethanol Plant Development Handbook, and other industrial specialists, is as "critical to the successful operation of a plant as the production process itself." They list several key planning steps in the Handbook (p.47) to help assure a successful operation:

* Establish, to the extent possible, contracts with gasoline marketers in oxy-fuel areas and local markets.
* Review the tax exemption programs in all states.
* Develop a program for an ethanol marketing staff for handling ethanol blends and instructing customers.
* Identify blenders who have on-site storage facilities; contract storage with regional gasoline terminals.
* Explore developing additional "off-plant-site" storage facilities to accommodate seasonal sales fluctuations.
* Secure credit history of buyers, establish sale terms (i.e., cash, net 10 days), and review invoicing practices to assure compatibility with accepted petroleum industry practices.
* Weigh pros and cons of offering top-off loads at the plant (can be difficult for employees).
* Build adequate on-site ethanol storage for potential price appreciation of inventory value for long holiday weekends (no less than 5 days production).
* Maintain a consistent pricing policy, and evaluate pricing on a daily basis using terminal rack price of gasoline, and/or other competitive oxygenates.
* Monitor Gulf Coast MTBE prices to determine ethanol's value as an oxygenate.
* Establish delivery, i.e., customer purchases FOB at plant, or deliver through a common carrier; establish freight rates with common carriers, examine possible rail car leasing.
* Develop an integrated, on-site loading system for rail - truck loading.

d. Utility (energy) sources or cogeneration electric and steam sources providing discounted rates for volume service.

e. Labor--available, of a quality which can be trained. Numbers vary according to size. For example, the Morris - Ag Energy, Inc., employs 25 for a 4 mgy plant, while High Plains, Kansas employs 40 employees for a 20 mgy plant.

4. Utility (energy) sources or cogeneration electric and steam sources providing discounted rates for volume service.

The following Chapter contains detail on specific site requirements and locations for Wisconsin. Please see Appendix III, page 47 for the economic and strategic issues involved, and the underlying economic rationale for Wisconsin developing an ethanol industry.

III. SITE LOCATION AND ETHANOL FEASIBILITY FOR WISCONSIN

A. General Rationale for State Industry

National

1. Increasing National and World-Wide demands for cleaner and healthier environments.
2. Strong national and federal support for ethanol economics, i.e., 54% tax credits, state incentive programs, EPA regulations and requirements favoring ethanol production.
3. Growth and improved profitability for ethanol industry since 1980.
4. Technology improvements for ethanol processing.
5. Growth and increasing demand for coproducts.
6. Larger facilities are more profitable than smaller ones due to economy-of-scale.

State

1. Active Wisconsin State Administration support for ethanol.
2. Plentiful state resources in feedstocks, energy, water, transportation, and labor.
3. Significant State gasoline and gasohol importation yearly to warrant an internal market for internally produced product.
4. Closeness to non-attainment population centers.
5. Potential multiple location site options.
6. Strong farmer support for value added production..

B. Ethanol Facility Site Location Requirements

Earlier under "Production-Operation Costs," several facility-location criteria were listed including available, high quality, reliable feedstock supply, transportation, closeness to markets, utility (energy) sources, and labor. Several more detailed requirements were also identified from the Ethanol Plant Development Handbook. In addition to the Handbook, several other analyses have been done regarding "locating" a site for ethanol production. Several studies corroborate criteria provided by several ethanol operators and owners which can be used for locating priority sites in Wisconsin. Two are Locating a Fuel Ethanol Industry in Missouri, by Donald L. Van Dyne, Dept. of Agricultural Economics, University of Missouri-Columbia, January 7, 1991, and Locating Ethanol Plants in Iowa by Richard T. Gadomski of PSI Process Systems, Inc., Memphis, Tennesse., 1993. Gadomski listed the following "criteria ranking" for a site location:

1. Primary profitability - strategic location
    a. Corn availability and costs
    b.` Coproduct markets
    c. Transportation costs
2. Supporting strategic consideration
    a. Water
    a. Energy costs (electrical)
    b. Labor cost/availability
    c. Concessions/incentives
3. Site Options and Site specific
    a. Site options
    b. Site Descriptions
    c. Site Ranking

1. Primary Profitability--Strategic Location

Corn is the highest item in "Cost of Sales" as well as for "operating cost" breakdowns, followed by labor and energy. Gadomski lists the following breakdowns to further confirm feedstock cost priority:

Table 1

Cost of Sales

Corn	44.4%
Debt Retirement	12.0%
Utilities	7.9%
$.20/Gal Incentive	6.5%
Labor & Materials	5.0%
Chemicals	3.5%
Taxes & Insurance	1.2%
Marketing & Misc	0.7%
Gross Operating Profit	19.6%

Operating Cost

Corn	74.1%
Labor	7.5%
Chemicals	5.8%
Electricity	5.5%
Gas	5.0%
Water & Waste	1.2%

As illustrated, under both cost variations, corn as a feedstock is the highest cost item, which corroborates Van Dyne's statement, "the net feedstock cost is the largest single cost item in ethanol production." Since feedstock cost is determined by both availability and the price, the objective in site locating is to find one nearest to relatively low corn prices with large production volumes.

a. Feedstock

Wisconsin is among the Nation's top ten corn producers, but the past three years' corn production has fallen significantly from 380.8 million bushels in 1991, to 216.2 million bushels in 1993. According to the National Corn Growers Association, this reduction "can be clearly related to the impact of weather conditions on the growing season. Corn markets, paralleling this decline from the 1992 record year, have also seen higher corn prices with January, 1994 Wisconsin at $2.68 per bushel in LaCrosse, $2.89 per bushel in Milwaukee, and $2.78 per bushel in Green Bay."

* The Wisconsin 1993 Agricultural Statistics report compiled by the Wisconsin Agricultural Statistics Service (pp. 24-25), Wisconsin Department of Agricultural, Trade and Consumer Protection (WDATCP), provides "corn for grain" data, district by district, on acreage, yield and production by Wisconsin counties (See Exhibit 7, p. 65). Along with data a Wisconsin corn yield profile map is furnished. By averaging the production numbers per district, a picture emerges regarding those districts' production ability, their ranking, their location within the State, and their comparative production value. Each district is comprised of several counties and is identified as SE (southeast) District, SC District, SW District and the like.

* The top five corn producing districts are prioritized below beginning with the top district:

Table 2

Top 5 Wisconsin Corn Producing Districts (000's of bushels)

District	1991	1992	1993	Total	Ave
SC District	93,790	81,528	59,967	235,285	78,428
SW District	65,913	57,418	41,304	164,635	54,878
WC District	60,702	46,675	34,576	141,953	47,318
EC District	53,991	36,837	21,189	112,017	37,339
E District	28,926	29,092	23,190	81,208	27,069
Total	303,322	251,550	180,226	735,098	49,007
Ave/yr	60,664	50,310	36,045	49,007	49,007

South Central (SC), Southwest (SW), and Westcentral (WC) districts account for 73% of the total 735 million bushels, while the SC, SW, and SE account for 65% of the total 735 million bushels. Another way of assessing location site potential is to compare individual county production. Below is a comparison of the top ten corn producing counties with an average 3-year yield:

Table 3

Top 10 Wisconsin Corn Producing Counties for 1991, 92, and 93

	County	Yield
1.	Dane (SC)	21.88 Million Bushels
2.	Grant (SW)	16.50
3.	Rock (SC)	16.43
4.	Columbia (SC)	12.88
5.	Lafayette (SW)	12.43
6.	Dodge (SC)	10.98
7.	Walworth (SE)	9.99
8.	Green (SC)	8.63
9.	Sauk(SW)	8.31
10.	Jefferson (SC)	7.65
	Total	125.68 million bu/year average production

Of the above 10 counties, six comprise the entire South Central District, while three are from the Southwest District, and one from the Southeast District. The South Central District produces 78.45 million bushels of the total, while the Southwest District produces 28.93 million, and the Southeast District 9.99 million bushels. Dane and Rock Counties, located in the South Central District, are the highest average corn producers within the State. Grant and Lafayette Counties are located approximately 60 miles to the West. The 1990-91, 1991-92, and 1992-93 Wisconsin Statistics corn grain maps (See Exhibit 7, p. 65), graphically illustrate Wisconsin's general major corn producing, or primary ethanol feedstock supply, somewhere within the Dane-Rock County area.

* The U.S. Department of Agriculture, Agricultural Marketing Services, provides a daily trade level summary of grain prices from Wisconsin Country Elevators. The following table is a compilation of prices for No. 2 Yellow Corn for six Wisconsin Districts -- South Central, Southeast, Southwest, Northeast, and Northwest -- for the years 1989 through part of 1994. The price figures shown are annual averages calculated from monthly averages.

Table 4

6-County Average Daily No.2 Corn Price/bu for 1989 - 1994

Year	So. Central	Southeast	Southwest	Northeast	Northwest
1989	$2.37	$2.33	$2.38	$2.42	$2.34
1990	2.30	2.28	2.40	2.30	2.22
1991	2.24	2.23	2.33	2.20	2.16
1992	2.20	2.18	2.22	2.16	2.18
1993	2.19	2.20	2.18	2.23	2.19
1994 (J - M)	2.70	2.72	2.69	2.80	2.70
Ave (w/94)	$2.33	$2.32	$2.37	$2.35	$2.30
Ave (w/o94)	$2.26	$2.24	$2.30	$2.26	$2.22

* From the above table, the addition of the 1994 corn prices distinctly changed the price by almost 10 cents over the 5-year average. To put that change into perspective, the following corn prices were being quoted on May 4, 1994, from both Wisconsin grain elevators and out-of-state processors:

Table 5

1994 Corn Grain Prices for No.2 Yellow Corn—on a Given Day

	Source	Location	Volume/bu Mo	Volume/bu Yr	Price
1.	DeLong Grain	Clinton	827K	4M	$2.54
2.	Demeter	S. Beloit, Ill.	333K	4M	$2.57
3.	Didion	Johnson Creek (Corp. Office-Cambria Mill)	300K	3.5M	$2.57
4.	American Maize	Chicago (Corp.) Hammond, Ind., Wet Mill Processor	2.5M	30M	$2.77(incl frt.)
5.	CPC, International	Chicago	4.2M	50.4M	$2.735 (Incl frt.)6.
6.	Peavey	Dubuque, IA	3.5M	31M	$2.65
7.	Cargill	LaCrosse	833K	10M	$2.69
8.	Cenex	Cottage Grove	291K	3.5M	$2.63

Each of the sources was contacted regarding its price, the volume, and the amount of corn purchased from Wisconsin. Each of the buyers or commodity marketers felt the past three years were not normal years for Wisconsin corn. Grain buyers and operators were reluctant to provide too much information as they felt it was proprietary, but some were helpful when asked about corn bought or shipped from Wisconsin areas.

Delong Grain has elevators in Clinton, Evansville, Janesville, and Sharon, Wisconsin, Kirby, Ohio. It buys its corn from Rock, Walworth and some from Dane County. It ships corn to CPC (Chicago Products Company) in Chicago with an average rail freight rate of $0.15 a bushel, and $0.21 per bushel by truck. Its major competitor for corn in the South Central and Southwest District is Demeter in South Beloit, Ill. It also sells to Krause (ADM subsidiary), an international exporter in Milwaukee, via the Great Lakes--total sales in February, 1994, were 1.5M bushels.

Demeter, located in South Beloit, buys its Wisconsin corn mostly east of Beloit to North of Edgerton, Wisconsin. It ships on the CN & W rail carrier at $0.13 per bushel. Lloyd Smith, manager, says that the last two years have been hard on quality and that consequently they haven't purchased as much as they usually do from Wisconsin.

Didion is one of the largest grain traders in Wisconsin with a major grinding mill at Cambria, Wisconsin. They compete in the market for corn in South Central, Southwestern, and Southeastern Wisconsin. In a normal year, they will trade about 30 million bushels, grind about 3.5 million bushels, and net export, depending upon the markets, from 0 to 100K bushels a month to CPC, American Maize, and others.

American Maize with corporate offices in Chicago, and its wet-mill processor in Hammond, Indiana, usually ships by rail. Its Commodity Manager, Diane Hanekamp, says that when Wisconsin Corn is good, American Maize usually buys about 25% of volume on a monthly basis or approximately 625 to 700 thousand bushels a month. Its main sources are Didion, Delong, and the Dane County Union Co-op at Cottage Grove.

CPC, Internationl buys corn and freights mostly by rail. According to commodities buyer, Marilyn Knapp, CPC, buys from the Southern Wisconsin elevator and grain dealers such as Didion when Wisconsin corn is of high quality.

Peavey, with corporate offices in Dubuque, Iowa, and licensed grain dealers in Waunakee, Prairie du Chien, and De Forest, Wisconsin, competes for corn in the South Central and Southwest Wisconsin districts and ships by barge out of Prairie du Chien.

Cargill, Inc., has river shipping ports in LaCrosse, Wisconsin, and Lockport, Illinois, with other grain elevators and dealerships in Cedar Rapids, Iowa, and Bloomington, Illinois.

Its manager did not provide data, but said that Cargill buys some corn from Wisconsin.

Dane County Farmers Union Co-op, according to its commodity broker, does about 3.5 million bushels of corn a year with most of it coming from a radius of 50 miles, although sometimes buying as far as 100 miles in the Southwest District. Most of its corn is trucked in by the producer from the surrounding Dane County area.

The above grain elevators and processors are among the key corn buyers and traders for Wisconsin corn, especially that corn raised in the South Central, Southwestern, and Southeastern Districts where the production is most intense. In addition to the ones discussed above, many others import corn from Wisconsin, especially Consolidated Grain and Barge with offices in Freeport, Illinois, and its elevators in Hennepin, Illinois, where the Wisconsin corn is shipped. For a complete listing of major Wisconsin Grain Dealers, please see the WGDA, I994 Directory for the Wisconsin Grain Dealer Association, Inc., membership, location, and other related details such as railroad services, river terminals, and functions such as "grain brokers," "terminal elevator," and "grain merchandiser."

The proximity of these elevators and processors to Wisconsin's major corn producing Districts (See composite map--Site Location Indicators--in Exhibit 8, p. 66), indicates intense market competition even without a local ethanol producer(s). Additional corn demand as feedstock for a new ethanol production plant would heighten that demand and impact corn prices.

b. Ethanol/Coproduct Markets -- As indicated earlier, coproduct production and sales are as important profit and loss factors as ethanol. Coproducts from wet mill production are corn gluten feed (CGF) (21%), corn gluten meal (CGM) (60%), corn oil, and CO_2. One bushel of corn yields approximately 13.5 pounds of CGF, 2.65 pounds of CGM, 1.55 pounds of corn oil, and 2.5 gallons of ethanol. The dry mill process produces an average 17.5 pounds of distillers dried grain plus solubles, CO_2 and 2.6 gallons of ethanol.

Locating an ethanol plant close to product buyers to reduce transportation costs, develop reliability, and encourage product as well as resource loyalty is important for profitability. A new ethanol production facility's major disadvantage is establishing markets for its products. The coproduct market is especially competitive. An advantage for a site located in the South Central and Southwest Districts area is its proximity to the cattle and calves and poultry production facilities also found within the same area as illustrated by Table 6 below:

Table 6

1992 - 1993 Cattle - Calf Population for South Central and Southwestern Districts

District	1992	1993	Average
South Central	597,000	599,999	598,000
Southwest	729,000	721,000	725,000

The total Wisconsin cattle and calf population average for the two years was 3.97 million. This population along with Wisconsin's dairy, poultry, and sheep industries provides a strong in-state buying base for ethanol coproducts. Because of an in- state proximity, versus out-of-state coproduct production and sales, a Wisconsin ethanol operation selling to relatively nearby customers should be as, or more, price competitive than other well-established, out-of-state operating producers. CGM, for example, according to Emeritus Professor and renowned Wisconsin poultry scientist, Milt Sunde, has special added value for poultry, versus other grain proteins, in that it is low in lysine and has a special pigment left after processing for which poultry producers are willing to pay more. Large poultry producers such as "Golden Plum" in Arcadia with a 15 million expanding to 30 million poultry population, and the growing duck and turkey operation numbering in millions of birds, are all potent-state marketing targets according to Professor Lew Arrington, UW-Madison Extension Poultry Specialist.

c. Transportation – Wisconsin's interstate highway system, as seen on the Composite Map, Exhibit 8, P. 66) clearly shows I-90 - 94 main arterials along Lake Michigan from Chicago to Milwaukee, through the middle to Rockford, Janesville, Madison, LaCrosse, Eau Claire, and into Minnesota. Main highways such as 151 from Madison to Green Bay, State Highway 51 from Madison to Iron Mountain, Michigan, provide truck transportation easily from every corner of the state for feedstock as well as fuel and coproduction distribution.

* Railways – Wisconsin has 15 railroad companies operating in Wisconsin according to Ronald E. Adams, Chief of the Wisconsin Department of Transportation, Rail Project Management Section. According to "Wisconsin Railroads, January, 1993," an official Wisconsin Railroad Map (See Exhibit 8, p. 66), the major junctions are Janesville (Dane County--SC District) where Wisconsin & Calumet (WICT), Wisconsin & Southern (WISOR), and Chicago & Northwestern Railroads (CNW) intersect and switch. Prairie du Chien and LaCrosse are interconnected with WICT and the Burlington Northern Inc. (BN) to Green Bay and the Fox River Valley, while Madison is an intersection for WICT, CNW, and the Canadian Pacific Rail System (CPRS). Rock, Dane, Walworth, and Grant Counties are all served by operating rail companies. All major Wisconsin, Iowa, Illinois, and Minnesota barge and shipping ports are connected to Wisconsin's corn and product resources by rail-ways.

* Barge-Ship--Wisconsin has 4 gateway ports which serve the corn shipping industry. They are located at LaCrosse and Prairie du Chien with terminal facilities for shipping on the Mississippi River, at Milwaukee for national and international export via the Great Lakes, and at Superior.

d. Wisconsin Petroleum Pipelines--A key element in ethanol production feasibility is availability of gasoline product and unloading terminals where ethanol can be blended easily and economically for distribution to population and market centers. Petroleum products, according to Erik Humlie, Bureau of Petroleum Inspection for Wisconsin, enters (and leaves) Wisconsin via four major pipelines as listed below (See Exhibit 9, p. 67):

1. West Shore Pipeline – Chicago/Indiana to Mitchell Field, Jones Island, and Granville (Milw.) extending to Green Bay
2. Badger Pipeline – Chicago/Indiana to Rockford extending to McFarland
3. Williams Pipeline – Twin Cities to Chippewa Falls extending to Mosinee
4. Koch Refining – Twin Cities to Junction City (Stevens Point) extending to Waupan then to McFarland (Madison) and Granville (Milw.)

According to Humlie, Wisconsin receives an estimated "75% of product entering

Wisconsin from the above pipelines to In-State terminals." By looking at the Petroleum Pipelines Map in Exhibit 8, page 66, one can identify the product pipelines serving Wisconsin and adjacent states, and terminal locations.

In addition to this major supply source, transport delivery (tractor trailer or tanker trucks) originates considerable volume from out-of-state terminals with the bulk entering in the following district locations from those terminals:

Superior	-	terminals in the Duluth area
Hudson	-	terminals in the Twin Cities
LaCrosse	-	terminals in Southern Minnesota (Rochester) and Northern Iowa
Hazel Green	-	terminals in Dubuque and occasionally Central Iowa
Beloit	-	terminals in Rockford and Rochelle, Illinois
Kenosha	-	terminals in Northern Illinois (Des Plaines) and Northern, Indiana (Hammond, Whiting) and occasional loads from Michigan, Ohio, Pennsylvania (these are often specialty loads such as aviation products, racing gasoline, etc.)
Green Bay	-	the last remaining lake terminal in Upper Michigan

According to Wisconsin Energy Statistics, Lake Michigan shipping has decreased considerably, and rail delivery is seldom used anymore although some rail companies will move distillate both into and out of state. Finally, according to Humlie, "The entire Wisconsin border extending from Upper Michigan to Minnesota, to Iowa and Illinois, are blanketed with small jobbers who move product both ways." Humlie states 55 cross-line out-of-state bulk plants are shipping product into Wisconsin.

A 1990-1991 Wisconsin product inspection showed greatest gasoline consumption in Districts #6 (Sauk, Columbia, Dane, Green, and Rock Counties); District #7 (Walworth, Racine, Kenosha, Waukesha, Milwaukee, Washington and Ozaukee Counties); and District #4 with 15 counties running along the eastern, northeastern side of Wisconsin above Milwaukee, Washington and Ozaukee Counties. The significance of these locations and statistics is that the greatest opportunity exists for ethanol product delivery in the same areas where corn feedstock is most plentiful. This is also where the greatest population and vehicle registrations are found.

These area characterictics also favor economic criteria such as transportation, distance, markets, and labor.

A graph, "Selected Statistics for Wisconsin and Metropolitan Chicago" (Exhibit 10), p. 68) illustrates Wisconsin and nearby Chicago's gasoline consumation, vehicle registration, and population densities. This southeast quadrant, an EPA designated ozone non-attainment area, lying within or close by to Wisconsin's major corn feedstock sources, and interlaced with excellent road and rail transportation, is a prime ethanol location site.

e. Pipelines-Natural Gas--As indicated in the "energy usage" statistics, natural gas is a utility component for producing ethanol. Wisconsin has several natural gas distribution and gas service companies as indicated by the *Gas Service Areas in Wisconsin, ANR Pipleine Company. Sept., 1991,* map (Exhibit 8). Per the enclosed map, Wisconsin Power and Light (WP&L), Madison Gas and Electric, and the Wisconsin Gas Company serve most of the South Central District. Northern Natural Pipeline reaches into and through the South Central and Southeastern Districts running through Rock County into Janesville and through the northern part of Walworth County. Marc Nielsen, gas pricing analyst with WP&L with whom Northern Natural has a Wisconsin distribution contract, says WP&L will extend feeder pipelines from its "city-gate" at no cost depending upon the customer's annual volume. WP&L's current pricing structure, according to Nielsen is based on a "Decatherm" measure equalling 1-million Btu's.

2. System Strategies

a. Water-- Wisconsin, thanks to its glaciated history, is blessed with large amounts of fresh underground water, especially in the South Central and Southeast Districts as illustrated by R.W. Devaul Map, *Probable Yield of Wells in the Sandstone Acquifer of Wisconsin,* published by the U.S. Geologic Survey, 1975. According to Wisconsin's Geological Survey Senior Scientist, Dr. Alex Zaporozec, "a vast sandstone acquifer storehouse lies throughout this entire area. . . Both deep and shallow wells," according to Zaporazec, are "literally limitless in their water availability." To reach the deep acquifers, Zaporozec says, "Wells must be drilled to at least 200 feet, but once this deep acquifer is tapped, at least 1000 gallons a minute is assured almost on a forever basis." The shallower wells, from 25 to 150 feet, tap the closer-to-surface waters and will pump about 100 gallons a minute. Dr. Zaporozec says shallower wells are easier and less expensive to tap, but have less water than the deeper water resources.

Should the proposed plant locate near an already available water supply (utility or surface water), then the necessity of digging wells becomes moot, depending upon area commercial and public water requirements and rates. Wisconsin Power and Light, for example, provides water services in the Beloit (Rock County) area. According to WP&L Distribution Engineer, Jeff Hicken, WP&L has in place a systematic approach to working with customers who are in a service area, or who need water line extensions. Wisconsin Power and Light have published water extension rules which provide a sense of what is involved for estimating costs and the pathway for planning water services to a new plant. Related to this general Beloit area is an "improved industrial park site" located at the junction of I-90 and I-43 interstate highways. This area already has water and gasoline service available.

Nan Laufenberg, WP&L Pricing Analyst, states that WP&L currently has a new rate request in to the Public Service Commission asking for "declining block rate" approval for its heavy usage customers. WP&L's 100 cubic ft. of water block rates are currently $1.02 from 50 to 100 cubic ft; $0.53/100 cubic feet for the next 450 cubic feet; and $0.50/100 cubic feet for 500 plus cubic feet. The 4th block rate option would be for "anything over 10,000 cubic feet usage" at $0.30/100 cubic feet.

b. Electricity–Electrical rates vary throughout Wisconsin. However, the lowest rate of all electrical facilities is that of Wisconsin Power and Light. That rate, according to Al Kjellund, account executive at Beloit, Wisconsin's WP&L main office translates into $0.04 to $0.045/kilowatt hour. To receive that rate, a customer must have 200 kwhs of demand per month. Another rate break comes with an "electrical interruptible rate" of $00.3 to $0.035. This rate is predicated upon a minimum of 500 kwhs of demand. WP&L does not have an economic development rate or option available.

Electrical energy consumption, for example, for a projected 15 mgy dry mill plant at an 85% connected load year in an out-of-state operation, is 1,417 kw per hour. At $0.038 per kw per hour the hourly cost is $53.85. One can easily see how a half-cent or a cent decrease in this cost item can significantly change the profitability figure. For example, if the kw cost were $0.03, or $0.008 lower, the hourly cost would be reduced by $11.34 (53.85 - 42.51). Over a year's time (340 operating days at 24 hours per day = 8,160 hours), that would amount to an additional cost of $92,534. By using those same figures for a 50 mgy plant (acknowledging other changes but not calculated here because of a larger plant efficiency), that amount would increase to approximately $324,000.

c. Labor – Labor, along with feedstock and energy, is one of the top three cost components for manufacturing a gallon of ethanol. The State of Wisconsin Division of Health, Labor, and Welfare provides through their District Employment Review publications, excellent labor summaries for Wisconsin. Wisconsin, regardless of its low employment rate, still provides a high quality available work force (State of Wisconsin, Department of Industry, Labor and Human Relations, Jobs Employment and Training Services [DIHLR]) .

Since this study's research already indicates a narrowing geographical focus for an ideal ethanol plant location or site to Wisconsin's South Central, Southwest, and Southeastern Districts, a closer look at the *Dane/Southwest (DSW) Wisconsin and Rock/South Central (RSC) Wisconsin Employment Review* (Vol. 1 Number 10, April 1994) provides a general/specific labor profile for those areas. Both publications for April 1994 indicate that "jobless rates are falling or showing a District-wide decrease." According to the "March Highlights" (Ibid, RSC, p.1), "The civilian labor force in the Rock/South Central District decreased by 2,100 persons, while total employment decreased by 400 from February estimates." Overall, "unemployment rates in the state ranged from a low of 2.7 percent in Dane County to a high of 22.1 percent in Menominee County. Columbia County had the highest jobless rate, while Rock and Jefferson Counties tied for 55th" (Ibid, RSC.p.1).

Labor eligibility and quality are as key as labor available when evaluating labor supply for an ethanol plant location. Wisconsin, through DIHLR's regional Labor Market Planning Information , *Dane/Southwest and Rock/South Central Region Statistical*

Report (Dane and Rock County Job Center. 1993), provides some help in the quest with "JTPA Title II Program Eligibility Projections PY 1994 - 1995, LMPI Dane/ Southwest (p.24); JTPA Title III Program Eligibility Projections PY 1993 (p.25); Characteristics of Job Service Applicants (p. 26); 1987 - 1992 Public High School Enrollments and Dropout" (p. 84); and "1987 - 1992 Public High School Graduates."

This information, plus much more detail from DIHLR's regional Job Service Division's Employment Reviews and the Labor Market Planning Information, shows the following available Dane/Southwest and Rock SC available employee base and characteristics:

Dane Table 7

* JTPA Title II eligibility at 52,739 (1994 - 1995 Projections)
    - 24,821 males; 27,918 females
    - 18,569 youth; 34,197 adults
* JTPA Title III Eligibility (1993)
    - 7,192 estimated dislocated workers
* Job Service Applicant Characteristics
    - Total 9,943 (Males 5,363, Females 4,580)
    - White - 87.5%, Black - 8.2%, Hispanic - 1.9%, Other - 2.4%
    - Ages 16-19 (6.5%); 20-34 (51.8%); 35-44 (24.9%); 45-54 (12.1%); 55-65 (5.0%)
    - Education - 8 grade (1.4%); 9-11(9.7%); 12 (47.0%); 12+ (41.9%)
    - School dropout rates have declined from 1987 - 1992 with a 1991-1992 low of 1.78%;
    - Same 5 - year period shows enrollment drop of 7.1%
    - 12th grade graduates declined 22 percent in same 5-years

Rock Table 8

* JTPA Title II Program Eligibility at 31,354 (1994 - 1995 Projections)
    - 12,815 males: 18,719 females
    - 5,565 youth; 25,969 adults
* JTPA Title III Program Eligibility (1993)
    - Rock, Jefferson, and Dodge County total 8937 eligibility
* Job Service Applicant Characteristics
    - Total 13,335 (Males 7,331, Females 6,004)
    - White 89%, Black 6.8%, Hispanic 2.2%, Other 1.5%
    - Ages 16-19 (5.14%); 20-24 (51.1%); 35-44 (23.3%); 44-54 (13.15%); 55-65 (6.1%); 65+ (1.2%); unknown (.01%)
    - Education -8 (2.76%); 9-11(16.37%);12 (58.65%);12+(22.2%)
    - Production workers and laborers make up the two largest applicant groups with services and administrative support next.

d. Concessions and Incentives – Goodwill and encouragement through economic development assistance, zoning guidance, and overall municipal administrative cooperation and public support are key site location considerations. Fully improved industrial sites with property tax incentives, industrial revenue bond financing, and/or tradeoffs of land for commitments to build are major, but common building incentives. An enthusiastic, understanding, and cooperative community public usually reduces start-up costs by promoting an exciting and spirited atmosphere for employee committment.

3. Site Options and Site Specific

In summary, the following elements give the Dane Southwest District, Rock South Central District, and Walworth County (Southeast District) the edge for a signficant sized (50 plus mgy capacity) ethanol plant: (**a**) feedstock supply and costs, (**b**)nearness to large populated ozone non-attainment areas (Milwaukee, Racine, Kenosha, and Chicago) for fuel product sales, (**c**) excellent transportation facilities and networks, (**d**) an abundance of electrical energy and water, (**e**) a more than adequate labor supply, (**f**) feasible distances to "splash-blend" pipeline terminals, (**g**) eager community economic development personnel with industrial parks and assistance programs in place, (**h**) area poultry and livestock industries, and (**i**) grain and feed distributors for coproduct marketing.

Within this regional area, four locations stand out as potential sites--Janesville Industrial Park, Beloit Industrial Park, the former Caterpillar site in sections #1 and #2 of Beloit Township, and the Whitewater, Wisconsin, Industrial Park. All four are located (See Exhibit 8, p. 66 for composite map) in, or directly adjacent to the South Central District and meet the site criteria parameters developed throughout this study. Following is a brief narrative description of each location, a rating chart quantifying and comparing each potential site's value, and a final prioritization.

The reader(s) should understand, regardless of the final prioritization, that any one site--because of unique, individual facility requirements--might best suit an ethanol plant even though others might seem to have superior ratings. In other words, plant size, plant technology, coproduct synergies, plant ownership relation ships, proximity with other industries, and plant management considerations, all outside of general site provisions, might have comparable or decisive influence on a site decision.

Site Description: **Janesville** – is located in Southern Wisconsin, approximately 12 miles north of the Wisconsin/Illinois border. Janesville is the seat of Rock County Government and is less than two hours driving time from Chicago, Milwaukee, Rockford, and Madison. The industrial park is a short distance from the pipeline terminals, 1.5 miles from the I-90 interchange and Highway 51, a half-mile from Highway 14 and has on-line electrical service, natural gas, water service, sewer service, and possible railroad siding service.

Site Description: **Beloit** – is located just north of the Illinois border approximately 12 miles south of Janesville. Beloit enjoys all of the transportation, pipeline, railroad, electrical and water facilities and resources as does Janesville. Like Janesville, it has looked forward by developing industrial parks through special economic development agencies. The Greater Beloit Economic Development Corporation (BEDCOR) was formed in l971 to help Beloit and surrounding areas provide professional assistance to firms seeking expansion or new facility locations. Its I-90 Industrial Park boasts a state-of-the-art sewerage disposal plant, on-line railroad facilities, electrical, water, and more--including location assistance, marketing activities, and financial assistance (Federal and State program).

Site Description: **Whitewater** -- is centrally located in Southeastern Wisconsin within 80 miles of Chicago, 50 miles from Madison, Milwaukee, and Rockford, Illinois. The *Whitewater Community Development Authority publication (1992 ,p. 1)* states, "In fact, Whitewater's central location also puts your business within a short commuting distance of 10 million people" (p.1). Like Beloit and Janesville, Whitewater has worked toward developing an attractive industrial park to invite in new businesses. Jim Halverson, Economic Development Director for the Whitewater Community Development Authority, also boasts of excellent electrical rates along with a new L.S. Power cogeneration facility as incentives to locate in their industrial park.

Site Description: **Beloit Township** -- potential plant site is located near the Beloit electrical power plant on a 441 acre site formerly owned by Caterpillar. This site is not a developed area but can be furnished with water, electricity, and is near a railroad, within 3 miles of the I-90 Systems, and also is located within Wisconsin's corn growing epicenter.

Chart I

Summary of Ethanol Site Considerations & Factors Influencing Site Location

Influencing Factors	Janesville SC	Beloit SC	Whitewater SE(Walworth C)	Beloit Town SC
Corn Production(bu/50m's)	64.8M	64.8M	64.8M	64.8M
Corn Price ($/bu)	2.33	2.33	2.32	2.33
Cattle & Calves(50 Mi)	1.4333M	1.4333M	1.4333M	1.4333 M
Poultry & Dairy	Yes	Yes	Yes	Yes
Industrial Park	Fully Dvlpd	Fully Dvlpd	Developing	NO
Adequate Space	yes	Yes	Yes	Yes
Space Price	$7.5 -30K/A	Negotiable	$6 - 30K/A	$1500/A
Electricity (Capacity)	See Insert*	See Insert	See Insert	N/A**
Electrical Price	See Insert	See Insert	See Insert	N/A**
Natural Gas	Yes	Yes	Yes	N/A**
Price	See Insert	See Insert	See Insert	N/A**
Labor Supply	200,000	258,000	200,000	258,000
Water Supply	1500 gpm	10" Main	2.4mgd-50%	N/A
Water Price	See Insert	See Insert	See Insert	N/A
Sewerage Disposal	City Pipe	12" Main	1.34 mgd	N/A
Interstate Highways	Yes	Yes	Yes	Yes
North/South	I-90 (1.5mi)	I-90 (.5mi)	I-90 (16mi)	I-90 (3.0)
East/West	I-43 (10 mi)	I-43 (.5mi)	I-43 (15mi)	I-43 (5.0)
Paved Access Roads	Yes	Yes	Yes	Yes
Pipeline Truck Terminal	Yes	Yes	Yes (20 mi)	Yes (5mi)
Rail Lines Present	Yes (C&N)	Yes	No	Yes
Rail Line Access	Potential	Yes	No	No
Barge Facilities	No	No	No	No
Tiff District	Yes	Yes	Yes	N/A
Tax Forgiveness	Yes	Yes	Yes	N/A
Financing	Yes	Yes	Yes	N/A
Quality of Life	+	+	+	+

* Detailed capacity and price information available for Janesville, Beloit, and Whitewater in Exhibit 12.

** Beloit Township has approximately 441 available acres for development owned by Caterpillar.The Greater Beloit Economic Development Corporation (See Insert) can be contacted.

4. Site Ranking – All four sites are relatively even in terms of feedstock supply and coproduct (cattle, calves, dairy and poultry industry populations) potential sales areas. Whitewater is a slight exception in that it is somewhat off center to the east of the core corn production area. All three metropolitan sites--Janesville, Whitewater, and Beloit--have industrial parks and economic development corporations with facilitating staff in place to assist interested industrial park or even extra-park potential buyers and builders. However, all three are at different development stages both landwise and in corporate structure support.

a. Of the three industrial park candidates, Whitewater is perhaps the least developed at this point, although it has many strong assets. It has convincing strength in its new steam generating cogeneration plant, its plentiful supply of water, ample electricity at low rates, a fine quality labor supply, the University of Wisconsin-Whitewater, relative nearness to Janesville's Blackhawk Technical College, and a small, uncrowded rural community character for living and raising children. Its major drawback is an inadequate transportation system and road or rail network connecting the park to the interstate highways or an operating rail system. Whitewater, however, as shown in the drawing in Exhibit 13, has a preliminary city highway by-pass in place for some future date construction.

b. Janesville and Beloit , as seen by the chart, and other considerations, meet all the major criteria and are the two front runners The only significant difference in location between Janesville, and the Beloit site, is proximity to the I-90 and I-43 interchanges. Whereas Beloit has located its industrial park literally next to these two interchanges, the Janesville Park is about 10 miles from that interchange. However, Janesville is only about 1.5 miles away from the I-90 interchange and has ready nearby access to Highways 51 and 14. Although it has a railroad line just within the Park, it does not have any access as Beloit does, and one would have to be constructed to provide service to and from a proposed ethanol facility. Both locations boast excellent water, electrical, and sewerage facilities with Beloit a little further ahead in that category with a new modern sewerage treatment plant able to handle a 100 mgy ethanol wet mill facility today, and which can still be expanded by 50 percent.

For building and operating assistance, both communities are ready, and have in place, many varied tax, tax exemptions, multiple financing and forgiveness plans--as does

Whitewater. Beloit, Janesville, and Whitewater are responsive to negotiations for site property acquisition of 20 to 60 acres, although Beloit is the only entity which so states in their literature. Land and space costs are budget capital items, but generally those costs are considered minor as compared to the actual facility equipment and construction costs. Beloit, per its own literature as well as that illustrated by Wisconsin's DIHLR labor reports for l994, would seemingly have a larger labor force from which to draw than Janesville, depending upon its defined area. Given that both communities are within 10 miles of each other and connected by several highway systems including Interstate-90, labor, although a major consideration for plant location, does not seem to be a significant factor difference between the two.

Beloit's location just on the Illinois-Wisconsin border offers a distinct advantage over the Whitewater site, and somewhat over Janesville's 14 mile proximity to the same border. The potential feedstock supply for an ethanol plant obviously does not stop at the border. The Illinois corn-rich area south of Beloit, fed directly by at least three major highway trunk lines and active railroads, provides a potential if not an actual doubling of feedstock resources. In fact, if one drew a 50 mile radius around the Beloit I-90 and I-43 interchange, the actual feedstock production volume would be well over 100 million bushels per year. Within a 75 mile radius, that amout would almost be doubled. On the other hand, Janesville, located ten miles to the North, is slightly more centrally located to Wisconsin's top corn producing counties than is Beloit.

c. Beloit Township, in which is located the 441 acre parcel known as the Caterpillar site, is undeveloped, but does have a 4-mile proximity to the Interstate highways. Its major shortfall is lack of a sewerage outlet or facility, railroad access, as well as mainline electrical and water facilities. Services from Wisconsin Power and Light could be extended into this area. According to WP & L representatives, the Greater Beloit Economic Development Corporation does work with the Beloit Community in terms of providing promotional and planning support for this parcel.

Each of the parcels is a potentially feasible ethanol plant site depending upon facility size and the varied considerations unique to each build. If one wanted to build a four to maximum 10 mgy dry mill plant, perhaps some of the amenities within the industrial park offerings might not be as important as if one were planning a 100 mgy facility. Acreage size is a variable and not necessarily a limiting factor for plant size.

Consider, for example, Pekin Energy Plant in Pekin, Illinois. This is a major wet mill producer in the United States with over $3 billion yearly production, well over a 100 mgy facility and additional other facilities--all on a 40-acre site. Morris Ag-Energy at Morris, Minnesota, started a four mgy dry mill operation, now near eight mgy with a goal of 15 mgy, on a 20-acre site with more space than will probably ever be used--so acreage, construction, and operating space varies depending upon the plant and management.

5. Site Specific -- Overall, considering all current factors and projections, with expectations for building over the next two years, the following top choice and rankings seem appropriate:

Table 9

Wisconsin Ethanol Site Location Ranking

Ranking	Identity
1st	**Beloit Industrial Park**
2nd	Janesville Industrial Park
3rd	Whitewater Industrial Park
4th	Beloit Township Caterpillar Site

IV. ETHANOL FACILITY BUILDING FEASIBILITY

Prioritizing sites according to feedstock, labor, energy, markets, transportation and many other factors is only part of deciding feasibility. The major issues remaining are--the kind of technology (dry-mill versus wet-mill), and the size (10 mgy to 150 mgy). The available average feedstock supply in the top ten counties surrounding Beloit is 127 million bushels. Wisconsin, according to its agriculture statistics reports, exports about 42 percent of that corn. Using that figure, and not making any assumptions about converting silage corn to grain, or reducing corn grain feeding, and assuming that Wisconsin farmers would sell to an in-state ethanol producer, Wisconsin potentially could supply about 53.3 million bushels for an ethanol operation. Multiplying that figure by 2.5 (wet-mill gallons produced per one bushel of corn) gives a possible 133.35 million gallons per year feedstock potential for a wet-mill operation. Multiplying 2.6 (dry-mill) gallons per a bushel of corn gives a dry-mill gallon per year feedstock capacity of 138.58 gallons.

These numbers indicate that Wisconsin, operating under the same kinds of economic conditions as in other states including neighboring Minnesota, Iowa, and Illinois, should be able to develop positive cash flows, and profits. Wisconsin would seemingly have the same kind of positive economic universal state impacts. Actually, when comparing Minnesota and Iowa plant locations to the potential Beloit or Beloit area, Wisconsin has more advantages in nearness to populated markets and ozone non-attainment areas, equal or superior transportation systems, plentiful energy and labor resources, and vast amounts of water. By using a 100 mgy capacity wet mill plant as a measure, and using the earlier categories (updated to 1992 - 1994 averages) for figuring a rough guesstimate of profitability, the outcome is encouraging:

Table 10

100 mgy Wet Mill Production Cash Flow

Corn		$ 0.93 /gal
Denaturant		0.05
Enzymes		0.04
Chemicals		0.01
Steam		0.08
Electricity		0.06
Water Treatment		0.01
Labor		0.06
Maintenance Materials		0.03
Depreciation		0.09
Taxes & Insurance	0.01	
General & Administrtive		0.02
Total		**$1.39 /gal**

Wet Mill Installed Cost and Income

Installed Cost			$3.00/gal
Revenue			
Alcohol	$ 1.30	(Includes $0.54 Federal Tax; $0.20 State producers incentive)	
Germ	0.19		
CGF	0.21		
CGM	0.15		
CO2	0.02		
Total			**$1.87**
Production Costs	$ 1.31		
Net Income			**$0.56/gal**

A $0.56 net income for a 100 mgy translates to a yearly figure of $56 million. Remember, however, that:

1. Principle and interest still must be amortized over indefinite operating income years.
2. Start-up requires intense up-front capital investment with no return for at least a year if not longer.
3. Marketing must be superb to develop feedstock producer trust and customer reliability and marketing sources to meet cash flow projections.
4. Veteran operating competitors will push newcomers to capture and hold feedstock and product markets.

For comparison purposes, Table 11 below illustrates a 20 mgy dry-mill cash flow:

Table 11
20 mgy Dry Mill Production Cash Flow

Corn	$0.93 /gal
Denaturant	0.05
Enzymes	0.04
Chemicals	0.01
Steam	0.08
Electricity	0.05
Water Treatment	0.01
Labor	0.06
Maintenance Materials	0.03
Depreciation	0.09
Taxes & Insurance	0.01
General & Administrative	0.02
Total	**$ 1.38**

Dry Mill Installed Cost and Income

Installed Cost		$1.38
Revenue		
Alcohol	$1.30	
CO2	0.02	
DDG*	0.35	
Total		**$1.67/gal**
Production Costs		$1.30
Net Income		**$0.37/gal**

*DDG figured at $126/ton x 14 lbs DDG (56lbs/corn bushel x .15[H20 extraction]) - [.70 x remaining 85% or 47.6 dry materials--starch extraction) = 14.28 lbs X $0.063 = $0.90 / 2.6 gallons/bu = $0.35 DDG/gallon revenue.

Under these hypothetical conditions, using average market pricing and costs for two different technologies and mill sizes, an ethanol operation apparently is feasibile for Wisconsin. Although the cash flow net income ($0.56 for wet-mill, and $0.37 for dry-mill), is positive, this is not the whole balance sheet for the operation. Each has principal amortization and interest costs which must be taken against the yearly net income. These amortization-interest costs will vary depending upon the capital structures, investment-investor agreements, municipal funding and funding devices, non-recourse financing agreements, tax forgiveness, and the like. Any combination of joint ventures, equity-to-debt loan agreements, and interest rates and amortization schedules can be incorporated to provide as comfortable a risk zone as possible.

V. CONCLUSION

Wisconsin is capable of supporting at least one 100 mgy capacity wet mill operation, or a combination of smaller wet and dry-mill plants regardless of the open cash flow hypotheses above, considering all factors enumerated and required for feasibility, and keeping in mind that "bigger is better," more profitable, and more able to move with the economic and technology trends. To provide precise proof of an operation's ability to be successful and profitable, a strategy and a business plan, including a complete financial pro forma, need to be developed.

The construction of such a precise entity is beyond the scope of this study. This study's purpose was to show Wisconsin as a feasible or infeasible state for an ethanol plant(s) investment, and to identify the best possible location for that plant(s). To that extent, this study and its findings would seem to provide more than ample preliminary proof to warrant the expenditure for the next step of investing in a complete business plan and pro forma construction, and for **the State of Wisconsin to encourage incentive legislation!**

Given the continued ethanol refining plant growth in neighboring states, especially in near by Minnesota, Iowa, and Illinois, a real and serious consequence exists if Wisconsin does not soon develop its own industry. Wisconsin could lose its opportunity for "value-added" corn products. Further, Wisconsin corn farmers and feedstock resource producers, without a Wisconsin outlet, would likely become contracted by out-of-state expanding refineries. That would mean starting a Wisconsin refinery would be too risky.

The findings above and supportive material strongly indicate ethanol's economic success in other states, its continuing acceptance, and future positive national legislative activity generated by the "Clean Air Act." These successes, along with Wisconsin's rich agriculture and human resources, should be more than enough evidence for the Wisconsin Legislature to overcome its skepticism, to pass needed legislation, and to become encouraging active partners with private industry and local governments to make Wisconsin a self-reliant renewable fuel producer. Wisconsin's time has arrived to convert itself from an uneconomic net fuel importer--completely dependent on foreign oil and out-of-state ethanol producers using state feedstocks--to a major ethanol producing state with positive state-wide economic impacts.

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Appendix I

A. Prior State Ethanol Studies and Operations

Several people and groups have dedicated time and resources to determine feasibility to start an operation. The Wisconsin Corn Promotion Board and WDATCP have continued to provide state agencies, members, and individual entrepreneurs, such as Roger Krejchik and Jerry Franz of Columbia County, with data, statistics, and contacts to encourage these efforts to find funds and to develop their plans for building a plant and operation. Krejchik and Franz were assisted in this quest in l987 by Ray Lenzi, at that time Community and Economic Development Specialist in Columbia County, as well as by an Action Grant from the Federal Development Grant Agency. To date, however, no study has stimulated market-place investors and risk capital commitment to an ethanol plant and operation.

Another study commissioned by the Wisconsin Corn Growers Association in l987 and sponsored in part by WDATCP, was completed by JMA Inc. of Green Bay,Wisconsin, and titled The Prospects for Additional Corn Processing Facilities in The State of Wisconsin: An Overview. This study found Wisconsin (1) had an ample corn supply to support a significant volume of corn processing without jeopardizing existing uses; (2) had an ample market in Wisconsin to support both primary and coproduct output; and that (3) many new products including sweeteners and fuel alcohol made from corn have shown rapid growth; (4) that the energy balance from corn processing has been greatly improved; (5) that corn processing offers the potential for improving the performance of many other state industries; (6) that other corn exporting states are actively supporting research, development, marketing, and development of corn processing firms through direct and indirect incentives; and (7) that Wisconsin should encourage opportunities to increase corn crop income and employment as part of its economic development.

B. Biomass Feedstock Information

Increased ethanol production from more than corn grain feedstock is forecast by many sources including the USDA *(Ibid, USDA, ERS, Bul. No. 663. P.10).* Authors Hohmann and Rendleman predict a number of factors could likely constrain ethanol production only through corn. They cite limited markets for coproducts such as corn gluten feed, and dried grains and solubles, competition for land suitable for corn, and the relatively high cost of corn. They say a doubling of ethanol production from corn would require approximately 350 million additional bushels of corn each year putting upward pressure on corn prices and doubling the supply of coproducts. They note other feedstocks such as potatoes and sugar cane are expensive because they also have a high value as human food products. On the other hand, organic material known as "biomass," available from agricultural, other processes, and/or waste material, does not have these restrictions.

Appendix I (cont.)

This premise is supported by a December 10, I993, Ethanol Study (Phase 1), titled *Ethanol Feedstock Resource Assessment* prepared by the University of Wisconsin-Stevens Point, College of Natural Resources Solid Waste Management Center. This study, headed by Professor Aga Razvi, with help from nine other team members including Jeff Knight, Wisconsin Governor Thompson's appointee on the Governors' Ethanol Coalition Board, and State Transportation Secretary Charles Thompson, profiles a "feedstock survey and economic model" with substantial research and laboratory activities to support its findings. Their summary of feedstock data sources (pp. 4 - 7) identifies "wood residue, whey waste, papermill and paper landfill sludge, old corrugated containers, old newspaper, old magazines, wastepaper, corn, corn stover, corn cobs, and potatoes."

Survey data on these products were obtained and continue to be updated by a "Feedstock Survey," which includes feedstock locations, feedstock generation, the physical, chemical and biological compostion of feedstocks, disposal methods, transportation methods and costs, etc. Determining costs and feasibility, i.e., ethanol yield per ton of raw material, raw material price, and selling price, are part of simulation models to determine "worst and best case" for product usage.

The Alternative Agricultural Research and Commercialization (AARC) Center, at USDA in Washington, D.C., is actively involved, as a risk capital investment fund for taxpayers, in selecting commercially viable projects that can compensate the AARC Center when successful. Two of these projects include converting raw materials, including alfalfa hay, coastal bermuda, straw, and manure, into sugars for ethanol. Another project is experimenting with using non-toxic biodegradable ethanol derived primarily from corn to produce an environmentally friendly windshield washer solvent.

Technically, however, according to USDA's Hohmann and Rendleman, converting biomass into ethanol is still unproven and "too costly for commercial scale ventures." *(Ibid, USDA Bul. 663. p. 10).* Processing municipal solid waste requires more complicated and costly sorting procedures than processing agricultural residues. Biomass conversion varies from conventional corn processing because of the need to break down cellulose and to ferment five carbon sugars. The difference is that a corn kernel is primarily starch, readily reduced into glucose, a sugar that can be efficiently fermented by yeast into ethanol, while most biomass (composed of cellulose), is much more difficult to break down and convert .

Hohmann and Rendleman feel that biomass's promise lies with potentially much lower feedstock cost as compared to corn grain, and environmental issues. For example, municipal solid waste and yard waste feedstocks could be zero or even negative cost. Realistically, regardless of its potential, lower feedcosts from biomass will not occur until a steady supply is insured along with a developed infrastructure for harvesting, storing, and transporting. Biomass's bulk and less developed production infrastructure could lead initially to smaller capacity conversion plants of 10 to 15 million gallons capacity. The USDA report indicates that ongoing conversion developments

Appendix I (cont.)

and continuing industry and research attention to biomass indicate an eventual emergence of plants converting municipal solid wastes and agricultural residues into ethanol. This evolution could invite a larger number of participants than in the corn ethanol industry, including local governments, farmer cooperatives, and small businesses. That in turn means planning for dual conversion of both grains and biomass in future ethanol conversion technology/operations.

For planning purposes, corn remains as the prime feedstock for near-term ethanol facility construction. The reasons for this are: (1) plentiful seed supplies for energy crops, (2) time to educate growers to risk and raise non-conventional crops, and (3) lack of any specific production strategy for these alternative crops–all of which puts biomass years behind corn as a foundation feedstock. Other grain feedstocks can be considered such as milo (sorghum), which is being profitably used in the Kansas High Plains Corporation operation, although it is a more abrasive production stock than corn. Wheat is another alternative, but its starch content varies and it requires an anti-foaming agent and special enzymes. Barley is also more abrasive, meaning more wear and tear on its pumps, piping, and other equipment, and produces only 2.1 gallons per bushel versus corn's 2.5 - 2.6 gallons. *(Ethanol Plant Development Handbook, 1992.* P.24)

C. Other Ethanol Economic Effects and Activities

a. North American Support -- A further indication of economic and growth confidence in ethanol comes from Canada, who is pushing for a projected US$117 million plant to be on-line by the fall of 1996. When completed, it would become the eighth largest ethanol facility in North America. In terms of environment, the July 1993 Council of Great Lakes Governors Final Report, summarizes an environmental sensitive study to compare the effect of air quality in the Lake Michigan region from using ethanol or MTBE in reformulated gasoline (RFG). The results of their study indicate there is essentially no difference in ozone-forming potential between 10 percent ethanol and 11 percent MTBE when blended to the same gasoline.

b. Ethanol Performance -- A report from *The Renewable Fuels Association,* May 1990,Vol, IV. Issue 8., illustrates, through several comparisons, the clean environmental benefits of ethanol blended gasolines on CO_2 emissions, on exhaust hydro-carbon emissions, on nitrogen oxide emissions, and on urban ozone formations.A memorandum dated August 30, 1993, from Dr. Kenneth F. Neusen, Manager of UW-Milwaukee's "Alternative Fuels Program," indicates in its executive summary that the "Drivers surveys continue to be conducted and the results show some interesting and optimistic results. . . In the opinion of those people operating vehicles with clean fuels, the performance generally is considered to be just as good as gasoline, and in several E-85 categories the clean fuel performed better than gasoline . . ."

Appendix I (cont.)

c. Other State Alternate Fuel Activities/Mandates -- Many states--including Arizona, California, New Hampshire, New York, Vermont, Idaho, Washington, Hawaii, Kentucky, and Minnesota--have been legislatively active establishing, increasing, or decreasing incentives for ethanol production and marketing. On March 10, 1993, the Idaho Legislature passed H.B. 627 to increase the state's gasoline excise tax from 18 to 21 cents. The bill subjects only the gasoline portion of the fuel to the excise tax, thus establishing a 2.1 cents/gal. tax incentive for 10 vol percentage ethanol-blended gasoline. In Nebraska, an attempt to revoke the state's ethanol fuel producer-incentive was tabled by the Legislature. Arizona introduced a bill which would expand the date law dealing with vehicles not passing emissions tests, while California introduced a bill requiring the purchase of low-emission and zero-emission vehicles by state and local governmental agencies. Other interesting legislation among states are bills which would establish statewide oxygenate content requirements similar to that which Minnesota adopted two years ago. The Wisconsin and Indiana legislatures have considered such bills. *(OXY-FUEL NEWS, 2/14 & 3/21, 1994)*.

Significant comparative statistics regarding Wisconsin missing a potential ethanol windfall is narratively and graphically described in the Corn Refineries Annual Report, *Corn Refineries: Benefitting Local Regional Economies.* (1993, p. 12), showing how 16 states, many of which have less corn production than Wisconsin, reap in total billions of dollars yearly.

d. National & State Legislative Trends and Activities -- The "Clean Air Act's" reformulated gasoline requirements (supported by President Clinton in a letter to Nebraska Governor Benjamin Nelson) are the key fulcrum which has helped increase the demand for oxygenated fuel capacity and stimulated legislation for ethanol production. President Clinton says his administration is committed to the production and use of domestically-produced renewable fuels and that "ethanol plays an important role in our nation's effort to build the domestic market for renewable fuels" *(OXY-FUEL NEWS,* Feb 21, 1994). This response was in part due to eleven letters from mid-western governors, including Wisconsin's Governor Tommy Thompson, 25 senators, and 96 representatives sent to the President, Vice President, and EPA Administrator in support of ethanol in reformulated gasoline.

In Wisconsin, Governor Thompson initiated an "Alternative Fuels Task Force" to "develop a common-sense, market driven application of alternative fuels in order to reduce air pollution from vehicles." The Wisconsin program illustrates Wisconsin's national leadership in integrating efforts of state and local governments, the private sector, and university researchers in a comprehensive exploration of all fuels. Southeastern Wisconsin is in one of the nation's nine ozone non-attainment areas, an economically vital area of the state ozone nonattainment areas, so clean fuel mandates of the Clean Air Act Amendments will have an impact on those areas.

e. Industry Response – In related activities indicating a continuing positive and testing mode, Ford Motor Company recently expanded its ethanol evaluation program and announced production of its "ethanol-ready" 1994 model year Ford Tauruses. The State of Illinois has awarded more than $300,000 to Ford to fund an employee training and up-grading program at its Chicago manufacturing plant *(OXY-FUEL NEWS,* 3/28/ 94*)*. Currently, the EPA ruling is for 10% blend to be an ethanol additive; and currently on the export market, ethanol continues to be supported by trade with Brazil at $1.13 per gallon, while domestic Gulf Coast spot sales averaged around $1.05 per gallon.

f. Incentive Programs -- An October 1993 article by Larry Johnson, an expert on ethanol, titled *Policy Initiatives for the Fuel Ethanol Industry: A History and Rationale,* provides a history of Federal incentives for the ethanol industry. A second 1993 document, *The Clean Fuels Report, a Comprehensive Coverage of Business, Government and Technology Issues for Transportation Fuels,* J.E. Sinor Consultants, Inc., Vol. 5, No. 5. Niwot, Colorado, provides an objective analysis of transportation fuels including compressed natural gas, liquefied natural gas, propane, methanol, ethanol and biofuels, hydrogen, electricity, and reformulated gasoline. This analysis covers each of these fuels from a general outlook, a legislative explanation, a technically descriptive vehicle application narrative, and a state-by-state description on mandates and incentives.

g. Incentives History (petroleum and ethanol) --Larry Johnson, in Policy Initiatives (p.5), concludes that the "ethanol industry always has depended upon government incentives or subsidies for its existence, and it will continue to for the foreseeable future--making it similar to most of the major industries in this country, including agriculture, health, transportation and certainly the oil industry. He also concludes that the oil industry through the American Petroleum Association has "somewhat successfully created the perception that ethanol production is highly subsidized. . . . neglecting to recognize that most of the air pollution and intervention in the Persian Gulf are subsidies and oil spills and resulting environmental clean up costs can only be their responsibility." Johnson also notes that the oil industry has historically received billions in tax breaks, depletion allowances and favorable exploration and drilling rights on federal land . . . with the total of these subsidies paid through tax forgiveness or other departments of the Federal budget, or through social costs paid by society as a whole.

h. Summary of Publications – The U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, has recently packaged an Alternative Fuel Information publication. It includes a Glossary with well over 100 words and terms, all defined and which are very helpful in reading through alternative fuel or ethanol related publications. Another publication, Alternative Fuel Information Sources, includes names of organizations from Automotive, to Certification and Training programs, to Reformulated Gasoline, to U.S. Department of Energy - Regional Support Offices. This is an excellent document for quickly finding sources. A publication in this package is titled State Alternative Fuel Laws and Incentives.

Appendix II

A. Wet- and Dry-Mill Process -- includes steeping, degerming, gluten separation, liquefaction, saccharification, fermentation, distillation, and dehydration (See Exhibit 3, p.61., milling process graph).

1. First phase -- In each process, the corn is cleaned before it enters the mill. In a dry mill, the milling step consists of grinding the corn and adding water to form the mash. Wet-milling and processing are more elaborate because the grain must be separated into its components. In the wet-mill process, the corn is first steeped in a water and sulfur dioxide solution for 24 to 48 hours to loosen the germ and hull fiber. The germ is then removed from the kernel, and corn oil, a valuable coproduct, is extracted from the germ. The remaining germ meal is added to the hulls and fiber to form the corn gluten feed (CGF) stream. Gluten, a high protein portion of the kernel is then separated into corn gluten meal (CGM), a high-value, high protein (60%) animal feed, while corn gluten feed has an approximate 20% protein value.

In wet milling, only the starch is fermented, unlike dry milling where the entire mash is fermented. The starch is cooked, or liquefied, and an enzyme is added to hydrolyze (break into smaller chains) the starch. In dry milling, the mash, still containing all the feed coproducts, is cooked, and an enzyme is added. In both systems, a second enzyme is added to turn the starch into a simple sugar--glucose (a process called saccharification). Though it usually takes about 24 hours, saccharification in a wet mill may take up to 48 hours, depending on the amount of enzyme used, the feedstock quality, etc. In modern dry mills, saccharification has been combined with the fermentation step in a process called simultaneous saccharification and fermentation (SSF).

2. Second Phase -- The next step in both processes is the fermentation of glucose into ethanol by yeast (the SSF step in most dry mills). The mash must be cooled to at least 95 degrees F before the yeast can be added. The yeast converts the glucose into ethanol, carbon dioxide, and small quantities of other organic compounds. The yeast, which produces almost as much carbon dioxide as ethanol, ceases fermenting when the concentration of alcohol is around 12 percent of volume.

3. Third Phase – Distillation, the most energy consuming process, is then required to separate the ethanol from the alcohol-water solution. This step has two parts--primary distillation and dehydration. Primary distillation yields ethanol that is up to 95 percent free of water. The dehydration step is necessary to bring the concentration of ethanol up to 99 percent. Several technological options are available for the dehydration step. A small amount of gasoline is added to the ethanol to denature (make unfit for human consumption) it before it leaves the plant. The feed coproducts, CGF and CGM in wet milling, and distiller's dried grains and solubles (DDGS) in dry-milling, must be concentrated in large evaporators and then dried.

4. Key process data emerging from the above include:

(a) The energy required to produce 1 gallon of ethanol (43,000 Btu) is less than the energy contained in a gallon of ethanol (78,000 Btu).

Appendix II (cont.)

(b) Each bushel of corn that enters the wet-milling process yields approximately 13.5 pounds of CGF, 2.65 pounds of CGM, 1.55 pounds of corn oil, and 2.5 gallons of ethanol.

(c) The dry-mill process produces an average 17.5 pounds of distiller's dried grain plus solubles (DDGS) and 2.6 gallons of ethanol. Higher ethanol yields are documented in some dry mills, where DDGS yields can be as low as 16 pounds per bushel.

(d) Final dehydration can be accomplished through (i) azeotropic distillation using benzene or another azeotrope, (ii) molecular sieve, (iii) a corn grits sieve, or (iv) pervaporation, the use of a semipermeable membrane.

(d) Recoverable coproducts can be increased with greater efficiency in the "starch to glucose" conversion as well as in the fermentation process. Starch converted to glucose with perfect efficiency would yield approximately 37.4 pounds versus 34 pounds of fermentable sugar in hydrous form. If these sugars were then fermented with perfect efficiency and all water removed with no ethanol loss, the result would be about 2.85 gallons of fuel grade ethanol versus 2.5 gallons from current processes.

(e) Converting the kernel's fiber portion would also add an additional 0.3 gallons versus the present 2.5 Coproducts from the fermentation of five carbon sugars present in the hemicellulose portion of grasses, wood fibers, and even corn hulls offer an even wider range of recoverable coproduct possibilities *(Tsao, Ladisch, and Bungay, 1987; Stevens Point--1994)*.

The above information regarding wet and dry-mill processes was taken from the following sources--Neil Hohmann & C. Matthew Rendleman, Emerging Technologies in Ethanol Production, USDA, ERS., No. 663, January 1993; Kathy and Mike Bryan, Ethanol Plant Development Handbook, Points to Consider Dry Milling, National Corn Growers Association; International Bio-Synthetics, Inc., Renewable Fuels Association, June, 1992.

B. Process Treatments --Each of the mechanical and biological process steps above are continually being improved upon. Ethanol capital and production costs depend on many factors including feedstock cost (corn), value of coproducts, energy and enzyme costs, production plant size, and the level of design and plant technology. Several innovative applications aimed at speeding the process and lowering operating costs continue to be tested and accepted by producers. "Gaseous injection of sulfur dioxide," the use of special corn hybrids, membrane filtration for shortening fermentation time, the development of low cost reliable membranes (allowing higher-value coproducts and lower operating costs), and the improvement of the fermenting organism of the yeasts to help lower energy costs are being implemented and further tested.

Example 1: The University of Illinois has been especially productive in its research regarding all of these areas as reflected in several Wet Milling Notes publications. Lead researcher in cooperation with several other researchers, Dr. Steven Eckhoff, Professor with the Food and Process Group of the College of Agriculture's Engineering Department, has contributed many articles to the industry. Their titles include: Alkali Process for Corn, Wet and Dry Milling (April, 1992); Wet Milling of Corn Using Gaseous SO2 Addition Before Steeping and the Effect of Lactic Acid on Steeping (1992); Wet Milling the 1992 Corn Crop (January, 1993), Effect of Fine Fiber and Added Cellulase on Starch-Gluten Separation (1993); Wet Milling of Maize Grits (1993); and Wet Milling of Soft-Endosperm, High-Lysine Corn Using Short Steep Times (1993). one conclusion is that "application of gaseous SO2 in corn wet milling by treating corn kernels before steeping could significantly save steep time."

Example 2 – An especially inclusive article (S. Eckhoff, *Improving Corn Milling Technology*, May 1991) singles out corn fractionation (milling) as the first important technology of many (fermentation, distillation, dehydration, etc.) for producing ethanol. Included in this article are alternative technologies for milling on the assumption that the "optimum" technology is still ahead. The point made by Eckhoff and echoed by producers like Bruce Jordan (Morris, Minnesota) is that technology costs vary and can be unique for each facility depending upon the methods decided upon: to fractionate the corn (milling versus grinding); to decrease diffusion time (hybrid wet/dry, sulfurous dioxide addition, pressure steeping, steeping of dry milled products, alkali debranning, alkali steeping of degerminated corn); to mechanically separate starch from protein, or chemically extract components or use of enzyme facilitated separation. These plus other alternatives are being used or tested for efficiency, all aiming to reduce the process time for producing ethanol and consequently to reduce production costs. These full text articles are placed in Exhibit 4, page 62 for further review.

C. Production and Operating Costs

1. Production Costs

Ethanol production costs are usually divided into three categories: feedstock, capital, and operating costs. Feedstock cost is a measure of the corn's net cost from which ethanol is produced, i.e., difference between cost of corn and total revenues received from sale of coproducts (CGM, CFM, CO2, corn oil, sweeteners). Net corn costs are dependent upon market volatility of corn prices, and coproduct prices. Other key factors are the corn's "quality" characteristics. Higher quality corn provids a higher starch yield and increases total value of products derived from milling. In a controlled feedstock market, for example, these costs could include premiums paid to corn producers to select improved varieties, and the harvesting and drying techniques.

A test was conducted by the University of Illinois-Urbana/Champaign Department of Agricultural Economics, Agricultural Engineering, and the Illinois Agricultural Experiment Station in conjunction with a Japanese processor, an importing trading company, and a U.S. exporter to see how "air dried corn" (ADC) would benefit the production and product value of the wet-milling process (*Economic Evaluation of Air Dried Corn,* AE-4698. February 1993 p.19.). The study's conclusions were that, "taking all factors into consideration, an increase in the value of wet milling products would range from $0.19 to $0.24 per bushel (dry matter basis), depending on the assumed prices of products, some of the qualitative improvements in value and ease in processing, and the base year used for comparison."

2. Operating costs – are the final component of production costs and include energy, enzymes, labor, management, taxes, and insurance. As in any business, lowering operating costs without lowering efficiency increases feasibility or profitability. Feedstocks are the largest cost component of production, while energy and labor are the two largest operating cost components. Cutting energy costs means using or developing technologies that conserve energy. Siting plants near steam or electrical cogeneration facilities lowers energy costs. Adopting more efficient alcohol dehydration, lowering membrane costs for pervaporation, and computerizing operations to control production processes reduce cost-per-gallon produced. Proper drying of DDGS for quality coproduct sales increases revenue; or eliminating drying by feeding DWG (distilled wet grains) to on-site, or nearby cattle operations, can signifcally lower operating costs. These are a few of many procedures to lower energy and labor costs, and increase revenues.

The following tables reflect an average of samplings for capital and energy usage, and cost percentages for general wet-mill manufacturing costs:

Table 12

Manufacturing Costs

Item	Percent
Labor	23.5% (Includes salaries & hourly workers)
Electric Power	21.3%
Steam	7.2%
Sewage	2.0%
Water	1.5%
Fuel	3.0%
Maintenance	17.2%
ROI/Depreciation	24.3%
Total	100.0%

Note that labor and electrical energy total 44.8% of total manufacturing costs. With steam added the total labor and energy cost is over 50%. Sewage and water costs can be reduced by water recycling innovations developed by such operators as Bruce Jordan for his dry-mill plant in Morris, Minnesota (Morris Ag - Energy Company, Inc.).

Appendix II (cont.)

Table 13

Wet-Mill Capital and Energy Usage

	Capital % of Total	Energy % of Total
1. Corn Handling/Cleaning	10	1
2. Steeping	14	5
3. Milling/Germ Separation	8	5
4. Germ wash/Drying	7	12
5. Steepwater Evaporation	7	15
6. Milling/Fiber Separation	9	8
7. Fiber wash/Drying	12	21
8. Feed Drying w/solubles	2	8
9. Starch Separation	11	5
10. Gluten Dewatering/Drying	9	12
11. Starch Drying	11	8
Total	100%	100%

Speeding the process time and lowering operating costs, for both dry- and wet-mill production, is critical for increasing profitability. New technological innovations mean more down-stream investments. Research, testing, and improvement on each of the processes such as SO2 gaseous injection, and membrane filtration improvements–to reduce saccharification time and to give greater operator control over alcohol production–must be ongoing. Regardless of operating efficiency, feedstock prices impact on end profitability as graphically illustrated by the figures below for the High Plains Corporation, Inc., 20mgy dry-mill operation using sorghum as its feedstock.*

Table 14
High Plains Grain Usage*

	1990	1991	1992
Bushels Used (000)	**4,014**	**4,800**	**6,453**
Cost/Bushel	**$2.11**	**2.34**	**2.55**
Grain Costs as % of Revenue	**42.2**	**45.0**	**51.6**
Grain Costs as % of C.G.S.	**49.4**	**53.4**	**58.3**

Note the rise in cost/bushel from $2.11 in 1990 to $2.55 for 1992 and the increases in grain costs percentages to revenue and corn grain solubles.

An October 1992 study on dry- wet-mill production costs and installed cost and income completed by PSI (Process Systems, Inc., Paul Wood, Senior Project Engineer) provides another per gallon breakdown analysis for a 100mgy (nominal) capacity

* (See next page.)

midwest plant with an operating period of 350 days/year, 24 hours/day. These costs and income statements were figured excluding sales, marketing, distribution, working capital, corporate expense allocations, and other interest charges. Plant capital exclusions included site development, electrical substation and distribution, land, pre-operation labor, chemical first fill, spare parts, plant vehicles, federal and state taxes, financing, anaerobic/ aerobic wastewater treatment, and financing.

The following costs* were used in calculating the dry-mill production costs in Table 15:

Corn	$ 2.25 per bushel
Ethanol	$ 1.20/gallon
Germ	$250.00 per ton
Gluten Feed	90.00 per ton
Gluten meal	2 40.00 per ton
CO2	6.00 per ton
Steam	2.00 per 1000 lb
Electricity	0.03 per KW-hr.

Table 15

Dry Mill Production Costs

Corn	$0.865 /gal
Denaturant	0.040
Enzymes	0.040
Chemicals	0.010
Steam	0.080
Electricity	0.050
Water Treatment	0.010
Labor	0.060
Maintenance Materials	0.030
Depreciation	0.090
Taxes & Insurance	0.010
General & Administrative	0.020
Total	**$1.305 /gal**

*

Braatz, Jonathon P. FAHNESTOCK, Equity Research. High Plains Corp., April 28, 1993

Appendix II (cont.)

Dry Mill Installed Cost and Income

Installed Cost		$1.31 /gal
Revenue		
Alcohol	$1.20	
CO2	0.02	
DDGS	0.45	
Total	**$1.67 /gal**	
Production Costs		**$1.305**
Net Income		**$0.365/gal**

Table 16

Wet Mill Production Costs

Corn	$0.90	/gal
Denaturant	0.04	
Enzymes	0.04	
Chemicals	0.01	
Steam	0.08	
Electricity	0.06	
Water Treatment	0.01	
Labor	0.06	
Maintenance Materials	0.03	
Depreciation	0.09	
Taxes & Depreciation	0.01	
General & Administrative	0.02	
Total	**$1.35**	**/gal**

WET MILL INSTALLED COST AND INCOME

Installed Cost		$1.80 /gal
Revenue		
Alcohol	1.20	
Germ	0.17	
Gluten Feed	0.27	
Gluten Meal	0.12	
CO2	0.02	
Total		**$1.78 /gal**
Production Costs	1.35	
Net Income		**$0.43 /gal**

As indicated from this late l992 hypothetical study and analysis, wet-mill production costs are higher, but so is net income--a difference of $0.10 per gallon--roughly supporting an earlier figure provided by Eckhoff. The year-end net income difference between the two processes for a 100 million gallon capacity facility is $10 million. This figure would then need to be factored against the higher capital investment and financing costs including interest, taxes, and other exclusions.

Appendix III

ETHANOL ECONOMICS-NATIONAL

A. General Data -- According to The National Corn Growers Association, 1993 corn production saw a significant decline from the 1992, 1991 record year as follows:

1991 7,475,480,000 bushels
1992 9,478,914,000 bushels
1993 6,344,000,000 bushels.

State-by-state, according to the National Corn Growers Association's 1993 data, the top 10 states in order are listed in Table 17.

Table 17
Top Ten Corn Producing States

Iowa	1,903,650	bushels
Illinois	1,646,450	
Nebraska	1,066,500	
Indiana	877,590	
Minnesota	741,000	
Ohio	507,650	
Missouri	324,000	
Wisconsin	306,800	
South Dakota	277,200	
Kansas	259,500	

Of these top ten states, Wisconsin, is ranked eighth and is the only state without an "ethanol" production facility; while states like Texas (12th–12 mgy ethanol), Tennessee (17th--4mgy), and Idaho (36th–7mgy) produce ethanol in the millions of gallons per year. One bushel of corn weighs 56 pounds most of which is:

* 31.5 lbs of starch, or 33 lbs. of sweetener, or 2.5 gallons of fuel ethanol;
* 1.6 lbs of corn oil;
* 10.9 lbs of 21% protein feed, and
* 2.6 lbs of 60% gluten meal.

As earlier described, a wet-mill operation produces 2.5 gallons ethanol per bushel, while a "dry-mill" plant produces 2.6 gallons per bushel of corn. The direct sales value of one gallon of ethanol per the OXY-FUEL NEWS, April 25, 1994, edition, was

* $1.05 on the Chicago market,
* $1.08 at the Decatur and Pekin, Illinois, market,
* $1.11in Minneapolis, and
* $1.15 in South Point, Ohio.

Cash grain corn prices for the same period were $2.65 to $2.67 at the Kansas City and Chicago markets; while coproduct

* DDG (Dist. Dried Grains) was at $123.50 per ton,
* CGM (Corn Gluten meal) at $275.00 per ton, and
* CGF (Corn Gluten feed) at $87.50 per ton.

Appendix III (cont.)

Unleaded, premium Gulf Coast Spot gasoline was at $0.49.4 /gal., while Gulf Coast Methanol spot was at $0.67/gal.

B. General Value

1. National – Ethanol, also known as ethyl alcohol, is derived from a renewable energy source (now primarily corn) meaning the source can be reproduced over and over again. Methanol is derived from three non-nonrenewable sources such as coal, oil, or natural gas. National health and economy are directly affected by petroleum oil based products. From a health standpoint, the EPA reports that 50% of all toxic related cancer deaths are caused by gasoline emissions (Renewable Fuels Assoc.). The I990 Clean Air Act was enacted by Congress to reduce carbon monoxide and ozone emissions from gasoline to help reduce both health and environmental threats. Specifically, the Act requires reduction of emission toxicity by 15% by I995, and by 25% by the year 2000 (EPA Requirements, USDA, March ,I993). The EPA further reports "over 100 million people live in excessively air polluted areas with 40% of that pollution traced to motor vehicles."

Economically, ethanol can help reduce the U.S.'s dependence on foreign oil and lower our balance of payments. Approximately 96% of all ethanol is made from corn or about 4% of our domestic corn production (Ethanol Tech Data, Department of Energy). U.S. farmers produced in I993, according to The National Corn Association, 6.344 billion bushels of which Wisconsin produced 216.2 million bushels. Of this amount, approximately 40% was sold off the farm (Wis. Ag. Stats, I993. p. 25). The Association sets the I993 U.S. corn grain value at $16.6 billion with about 59% or 33 million metric tons exported. It also said that one acre of U.S. corn produces 300 gallons of ethanol–enough to drive 4 cars for one year when blended at 10 percent level with gasoline–and displaces 400 gallons of imported oil.

At 2.5 gallons per bushel, the USDA states that 2 to 3 billion gallons of corn alcohol would require about one billion bushels and could be accomplished "without disrupting current markets." One billion bushels of corn would "add $13.4 billion to the country's gross national product; create 273,000 new jobs; increase consumer income $3.8 billion in new plant investments (Report to U.S. House of Representatives Committee from GAO)"

According to the I990 GAO, ethanol production will increase corn demand by nearly 6% and corn prices by about 15% by I997. Based on these figures as well as on the increasing consumption of gasohol – I86,384,000 gallons increase from I991 to I992 (I992 Highway stats, Federal Hwy. Adm., USDOT) – added value from ethanol production will continue to increase with the following overall economic impact:

* reduce annual oil imports by 270 million barrels,
* prevent offshore exploration of $4 billion,
* provide more new domestic jobs,
* clean the vehicle emissions in all non-attainment areas, and

Appendix III (cont.)

* still provide enough corn to meet domestic and export corn demand for both food and feed needs (ADM).

Other USDA statistical estimates show further "value added" impacts to the national economy and specifically to rural America by ethanol's continued production growth (GAO):

* 1-billion corn bushels converted to ethanol creates $340 million direct farm income.
* Each dollar generated creates another $3 in economic growth.
* 1-billion corn bushels converted will increase 'agricultural output' $2.6 billion and generate industry output of $6.2 billion.

The USDA further estimates that "each 100 million bushels of corn converted to ethanol raises corn prices 3 cents per bushel." Converting a little over 1 billion bushels of corn to ethanol would raise prices 36 cents per bushel higher than otherwise and result in farm income of $2.4 billion on an 8 billion bushel crop (USDA,GAO). Finally, because ethanol burns cleaner and clean air improves health, the 44 non-attainment cities with carbon monoxide levels above EPA limits would be able to reduce carbon monoxide to acceptable levels--a dramatically positive value added by corn converted to ethanol.

2. Assessing Wisconsin Value --Projecting the value and economic impact of the above national figures to an ethanol production industry in Wisconsin can perhaps be best described and visualized by reviewing The Economic Impact of the Ethanol Industry in Minnesota: Present Situations and Future Opportunities (January 1994 Updated Report prepared by the Market Development and Promotion Division, Minnesota Department of Agriculture).

a. This report indicates that ethanol consumption in Minnesota has increased seven-fold since 1988 to a projected 115 mgy in 1993. According to the study (p.1), "ethanol-blends accounts for 60 percent of all gasoline sold in the state," and the ethanol market "gained remarkably in November of 1992, under the oxygenated fuels requirements of the Federal Clean Air Act." The down side of these figures is that Minnesota only produced 38 mgy in 1993, but projects a rise to 77 million gallons by 1995. Wisconsin, which produces no ethanol, consumed in 1993, according to the Federal Highway Administration, 2.068 billion gallons of gasoline, and 125.2 million gallons of gasohol. Less gasohol was consumed in 1993 than the 157.6 million gallons in 1992, or the 201.9 in 1991

b. The analysis identifies several major financial benefits of a 100 percent market penetration by ethanol blends and an overall economic impact per the categories below *(Ibid., Economic Impact.[p.1])*--(figures vary between wet and dry mills):

Appendix III (cont.)

Table 18
Minnesota Economic and Fiscal Parameters

Balance of Trade	(Dollars saved on imported oil)	$100 million/yr
Value Added	(Value of ethanol & by-products less value of corn)	$140-174 million/yr*
Jobs & Payroll	(Incl. construction & service jobs)	$111-135 million/yr
Capital Investment	(Plants, equipment, design, etc.)	$300-400 million
Fiscal Impact	(Tax revenue minus fuel subsidies)	$19-21 million/yr**

Equally impressive, according to the study (p.3), are the following benefits that would accrue to Minnesota and its citizens from an expanded 200 million-gpy ethanol enterprise:

* A $300-400 million (difference between dry and wet mills) net capital investment in plant construction and equipment.
* 4,597 to 5,576 new jobs (difference between dry and wet mills) which include all production, construction, and support/service jobs.
* A total annual payroll of $11 - 135 million (difference between wet and dry mills).
* A State benefit from the total multiplier effect of $431- 475 million for all economic sectors including agriculture, manufacturing, transportation, wholesale and retail trade, services, utilities, finance, insurance, & real estate.

Especially important is a showing of a "break-even" point--where tax revenues generated by the ethanol industry exceed producer subsidies, and where approximately 33 percent (660 million gallons) of the gasoline sold in Minnesota contains an admixture of 10 percent ethanol (66 million gallons)--See Exhibit 5, p. 63). For a non-ethanol, but corn-rich producing state debating the issue of incentives, i.e., Wisconsin, the Minnesota projection, based on an on-going growth industry with steady production and revenue increase, provides a positive model to encourage a new self sustaining industry based on renewable resources.

c. Minnesota is also a "crop rich and energy poor state"*(Ibid.,Economic Impact. p. 4)*. This acknowlegment was borne out by the petroleum industry's crises during the Gulf War. Minnesota (as every other state) was vulnerabile to market dislocation with consequent negative impact on the farm segment because of higher petroleum prices without a counterbalance which "ethanol-from-corn" prices might have provided. According to the MDA report, "If ethanol production is not dramatically increased in Minnesota,...we will face the inefficient reality of exporting two-thirds of our corn as a raw commodity, while importing ethanol from neighboring states."

* (Includes ethanol, gluten feed and meal or DDG, corn oil, etc.)

** (Includes balance of Minnesota taxes paid by ethanol producers above the statutory $10-million ethanol incentives, and $40 million tax credits to gasoline blenders and marketers.)

Appendix III (cont.)

The MDA report recognizes the irony in the above scenario in that Minnesota has lower corn prices than either Illinois or Iowa. Minnesota feels, and indeed is proving, through its continued support of the in-state ethanol industry, that "it has the opportunity to add value to its most abundant crop, create jobs, stimulate rural economic development and expand the tax base by encouraging the agricultural processing industry." (p.5)

Earlier in this document, reference was made to the differences between wet-mill and dry-mill by-products, construction and operating costs, and revenues. The MDA notes that its study analysis only includes "the ethanol portion of wet mill (Marshall, Minn.–Minnesota's largest wet-mill operation) production which in reality represents only one-third of bushels of corn processed and income generated by wet mills. The study notes that the wet mill also produces equal amounts of corn starch and sweeteners, generating twice as much economic benefit as the ethanol alone but which were not calculated in the analysis" *(Sue Ye, Program Leader, Market Opportunity Research, MDA).* In 1993, 84% of the 38 million gallons, or 32 million gallons of ethanol production in Minnesota, were produced by wet-mill process.

The MDA study also provides an interesting ethanol production comparison for Minnesota with Illinois and Iowa which indicates the abundant corn reserves in each of these states and by interpolation Wisconsin's ability to become an ethanol producer without disrupting its farming feedstocks. The figures quoted are for 1991 as follows:

Table 19

3-State Corn Processing/Ethanol Production

State	Yield Bu	% of Corn Crop Processed	Amt. Of Bushels	% Ethanol Processed	% of Natl Production
Illinois	1.177B	34%	400 million	19%	49%
Iowa	1.427B	18%	250 million	8%	25%
Minn	720 M	2%	15 million	1%	2%

As earlier mentioned, Minnesota's ethanol sales have increased 7-fold since 1988 and the reasons are seemingly due, according to the MDA report, to extra-economic factors–mainly heightened consumer demand triggered by positive state legislation, vigorous educational efforts of state agricultural interests, and the Minnesota Ethanol Commission. Consequently, Minnesota's ethanol fuel production from Minnesota grains has not kept pace with the demand as indicated by the figures cited above. (See Minnesota Ethanol Study Impact graphs in Exhibit 5, p. 63.)

d. The Minnesota Department of Agriculture's study provides a strong persuasion that ethanol and increased ethanol production, in the light of demand, economics, environment, and growing biotechnology, are the answers for improving Minnesota's rural farm economy as well as that of other corn producing states. That assessment is further borne out by a January 1994 *"IMPLAN Analysis: Total Economic Impact of the Ethanol Industry in Minnesota (Impact Report #906. Minnesota Agricultural Department)."* This report (Exhibit 6, p. 64) illustrates the positive effects on randomly selected Minnesota industries (manufacturing, construction, mining, agriculture, forestry and fisheries, transportation, communication and utilities, trade, government, services, special sectors) for each $1 million worth of ethanol and by-product production.

Appendix III (cont.)

The graph illustrates:

* final demand (sum of all purchases for final use or consumption);
* total industry output –(sum of all purchases by an industry in its production process);
* total payroll–(includes wages, salaries,and benefits paid by local industries);
* proprietary income–(income from self-employment, corporate income, rental income, interest, and corporate transfer payments);
* total place-of-work income–(sum of employee compensation income and property income);
* total value added–(amount added to intermediate costs of goods and services, i.e., sum of employee compensation, proprietary income, indirect business taxes [sales and excise taxes], other property income); and
* employment (number of jobs--annual average–required by industry, including self-employed).

These positive economic impact projections are based on current and past ethanol production experiences, but also on other encouraging trends including the "Projected U.S. Oxygenate Demand (MTBE Equivalent)." Currently, according to The Oil Daily, Information Resources, Inc., Hewitt (Prepared by Marketing Division, Minn. Agriculture Department. Feb 1, l994. p. 35), a 5.16 billion gallons/year oxygenate demand including usage outside non-attainment areas existed in l993 along with a 3.66 oxygenate demand as required by the Clean Air Act. The projections for l995 are 6.72 billion gallons/year for demand including areas outside of non-attainment, and 5.22 billion gallons demand just to satisfy the Clean Air Act. By the year 2000, those numbers have increased to 12.98 and 11.48 billion gallons/year respectively. The gap between corn produced and corn processed, according to a l991 MAD Marketing Division report (see table on previous page), indicates plentiful corn reserves in Iowa, Illinois, and Minnesota (to say nothing about Wisconsin and other potential or actual ethanol producing states) to help meet those demands without seriously dislocating other traditional usage.

e. A Report to The Missouri Corn Merchandising Council, April l993, by Dr. Donald L. Van Dyne, Research Associate Professor of the Department of Agricultural Economics, University of Missouri-Columbia, was equally positive and its figues were equally encouraging. Van Dyne's study examined three levels of in-state ethanol production and use. They were (1) 24.5 million gallons--the estimated level consumed in gasohol blends in Missouri in l990; (2) 67 million gallons which would provide ethanol for gasohol blends for 25 percent of the gasoline used in Missouri; and (3) 268 million gallons which assumes that all gasoline fueled vehicles in Missouri would use gasohol blends.

This study's conclusions were that developing an ethanol production and use industry in Missouri would have very positive impacts on investment, jobs, and income in the state (p.1). The following impacts were estimated for each of the three ethanol production and use levels:

Appendix III (cont.)

Table 20
Real and Potential Macroeconomic Ethanol Impacts for Missouri

Category	L#1	L#2	L#3
1. Plant & Equipment Investment	$ 4 Million	$134Million	$ 563Million
2. Reduced gasoline imports	12.0M	34.0M	134.0M
3. Value added to corn	12.0M	57.0M	239.0M
4. Wages & Salary	9.0M	25.0M	102.0M
5. State & Local Income from Taxes	1.1M	3.1M	12.3M
6. Total increase in economic Activity	41.4M	119.3M	487.9M
7. Permanent Jobs	350	957	3,828
8. Temporary Jobs during Plant Const.	150	410	1,641

Van Dyne says the single best opportunity to reemploy and/or fully employ idled resources in rural communities is to diversify beyond food, feed and fiber into production of feedstocks to help support our national industrial base. He points out that while almost 25 million gallons of ethanol were used in Missouri gasohol blends in l990, none were produced in Missouri--giving, in effect, the economic benefits of that Missouri consumption to adjacent states such as Illinois and Iowa. This analysis paralleled that of Minnesota's in terms of overall economic benefits, showing the internal economic loss by not producing product to satisfy the demand, and illustrating the gains by meeting those demands internally.

f. Further support for ethanol in Wisconsin as a continuing growth, demand and value-added product is furnished by evidence that ethanol is "surpassing MTBE as a winter time gasoline additive . . . as the choice for major gasoline producers." *(Nancy Seman, The Denver Post Business Section, Friday, January 21, l944)* Several examples of markets, according to this business report, are changing from MTBE to ethanol including Denver (5% ethanol share to 95% MTBE in l988-89, to a 45% ethanol market share in l991-92); Las Vegas-Reno (32% - 68% ethanol to MTBE share in l989 compared to an even 50-50 in l991-92); Albuquerque went from 15% ethanol share in l989 to 95% commanding share in l991-1992; El Paso has a 98% ethanol share, while in l993, Conoco, Inc., Texaco Inc., and Total switched from using MTBE to ethanol at some 265 service stations. *OXY-FUEL NEWS (April 25, l994 issue, p.7)* states that "blended fuels were sold by a larger number of marketers last year, aided by the Clean Air Act Amendments requirements. According to OXY-FUEL NEWS, "the most common blending component was ethanol, which was in 35% of all of the gallons of gasoline sold by marketers selling blended fuel. The oxygenate was sold by 26% of the total motor fuels marketers--up from 22% in l992 and 13% in l989."

Three major oil companies switching to "ethyl tertiary butyl ether" (ETBE) are Atlantic Richfield Co., Coastal Corp. and Chevron Corp with Arco considered the industry leader in ETBE manufacturing. Arthur J. Zadrozny, Manager of Government

Outreach, ARCO Chemical Company presented a speech, "TheRole of ETBE in Ethanol's Future," March 18, 1994, to the American Corn Growers Association, where he spoke about the ethanol's last two barriers to overcome to become a premier universal market fuel. He identified the first as its affinity for water; that is, unlike gasoline, ethanol mixes well with water--a property which has prevented shipping ethanol/gasoline blends in the nation's vast pipeline distribution systems; and secondly, ethanol increases gasoline vapor pressure.

According to Zadrozny, while ethanol has had a major positive impact on air quality, the "fact remains that overcoming this (water soluble) drawback would further enhance the benefits of ethanol's use in gasoline." The solution is chemically combining ethanol with butane, a natural component found in crude oil and natural gas liquids, to produce ETBE (ethyl tertiary-butyl ether). The advantage of ETBE is that its water solubility is very low. This means it will stay mixed with gasoline should it come in contact with water in distribution systems or even a vehicle's fuel tank. Secondly, ETBE, which lowers the blending vapor pressure at the pump when blended with gasoline, more than meets the EPA vapor pressure requirements.

This chemical transformation will allow ethanol to compete for essentially the entire U.S. gasoline market--one of the largest markets in the country at well over $100 billion dollars in sales and approximately 2.5% of GNP. Zadrozny, like many other manufacturers, feels ETBE is an answer to EPA's "renewable oxygen requirement" in the reformulated gasoline program--which, in 1995, begins requiring oxygenates in gasoline sold in most of the North-eastern Atlantic states, Houston, Chicago, and most of California.

ARCO has found that ETBE is superior to MTBE in lowering carbon dioxide emissions and can reduce fossil energy consumption almost twice as much as ethanol or MTBE (Zadrony). Will increased use of ETBE affect the demand for ethanol? The ARCO report says lowered ethanol demand is not expected since the RFG specifications are based on oxygen content, and refiners are expected to blend to the 2.0% minimum oxygen level, or about 5.4% ethanol by volume. Since the oxygen content in ETBE comes from ethanol, and refiners are blending to meet the 2.0% oxygen standard, the rate of ethanol consumption should be the same whether it is blended directly or as ETBE. The only remaining block to overcome is to make sure the existing tax law provides sufficient flexibility to allow the $00.54 tax credit more amenable to the use of ETBE.

<u>Conclusion</u> -- All national economic indicators regarding fuel consumption and effects point to improved environmental and consequent health conditions through the use of ethanol. Ethanol, as a renewable fuel, has the potential to reverse U.S. dependence on foreign oil and simultaneously increase the overall economy by adding to the GNP, creating new jobs, and increasing consumer income and new plant investments, while reducing CO2 and toxic vehicle emissions. Ethanol growth continues in the contiguous states to Wisconsin with comparative state-by-state, year-end data showing positive economic impacts. Minnesota, Wisconsin's sister state, has proven a "break-even" point for tax revenues generated by the ethanol industry

Appendix III (cont.)

exceeding producer subsidies, even as Minnesota farmers increased their income without dislocation of other corn uses. Overall, a 1994 IMPLAN analysis showed Minnesota's ethanol sales positively impacting several Minnesota industries in addition to the agricultural industry.

Oxygenate demand will continue to increase over the coming years as demands to meet the "Clean Air Act" oxygenate minimal requirements to clean up the non-attainment areas increase. This demand will stimulate a virtual doubling of current ethanol production. To meet these demands, research continues to improve ethanol viability through new blends such as ETBE now beginning to replace fossil based methane MBTE.

The above positive results from multiple state environmental and economic experiences, the overall industry's positive self-assessment, the forward movements through the EPA of reformulated gasoline production requirements, and the positive attitude of the Clinton Administration toward an ethanol industry--a cleaner environment--lowers the risk and increases the incentive for such an enterprise investment.

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Exhibit I

State Importation of Ethanol

1991

MONTH	GROSS TAXED GASOLINE	GROSS TAXED GASOHOL	GROSS TAXED MOTOR FUEL	REFUNDS	NET TAXED MOTOR FUEL	UNADJUSTED GROSS TAXED DIESEL	INTERSTATE DIESEL ADJUSTMENT	ADJUSTED GROSS TAXED DIESEL	TOTAL GROSS FUEL	TOTAL NET FUEL
JANUARY	153,517,254	9,863,209	163,380,463	4,473,175	158,907,288	39,672,523		39,672,523	203,052,986	198,579,811
FEBRUARY	137,459,740	9,597,052	147,056,792	2,336,006	144,720,786	33,107,516		33,107,516	180,164,308	177,828,302
MARCH	150,278,305	8,904,272	159,182,577	1,692,285	157,490,292	36,984,730	(6,974,415)	30,010,315	189,192,892	187,500,607
APRIL	155,179,227	10,159,783	165,339,010	1,690,453	163,648,557	37,996,247		37,996,247	203,335,257	201,644,804
MAY	174,166,369	12,262,423	186,428,792	883,453	185,545,339	40,065,419		40,065,419	226,494,211	225,610,758
JUNE	162,818,846	20,278,362	183,097,208	346,066	182,751,142	39,483,245	(6,236,652)	33,246,593	216,343,801	215,997,735
JULY	173,087,081	26,318,520	199,405,601	1,578,200	197,827,401	39,277,639		39,277,639	238,683,240	237,105,040
AUGUST	184,265,143	12,593,649	196,858,792	1,132,151	195,726,641	41,224,056		41,224,056	238,082,848	236,950,697
SEPTEMBER	147,262,534	21,513,444	168,775,978	893,712	167,882,266	40,922,483	(4,796,686)	36,125,797	204,901,775	204,008,063
OCTOBER	157,878,593	25,351,014	183,229,607	1,062,785	182,166,822	44,727,193		44,727,193	227,956,800	226,894,015
NOVEMBER	147,417,886	22,588,710	170,006,596	711,996	169,294,600	37,783,414		37,783,414	207,790,010	207,078,014
DECEMBER	153,372,541	22,473,297	175,845,838	704,749	175,141,089	39,354,646	(3,643,249)	35,711,397	211,557,235	210,852,486
TOTAL	1,896,703,519	201,903,735	2,098,607,254	17,505,031	2,081,102,223	470,599,111	(21,651,002)	448,948,109	2,547,555,363	2,530,050,332

1990

MONTH	GROSS TAXED GASOLINE	GROSS TAXED GASOHOL	GROSS TAXED MOTOR FUEL	REFUNDS	NET TAXED MOTOR FUEL	UNADJUSTED GROSS TAXED DIESEL	INTERSTATE DIESEL ADJUSTMENT	ADJUSTED GROSS TAXED DIESEL	TOTAL GROSS FUEL	TOTAL NET FUEL
JANUARY	152,264,793	1,705,902	153,970,695	3,737,909	150,232,786	36,343,885		36,343,885	190,314,580	186,576,671
FEBRUARY	146,200,403	3,712,032	149,912,435	2,214,409	147,698,026	35,581,013		35,581,013	185,493,448	183,279,039
MARCH	158,317,438	7,287,227	165,604,665	2,096,086	163,508,579	38,674,343	(3,074,421)	35,599,922	201,204,587	199,108,501
APRIL	156,902,531	6,782,592	163,685,123	1,190,208	162,494,915	37,604,351		37,604,351	201,289,474	200,099,266
MAY	180,253,224	4,632,613	184,885,837	1,118,729	183,767,108	40,660,694		40,660,694	225,546,531	224,427,802
JUNE	176,793,932	7,604,456	184,398,388	1,124,868	183,273,520	40,492,454	(6,564,558)	33,927,896	218,326,284	217,201,416
JULY	187,170,800	10,233,677	197,404,477	1,196,754	196,207,723	39,582,464		39,582,464	236,986,941	235,790,187
AUGUST	195,673,188	7,445,467	203,118,655	990,715	202,127,940	41,465,089		41,465,089	244,583,744	243,593,029
SEPTEMBER	161,758,465	6,921,930	168,680,395	1,228,443	167,451,952	39,699,330	(5,884,965)	33,814,365	202,494,760	201,266,317
OCTOBER	159,428,773	10,967,157	170,395,930	965,811	169,430,119	42,763,804		42,763,804	213,159,734	212,193,923
NOVEMBER	169,460,471	5,506,928	174,967,399	1,220,415	173,746,984	40,946,781		40,946,781	215,914,180	214,693,765
DECEMBER	164,962,007	8,916,299	173,878,306	1,410,061	172,468,245	37,256,466	(4,982,534)	32,273,932	206,152,238	204,742,177
TOTAL	2,009,186,025	81,716,280	2,090,902,305	18,494,408	2,072,407,897	471,070,674	(20,506,478)	450,564,196	2,541,466,501	2,522,972,093

1992

GROSS TAXED GASOLINE	GROSS TAXED GASOHOL	GROSS TAXED MOTOR FUEL	REFUNDS	NET TAXED MOTOR FUEL	UNADJUSTED GROSS TAXED DIESEL	INTERSTATE DIESEL ADJUSTMENT	ADJUSTED GROSS TAXED DIESEL	TOTAL GROSS FUEL	TOTAL NET FUEL
151,638,253	10,267,226	161,905,479	2,817,457	159,088,022	39,583,149		39,583,149	201,488,628	198,671,171
149,990,373	10,089,286	160,079,659	2,524,938	157,554,721	38,933,342		38,933,342	199,013,001	196,488,063
164,261,872	11,158,080	175,419,952	2,440,868	172,979,084	43,861,805	(4,682,452)	39,179,353	214,599,305	212,158,437
157,930,245	8,602,261	166,532,506	833,036	165,699,470	40,422,949		40,422,949	206,955,455	206,122,419
177,559,048	8,138,828	185,697,876	1,241,879	184,455,997	42,664,310		42,664,310	228,362,186	227,120,307
183,075,427	9,969,756	193,045,183	206,821	192,838,362	44,239,389	(5,351,750)	38,887,639	231,932,822	231,726,001
195,882,211	10,178,901	206,061,112	1,734,326	204,326,786	42,475,898		42,475,898	248,537,010	246,802,684
185,397,448	14,065,948	199,463,396	655,135	198,808,261	44,772,672		44,772,672	244,236,068	243,580,933
171,204,352	9,770,836	180,975,188	753,957	180,221,231	47,778,463	(4,182,324)	43,596,139	224,571,327	223,817,370
179,601,733	10,477,809	190,079,542	1,270,572	188,808,970	47,423,094		47,423,094	237,502,636	236,232,064
173,907,191	9,380,835	183,288,026	997,082	182,290,944	45,146,540		45,146,540	228,434,566	227,437,484
177,944,556	13,110,508	191,055,064	1,141,573	189,913,491	45,330,817	(3,794,521)	41,536,296	232,591,360	231,449,787
2,068,392,709	125,210,274	2,193,602,983	16,617,644	2,176,985,339	522,632,428	(18,011,047)	504,621,381	2,698,224,364	2,681,606,720

1993

GROSS TAXED GASOLINE	GROSS TAXED GASOHOL	GROSS TAXED MOTOR FUEL	REFUNDS	NET TAXED MOTOR FUEL	UNADJUSTED GROSS TAXED DIESEL	INTERSTATE DIESEL ADJUSTMENT	ADJUSTED GROSS TAXED DIESEL	TOTAL GROSS FUEL	TOTAL NET FUEL
142,447,920	24,015,610	166,463,530	3,359,096	163,104,434	37,726,294		37,726,294	204,189,824	200,830,728
137,364,517	19,214,139	156,578,656	2,271,622	154,307,034	36,465,311		36,465,311	193,043,967	190,772,345
137,481,418	18,112,574	155,593,992	2,105,422	153,488,570	49,671,106	(5,254,476)	44,416,630	200,010,622	197,905,200
155,525,005	13,699,222	169,224,227	498,043	168,726,184	39,685,701		39,685,701	208,909,928	208,411,885
184,802,537	11,237,668	196,040,205	1,546,216	194,493,989	31,333,073		31,333,073	227,373,278	225,827,062
168,909,004	11,213,880	180,122,884	918,255	179,204,629	41,138,437	(4,822,510)	36,315,927	216,438,811	215,520,556
186,893,937	9,751,096	196,645,033	1,431,658	195,213,375	40,323,264		40,323,264	236,968,297	235,536,639
186,008,940	9,621,805	195,630,745	932,606	194,698,139	41,476,435		41,476,435	237,107,180	236,174,574
165,054,238	10,920,065	175,974,303	1,113,975	174,860,328	41,842,231	(4,924,071)	36,918,160	212,892,463	211,778,488
177,190,931	9,711,371	186,902,302	936,406	185,965,896	44,302,944		44,302,944	231,205,246	230,268,840
162,939,585	10,268,044	173,207,629	1,162,104	172,045,525	41,143,409		41,143,409	214,351,038	213,188,934
175,548,882	9,882,269	185,431,151	876,092	184,555,059	44,634,382	(2,508,283)	42,126,099	227,557,250	226,681,158
1,980,166,914	157,647,743	2,137,814,657	17,151,495	2,120,663,162	489,742,587	(17,509,340)	472,233,247	2,610,047,906	2,592,896,409

Exhibit 2

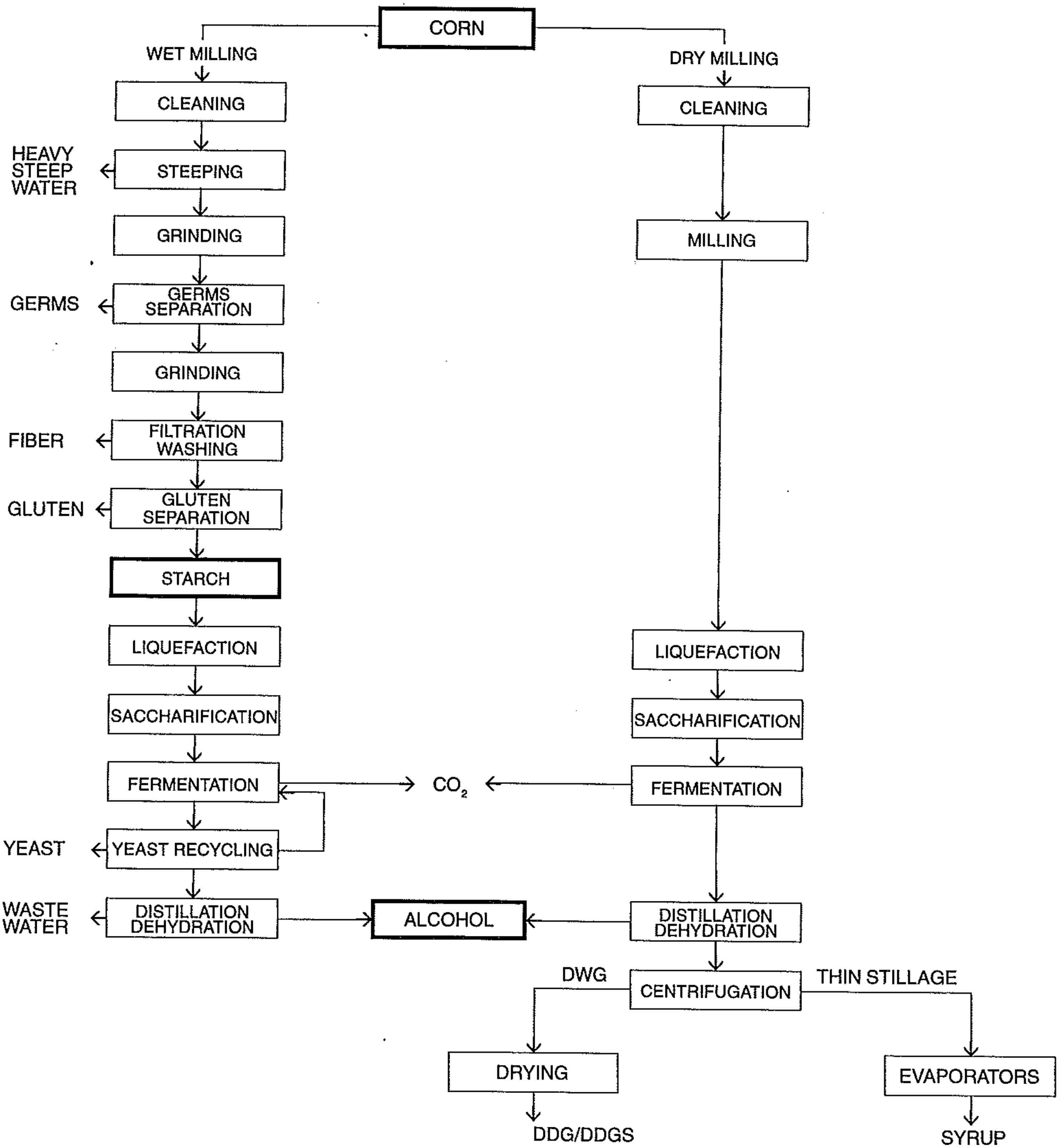
Total Economic Impact Analysis of the Ethanol Industry in Minnesota

(See Exhibit #6 -- page 64)

Exhibit 3

Wet- and Dry-Mill Process

ETHANOL PRODUCTION FROM CORN



MK-0322

PROCESS DIFFERENCES

The primary difference between wet and dry milling is in the front end or initial corn processing part of the plant.

* **Wet Mill Process**
  In wet milling, the corn is soaked or steeped then separated into its component parts, which are recovered prior to fermentation.

- The components are:

  a. starch
  b. germ
  c. oil
  d. hull

- the starch is converted into ethanol or sweeteners depending on seasonal demand. The other components are sent to various parts of the plant for further processing

- higher up-front construction costs

- added coproduct revenue stream can justify higher capital investment

- Marketable coproducts are:

  a. ethanol or sweeteners
  b. corn oil
  c. corn gluten feed
  d. corn gluten meal
  e. CO_2

* **Dry Mill Process**
  In dry milling, the corn is ground into a flour and processed without the separation of component parts.

- lower initial construction cost

- marketable coproducts are:

  a. ethanol
  b. distillers grain
  c. thin stillage (sweetwater) for cattle feed according to the process used
  d. CO_2

- emerging technologies may provide more marketable coproducts in the near term

Exhibit 4

Eckhoff Articles

(For full texts of Dr. Eckhoff's articles, as well as other research related publications used for this study, please contact Mr. Robert C. Karls, Executive Director, Wisconsin Corn Promotion Board, 2976 Triverton Pike Rd., Madison, Wisconsin 53711-5808, telephone (608) 274-7266, or Fax at (608) 274-2006)

Exhibit 5

Minnesota Impact Study Graphs

Value of Corn

Raw Commodity vs. Value-Added

(per bushel of corn)

Market Price as of March 1993.

Products	Corn	Value-Added				
		Wet-Milling				Dry-Milling
				Sweeteners & Products		
	Raw Commodity	Starch & Products	Ethanol & Products	Corn Syrup	HFCS	Ethanol & DDG
Corn	$2.12					
Corn Oil		$0.33	$0.33	$0.33	$0.33	
Gluten Feed		$0.68	$0.68	$0.68	$0.68	
Gluten Meal		$0.40	$0.40	$0.40	$0.40	
Starch		$3.15				
Ethanol			$3.06			$3.23
Corn Syrup				$3.60		
HFCS					$6.66	
DDG						$1.08
Total Value	**$2.12**	**$4.56**	**$4.47**	**$5.01**	**$8.07**	**$4.31**

Prepared by Marketing Division, Minnesota Department of Agriculture.

Computation based on the following:

Corn: $2.115/bushel cash price (Wall Street Journal, March 5, 1993).
Corn oil: 1.55 lb./bushel, $0.21/lb. (Wall Street Journal, March 5, 1993).
Gluten feed: 13.5 lb./bushel, $97.5/ton, Illinois point (USDA Market News, March 4, 1993).
Gluten meal: 2.65 lb./bushel, $295/ton, Illinois point (USDA Market News, March 4, 1993).
Starch: 31.5 lb./bushel, $0.10/lb. (USDA, ERS).
Ethanol: 2.45 (wet-milling) & 2.58 (dry-milling) gallon/bushel, $1.25/gallon (Mpls/St. Paul market, March 4, 1993).
Corn syrup: 40 lb./bushel, $0.09/lb. (Milling & Baking News, March 5, 1993).
HFCS: 33.3 lb./bushel for 55% HFCS (dry weight), $0.20/lb. (Milling & Baking News, March 5, 1993).
DDG: 18 lb./bushel, $112/ton (USDA Market News, March 1993).

Impact of Ethanol Production on Jobs and Payroll in Minnesota

Scenario 1

Current petroleum refining and ethanol production in Minnesota:

	Annual Production *(gallons)*	Total Jobs
Gasoline refining	1,965,000,000	1,000
Ethanol Production	35,000,000	150
State total	**2,000,000,000**	**1,150**

Scenario 2

Assuming a reduction of 10% in petroleum refining as a result of 100% market penetration of ethanol in Minnesota:

	Annual Production *(gallons)*	Total Jobs
Gasoline refining	1,800,000,000	900
Ethanol production	200,000,000	857
State total	**2,000,000,000**	**1,757**

(Scenario 2 results in a net gain of 607 new jobs or an increase of 53% in employment in Minnesota.)

IMPACT OF ETHANOL ON MINNESOTA'S ECONOMY (continued)

OVERALL ECONOMIC IMPACT

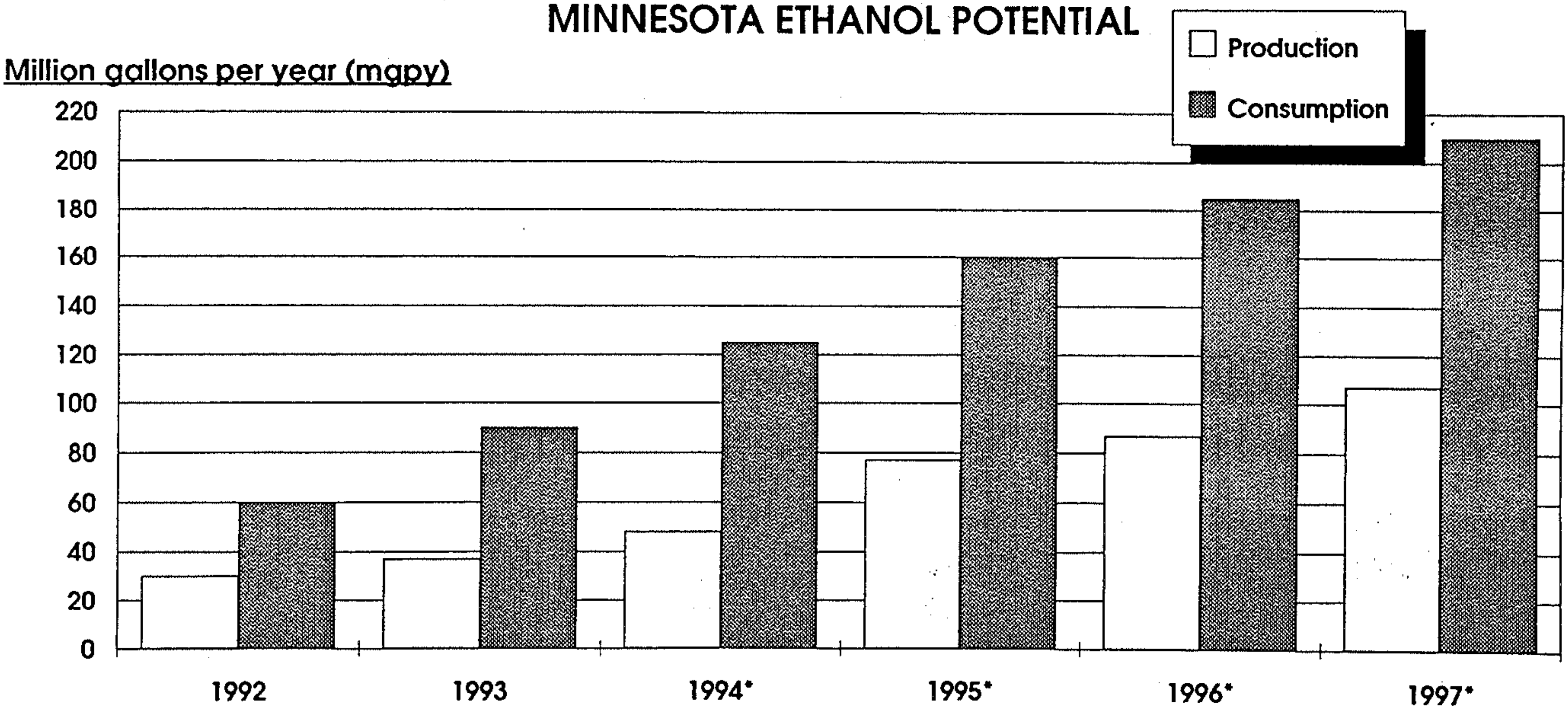
Economic Gains for MN	1990 Level 12.5% Market Share	Current Level 25% Market Share	Full Market Penetration 100% Market Share
Balance of trade *1)*	$13 million	$25 million	$100 million
Industry capitol investments *2)*	$50 million	$100 million	$400 million
Value-added (ethanol & by-products) *3)*	$23.5 million	$45 million	$175 million
Jobs created *4)*	500	1,000	4,000
Payroll -- wages and salaries *4)*	$10 million	$20 million	$80 million
Fiscal impact *5)*	($1.5 million)	($4 million)	$14 million
TOTAL MULTIPLIER EFFECT TO THE STATE ECONOMY*	**??**	**??**	**??**

** The overall economic impact on production/manufacturing, processing, transportation/distribution, services, satellite industries, export and import, corn prices, farm income, state's economic infrastructure, local communities, employment, personal disposable income, consumer goods market, short-term and long-term consumer spending, etc.*

Notes:

1) *Balance of trade is derived from dollars saved on import oil when ethanol is used. Please see Page 1.*
2) *For ethanol industry, to produce one gallon of ethanol, two dollars of capitol investment is required (wet milling). Therefore, a 25 million gallon production capacity means a $50 million initial industry investment.*
3) *Please see Page Two for value of ethanol production and value of by-products (wet milling).*
   Value-added = Value of ethanol + Value of by-products - Value of corn (at an average market price of $2.50/bushel)
4) *Please see Page 3.*
5) *Please see Page 4.*

MINNESOTA ETHANOL POTENTIAL



* Projected.

Prepared by Marketing Division, Minnesota Department of Agriculture.

EXECUTIVE SUMMARY

Ethanol production has benefitted from technological advances in recent years whch have made any data that has been compiled previous to 1985 nearly obsolete.

For this reason, this study assembles current data on the ethanol industry with regard to the energy requirements from the cornfield to the final ethanol product.

Resources used are: Iowa State University,[1] Oak Ridge National Laboratory,[2] three commercial ethanol producers,[3] and the 1987 Fuel Ethanol Cost Effectiveness Study[4] prepared for Congress.

FINDINGS

Energy requirement of growing corn (avg of two studies)	20,346 BTU/Gal.
Add the average energy needed for corn processing	46,500 BTU/Gal.*
Total energy needed to produce ethanol	66,846 BTU/Gal.
Subtract the energy credit for co-products	32,693 BTU/Gal.
NET ENERGY TO PRODUCE ETHANOL	34,153 BTU/Gal.

Ethanol contains	76,000 BTU/Gal.
Subtract energy costs	34,153 BTU/Gal.
ENERGY GAIN	**41,847 BTU/Gal.**
OR	106,710 BTU/Bushel of corn
OR	Approximately 1 BTU/Kernel of corn

---

[1] Iowa State University

[2] "CO2 Emissions from Production and Combustion of Fuel Ethanol From Corn," G. Marland and A.F. Turhollow, Environmental Sciences Division and Energy Division, Oak Ridge National Laboratory, November 1990. Research sponsored by the Carbon Dioxide Research Program, Atmospheric and Climate Research Division, Office of Health and Environmental Research, U.S. Department of Energy.

[3] Archer Daniels Midland, South Point Ethanol, Energy Fuels Development Corporation.

[4] The National Advisory Panel on the Cost-Effectiveness of Fuel Ethanol Production was a seven-member panel appointed by Secretary of Agriculture Richard Lyng to do an independent study for Congress in 1987.

* The most efficient processor, Archer Daniels Midland, has an energy requirement of 34,000 BTU/Gal.

Exhibit 6

IMPLAN Analysis

IMPLAN Analysis: Total Economic Impact of The Ethanol Industry in Minnesota 04/05/94

Definitions:

MM$:	Million Dollars
Final Demand:	The sum of all purchases for final use or consumption.
TIO:	Total Industry Output -- The sum of all purchases by an industry in its production process.
Employee Comp Income:	Total payroll, including wages, salaries, and benefits, paid by local industries.
Property Income:	Proprietary income (income from self employment) plus corporate income, rental income, interest, and corporate transfer payments.
Total PoW Income:	Total Place of Work income -- The sum of employee compensation income and property income.
Total Value Added:	The amount added to the intermediate costs of goods and services. It is the sum of employee compensation, proprietary income, indirect business taxes (sales and exercise taxes paid by firms during their production processes), and other property income.
Employment:	Number of jobs (annual average) required by the industry, including self-employed.

MN-FILE ($MM 1990 AS BASE)
Scenario ETHANOL: Total Effects of $1,000,000 Output Value

Impact Report #906
1/1994

Industry (By SIC Code)	Final Demand (MM$)	TIO (MM$)	Employee Comp Income (MM$)	Property Income (MM$)	Total PoW Income (MM$)	Total Value Added (MM$)	Employment (Number of Jobs)
1. AG, FORESTRY & FISHERIES	.0011	.0622	.0027	.0265	.0294	.0316	.93
28. MINING	.0001	.0007	.0000	.0001	.0001	.0006	.00
48. CONSTRUCTION	.0000	.0256	.0131	.0033	.0165	.0166	.49
58. MANUFACTURING	1.0218	1.1313	.0980	.1890	.2877	.2953	2.37
433. TRANSP, COMM & UTILITIES	.0199	.1928	.0489	.0464	.0949	.1035	1.47
447. TRADE	.0611	.1386	.0833	.0177	.1007	.1214	3.91
456. F.I.R.E.	.0741	.1183	.0247	.0411	.0657	.0809	1.01
463. SERVICES	.0834	.1692	.0730	.0232	.0965	.1003	4.28
510. GOVERNMENT	.0057	.0549	.0172	.0106	.0277	.0277	.45
524. MISC. SPECIAL SECTORS	.0000	.0000	.0000	.0000	.0000	.0000	.00
Total	**1.2672**	**1.8936**	**.3609**	**.3579**	**.7192**	**.7779**	**14.91**

Change in Population = 25.

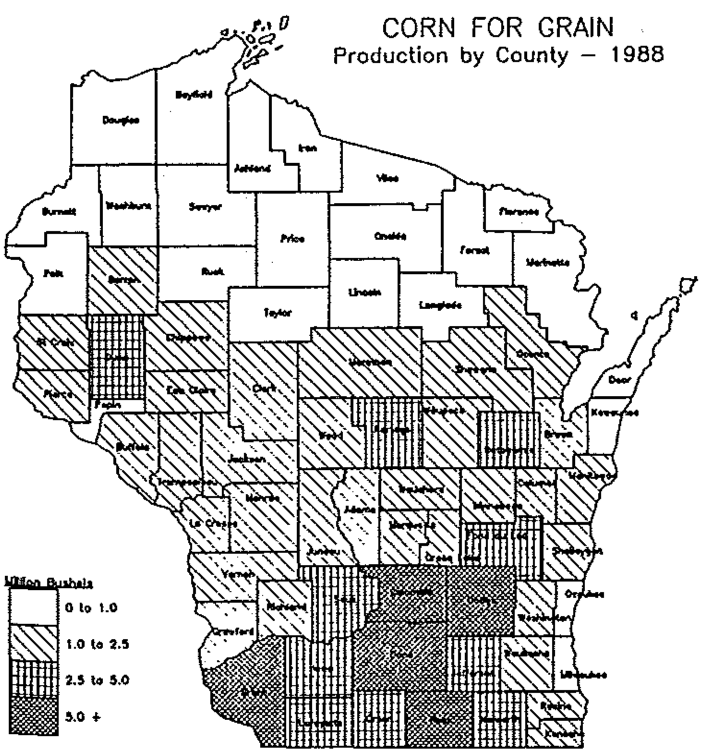
Exhibit 7

Wisconsin District "Corn-for-Grain" Selection Data (l987-88, l989-90, l991-92, l993-94)

CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin, 1987-88, Continued

County	1988					1987			
	Acres		Yield	Production		Acres		Yield	Production
	Planted	Harvested	Per acre	Quantity	Rank	Planted	Harvested	Per acre	
	Acres		Bushels			Acres		Bushels	
Crawford	33,000	20,500	56.7	1,163,000	43	36,600	31,800	116.5	3,705,000
Grant	139,500	93,700	60.4	5,658,000	5	156,800	140,400	130.5	18,327,000
Iowa	80,000	42,700	61.3	2,618,000	15	80,000	66,400	121.4	8,061,000
Lafayette	110,300	69,400	58.3	4,047,000	9	113,400	99,400	128.3	12,751,000
Richland	44,900	21,800	59.7	1,302,000	37	41,900	32,300	117.4	3,793,000
Sauk	91,500	49,400	68.2	3,371,000	10	92,800	75,200	108.8	8,179,000
Vernon	52,800	24,500	74.3	1,820,000	29	50,500	39,500	125.9	4,973,000
S.W. District	**552,000**	**322,000**	**62.0**	**19,979,000**		**572,000**	**485,000**	**123.3**	**59,789,000**
Columbia	113,700	84,000	72.7	6,104,000	3	124,200	109,900	116.7	12,821,000
Dane	186,200	134,700	68.7	9,259,000	1	203,900	180,600	119.2	21,527,000
Dodge	135,400	77,500	77.9	6,039,000	4	133,900	102,200	120.0	12,266,000
Green	89,000	48,900	56.1	2,742,000	13	87,800	72,500	116.6	8,450,000
Jefferson	77,700	46,500	61.4	2,856,000	12	77,500	62,600	112.6	7,049,000
Rock	136,000	102,400	75.1	7,688,000	2	146,700	134,200	114.3	15,334,000
S.C. District	**738,000**	**494,000**	**70.2**	**34,688,000**		**774,000**	**662,000**	**117.0**	**77,447,000**
Kenosha	35,300	24,000	56.2	1,349,000	36	36,400	31,400	122.3	3,839,000
Milwaukee	1,600	1,400	50.0	70,000	61	1,600	1,500	96.0	144,000
Ozaukee	20,000	13,200	61.8	816,000	51	19,700	16,600	112.5	1,868,000
Racine	41,300	28,500	71.8	2,046,000	24	39,700	33,700	123.8	4,172,000
Walworth	91,400	70,800	64.5	4,567,000	6	91,600	82,200	107.2	8,815,000
Washington	40,100	19,500	59.7	1,165,000	42	35,000	25,300	118.9	3,008,000
Waukesha	46,300	32,600	53.3	1,738,000	30	48,000	42,300	120.3	5,089,000
S.E. District	**276,000**	**190,000**	**61.8**	**11,751,000**		**272,000**	**233,000**	**115.6**	**26,935,000**
State	**3,450,000**	**1,950,000**	**67.0**	**130,650,000**		**3,550,000**	**2,800,000**	**118.0**	**330,400,000**

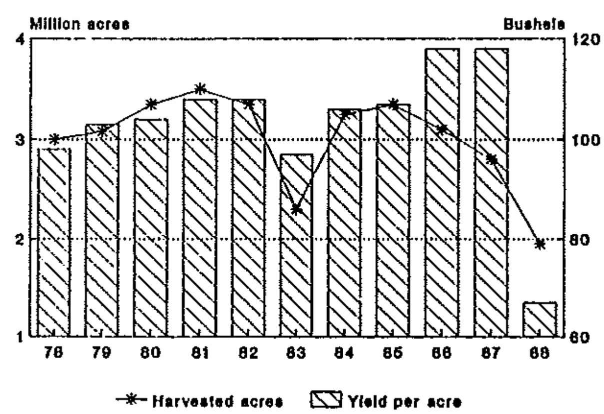
*Tied.



CORN: All Corn Acreage Planted, and Acreage, Yield, and Production of Corn for Grain Wisconsin, 1981-88

Year	All corn acres planted	Corn for grain		
		Acres harvested	Yield per acre	Production
	1,000		Bushels	1,000 bushels
1988	**3,450**	**1,950**	**67.0**	**130,650**
1987	3,550	2,800	118.0	330,400
1986	3,900	3,100	118.0	365,800
1985	4,300	3,350	107.0	358,450
1984	4,150	3,250	106.0	344,500
1983	3,190	2,300	97.0	223,100
1982	4,400	3,350	108.0	361,800
1981	4,520	3,500	108.0	378,000

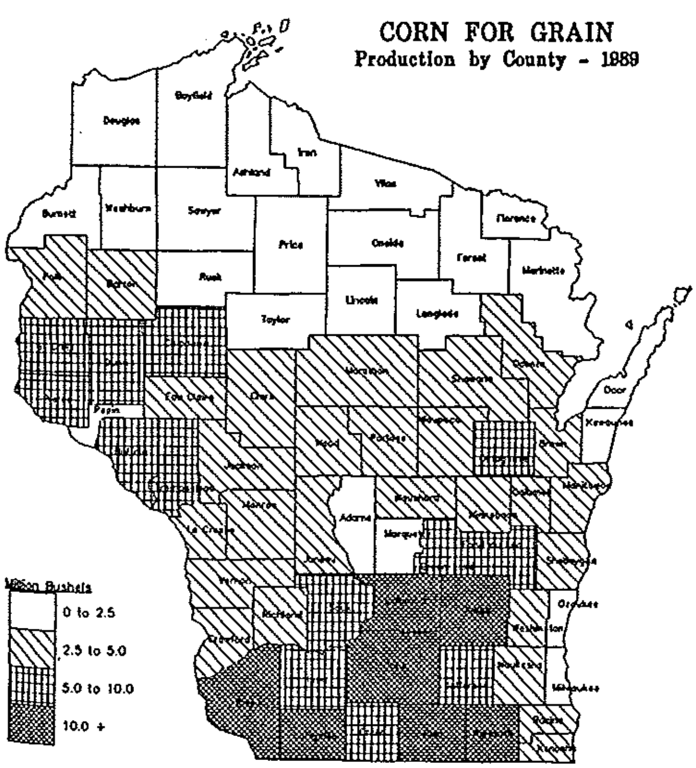
WISCONSIN CORN FOR GRAIN



CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin, 1988-89, Continued

County	1989					1988			
	Acres		Yield	Production		Acres		Yield	Production
	Planted	Harvested	Per acre	Quantity	Rank	Planted	Harvested	Per acre	
	Acres		Bushels			Acres		Bushels	
Crawford	34,600	29,100	116.8	3,400,000	37	33,000	20,500	56.7	1,163,000
Grant	146,000	129,000	115.5	14,900,000	3	139,500	93,700	60.4	5,658,000
Iowa	76,600	61,500	114.5	7,040,000	13	80,000	42,700	61.3	2,618,000
Lafayette	124,300	108,200	121.5	13,150,000	4	110,300	69,400	58.3	4,047,000
Richland	37,500	29,300	115.4	3,380,000	38	44,900	21,800	59.7	1,302,000
Sauk	85,600	69,900	117.7	8,230,000	10	91,500	49,400	68.2	3,371,000
Vernon	50,400	37,000	116.2	4,300,000	28	52,800	24,500	74.3	1,820,000
S. W. District	**555,000**	**464,000**	**117.2**	**54,400,000**		**552,000**	**322,000**	**62.0**	**19,979,000**
Columbia	119,600	105,100	118.9	12,500,000	5*	113,700	84,000	72.7	6,104,000
Dane	208,900	181,000	114.9	20,800,000	1	186,200	134,700	68.7	9,259,000
Dodge	133,600	104,700	119.4	12,500,000	5*	135,400	77,500	77.9	6,039,000
Green	88,200	71,300	117.8	8,400,000	9	89,000	48,900	56.1	2,742,000
Jefferson	74,400	61,400	114.0	7,000,000	14	77,700	46,500	61.4	2,856,000
Rock	149,300	135,500	120.3	16,300,000	2	136,000	102,400	75.1	7,688,000
S. C. District	**774,000**	**659,000**	**117.6**	**77,500,000**		**738,000**	**494,000**	**70.2**	**34,688,000**
Kenosha	36,000	31,700	119.6	3,790,000	34	35,300	24,000	56.2	1,349,000
Milwaukee	2,100	2,000	130.0	260,000	60	1,600	1,400	50.0	70,000
Ozaukee	20,400	17,500	117.1	2,050,000	51	20,000	13,200	61.8	816,000
Racine	42,800	37,400	122.5	4,580,000	24	41,300	28,500	71.8	2,046,000
Walworth	101,100	93,200	124.5	11,600,000	7	91,400	70,800	64.5	4,567,000
Washington	38,400	28,200	116.0	3,270,000	40	40,100	19,500	59.7	1,165,000
Waukesha	45,200	40,000	121.3	4,850,000	21	46,300	32,600	53.3	1,738,000
S. E. District	**286,000**	**250,000**	**121.6**	**30,400,000**		**276,000**	**190,000**	**61.8**	**11,751,000**
State	**3,600,000**	**2,800,000**	**111.0**	**310,800,000**		**3,450,000**	**1,950,000**	**67.0**	**130,650,000**

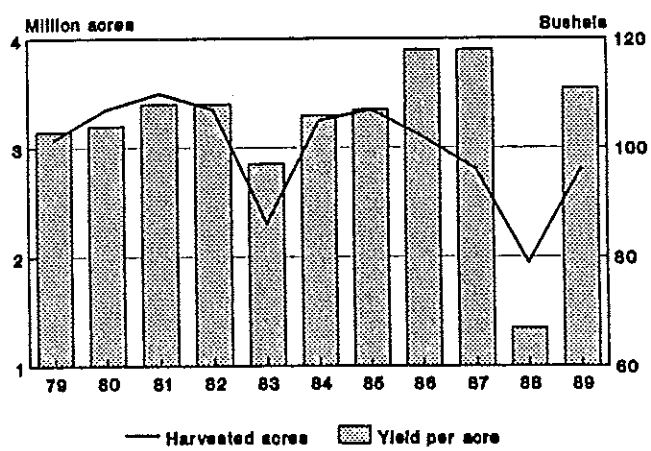
*Tied.



CORN: All Corn Acreage Planted, and Acreage, Yield, and Production of Corn for Grain Wisconsin, 1982-89

Year	All corn acres planted	Corn for grain		
		Acres harvested	Yield per acre	Production
	1,000		Bushels	1,000 bushels
1989	3,600	2,800	111.0	310,800
1988	3,450	1,950	67.0	130,650
1987	3,550	2,800	118.0	330,400
1986	3,900	3,100	118.0	365,800
1985	4,300	3,350	107.0	358,450
1984	4,150	3,250	106.0	344,500
1983	3,190	2,300	97.0	223,100
1982	4,400	3,350	108.0	361,800

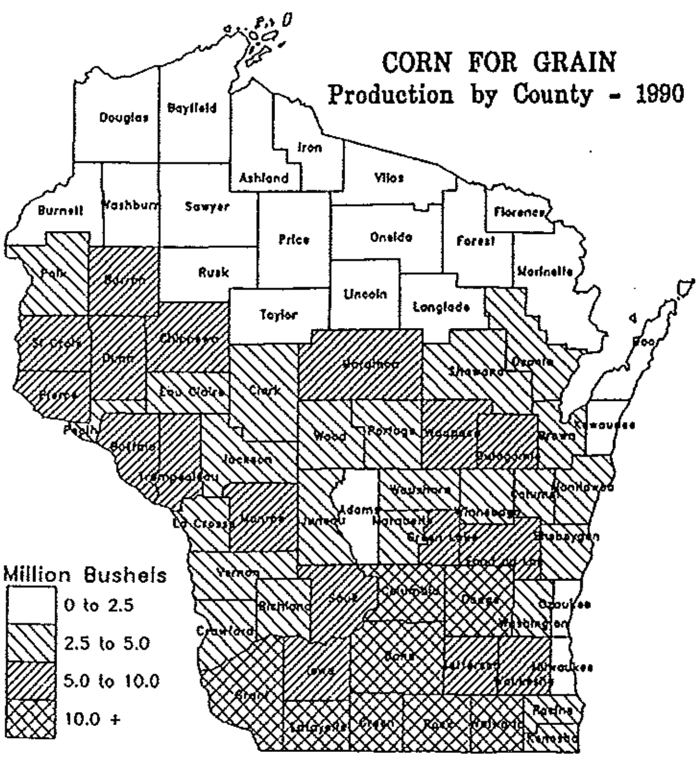
WISCONSIN CORN FOR GRAIN



CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin, 1989-90, Continued

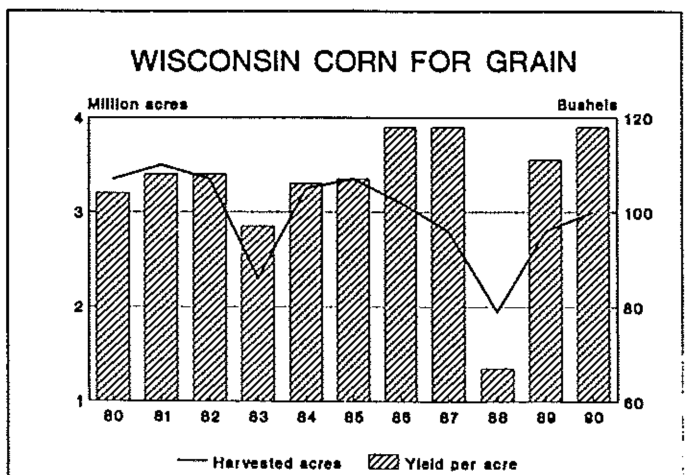
County	1990 All corn planted	1990 Grain harvested	1990 Yield per acre	1990 Production Quantity	1990 Production Rank	1989 All corn planted	1989 Grain harvested	1989 Yield per acre	1989 Production
	Acres	Acres	Bushels	Bushels		Acres	Acres	Bushels	Bushels
Crawford	35,200	31,000	123.5	3,830,000	41	34,600	29,100	116.8	3,400,000
Grant	153,000	140,000	123.7	17,320,000	3	146,000	129,000	115.5	14,900,000
Iowa	78,700	67,000	126.7	8,490,000	12	76,600	61,500	114.5	7,040,000
Lafayette	130,000	115,000	127.7	14,690,000	4	124,300	108,200	121.5	13,150,000
Richland	38,400	32,000	123.4	3,950,000	38	37,500	29,300	115.4	3,380,000
Sauk	88,500	76,000	123.7	9,400,000	10	85,600	69,900	117.7	8,230,000
Vernon	49,200	39,000	126.2	4,920,000	27	50,400	37,000	116.2	4,300,000
S. W. District	**573,000**	**500,000**	**125.2**	**62,600,000**		**555,000**	**464,000**	**117.2**	**54,400,000**
Columbia	126,100	115,000	127.7	14,680,000	5	119,600	105,100	118.9	12,500,000
Dane	218,000	195,000	130.2	25,390,000	1	208,900	181,000	114.9	20,800,000
Dodge	134,000	110,000	127.7	14,050,000	6	133,600	104,700	119.4	12,500,000
Green	96,600	80,000	127.6	10,210,000	8	88,200	71,300	117.8	8,400,000
Jefferson	80,300	70,000	125.1	8,760,000	11	74,400	61,400	114.0	7,000,000
Rock	156,000	145,000	131.8	19,110,000	2	149,300	135,500	120.3	16,300,000
S. C. District	**811,000**	**715,000**	**129.0**	**92,200,000**		**774,000**	**659,000**	**117.6**	**77,500,000**
Kenosha	37,300	33,000	117.6	3,880,000	39	36,000	31,700	119.6	3,790,000
Milwaukee	2,200	2,000	115.0	230,000	62	2,100	2,000	130.0	260,000
Ozaukee	22,500	19,000	107.9	2,050,000	52	20,400	17,500	117.1	2,050,000
Racine	45,400	40,000	120.5	4,820,000	29	42,800	37,400	122.5	4,580,000
Walworth	106,000	98,000	121.2	11,880,000	7	101,100	93,200	124.5	11,600,000
Washington	39,900	30,000	114.7	3,440,000	44	38,400	28,200	116.0	3,270,000
Waukesha	48,700	43,000	118.6	5,100,000	22	45,200	40,000	121.3	4,850,000
S. E. District	**302,000**	**265,000**	**118.5**	**31,400,000**		**286,000**	**250,000**	**121.6**	**30,400,000**
State	**3,700,000**	**3,000,000**	**118.0**	**354,000,000**		**3,600,000**	**2,800,000**	**111.0**	**310,800,000**

*Tied.



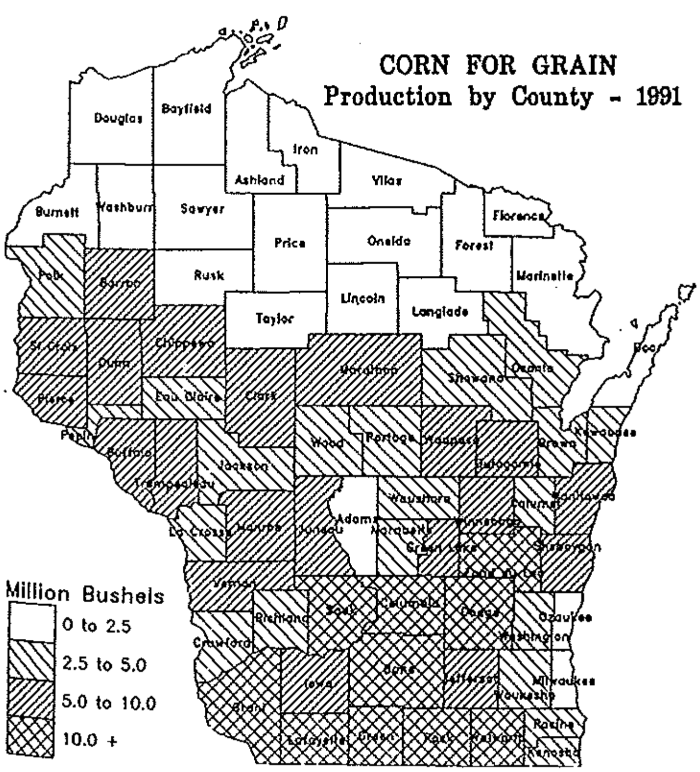
CORN: All Corn Acreage Planted, and Acreage, Yield, and Production of Corn for Grain Wisconsin, 1983-90

Year	All corn acres planted	Corn for grain Acres harvested	Corn for grain Yield per acre	Corn for grain Production
	1,000	1,000	Bushels	1,000 bushels
1990	**3,700**	**3,000**	**118.0**	**354,000**
1989	3,600	2,800	111.0	310,800
1988	3,450	1,950	67.0	130,650
1987	3,550	2,800	118.0	330,400
1986	3,900	3,100	118.0	365,800
1985	4,300	3,350	107.0	358,450
1984	4,150	3,250	106.0	344,500
1983	3,190	2,300	97.0	223,100



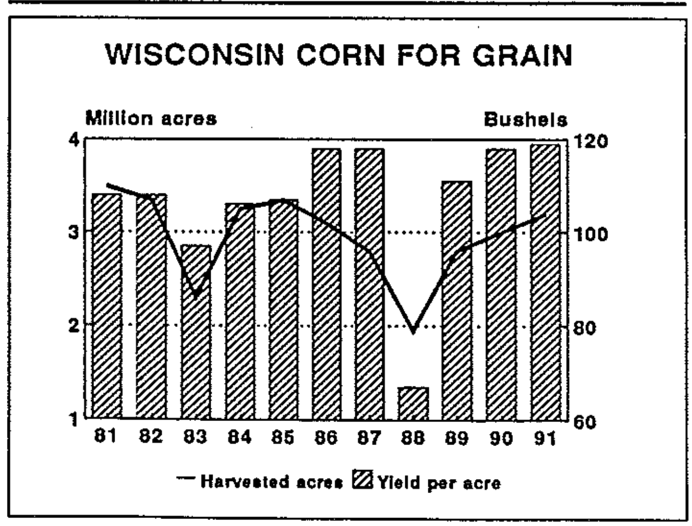
CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin, 1990-91, Continued

County	1990 All corn planted	1990 Grain harvested	1990 Yield per acre	1990 Production	1991 All corn planted	1991 Grain harvested	1991 Yield per acre	1991 Production Quantity	1991 Production Rank
	Acres		Bushels		Acres		Bushels		
Crawford	35,200	31,000	123.6	3,830,000	35,800	31,900	118.1	3,767,000	44
Grant	153,000	140,000	123.7	17,320,000	163,500	151,700	126.1	19,121,000	2
Iowa	78,700	67,000	126.7	8,490,000	82,100	71,600	115.3	8,258,000	15
Lafayette	130,000	115,000	127.7	14,690,000	132,200	121,200	128.3	15,546,000	5
Richland	38,400	32,000	123.4	3,950,000	39,800	34,200	117.1	4,006,000	42
Sauk	88,500	76,000	123.7	9,400,000	93,700	82,700	121.8	10,074,000	10
Vernon	49,200	39,000	126.2	4,920,000	50,900	41,700	123.3	5,141,000	28
S. W. District	**573,000**	**500,000**	**125.2**	**62,600,000**	**598,000**	**535,000**	**123.2**	**65,913,000**	
Columbia	126,100	115,000	127.7	14,680,000	131,100	121,600	130.3	15,843,000	4
Dane	218,000	195,000	130.2	25,390,000	228,900	208,000	124.4	25,874,000	1
Dodge	134,000	110,000	127.7	14,050,000	134,500	115,100	131.7	15,153,000	6
Green	96,600	80,000	127.6	10,210,000	97,500	85,100	119.5	10,173,000	9
Jefferson	80,300	70,000	125.1	8,760,000	83,000	73,700	123.8	9,122,000	12
Rock	156,000	145,000	131.8	19,110,000	160,000	151,500	116.3	17,625,000	3
S. C. District	**811,000**	**715,000**	**129.0**	**92,200,000**	**835,000**	**755,000**	**124.2**	**93,790,000**	
Kenosha	37,300	33,000	117.6	3,880,000	38,500	34,600	97.0	3,357,000	46
Milwaukee	2,200	2,000	115.0	230,000	2,200	1,900	113.7	216,000	63
Ozaukee	22,500	19,000	107.9	2,050,000	22,900	20,100	107.8	2,166,000	52
Racine	45,400	40,000	120.5	4,820,000	46,800	42,000	96.7	4,060,000	41
Walworth	106,000	98,000	121.2	11,880,000	112,700	105,200	98.0	10,312,000	8
Washington	39,900	30,000	114.7	3,440,000	41,400	33,300	116.4	3,875,000	43
Waukesha	48,700	43,000	118.6	5,100,000	49,500	44,900	110.0	4,940,000	32
S. E. District	**302,000**	**265,000**	**118.5**	**31,400,000**	**314,000**	**282,000**	**102.6**	**28,926,000**	
State	**3,700,000**	**3,000,000**	**118.0**	**354,000,000**	**3,800,000**	**3,200,000**	**119.0**	**380,800,000**	



CORN: All Corn Acreage Planted, and Acreage, Yield, and Production of Corn for Grain Wisconsin, 1984-91

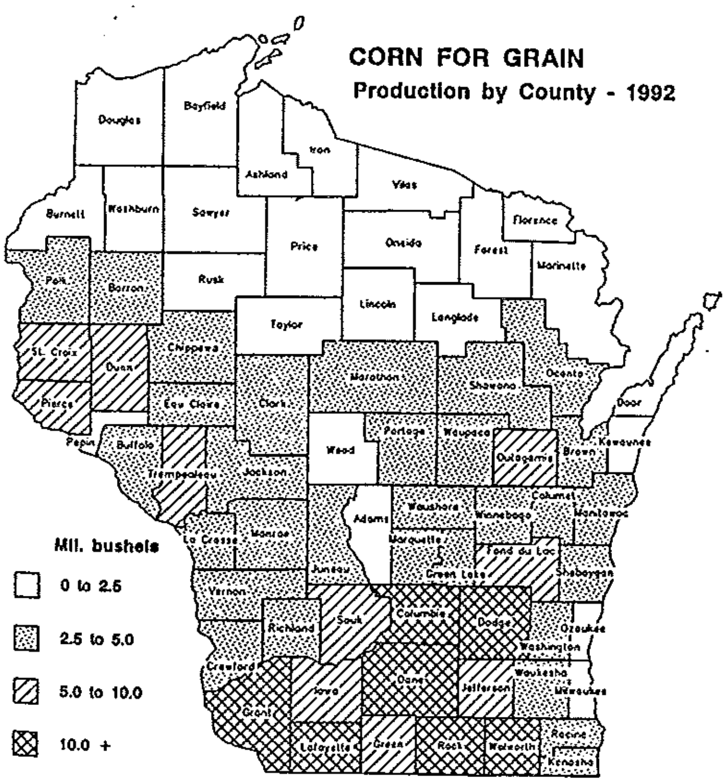
Year	All corn acres planted	Corn for grain: Acres harvested	Corn for grain: Yield per acre	Corn for grain: Production
	1,000		Bushels	1,000 bushels
1984	4,150	3,250	106.0	344,500
1985	4,300	3,350	107.0	358,450
1986	3,900	3,100	118.0	365,800
1987	3,550	2,800	118.0	330,400
1988	3,450	1,950	67.0	130,650
1989	3,600	2,800	111.0	310,800
1990	3,700	3,000	118.0	354,000
1991	**3,800**	**3,200**	**119.0**	**380,800**



CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin, 1991-92, Continued

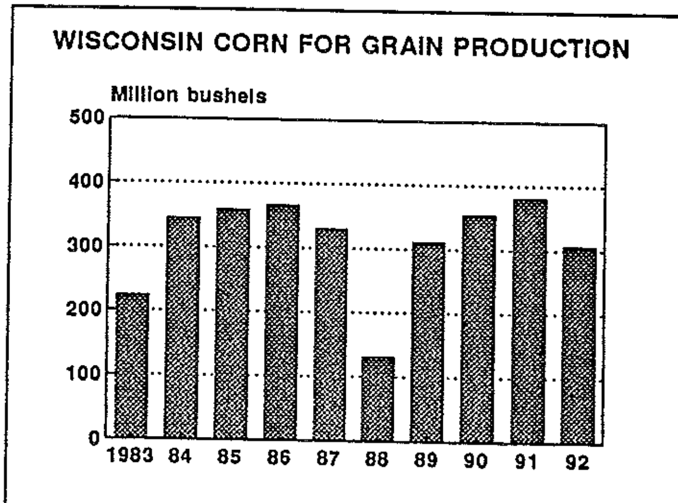
County	1991 All corn planted	1991 Grain harvested	1991 Yield per acre	1991 Production	1992 All corn planted	1992 Grain harvested	1992 Yield per acre	1992 Production Quantity	1992 Production Rank
	Acres		Bushels		Acres		Bushels		
Crawford	35,800	31,900	118.1	3,767,000	37,900	30,200	116.6	3,520,000	34
Grant	163,500	151,700	126.0	19,121,000	172,300	147,900	121.3	17,943,000	3
Iowa	82,100	71,600	115.3	8,258,000	83,500	68,500	108.6	7,442,000	12
Lafayette	132,200	121,200	128.3	15,546,000	130,800	109,000	114.6	12,493,000	5
Richland	39,800	34,200	117.1	4,006,000	38,100	28,800	115.5	3,327,000	38
Sauk	93,700	82,700	121.8	10,074,000	93,500	77,600	111.5	8,655,000	9
Vernon	50,900	41,700	123.3	5,141,000	50,900	34,000	118.8	4,038,000	28
SW District	**598,000**	**535,000**	**123.2**	**65,913,000**	**607,000**	**496,000**	**115.8**	**57,418,000**	
Columbia	131,100	121,600	130.3	15,843,000	133,700	115,700	115.2	13,325,000	4
Dane	228,900	208,000	124.4	25,874,000	234,500	202,900	112.1	22,753,000	1
Dodge	134,500	115,100	131.7	15,153,000	128,600	93,200	108.2	10,083,000	7
Green	97,500	85,100	119.5	10,173,000	99,500	80,400	113.4	9,114,000	8
Jefferson	83,000	73,700	123.8	9,122,000	83,500	70,400	112.8	7,943,000	10
Rock	160,000	151,500	116.3	17,625,000	168,200	154,400	118.6	18,310,000	2
SC District	**835,000**	**755,000**	**124.2**	**93,790,000**	**848,000**	**717,000**	**113.7**	**81,528,000**	
Kenosha	38,500	34,600	97.0	3,357,000	39,000	33,900	103.9	3,522,000	33
Milwaukee	2,200	1,900	113.7	216,000	2,100	1,400	113.6	159,000	61
Ozaukee	22,900	20,100	107.8	2,166,000	22,200	18,700	94.3	1,763,000	52
Racine	46,800	42,000	96.7	4,060,000	50,000	44,400	111.1	4,934,000	18
Walworth	112,700	105,200	98.0	10,312,000	111,900	100,500	110.1	11,064,000	6
Washington	41,400	33,300	116.4	3,875,000	39,500	30,100	96.9	2,917,000	44
Waukesha	49,500	44,900	110.0	4,940,000	53,300	48,000	98.6	4,733,000	22
SE District	**314,000**	**282,000**	**102.6**	**28,926,000**	**318,000**	**277,000**	**105.0**	**29,092,000**	
State	3,800,000	3,200,000	119.0	380,800,000	3,900,000	2,950,000	104.0	306,800,000	

*Tied.



CORN: All Corn Acreage Planted, and Acreage, Yield, and Production of Corn for Grain Wisconsin, 1988-92

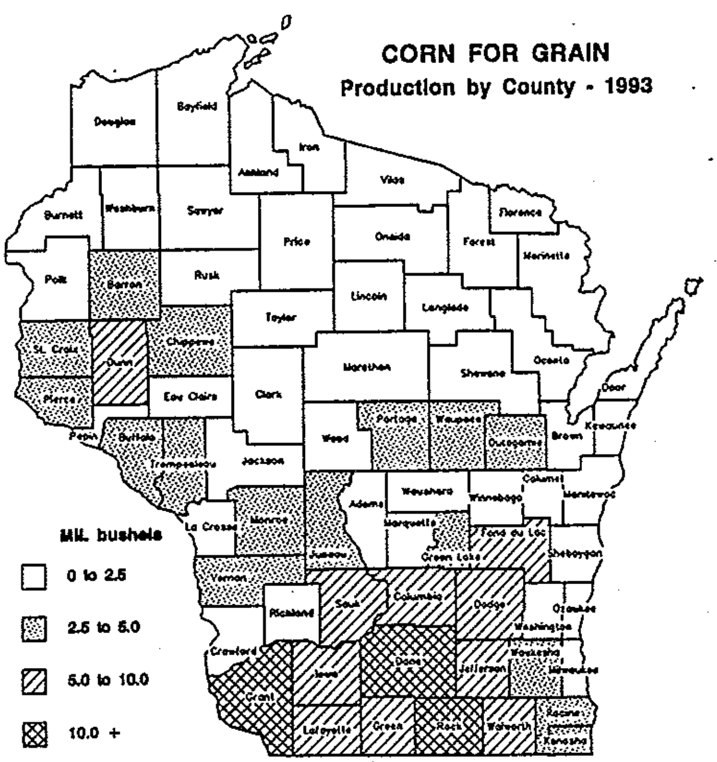
Year	All corn acres planted	Corn for grain: Acres harvested	Corn for grain: Yield per acre	Corn for grain: Production
	1,000		Bushels	1,000 bushels
1988	3,450	1,950	67.0	130,650
1989	3,600	2,800	111.0	310,800
1990	3,700	3,000	118.0	354,000
1991	3,800	3,200	119.0	380,800
1992	**3,900**	**2,950**	**104.0**	**306,800**



CORN FOR GRAIN: Acreage, Yield, and Production, By Counties, Wisconsin, 1992-93, Continued

County	1992 All corn planted	1992 Grain harvested	1992 Yield per acre	1992 Production	1993 All corn planted	1993 Grain harvested	1993 Yield per acre	1993 Production Quantity	1993 Production Rank
	Acres		Bushels		Acres		Bushels		
Crawford	37,900	30,200	116.6	3,520,000	33,300	25,200	98.9	2,493,000	30
Grant	172,300	147,900	121.3	17,943,000	147,000	118,000	105.5	12,450,000	3
Iowa	83,500	68,500	108.6	7,442,000	72,500	55,200	98.6	5,442,000	11
Lafayette	130,800	109,000	114.6	12,493,000	110,500	88,400	104.7	9,252,000	5
Richland	38,100	28,800	115.5	3,327,000	32,100	23,800	104.6	2,490,000	32
Sauk	93,500	77,600	111.5	8,655,000	80,700	60,600	102.4	6,205,000	9
Vernon	50,900	34,000	118.8	4,038,000	47,900	28,800	103.2	2,972,000	25
SW District	**607,000**	**496,000**	**115.8**	**57,418,000**	**524,000**	**400,000**	**103.3**	**41,304,000**	
Columbia	133,700	115,700	115.2	13,325,000	112,400	91,500	103.6	9,479,000	4
Dane	234,500	202,900	112.1	22,753,000	198,500	161,100	105.6	17,013,000	1
Dodge	128,600	93,200	108.2	10,083,000	114,100	76,600	100.6	7,705,000	7
Green	99,500	80,400	113.4	9,114,000	87,400	63,600	104.1	6,619,000	8
Jefferson	83,500	70,400	112.8	7,943,000	73,500	57,500	100.5	5,781,000	10
Rock	168,200	154,400	118.6	18,310,000	140,100	123,700	108.1	13,370,000	2
SC District	**848,000**	**717,000**	**113.7**	**81,528,000**	**726,000**	**574,000**	**104.5**	**59,967,000**	
Kenosha	39,000	33,900	103.9	3,522,000	33,100	27,100	105.3	2,853,000	26
Milwaukee	2,100	1,400	113.6	159,000	1,700	1,100	100.0	110,000	61
Ozaukee	22,200	18,700	94.3	1,763,000	19,600	14,300	90.7	1,297,000	51
Racine	50,000	44,400	111.1	4,934,000	43,000	36,000	107.8	3,880,000	18
Walworth	111,900	100,500	110.1	11,064,000	94,800	80,000	105.5	8,440,000	6
Washington	39,500	30,100	96.9	2,917,000	34,900	24,400	100.9	2,462,000	34
Waukesha	53,300	48,000	98.6	4,733,000	46,900	39,100	106.1	4,148,000	17
SE District	**318,000**	**277,000**	**105.0**	**29,092,000**	**274,000**	**222,000**	**104.5**	**23,190,000**	
State	3,900,000	2,950,000	104.0	306,800,000	3,400,000	2,350,000	92.0	216,200,000	

*Tied.



CORN: All Corn Acreage Planted, and Acreage, Yield, and Production of Corn for Grain Wisconsin, 1989-93

Year	All corn acres planted	Corn for grain: Acres harvested	Corn for grain: Yield per acre	Corn for grain: Production
	1,000		Bushels	1,000 bushels
1989	3,600	2,800	111.0	310,800
1990	3,700	3,000	118.0	354,000
1991	3,800	3,200	119.0	380,800
1992	3,900	2,950	104.0	306,800
1993	**3,400**	**2,350**	**92.0**	**216,200**

WISCONSIN CORN FOR GRAIN PRODUCTION

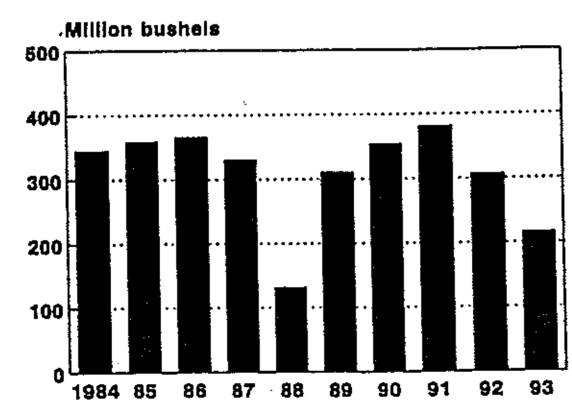


Exhibit 8

Composite Facility and Location Indicator Map

Exhibit 8
Ethanol Resource Composite Map

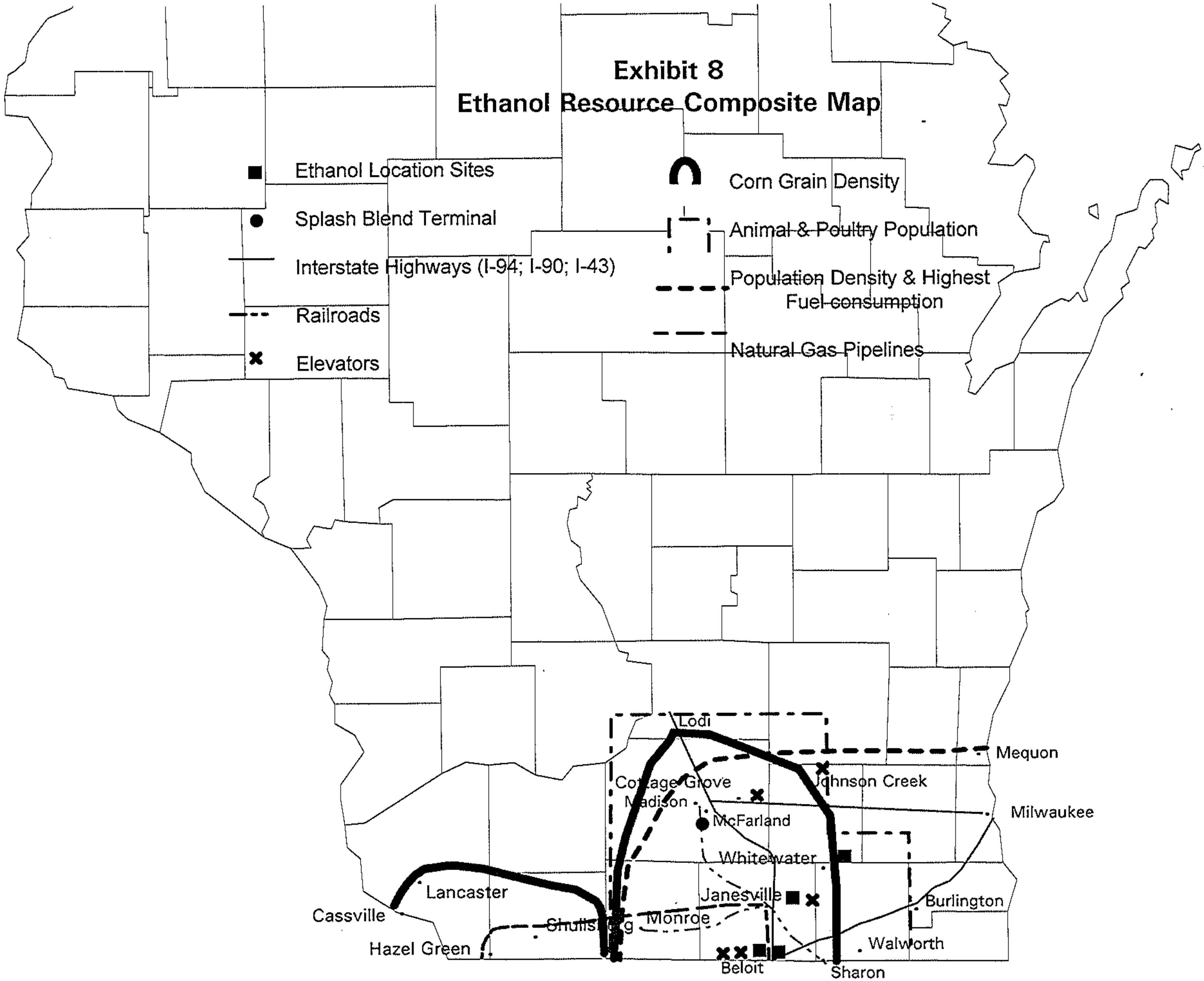
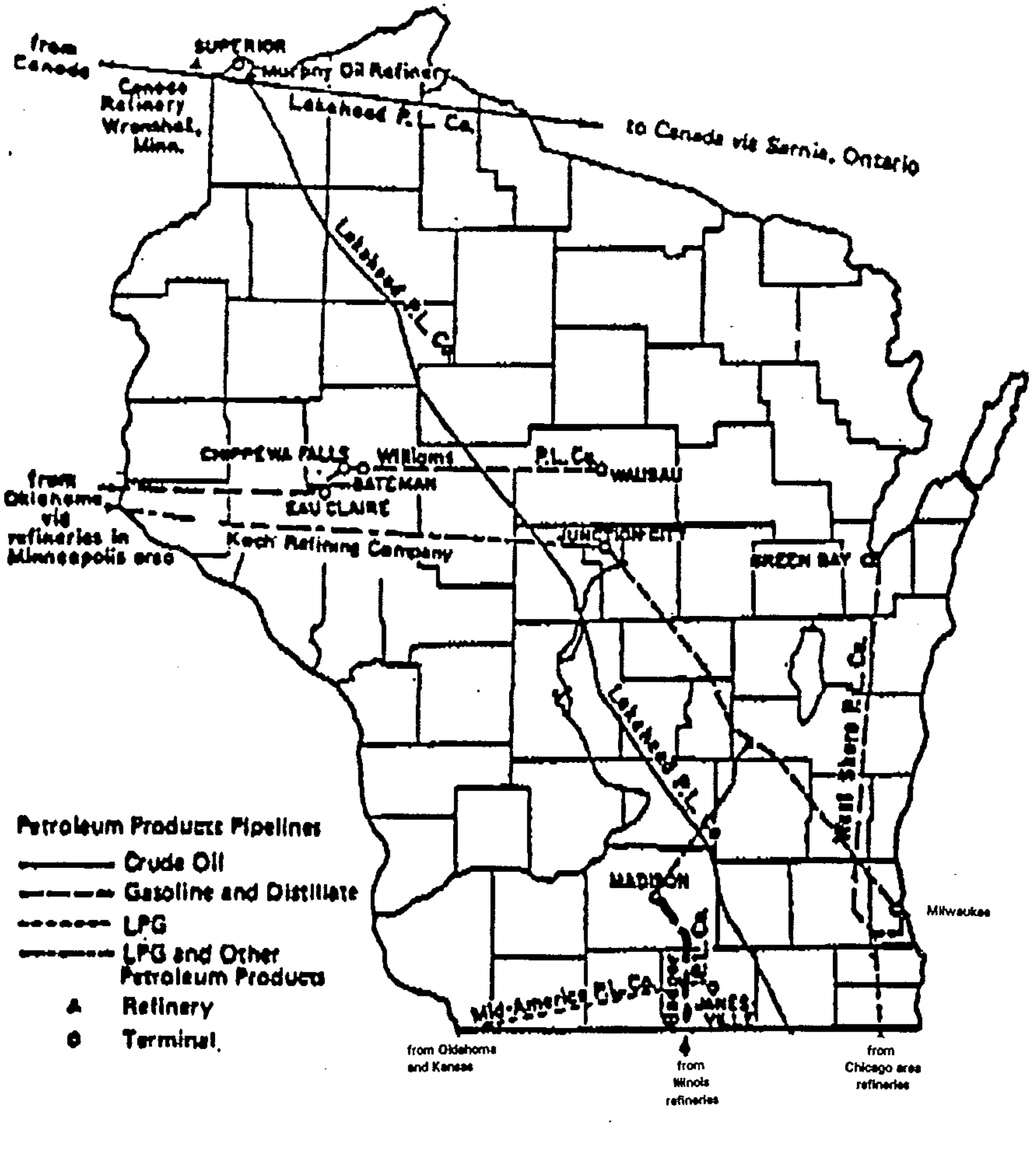


Exhibit 9

Wisconsin Gasoline Stations

Wisconsin Petroleum Pipelines



Sources: Wisconsin Department of Administration, Division of Energy and Intergovernmental Relations

A listing of Wisconsin gas stations selling Ethanol-blended fuel

Clean Air ✷ Quality Fuel ✷ Renewable Resources ✷ Energy Independence ✷ Economic Growth

Winter/Spring 1992

A

Adams	Kwik Trip	190 Main St	608/339-6991
Adams	Farmers Union Co-op Ser	451 S Main St	608/339-3626
Alma	Alma Farmers Union Co-op	1300 S Main St	608/685-4481
Almena	Almena Co-op Assn	Rt 1	715/357-3650
Amery	Equity Co-op of Amery	116 E Birch St	715/268-8177
Antigo	Antigo Co-op Oil Assn	620 6th Ave	715/627-4841
Antigo	SuperAmerica	803 Superior St	715/623-4420
Appleton	Kwik Trip	1342 W Prospect Ave	414/734-9260
Appleton	Outagamie Co-op Ser	3011 W Wis Ave	414/788-7966
Appleton	SuperAmerica	1920 E Wis Ave	414/733-3652
Appleton	SuperAmerica	2005 S Oneida	414/731-4014
Appleton	SuperAmerica	415 S Memorial Dr	414/739-0738
Appleton	Woodman's Foods	595 NW Hill Blvd	414/735-6655
Arcadia	Arcadia Co-op Assn	144 W Cleveland St	608/323-3311
Augusta	Augusta Farmers Union Co-op	213 E Railroad St	715/286-2263

B

Baldwin	Farmers Co-op Produce Assn	930 10th Ave	715/684-3371
Baldwin	Kwik Trip	1010 Main St	715/684-3545
Bangor	IGA 1800 Commercial	608/486-2626	
Baraboo	Kwik Trip	602 W Pine	608/356-2620
Baraboo	R & L Supply	S3553 Hwy 12 & 33	608/356-8940
Baraboo	Sauk City Farmers Union Coop Ser	325 Lynn St	608/356-6636
Barron	Barron Farmers Union Co-op Ser	505 E Grove St	715/537-3181
Barron	Kwik Trip	211 E Div St & N 2nd St	715/537-3103
Bayside	PDQ	340 W Brown Deer Rd	414/352-8670
Beaver Dam	Kwik Trip	W9153 Cty Hwy G	414/887-3250
Beaver Dam	Kwik Trip	1504 N Central	414/885-6055
Beaver Dam	SuperAmerica	817 Park Ave	414/885-6788
Belleville	Union Co-op Assn	20 Park St	608/424-3651
Belmont	Lafayette Cty Co-op Oil Co.	Hwy 151 N	608/762-5187
Beloit	Cub Foods	20 Park Ave	608/364-3680
Beloit	Stop-N-Go	1180 Madison Rd	608/365-0693
Beloit	Stop-N-Go	907 Inman Pkway	608/365-4909
Beloit	Stop-N-Go	854 Henry Ave	608/362-5092
Beloit	SuperAmerica	2781 Milwaukee Rd	608/364-1917
Beloit	SuperAmerica	148 Liberty St	608/362-0805
Beloit	Woodman's Foods	1877 Madison Rd	608/362-0420
Berlin	Kwik Trip	247 Broadway	414/361-4957
Black Earth	Patrons Mercantile Co.	917 Mills St	608/767-2581
Black River Flls	Federation Co-op Inc108 N Water St		715/284-5354
Black River Flls	Kwik Trip	751 Hwy 54 E	715/284-9247
Blair	Kwik Trip	Box 13	608/989-2144
Bloomer	Farmers Union Co-op Oil Co.	1110 14th Ave	715/568-2170
Blue River	New Horizons Supply Co-op	Hwy 133	608/537-2751
Bonduel	Kwik Trip	103 S Cecil St	715/758-2366
Boscobel	Fennimore Co-op Oil Co	715 Wisconsin Ave	608/375-5474
Boscobel	New Horizons Supply Co-op	401 Elm St	608/375-4801
Brodhead	Stop-N-Go	2503 1st Center Ave	608/897-2016
Brodhead	Stop-N-Go	1002 Center St	608/897-2000
Brussels	Door Cty Co-op	9759 Hwy 57	414/825-7400
Burlington	J & L Oil	500 E State St	414/763-8214

C

Camp Douglas	Farmers Co-op	Main St	608/427-3188
Cashton	IGA Broadway & Front St	608/654-7682	
Cedarburg	SuperAmerica	W63 N121 Washington St	414/377-8480
Chetek	Chetek Co-op Inc	302 Knapp St	715/924-3329
Chetek	Kwik Trip	424 2nd St	715/924-2020
Chilton	Kwik Trip	45 Chestnut St	414/849-2737
Chippewa Flls	Kwik Trip	5227 S Pr View Rd	715/723-0291
Chippewa Flls	River Cntry Co-op	1080 W River St	715/723-2828
Chippewa Flls	SuperAmerica	501 N Bridge St	715/723-9585
Clinton	Badgerland Farm Center	200 Church St	608/676-4290
Clinton	Stop-N-Go	600 Milwaukee Rd	608/676-4671
Colfax	Farmers Union Co-op Supply Assn	214 Railroad St	715/962-3172
Columbus	Kwik Trip	675 Park St	414/623-2844
Coon Valley	Kwik Trip	308 Central Ave	608/452-3126
Cornell	Farmers Union Co-op	1st & Main St	715/239-3173
Cottage Grove	Dane Cty Farmers Union Co-op/Cenex	203 W Cottage Grove	800/362-7553
Cross Plains	Kwik Trip	2508 Main St	608/798-2988
Cuba City	Kwik Trip	166 N Main	608/744-8777
Cudahy	SuperAmerica	6265 S Penn Ave	414/764-2260
Cumberland	Farmers Union Co-op	1250 1st Ave	715/822-2191

D

Darlington	Casey's	145 S Main St	608/776-8801
Darlington	Lafayette Cty Co-op Oil Co.	211 Main St	608/776-4437
Deerfield	Cntry View Store	537 State Farm Rd	608/423-4366
Deerfield	Farmers Co-op	201 N Main St	608/764-5454
DeForest	Stop-N-Go	781 S Main St	608/846-2300
Delafield	PDQ	2694 Sun Valley Dr	608/646-8827
Dodgeville	Kwik Trip	115 S Iowa St	608/935-9484
Dorchester	Dorchester Co-op	152 S Front	715/654-5134
Durand	Durand Co-op	514 E Main St	715/672-8947

E

East Troy	J & L Oil	2711 E Main St	414/642-5994
Eau Claire	Consumers Co-op Assn	1201 S Hastings	715/836-8710
Eau Claire	Eau Claire Co-op Oil Co	2626 London Rd	715/835-1153
Eau Claire	Kwik Trip	900 McKinley Rd	715/839-7480
Eau Claire	Kwik Trip	2809 Golf Rd	715/839-7030

Eau Claire	M & H	324 N Berbarstow St	715/835-4304
Eau Claire	SuperAmerica	203 E Madison	715/834-6519
Eau Claire	SuperAmerica	1731 Brackett Ave	715/834-1431
Edgerton	Stop-N-Go	1 S Main St	608/884-9844
Elkhorn	Consumers Co-op of Walworth Cty	E Walworth St	414/723-2906
Elkhorn	SuperAmerica	109 E Geneva St	414/723-5750
Ellsworth	Farmers Union Co-op Oil Co	610 E Main St	715/273-4363
Ellsworth	SuperAmerica	1176 W Main St	715/273-4700
Elmwood	Durand Co-op	404 E Omaha Ave	715/639-2761
Elroy	Kwik Trip	1003 Academy St	608/462-5932

F

Fairchild	Farmers Union Co-op	303 N Front	715/334-2842
Fennimore	Fennimore Co-op Oil Co	720 Lincoln Ave	608/822-3217
Fennimore	Kwik Trip	745 Lincoln Ave	608/822-3125
Fennimore	New Horizons Supply Coop	770 Lincoln St	608/822-3217
Fitchburg	SuperAmerica	2810 Fish Hatch Rd	608/271-9779
Fond du Lac	Kwik Trip	W6591 Hwy 23	
Fond du Lac	Kwik Trip	456 S Main	414/922-5362
Fond du Lac	Kwik Trip	471 N Park Ave	414/929-9070
Fond du Lac	Kwik Trip	235 W Scott	414/922-5390
Fond du Lac	PDQ	400 Van Dyne Rd	414/922-5006
Fond du Lac	SuperAmerica	550 W Johnson St	414/922-0100
Fort Atkinson	Stop-N-Go	313 Madison Ave	414/563-8204
Foster	Augusta Farmers Union Co-op	E10914 Cty Rd HH	715/597-3766
Fox Lake	Kwik Trip	103 Spring St	414/928-2070
Fremont	Outagamie Co-op Services	Hwy 10 & 110	414/446-3344

G

Galesville	A & G Co-op Creamery	219 Winnebago Rd	608/582-4131
Gays Mills	G C Farmers Co-op	Hwy 131N	608/735-4308
Germantown	Fleet Farm	Appleton Ave & Cty Q	414/255-1420
Germantown	PDQ	N112 W15800 Mequon Rd	414/255-3033
Glendale	SuperAmerica	6170 N Green Bay Ave	414/228-7676
Glenwood City	Farmers Co-op Produce	525 1st St	715/265-4224
Grantsburg	Burnett Dairy Co-op	11679 State Rd 70	715/689-2467
Green Bay	SuperAmerica	610 E Walnut St	414/435-3600
Green Bay	SuperAmerica	952 W Mason St	414/497-7080
Green Bay	SuperAmerica	1688 E Mason St	414/465-9260
Green Bay	SuperAmerica	1300 S Military Ave	414/499-8116
Green Bay	Superstop Qwik Mart	871 Hansen Rd	414/494-0204
Greendale	SuperAmerica	5490 S 76th St	414/421-3111
Greenfield	Greenfield Pump	4306 W Layton Rd	414/281-2366
Greenville	Greenville Co-op Gas Co	Hwy 76N	414/757-6556
Greenfield	SuperAmerica	3390 W Loomis Rd	414/281-0205
Gresham	Gresham Co-op Assn	Main St	414/787-3208

H

Hartford	Stop-N-Go	806 Grand Ave	414/673-9655
Hayward	Northern Lakes Co-op	Hwy 63 S	634-4841 or 634-2225
Hillsboro	Hillsboro Farmers Co-op Whse	140 Short St	608/489-2330
Hillsboro	Kwik Trip	229 Mill St	608/489-2300
Hixton	Farmers Co-op Oil Co	64 S State Rd	715/963-3211
Horicon	Kwik Trip	716 E Lake St	414/485-4046
Horicon	Kwik Trip	305 Barstow St	414/485-6610
Hortonville	Kwik Trip	261 E Main St	414/779-6151
Hudson	Burkhardt Co-op Assn	Cty Trunk A	715/386-8815
Hudson	SSG Corporation	512 2nd St	715/386-8281
Hustisford	River Valley Co-op	130 S Hustis St	414/349-3130

J

Janesville	Kwik Trip	2518 W Court St	608/756-2880
Janesville	Kwik Trip	254 E Memorial Ave	608/754-4088
Janesville	Kwik Trip	3123 S Hwy 51	608/752-3354
Janesville	Stop-N-Go	1804 E Milwaukee St	608/754-5416
Janesville	Stop-N-Go	1604 E Racine St	608/754-0479
Janesville	Stop-N-Go	3515 E Milwaukee St	608/752-2320
Janesville	SuperAmerica	404 N Parker Dr	608/754-1669
Janesville	Woodman's Foods	2819 N Lexington Dr	608/754-8382
Jefferson	SuperAmerica	738 S Main St	414/674-3500
Jim Falls	River Cntry Co-op	1080 W River St	715/723-2828
Juneau	Kwik Trip	210 S Main St	414/386-2574

K

Kaukauna	Outagamie Co-op Ser	3011 Wis Ave	414/739-9176
Kenosha	Bourque Petrol. Inc	1401 - 75th St	414/652-5868
Kenosha	Bourque Petrol. Inc	3032 Roosevelt Rd	414/654-3232
Kenosha	Bourque Petrol. Inc	2619 - 22nd Ave	414/657-3765
Kenosha	Bourque Petrol. Inc	2802 - 52nd St	414/652-8700
Kenosha	Bourque Petrol. Inc	5006 - 60th St	414/652-0714
Kenosha	Bourque Petrol. Inc	5922 Sheridan Rd	414/657-6060
Kenosha	Bourque Petrol. Inc	11748 - 75th St	414/857-9192
Kenosha	J & L Oil	12439 S Sheridan Rd	414/694-7406
Kenosha	Kwik Trip	6300 52nd St	414/652-6055
Kenosha	PDQ	8012 39th Ave	414/694-9005
Kenosha	SuperAmerica	704 75th St	414/657-4840
Kenosha	SuperAmerica	3708 60th St	414/658-3891
Kenosha	SuperAmerica	4417 75th St	414/694-5664
Kewaunee	Kewaunee Co-op	223 Milwaukee St	414/388-4243
Kiel	East Central Co-op Assn	721 Fremont	414/894-3436
Kiel	Kwik Trip	213 Fremont St	414/894-3202

L

La Crosse	Kwik Trip	530 W Ave N	608/782-1115
La Crosse	Kwik Trip	3130 State Rd	608/788-9230
La Crosse	Kwik Trip	921 Losey Blvd S	608/788-5604
La Crosse	Kwik Trip	71 Copeland Ave	608/785-2320
La Crosse	Kwik Trip	105 Clinton St	608/784-2422
La Crosse	Kwik Trip	722 Rose St	608/782-8887
La Crosse	Kwik Trip	507 Lang Dr	608/785-2344
La Crosse	Kwik Trip	4605 Mormon Coulee Rd	608/788-8664
La Crosse	Kwik Trip	2216 State Hwy 16	608/781-3468
La Crosse	Kwik Trip	2506 S Ave	608/788-5534
La Crosse	SuperAmerica	2308 Rose St	608/781-4881
Lancaster	Kwik Trip	141 N Madison	608/723-6494
Lancaster	Peoples Community Oil Co-op	463 N Washington St	608/723-4196
Lancaster	Peoples Community Oil Co-op	Hwy 61N	608/723-7800
Larsen	Kwik Trip	5291 Hwy 150	414/836-9510
Larsen	Larsen Co-op	4459 Cty Rd T	414/836-2113
Livingston	Livingston Co-op Oil Co	Rt 1	608/943-6251
Lodi	Kwik Trip	215 N Main	608/592-4491
Loganville	R & L Supply Co-op	100 Main St	608/727-2211

M

Madison	Cub Foods	4141 Nakoosa Tr	608/246-3663
Madison	Cub Foods	7455 Mineral Point Rd	608/829-3500
Madison	J & L Oil	1407 Monroe St	608/256-2223
Madison	Kwik Trip	4325 Mohawk Dr	608/271-8632
Madison	Kwik Trip	901 S Gammon Rd	608/274-1950
Madison	PDQ	2402 W Broadway	608/222-9400
Madison	PDQ	7502 Mineral Point Rd	608/829-3100
Madison	PDQ	105 E Broadway	608/222-7890
Madison	PDQ	7717 Mineral Point Rd	608/833-1611
Madison	PDQ	1625 N Stoughton Rd	608/244-6565
Madison	PDQ	2538 Fish Hatch Rd	608/255-1888
Madison	PDQ	6702 Raymond Rd	608/273-3700
Madison	PDQ	3310 University Ave	608/233-1345
Madison	PDQ	5280 Williamsburg Way	608/271-2200
Madison	PDQ	4202 Milwaukee St	608/241-3600
Madison	PDQ	4426 E Buckeye Rd	608/222-6780
Madison	PDQ	1434 Northport Dr	608/244-3660
Madison	Stop-N-Go	5445 University Ave	608/238-0200
Madison	Stop-N-Go	2050 Fish Hatch Rd	608/255-0588
Madison	Stop-N-Go	6202 Schroeder Rd	608/274-3377
Madison	Stop-N-Go	2932 Fish Hatch Rd	608/274-3540
Madison	Stop-N-Go	3734 Speedway Rd	608/233-8988
Madison	Stop-N-Go	5300 Monona Dr	608/222-9619
Madison	Stop-N-Go	3510 Packers Ave	608/241-3221
Madison	SuperAmerica	1101 N Sherman Ave	608/249-0535
Madison	SuperAmerica	4902 Verona Rd	608/271-2467
Madison	Woodman's Foods	711 S Gammon Rd	608/274-8944
Madison	Woodman's Foods	3817 Milwaukee St	608/244-6630
Manawa	Tomorrow Valley Co-op Ser	961 Depot St	414/596-3303
Manitowoc	Kwik Trip	2102 Washington Ave	414/683-7960
Manitowoc	Kwik Trip	401 N 8th St	414/683-7979
Manitowoc	Kwik Trip	2819 Meadow Ln	414/683-7977
Manitowoc	SuperAmerica	1807 Washington St	414/684-7241

Marathon	Marco Farmers Union Co-op	Box 215	715/443-2241
Markesan	Grand River Co-op	225 E John St	414/398-2891
Marshall	Kwik Trip	436 W Main St	608/655-4321
Marshfield	SuperAmerica	120 N Central Ave	715/387-3417
Mauston	Farmers Co-op Assn	310 Prairie St	608/847-5679
Mauston	Kwik Trip	22 N Union St	608/847-4866
Mayville	Kwik Trip	121 N Main St	414/387-5774
McFarland	Kwik Trip	4701 Farwell St	608/838-9011
Medford	Medford Co-op Inc	160 Medford Plza	715/748-2056
Menasha	Kwik Trip	811 Plank	414/725-9297
Menasha	PDQ	1065 Racine Rd	414/725-3300
Menasha	SuperAmerica	209 Racine St	414/725-7068
Menomonee Flls	J & L Oil	N91 W17271 Appleton Ave	414/251-6830
Menomonee Flls	SuperAmerica	N87 W17245 Main St	414/251-0050
Menomonie	Farmers Union Co-op/Cenex	807 Main St	715/232-6210
Menomonie	SuperAmerica	701 Main St	715/235-7000
Menomonie	SuperAmerica	1903 Stout Rd	715/235-0204
Menomonie	SuperAmerica	1708 N Broadway	715/235-9103
Mequon	Kwik Trip	10360 Cedarburg Rd	414/242-0256
Middleton	PDQ	6519 Century Ave	608/831-1848
Middleton	PDQ	5301 S Ridge Way	608/831-6200
Middleton	PDQ	2002 Parmenter St	608/831-6600
Milton	Kwik Trip	603 W Madison Ave	608/868-7295
Milwaukee	Baker Hawley Rd Pump	5706 W Bluemound Rd	414/258-7229
Milwaukee	Cub Foods	123 W Oklahoma	414/483-1114
Milwaukee	Cub Foods	7901 W Layton	414/282-3400
Milwaukee	Cub Foods	11111 W Greenfield	414/779-4660
Milwaukee	Cub Foods	4061 N 54	414/449-9721
Milwaukee	Enterprized Self-Service, Inc	27 W Holt Ave	414/769-6866
Milwaukee	Riverbend Quik-Mart	3101 S 76 St	414/321-7231
Milwaukee	Southside Pump	1605 W Forest Home	414/647-2858
Milwaukee	SuperAmerica	4780 N 76th St	414/462-9620
Milwaukee	SuperAmerica	8431 W Appleton Ave	414/462-3900
Milwaukee	SuperAmerica	907 W Greenfield Ave	414/383-9593
Milwaukee	SuperAmerica	3928 W N Ave	414/873-3940
Milwaukee	SuperAmerica	9200 W Bluemound Rd	414/257-2148
Milwaukee	SuperAmerica	3102 S Chicago Rd	414/762-3080
Milwaukee	SuperAmerica	6512 N Teutonia Ave	414/352-0580
Milwaukee	SuperAmerica	959 W Lincoln Ave	414/643-6380
Milwaukee	SuperAmerica	3869 S 84th St	414/546-1314
Milwaukee	SuperAmerica	302 N 35th St	414/342-5444
Milwaukee	SuperAmerica	9091 N 76th St	414/355-8410
Milwaukee	SuperAmerica	9200 W Burleigh	414/447-1188
Milwaukee	SuperAmerica	369 E Oklahoma Ave	414/481-6550
Milwaukee	SuperAmerica	800 E Layton Ave	414/483-6242
Milwaukee	SuperAmerica	1454 N 27th St	414/933-4060
Mindoro	Farmers Central Co-op	N8319 Hwy 108	608/857-3414
Mineral Pt	Kwik Trip	535 Ridge St	608/987-2922
Mishicot	Valders Elevator Co-op	150 E Main St	414/755-2231
Mondovi	Mondovi Co-op Equity Assn	735 E Main St	715/926-4212
Mondovi	SuperAmerica	Hwy 10 & Joel St	715/926-4450
Monroe	Southern Wis Co-op	2914 13th St	608/325-4320
Monona	SuperAmerica	1220 E Broadway	608/221-8109
Monona	SuperAmerica	5450 Monona Dr	608/221-2808
Monroe	SuperAmerica	907 20th Ave	608/328-4328
Montello	Kwik Trip	99 E Montello St	608/297-7697
Mount Horeb	Farmers Co-op	501 W Main St	608/437-5536
Mt Horeb	Kwik Trip	525 Springdale St	608/437-4821

N

Necedah	Kwik Trip	Hwy 21 & 80	608/545-7744
Neenah	SuperAmerica	309 First St	414/725-7348
Neillsville	Full Circle Inc/ Cenex	Hwy 10 E	715/743-4678
New Berlin	SuperAmerica	14001 W Greenfield Ave	414/784-9304
New Holstein	Kwik Trip	1521 Wisconsin Ave	414/898-5696
New Lisbon	Kwik Trip	108 W Bridge St	608/562-3541
New London	Kwik Trip	420 N Shawano St	414/982-7513
New London	Kwik Trip	Rt 4 Hwy 45 S	414/982-7530
New Richmond	Farmers Union Co-op Oil	715 N 4th St	715/246-2593

O

Oconomowoc	Kwik Trip	39345 W Wisconsin Ave	414/567-0844
Oconomowoc	SuperAmerica	403 E Wisconsin Ave	414/567-8206
Omro	Kwik Trip	244 E Main	414/685-6833
Onalaska	Kwik Trip	1276 Crossing Meadows Dr	608/781-3350
Onalaska	Kwik Trip	950 2nd Ave N	608/783-5440
Onalaska	Kwik Trip	3525 Hwy 157	608/781-1068
Onalaska	Kwik Trip	1802 Cty Trunk OS	608/783-2433
Onalaska	Kwik Trip	229 Oak Forest Dr	608/783-6061
Onalaska	Kwik Trip	N6353 US Hwy 53	608/526-3010
Oregon	Kwik Trip	933 N Main St	608/835-5908
Oregon	Kwik Trip	135 N Main	608/835-8540
Oregon	Stop-N-Go	856 Janesville St	608/835-7877
Oshkosh	Fleet Farm	177 N Washburn Rd	414/231-5738
Oshkosh	J & L Oil	123 N Sawyer Ave	414/235-9233
Oshkosh	Kwik Trip	2109 Omro Rd	414/231-7141
Oshkosh	Kwik Trip	2222 Jackson St	414/231-2474
Oshkosh	Kwik Trip	2005 Oregon St	414/235-6389
Osseo	Kwik Trip	301 N 10th St W	715/597-3278

P

Paddock Lake	J & L Oil Co	24820 75th St	414/843-3148
Patch Grove	New Horizons Supply Co-op	Hwy 35 N	715/994-2757
Pepin	Durand Co-op	514 E Main St	715/672-8947
Pewaukee	Stop-N-Go	405 Ryan Rd	414/691-4808
Pickett	Pickett Co-op	Rt 1	414/589-2311
Platteville	Consumers Co-op Oil Co.	840 Valley Rd	608/348-9703
Platteville	Kwik Trip	3005 Water St	608/348-8887
Portage	J & L Oil	W10416 Hwy 33	608/742-6455
Portage	Kwik Trip	1925 New Pinery Rd	608/742-8005
Portage	Kwik Trip	1606 New Pinery Rd	608/742-3889
Portage	Kwik Trip	1324 E Wis Ave	608/742-5226
Poynette	Co-op Ser Inc	118 S Main St	608/635-4386
Prairie du Chien	Grant-Crawford Co-op Oil Co	Rt 2	608/326-6805
Prairie du Chien	Kwik Trip	1000 S Marquette Rd	608/326-8009
Prairie du Chien	New Horizons Supply Co-op	RFD #2	608/326-6805
Princeton	Kwik Trip	303 Fulton St	414/295-6905
Pulaski	Pulaski Chase Co-op	428 3rd St	414/822-3235

R

Racine	PDQ	4006 Durand Ave	414/554-7740
Racine	PDQ	6220 Washington Ave	414/886-5333
Random Lake	Random Lake Co-op Assn	430 1st St	414/994-4316
Readfield	Larsen Co-op Oil	Rt 1	414/667-4355
Redgranite	Kwik Trip	549 Wautoma Rd	414/566-2276
Reedsburg	Kwik Trip	101 S Albert St	608/524-4440
Reedsburg	Kwik Trip	E6766 State Hwy 23 & 33	608/524-3112
Reedsburg	R & L Supply Co-op	300 Vine St	608/524-6419
Reedsburg	Farmers Co-op	224 S Walnut St	608/524-3651
Reedsville	Reedsville Co-op Assn	Hwy 10	414/754-4212
Reedsville	Reedsville Co-op Assn	305 N 6th St	414/754-4321
Rhinelander	SuperAmerica	48 W King St	715/369-2565
Rice Lake	Kwik Trip	1903 S Main St	715/234-6895
Rice Lake	Farmers Union Co-op	924 Hammon St	715/234-8191
Rice Lake	SuperAmerica	2025 S Main St	715/234-3934
Richland Center	Consumers Co-op of Richland Cty	165 W Haseltine Rd	608/647-6171
Richland Center	Kwik Trip	172 S Main	608/647-4145
Ridgeland	Farmers Union Co-op	229 Railroad St	715/949-1165
Ridgeland	Farmers Union Co-op	Hwy 25	715/949-1165
Rio	Farmers Union Co-op	115 W Hwy 16	414/992-3535
Ripon	Ripon Co-op	Scott St	414/748-7721
Ripon	Ripon Co-op	E Oshkosh St	414/748-6260
River Falls	Cenex LTD/Cenex Supply	119 W Cedar St	715/425-8483
River Falls	Cenex LTD/Cenex Supply	302 N Clark	715/425-2724

S

Sauk City	Kwik Trip	110 Phillips Blvd	608/643-2133
Scandinavia	Co-op Produce Co	190 N Main St	715/467-2316
Schofield	SuperAmerica	5240 Hwy 50 S	715/359-6459
Seymour	Seymour Co-op	W Morrow St	414/833-6151
Shawano	Kwik Trip	Rt 1 Box 19	715/526-6932
Shawano	Kwik Trip	1063 E Green Bay St	715/526-2939
Shawano	Shawano Equity Co-op	E Seward Rd	715/526-3197
Sheldon	Sheldon Co-op Ser	Rt 1	715/452-5111

Shell Lake	Shell Lake Co-op	113 Hwy 63 N	715/468-2302
Sister Bay	Door Cty Co-op	10252 Hwy 57	414/839-9122
South Wayne	Pecatonica Co-op Oil Co	201 N Galena St	608/439-5301
Sparta	Kwik Trip	630 S Black River Dr	608/269-4656
Sparta	Kwik Trip	1750 Hwy 16	608/269-6122
Sparta	Co-op Oil Co	300 S Water St	608/269-5025
Spooner	SuperAmerica	730 River St S	715/635-9112
Spring Valley	Durand Co-ops	514 E Main St	715/672-8947
Stevens Point	SuperAmerica	1616 Marie Dr	715/345-2920
Stoddard	Kwik Trip	126 Main St	608/457-2135
Stoughton	Dane Cty Farmers Union Co-op	203 W Cottage Grove	800/362-7553
Stoughton	Kwik Trip	517 W Main St	608/873-3383
Stoughton	Kwik Trip	1231 E Main St	608/873-4599
Sturgeon Bay	Door Cty Co-op	92 E Maple Rd	414/743-6555
Sun Prairie	Dane Cty Farmers Union Co-op	203 W Cottage Grove	608/839-4511
Sun Prairie	Stop-N-Go	1706 Windsor St	608/837-7522
Suring	Suring Co-op Assn	223 Heasley Rd	414/842-2353

T

Tomah	Kwik Trip	Rt 1 Box 73 (Store)	608/372-5776
Tomah	Kwik Trip	1504 Superior Ave	608/372-7600
Tomah	Co-op Ser Inc	115 N Superior Ave	608/372-2458
Trevor	J & L Oil	12511 Antioch Rd	414/862-6557
Two Rivers	Kwik Trip	2107 Washington	414/793-5377
Two Rivers	SuperAmerica	1630 22nd St	414/794-7715

U

Union Grove	J & L Oil	1645 Main St	414/878-4068
Union Center	Kwik Trip	Hwys 33/80/82	608/462-5367

V

Valders	Elevator Co-op	120 McKinley St	414/775-4131
Verona	Kwik Trip	201 E Verona Ave	608/845-8997
Verona	Kwik Trip	7583 Mineral Point Rd	608/833-6766
Viroqua	Kwik Trip	603 S Main St	608/637-8160

W

Wales	Kwik Trip	31856 Summit Ave	414/968-5010
Waterloo	Kwik Trip	155 Portland Rd	414/478-2552
Watertown	SuperAmerica	104 N Church St	414/261-4733
Waukesha	J & L Oil	S3124601 W Sunset	414/547-1100
Waukesha	Kwik Trip	1809 W St Paul Ave	414/547-1450
Waukesha	PDQ	21980 Watertown Rd	414/796-1026
Waukesha	PDQ	2302 E Moreland Blvd	414/784-3537
Waukesha	PDQ	426 W Sunset Dr	414/547-2381
Waukesha	Riverbend Quik-Mart	304 N Grand Ave	414/547-0313
Waukesha	Stop-N-Go	910 W St Paul Ave	414/544-4435
Waukesha	SuperAmerica	521 S Grand Ave	414/547-1755
Waukesha	SuperAmerica	400 Summit Ave	414/542-8576
Waukesha	SuperAmerica	1600 E Sunset Dr	414/542-5970
Waumandee	Garden Valley Co-op	Cty Hwy U	608/626-2111
Waunakee	Kwik Trip	208 E Main St	608/849-5008
Waunakee	Stop-N-Go	5305 Cty Trunk N	608/849-7125
Waunakee	Stop-N-Go	404 W Main St	608/849-4622
Waupaca	Kwik Trip	219 W Fulton	715/258-5227
Waupaca	SuperAmerica	120 Badger St	414/258-2661
Waupun	Kwik Trip	121 E Main St	414/324-9112
Waupun	Kwik Trip	235 Fond du Lac Ave	
Wausau	Cloverbelt Co-op	1202 N 1st	715/845-7351
Wauwatosa	PDQ	11500 W N Ave	414/476-3425
West Allis	Baker Beloit Pump	5926 Beloit Rd	414/453-3200
West Allis	Baker Enterprises	9431 W Beloit Rd	414/327-6110
West Allis	Baker West Allis Pump	23 W S 76th St	414/543-9449
West Allis	Enterprised Self-Ser Inc	9530 W National Ave	414/545-3845
West Allis	SuperAmerica	9111 W National Ave	414/543-5310
West Allis	SuperAmerica	5712 W Burnham St	414/545-8311
West Allis	SuperAmerica	12340 W Oklahoma Ave	414/327-1550
West Allis	SuperAmerica	10306 W Greenfield Ave	414/476-1223
West Salem	Farmers Co-op Supply & Shipping	136 E Elm	608/786-1100
West Salem	IGA 140 S Mills	608/786-1730	
Westby	IGA Hwy 14 & 27	608/634-2464	
Weyauwega	Union Co-op	706 N Mill St	414/867-2176
Weyauwega	Union Co-op	Cty X	414/867-2166
Weyerhauser	Equity Co-op Assn	PO Box 148 428 Railway Ave	715/353-2214
Whitehall	Co-op Equity Whitehall	1214 Main St	715/538-4324
Whitehall	Kwik Trip	1626 Main St	715/538-2477
Whitewater	SuperAmerica	1184 W Main St	414/473-7770
Wild Rose	Tomorrow Valley Co-op Ser	1010 Main St	414/622-3561
Wilson	Kwik Trip	I-90 & Hwy 128 (Store)	715/772-4282
Windsor	SuperAmerica	6340 Lake Rd	608/846-5367
Winneconne	Kwik Trip	921 E Main	414/582-4596
Wisconsin Dells	Mauston Farmers Co-op Assn	130 Wash Ave	608/253-1361
Wisconsin Rapids	SuperAmerica	2411 8th St S	715/421-1760
Wisconsin Rapids	SuperAmerica	211 8th St S	715/424-2370

This publication was produced by the Wisconsin Department of Agriculture, Trade and Consumer Protection in cooperation with the Wisconsin Corn Growers Association and the Wisconsin Corn Promotion Board, Inc. Special thanks to the stations who submitted information for this publication. For more copies or to update or add to this listing, write: Wisconsin Department of Agriculture, Trade and Consumer Protection, P. O. Box 8911, Madison, WI 53708-8911, 608/267-9644. We seek your assistance in keeping this list up-to-date.

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Address Correction Requested

SELECTED STATISTICS FOR WISCONSIN AND METROPOLITAN CHICAGO

	1980-81	1985-86	1990-91
WISCONSIN GASOLINE (a)			
Gallons	2,130,732,950	2,051,213,800	2,135,602,350
Barrels	42,614,659	41,024,276	42,712,047
Gallons	2.13 Billion	2.05 Billion	2.13 Billion
Gain/Loss		-79,519,150	+84,388,550
% Gain/Loss		-3.7%	+3.9%
WISCONSIN VEHICLE REGISTRATIONS (b) (Does not include trucks)	3,297,637	3,505,630	3,991,920
Gain		+207,993	+486,290
% Gain		+5.9%	+12.2%
WISCONSIN POPULATION (c)	4,730,902	4,789,122	4,920,507
Gain		+58,220	+131,385
% Gain		+1.2%	+2.7%
CHICAGOLAND POPULATION (d)	7,937,000		8,066,000 +129,000 +1.6%
CHICAGOLAND VEHICLE REGISTRATIONS (e) (Does not include trucks)	3,017,534		3,778,048 +760,514 +20.1%

a. Petroleum Inspection Annual Report
b. DOT-Bureau of Vehicle Registration
c. Brown County Library reference-quoted Wisconsin Blue Book
d. UW-GB Dept. of Commerce-U.S. Statistics
e. Illinois DOT (counties include; Cook, DuPage, Lake, McHenry, Will and the City of Chicago)

Exhibit 10

Selected Statistics for Wisconsin and Metropolitan Chicago

Exhibit 11

Individual Site Detail (Beloit, Beloit Township,
Janesville, and Whitewater)

(The above materials are available at the Corn Promotion Board Office. Please contact Robert Karls, Executive Director, Corn Promotion Board, 2976 Triverton Pike Road, Madison, WI 53711-5808; Tele–(608) 274-7266; or Fax–(608) 274-2006.)