ABILITY OF THE U.S. ETHANOL INDUSTRY TO REPLACE MTBE

PREPARED FOR:

GOVERNORS' ETHANOL COALITION

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The U.S. ethanol industry is capable of expanding to meet the demand for oxygenates that would result from a total withdrawal of Methyl Tertiary Butyl Ether (MTBE) from the domestic marketplace. In response to rising national concern about the presence of MTBE in groundwater and potential risk to public health and the environment, the U.S. Environmental Protection Agency (EPA) convened a Blue Ribbon Panel to assess policy options for MTBE. The Blue Ribbon Panel recommended that the use of MTBE be dramatically reduced or eliminated. EPA has subsequently stated that MTBE should be removed from all gasoline.

The replacement of MTBE with ethanol will increase the demand for ethanol to nearly 3.2 billion gallons by 2004 from an estimated 1.3 billion gallons this year. As shown in the following table the U.S. ethanol industry can virtually double capacity within a two-year timeframe and has the ability to exceed the increased demand created by the phase out of MTBE. The increased capacity will come from improvements in production efficiency leading to increased utilization of existing plants; expansion of existing operating facilities; new construction in place, and proposed facilities currently in various stages of development.

Ability of the Ethanol Industry to Replace MTBE
(Million Gallons per Year)

	2000	2001	2002	2003	2004
Ethanol Demand	**1,343**	**1,781**	**2,231**	**2,693**	**3,168**
Current Production	1,533	1,533	1,533	1,533	1,533
Increased Utilization	0	180	180	180	180
Expansion of Existing Plants	0	420	839	1,049	1,049
Cap'y Under Construction	0	60	121	121	121
Cap'y Under Development	0	0	0	333	598
Total Supply	**1,533**	**2,193**	**2,673**	**3,216**	**3,481**
Surplus	**190**	**412**	**444**	**523**	**313**

There do not appear to be any material constraints to increasing ethanol capacity in the near or long-term. Consequently the need to expand domestic ethanol production to replace MTBE will not lead to a shortfall of oxygenate supply that could result in an increase in gasoline prices.

The cost to add the new ethanol capacity to replace MTBE is estimated at nearly $1.9 billion. The level of construction activity associated with this expansion combined with the increased demand for corn and other grain to produce the additional ethanol will add $11.7 billion to real GDP by 2004, increase household income by $2.5 billion, and generate more than 47,800 new jobs throughout the entire economy.

THE MARKET TO REPLACE MTBE

A ban on the use of MTBE in all gasoline accompanied by retention of the minimum oxygenate requirement in reformulated gasoline will increase the demand for ethanol as ethanol replaces MTBE. Reformulated gasoline makes up about one-third of all gasoline sold in the United States. MTBE has been the dominant oxygenate in reformulated gasoline; virtually all of the MTBE supply is used in reformulated and oxygenated gasoline. Ethanol is the dominant source of oxygen in oxygenated gasoline although this accounts for only about half of total ethanol use. Demand for gasohol blending and to improve octane in conventional gasoline make up the remainder of ethanol use. According to the Energy Information Administration of the Department of Energy (EIA), oxygenated gasoline accounts for about 5 percent of the gasoline sold during the winter months, or about 1.3 percent over the full year.[1] As shown in Table 1 the EIA reported that 3.9 billion gallons of MTBE were used to oxygenate 40.3 billion gallons of reformulated gasoline (RFG) in 1997.[2] Ethanol use in reformulated and oxygenated gasoline in 1997 was estimated by EIA at 695 million gallons, or about 55 percent of total use. Ethanol demand for gasohol and to enhance octane in conventional gasoline accounted for the remaining 45 percent of total use.

[1] *Petroleum Marketing Annual, 1998*. Energy Information Administration, U.S. Department of Energy, Washington, DC, October 1999.

[2] "MTBE, Oxygenates, and Motor Gasoline." http://www.eia.doe.gov/emeu/steo/pub/special/mtbe.html, March 10, 2000.

Table 1
Baseline Demand for MTBE
(1997 – 2004)

	RFG (MGY)	Oxy/RFG (MGY)	Oxy/CO (MGY)	Octane (MGY)	Total (MGY)
1997	3,650	274	12	184	4,121
1998	3,769	278	13	200	4,259
1999	3,793	282	13	215	4,303
2000	3,853	278	13	231	4,374
2001	3,913	274	12	246	4,445
2002	3,974	270	12	262	4,518
2003	4,036	266	12	277	4,591
2004	4,099	262	12	293	4,665

Baseline Demand for Ethanol
(1997 – 2004)

	RFG (MGY)	Oxy/RFG (MGY)	Oxy/CO (MGY)	Octane (MGY)	Total (MGY)
1997	371	43	281	567	1,262
1998	383	44	289	575	1,291
1999	386	44	291	583	1,304
2000	392	43	286	591	1,313
2001	398	43	282	600	1,322
2002	404	42	278	608	1,332
2003	410	42	274	617	1,342
2004	417	41	270	625	1,352

The demand for MTBE and ethanol in the absence of any regulatory action will depend on the use of reformulated and oxygenated gasoline. Table 1 also shows the projected baseline demand for MTBE and ethanol through 2004. The U.S. Department of Energy projects long-term gasoline demand in the United States to grow at an annual rate of 1.4 percent over the next two decades.[3] Applying this growth rate to 1997 RFG use suggests that demand for reformulated gasoline will reach 45.6 billion gallons by 2004. An estimated 4.3 billion gallons of MTBE would be required to oxygenate this quantity of RFG.

Under baseline conditions where MTBE is available for use, ethanol demand for RFG is expected to increase to 417 million gallons by 2004. Demand for oxygenated gasoline to

[3] *Annual Energy Outlook 2000,* U.S. Department of Energy, Energy Information Administration, Washington, DC, December 1999.

achieve carbon monoxide standards in the winter months is expected to decline modestly through 2004 as cities and municipalities come into compliance. However, demand for ethanol to enhance octane in conventional gasoline is expected to increase along with overall gasoline demand.

A ban on the use of MTBE accompanied by the retention of the minimum oxygenate requirement in RFG will increase the demand for ethanol. Since ethanol provides roughly twice the oxygen content of an equivalent volume of MTBE, half as much ethanol would be required to oxygenate the same amount of RFG.[4] As outlined in Table 2, assuming that a phase out of MTBE would be gradually implemented (20 percent reduction in 2000, 40 percent in 2001, etc. to a full phase out by 2004), the amount of ethanol required to replace MTBE would increase from an estimated 396 million gallons in 1999 to almost 2.3 billion gallons in 2004. When the volume of ethanol used as an oxygenate to meet CO attainment and to enhance octane in conventional gasoline is added to this, total ethanol demand is projected to increase from an estimated 1.3 billion gallons in 1999 to 3.2 billion gallons by 2004.

Table 2
Ethanol Demand to Replace MTBE
(Million Gallons per Year)

	RFG	Oxy/RFG	Oxy/CO	Octane	Total
1997	371	43	281	567	1,262
1998	383	44	289	575	1,291
1999	386	44	291	583	1,304
2000	431	35	286	591	1,343
2001	873	26	282	600	1,781
2002	1,328	17	278	608	2,231
2003	1,794	8	274	617	2,693
2004	2,273	0	270	625	3,168

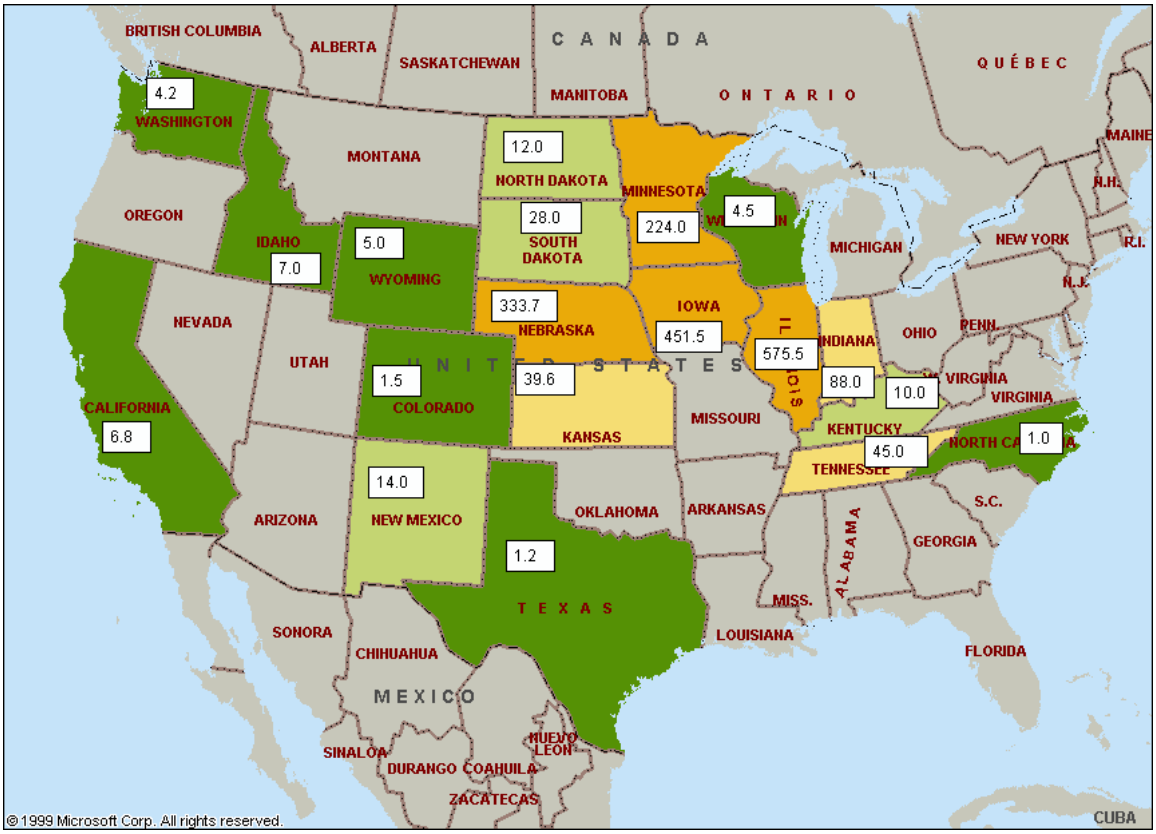
[4] To achieve two percent oxygen content RFG must contain 11 percent MTBE. The same oxygen content can be achieved with 5.7 percent ethanol.

ETHANOL PRODUCTION CAPACITY

1. Existing Facilities

The U.S. ethanol industry will produce an estimated 1.5 billion gallons of ethanol on a base capacity of 1.85 billion gallons in 2000.[5] The difference between production of 1.53 billion gallons and estimated demand of 1.3 billion gallons is accounted for by ethanol inventories in storage. These inventories, currently at record levels, are immediately available to meet the demand of replacing MTBE. Forty-five firms, including farmer-owned cooperatives, currently operate 58 ethanol plants in 19 states. Current ethanol capacity by state is illustrated in Figure 1. Existing plants are identified by operator, location, nameplate capacity, and principal feedstock in Table 3.

Figure 1



Ethanol Capacity by State, March 2000

[5] Capacity is quoted on "name-plate" basis. That is, each plant has a rated capacity. Many of the new dry-mill ethanol plants frequently operate at levels in excess of 120 percent of rated capacity.

Table 3
Ethanol Production Capacity
March 2000

Company	City	State	Primary Feedstock	Capacity (MGY)
A.E. Staley	Louden	TN	Corn	45.0
Ag Power, Inc	Commerce City	CA		2.0
AGP	Hastings	NE	Corn	45.0
Agri-Energy	Luverne	MN	Corn	18.0
Al-Corn	Claremont	MN	Corn	18.0
Alchem	Grafton	ND	Wheat	12.0
Archer Daniels Midland	Decatur	IL	Corn	750.0
	Cedar Rapids	IA	Corn	
	Peoria	IL	Corn	
	Clinton	IA	Corn	
Broin Assoc	Scotland	SD	Corn	8.0
Cargill	EddyVille	IA	Corn	70.0
	Blair	NE	Corn	35.0
Cent MN Ethanol Coop	Little Falls	MN	Corn	18.0
Chief Ethanol	Hastings	NE	Corn	62.0
Chippawa Valley	Benson	MN	Corn	20.0
Corn Plus	Winnebago	MN	Corn	17.5
DENCO	Morris	MN	Corn	15.0
Eco Products of Plover	Plover	WI		4.0
ESE Alcohol	Leoti	KS	Corn	1.1
Ethanol 2000	Bingham Lake	MN	Corn	15.0
Exol	Albert Lea	MN	Corn	18.0
Farm Tech USA	Spring Green	WI	Corn	0.5
Georgia Pacific	Bellingham	WA	Waste	3.5
Golden Cheese of CA	Corona	CA	Cheese/Whey	2.8
Grain Processing Corp	Muscatine	IA	Corn	10.0
Heartland Corn Prods	Winthrop	MN	Corn	17.0
Heartland Grain Fuels	Aberdeen	SD	Corn	8.0
	Huron	SD	Other	12.0

Table 3 (Continued)
Ethanol Production Capacity
March 2000

Company	City	State	Primary Feedstock	Production Capacity (MGY)
High Plains	Portales	NM	Corn	14.0
	Colwich	KS	Corn	20.0
	York	NE	Corn	40.0
Hubinger	Keokuk	IA	Corn	18.0
J.R. Simplot	Heyburn	ID	Potato Waste	3.0
	Caldwell	ID	Potato Waste	4.0
Jonton Alcohol	Edinburg	TX		1.2
Kraft	Melrose	MN	Cheese/Whey	3.0
Manildra Energy	Hamburg	IA	Corn	7.0
Midwest Grain	Atchinson	KS	Corn	8.0
	Pekin	IL	Corn	100.0
Minnesota Clean Fuels	Dundas	MN		1.5
MMI/ETOH	Golden	CO		1.5
MN Corn Processors	Marshall	MN	Corn	32.0
	Columbus	NE	Corn	90.0
MN Energy	Buffalo Lake	MN	Corn	12.0
New Energy Co of IN	South Bend	IN	Corn	88.0
Pabst Brewing	Olympia	WA	Bev Waste	0.7
Parallel Products	Rancho Cucamonga	CA	Food Waste	2.0
	Louisville	KY	Corn	10.0
Permeate Prods	Hopkinton	IA		1.5
Pro-Corn	Preston	MN	Corn	19.0
Reeve Agri-Energy	Garden City	KS	Corn	10.5
Stroh's Brewery	Winston Salem	NC	Bev Waste	1.0
Sunrise Energy	Blairstown	IA	Corn	5.0
Vienna Correctional	Vienna	IL	Corn	0.5
Williams Energy	Aurora	NE	Corn	30.0
	Pekin	IL	Corn	100.0
Wyoming Ethanol	Torrington	WY	Corn	5.0
Total				1,855.8

Source: Bryan and Bryan, Inc. and discussions with plant operators and builders.

There are two sources of potential additional production from these existing facilities: increased capacity utilization and plant expansion.

- Increased Utilization

  Annual production of 1.53 billion gallons on a rated capacity of 1.85 billion gallons indicates an industry capacity utilization rate of 82 percent. Discussions with ethanol

plant operators and builders indicate that if the demand for ethanol increased significantly, improvements in operating efficiencies could readily – and inexpensively -- improve industry-wide capacity utilization to an average of 90 percent.[6] This would very quickly add an additional 180 million gallons of ethanol production per year.

- Expansion to Existing Plants

  One of the quickest methods of obtaining meaningful increases in ethanol production is to expand an existing production facility. Expansion of an existing plant generally can be accomplished in less than half the time required to bring a new plant on line. One major ethanol plant contractor estimated that it would take 10 to 12 months to bring additional production on line by expanding an existing plant compared to the 15 to 20 months that would be required to build a new dry mill corn ethanol plant. The major savings for a plant expansion include the costs and time involved with permitting and infrastructure development.

Not every ethanol plant can be expanded. Very small plants (those under 10 million gallons per year) may have land or other infrastructure limitations that restrict their ability to expand. However, most large, mid-sized, and small wet mill and dry mill ethanol plants can be expanded with little problem.

- Several of the largest ethanol producers including ADM and Williams Energy have indicated a willingness to significantly expand existing ethanol production facilities if ethanol is used to replace MTBE in reformulated gasoline.[7]

- Other industry participants report that most mid-sized ethanol facilities could readily be expanded by at least 20 percent. Some wet mill ethanol facilities have the potential to increase ethanol production by a larger amount.

[6] Discussions regarding the potential for improved production efficiency and constraints for expanding ethanol production were held with Mr. Jeff Broin, President of Broin Companies; Jack Dornan, North American Sales Director, Delta-T Corporation; William Wells, VP, Industrial Relations; Fagen, Inc.; Dick Gadomski, President, Lurgi PSI; Ed Stahl, DFI Group; and Phil Madson, Katsen International.

[7] Personal discussions with executives at ADM and Williams Energy.

- Discussions with ethanol plant designers and builders indicate that most small ethanol plants, particularly the new and relatively new dry mill ethanol plants in the 10 to 15 million gallon per year range, would likely be expanded to the 30 million gallon limit imposed by the small ethanol producer credit.

- One major engineering firm reported that several corn wet milling plants that currently do not produce ethanol have expressed interest in redirecting some of their starch conversion to ethanol production. Combined with additions of new ethanol capacity to these plants, this could represent an additional 200 million gallons of ethanol production annually.

Applying the estimates of expansion potential provided by ethanol industry participants to existing capacity suggests that an additional 1.2 billion gallons of ethanol capacity could be added within a relatively short time frame. Applying a 90 percent capacity utilization rate to this expansion indicates additional annual ethanol production of about one billion gallons per year.

A key contributor to the ability of the ethanol industry to quickly expand existing operations is the relatively uncomplicated nature of the ethanol production process.

- ***According to the major U.S. ethanol engineering and construction firms interviewed for this study, there are no technical, machinery, or equipment constraints that would inhibit or otherwise restrain the ability of existing ethanol producers to expand capacity***.

- Expanding existing capacity is less expensive than building new capacity. Industry sources suggest that the cost to bring a new dry mill ethanol plant on line amounts to $1.25 to $1.50 per gallon and that expanding an existing facility costs about half that amount.[8] Considering this, the industry-wide cost of adding 1.2 billion gallons of new production by expanding existing plant capacity would cost $874 million ($0.75 per gallon times 1,166 million gallons).

[8] Op. Cit. "MTBE, Oxygenates, and Motor Gasoline."

2. Production Capacity Currently Under Construction

Industry sources indicate that an estimated 134 million gallons of new ethanol capacity (121 million gallons of production at a 90 percent utilization rate) is currently under construction and will be brought on line within the next 12 to 18 months. These facilities are listed in Table 4.

Table 4
Ethanol Production Under Construction, March 2000

Company	City	State	Capacity MGY	Feedstock
Golden Triangle	Craig	MO	14.0	Corn
Adkins Energy	Lena	IL	30.0	Corn
BC International	Jennings	LA	20.0	Bagasse/rice hulls
Nebraska Nutrients	Sutherland	NE	15.0	Corn
Dakota Ethanol	Wentworth	SD	40.0	Corn
NE Missouri Grain Proc	Macon	MO	15.0	Corn
Total			**134.0**	

Source: Bryan and Bryan, Inc. and discussions with ethanol plant builders.

3. Proposed Ethanol Projects

A significant number of ethanol projects are on the drawing board. Ethanol industry sources indicate that an estimated one billion gallons of new ethanol capacity are in various stages of proposal and development. These projects, ranked alphabetically by primary feedstock and state are listed in Table 5. This list includes projects ranging from those in the final stages of financing to the preliminary feasibility stage. The increased market for ethanol that would be created by a phase out of MTBE can be expected to provide a significant incentive for financial institutions looking to underwrite these projects.

Table 5
Ethanol Plants Under Development, March 2000

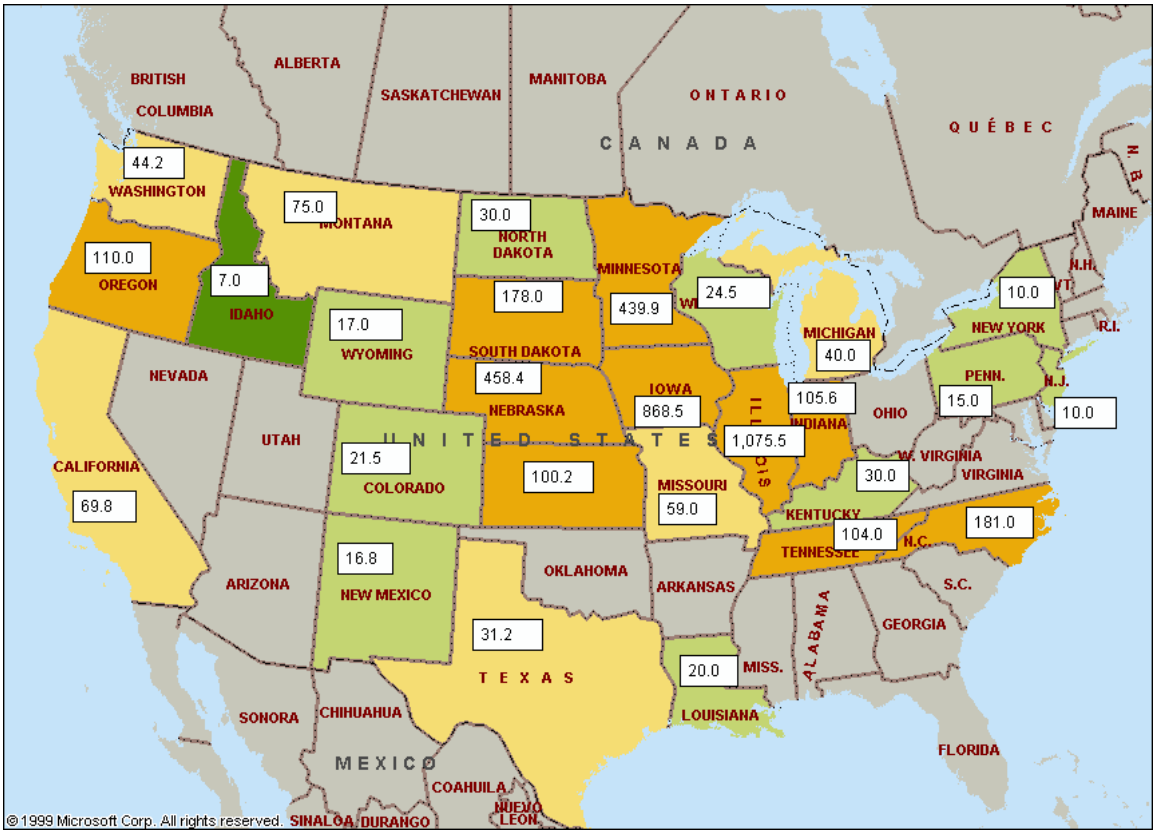
City	State	Capacity (MGY	Feedstock
Grain			
Undisclosed	CO	20.0	Corn
Central Iowa	IA	15.0	Corn
NW Iowa	IA	40.0	Corn
L. Cascade	IL	100.0	Corn
Pratte	KS	15.0	Corn/milo
Undisclosed	KS	40.0	Corn
Undisclosed	KY	20.0	Corn
Central State	MI	40.0	Corn
St. Paul	MN	30.0	Corn
SE Missouri	MO	30.0	Corn
Great Falls	MT	75.0	Wheat/Barley
Neely	NE	15.0	Corn
Central State	NJ	10.0	Corn
Clatskanie, OR	OR	80.0	Corn/wheat
Milbank	SD	40.0	Corn
Platte	SD	15.0	Corn
Rosholt	SD	15.0	Corn
Undisclosed	TX	30.0	Corn
Moses Lake	WA	40.0	Corn/Barley
Lacrosse	WI	20.0	Corn
Subtotal		**690.0**	
Biomass Conversion			
SE Region	AK	8.0	Wood Waste
NE Region	CA	15.0	Forest Residues
Gridley	CA	20.0	Rice Straw
Mission Viejo	CA	8.0	Rice straw
Chester	CA	20.0	Forest Residues
Onslow County	NC	60.0	Sweet potatoes
Greene County	NC	60.0	Sweet potatoes
Martin County	NC	60.0	Sweet potatoes
Middletown	NY	10.0	MSW
Central Region	OR	30.0	Wood Waste
Philadelphia	PA	15.0	MSW
Black Hills	WY	12.0	Forest Residues
Subtotal		**318.0**	
TOTAL NEW CAPACITY		**1,008.0**	

One of the most interesting features of the new ethanol plants under development is the diversity of feedstocks. Only about two-thirds of new ethanol plants plan to use corn and other grains as the feedstock (compared to 90 percent of existing capacity). The ethanol engineering firms contacted for this study report that one-third of new capacity will use biomass conversion

to produce ethanol. These plants will use a wide range of feedstocks including forest residues and wood waste, non-traditional agricultural products such as sweet potatoes and rice straw, and municipal sewage waste. The technology supporting biomass conversion for ethanol production is emerging. Maturation and commercialization of biomass conversion technology is expected to provide an almost limitless potential for ethanol production.

The addition of new ethanol capacity from expansion of existing plants, projects under construction, and those under development to existing capacity are illustrated in Figure 2. This highlights the potential geographic expansion of the ethanol industry.

Figure 2
Projected Total Ethanol Capacity by State



In addition to the feedstocks discussed above significant potential exists to use sugar for ethanol production. U.S. sugar production reached record levels last season resulting in stock accumulation and declining domestic prices. As a consequence, sugar processors have begun forfeiting on non-recourse loans under the 1996 Farm Bill and sugar is transferring to government ownership. Industry estimates indicate that the government may acquire as much as 350,000 metric tonnes of sugar through loan defaults. This is the equivalent of 56 million

gallons of ethanol. Additionally, the world sugar situation points to continued large stocks and declining prices which will further pressure domestic sugar producers and processors. Sale of this sugar to ethanol manufacturers may provide an opportunity to limit net budgetary outlays this year and next. The use of this sugar in ethanol production has not been considered in our supply and demand estimates, but this is another factor supporting the potential for higher ethanol output.

Under the assumption that only two-thirds of the ethanol plants currently under proposal eventually break ground and produce ethanol, this amounts to 665 million gallons of capacity and 598 million gallons of production at a 90 percent capacity utilization rate by late 2003 or 2004. The cost to build the 665 million gallons of Greenfield ethanol production is estimated at $1 billion.

As was the case with expanding existing production capacity, industry sources do not foresee any technical or material constraints to building an additional one billion gallons of new ethanol capacity by 2004. The concern most frequently cited by builders was the availability and price of grain feedstock for ethanol production. Although this is a legitimate concern, the availability of corn and other grain should not be a problem for the ethanol industry.

- A recent analysis prepared for Senator Tom Harkin by the Office of the Chief Economist at the U.S. Department of Agriculture examined the implications of replacing MTBE with ethanol.[9] The ethanol demand projections used by USDA were consistent with those presented in this analysis. USDA concluded, "…that a 4-year adjustment period is sufficient to enable ethanol production and distribution capacity to expand to meet the projected increase in demand."[10]

- The replacement of MTBE with ethanol would require the equivalent of an additional 654 million bushels of corn by 2004 over baseline demand levels. This represents about 37 percent of projected ending stocks of corn, and at the five-year average yield of 127.1 bushels per acre, this would require about 5 million acres of production.

[9] "Economic Analysis of Replacing MTBE with Ethanol in the United States." Office of the Chief Economist, USDA, November 1999.

[10] Transmittal letter from Sec. Dan Glickman to Sen. Tom Harkin, November 15, 1999.

- As indicated earlier, a significant share of proposed new production will use biomass conversion to produce ethanol. As this technology develops and matures, the range of potential feedstocks will expand thereby lessening the potential for disruption in the supply of any individual input.

ETHANOL SUPPLY AND DEMAND BALANCE

The replacement of MTBE will result in a demand for ethanol of 3,168 million gallons by 2004. The combination of current production; increased utilization of existing capacity; expansion of existing capacity; capacity under construction; and new capacity under development is expected to provide a total ethanol supply that more than exceeds the requirement to replace MTBE on an annual basis through 2004. The expansion plans discussed above will result in total production of more than 3.4 billion gallons of ethanol by 2004, 313 million gallons more than will be needed to replace MTBE and meet all other uses of ethanol.

A likely path for expanded ethanol production incorporating the supply and demand factors discussed above is presented in Table 6. The projected supply of ethanol assumes that ethanol producers maintain a 90 percent capacity utilization rate and two-thirds of the ethanol projects currently under development are consummated and brought on-line.

Table 6
Ethanol Supply and Demand Balance: Replacement of MTBE
(Million Gallons per Year)

	2000	2001	2002	2003	2004
Ethanol Demand	1,343	1,781	2,231	2,693	3,168
Current Production	1,533	1,533	1,533	1,533	1,533
Increased Utilization	0	180	180	180	180
Expansion of Existing Plants	0	420	839	1,049	1,049
Under Construction	0	60	121	121	121
Capy Under Development	0	0	0	333	598
Total Supply	**1,533**	**2,193**	**2,673**	**3,216**	**3,4815**
Percent Increase from 2000		**43.0%**	**74.4%**	**119.8%**	**127.1%**
Surplus	**190**	**412**	**443**	**523**	**313**

This projection is based on the expectation of expansions to existing capacity and projects known to be under development. As discussed above, the expansion of ethanol demand to replace MTBE can be expected to stimulate additional production from other new plants and the conversion of new feedstocks such as sugar. Any of these additional facilities will only expand production potential beyond that indicated in Table 6.

ECONOMIC IMPACTS

The replacement of MTBE with ethanol will have a positive impact on the American economy. Expenditures on machinery, equipment, labor, and supplies to expand existing capacity and build new plants represent the purchase of final demand from supplier industries. The increased demand for corn and other grains as inputs for ethanol production raises corn prices and results in increases in the aggregate value of agricultural production measured by increased farm cash receipts from marketing. These additional dollars resulting from expanded ethanol production will circulate throughout the entire economy generating additional final demand and creating new jobs and income for all Americans. The full range of these impacts can be estimated by applying final demand multipliers for output, employment and earnings to the increases caused by ethanol expansion.[11]

The expansion of current ethanol capacity to meet the demand created by replacement of MTBE in the nation's reformulated gasoline is projected to cost nearly $1.9 billion. USDA projected that the increased demand for corn to support the additional ethanol production will increase cash receipts from marketings for farmers by $2.3 billion between 2000 and 2004.[12] The combination of these direct effects is summarized in Table 7.

[11] The multipliers used in this analysis are the current two-digit industry RIMS II multipliers estimates by the Bureau of Economic Analysis, U.S. Department of Commerce.

[12] Op.Cit. USDA.

Table 7
Economic Impacts of Expanding Ethanol Production to Replace MTBE

	Ethanol Expansion 2000-2004	Increased Farm Cash Receipts	Total Impact (2000-2004)
Direct Impacts (Mil $)	$1,871	$2,337	$4,208
Real Output (Mil $)	$5,228	$6,446	$11,674
Household Income (Mil $)	$962	$1,508	$2,470
Employment (Jobs)	34,316	13,493	47,809
Food Processing	2,304	7,313	9,617
Construction	1,007	254	1,261
Transportation	1,873	403	2,276
Retail Trade	2,473	730	3,203
Service Industries	8,854	2,444	11,298

The combination of direct expenditures resulting from the expansion of ethanol capacity and increased agricultural output will add $11.7 billion to final demand in the economy. This means that real GDP will be $11.7 billion higher by 2004 as a direct consequence of the replacement of MTBE by ethanol. The increased economic activity resulting from the expansion of the ethanol industry will put an additional $2.5 billion of income in the pockets of American households.

Finally, the increase in final demand from ethanol expansion and increased agricultural output will create more than 47,800 new jobs across the entire economy. While more new jobs will be created in the food processing industry which includes ethanol production (about one third of all new jobs), other industries will benefit. Specifically, about 2,300 new jobs will be created in the transportation industry, 1,300 in construction, 3,200 in the retail trade sector, and more than 11,000 in the service industries.

CONCLUSION

The replacement of MTBE in the nation's reformulated gasoline supply will present a significant market opportunity for the domestic ethanol industry. Through a combination of improved efficiency; expansion of existing facilities; and new construction American ethanol producers will be able to produce more than enough ethanol to replace MTBE as it is phased out of the nation's gasoline supply. By 2004, the domestic industry is capable of producing more than 3.4 billion gallons of ethanol, some 317 million gallons more than will be required to replace MTBE.

The cost to add this new ethanol capacity is estimated at nearly $1.9 billion. However, these expenditures represent the purchase of final demand from other industries and, when combined with increased agricultural output, will have a significant positive impact of gross output, income, and job creation in the entire economy.