



MINNESOTA DEPARTMENT
OF AGRICULTURE

Legislative Report on Ethanol

Review of E20



Christina Connelly, 651-201-6220
Ralph Groschen, 651-201-6223
625 Robert St. N., St. Paul, MN
www.mda.state.mn.us

January 15, 2011

Table of Contents

Executive Summary	3
Introduction	4
Background	4
E20 Use and Issues	5
EPA Waiver	5
Minnesota’s Ethanol Content Mandate.....	5
E20 Testing and Certification	6
Growth Energy E15 Application	6
Minnesota’s E20 Strategy	6
The Example of Brazil	7
Impact on Minnesota’s Ethanol Industry	7
Potential Market Impact of E15 and E20	8
Market Impact of E85 and Blender Pumps	8
Discussion	9
Impact on Minnesota Consumers	9
Ethanol and Gasoline Prices	9
Employment and Other Economic Indicators	10
Conclusions	11

Pursuant to Minn. Stat. § 3.197, the cost of preparing this report was approximately \$5,000.

In accordance with the Americans with Disabilities Act, an alternative form of communication is available upon request. TDD: 1-800-627-3529

An Equal Opportunity Employer

Executive Summary

Virtually all gasoline in Minnesota is blended with 10 percent ethanol—commonly referred to as “E10.”¹ According to Minnesota Statutes §239.791, subdivision 1a, all gasoline sold or offered for sale in the state of Minnesota must contain 20 percent ethanol by August 30, 2013. Minnesota could meet this mandate either by increasing its sales of E85 and other midlevel blends, or by increasing the amount of ethanol blended into gasoline to 20 percent (E20).² Current data indicates that Minnesota is unlikely to achieve this requirement through E85 and midlevel blend sales alone.

According to the federal Clean Air Act, the U.S. Environmental Protection Agency (EPA) is responsible for certifying the maximum allowable content of ethanol in gasoline. Specifically, the EPA must grant a waiver to the Clean Air Act certifying higher blends that contain more than 10 percent ethanol as a legal fuel. A waiver application must be submitted by industry with data demonstrating that the blend will not cause more pollution than gasoline or adversely affect engines or fuel and emissions control systems. In March 2009, an industry group called Growth Energy applied to EPA for a waiver of up to 15 percent ethanol in gasoline (E15). EPA approved the request in October 2010 for 2007 and newer model year vehicles with plans for a subsequent decision on 2001 to 2006 vehicles by 2011.

Minnesota law mandates use of federally-approved higher blends—but *only if* EPA grants a waiver for all model year vehicles. Absent a mandate, EPA’s E15 decision is unlikely to have much, if any, impact in Minnesota due to the cost to retailers of voluntarily installing E15 pumps for only a small segment of the vehicle market. Minnesota thus continues to pursue its E20 mandate as an optimal strategy for meeting state—and ultimately, national—energy goals. A variety of state and federal studies indicate no serious detriment from the use of higher blends, including E20. Some federal-level research is still ongoing, however, and must be completed before an E20 waiver application can be submitted.

The use of E20 fuel throughout Minnesota would have a significant positive impact on the state’s ethanol industry and its consumers. Minnesota currently has the capacity to produce more than 1 billion gallons of ethanol per year, but Minnesotans only consume about 250 million gallons through E10, midlevel blend and E85 sales combined. Increasing the percentage of ethanol that is blended into gasoline from 10 to 20 percent would double the market for ethanol both in Minnesota and potentially on a national basis. This new market would protect investments in existing corn ethanol plants and stimulate development in the emerging cellulosic ethanol industry in Minnesota and across the nation.

Consumers would also benefit from the implementation of the E20 requirement in Minnesota. Since the year 2000, the average net price of one gallon of ethanol³ has been approximately 30 cents lower than a gallon of gasoline.⁴ Ethanol also increases the octane value of fuel—for instance, blending one gallon of ethanol with nine gallons of gasoline results in E10 with an octane rating equal to “super unleaded” gasoline. This type of gasoline typically costs 10 cents more than unleaded regular gasoline at retail in most metropolitan areas. Using more lower-cost, higher-octane ethanol in gasoline provides an opportunity to reduce costs and pass savings onto consumers.

¹ Certain applications are exempt from the use of non-oxygenated premium gas in airports, resorts, marinas, race tracks, and collector vehicles.

² E85 is a nominal blend of 85 percent ethanol and 15 percent gasoline; midlevel blends are those containing over 10 percent but less than 70 percent ethanol; E20 is a blend of 20 percent ethanol and 80 percent gasoline.

³ The average net price refers to the price of E100 at the rack (wholesale) minus the 45 cent tax credit to the blender. The tax credit has been reduced incrementally from 60 cents beginning in 1997.

⁴ Gasoline refers to 87 octane unleaded regular gasoline.

Introduction

This report is submitted pursuant to Laws of Minnesota 2005, Chapter 52, Section 4:

“The commissioner of agriculture in consultation with the commissioners of employment and economic development and the Pollution Control Agency, shall review the information and data collected in the evaluation of any federal waiver request for the use of E20 fuel in Minnesota. The commissioner shall use existing budgetary and staff resources in conducting the review. The review must include:

- (1) issues involving the use of E20 fuel if such fuel is mandated in Minnesota;*
- (2) effects of E20 on development of Minnesota’s ethanol industry; and*
- (3) effects of E20 on Minnesota consumers.*

The commissioner shall present an initial report to the legislative committees having jurisdiction over agriculture and environment policy and finance on the findings of the review to the legislature by January 15, 2009 and present an updated report to those committees on January 15, 2011.

Background

Minnesota has a long history of leadership in biofuels development, beginning in the late 1980s with production incentives that helped rapidly build the state’s ethanol industry. In 2003 Minnesota became the first state to require the blending of 10 percent ethanol in gasoline (E10), and in 2005 implemented a mandate for E20 by 2013.⁵ The 2005 Legislature also authorized grants to develop data on the efficiency of ethanol combustion to inform potential authorization of E20 as a legal fuel by the U.S. Environmental Protection Agency (EPA).⁶

As of 2010, Minnesota had 21 ethanol plants with a combined production capacity of over 1 billion gallons. Minnesota ethanol sales, which include E10, E85 and a limited amount of mid-level blends such as E30, are estimated at approximately 250 million gallons, or nearly 10 percent of the 2.5 billion gallons of gasoline sold annually.⁷ However, Minnesota’s ethanol industry—like many industries in the United States and around the world—has felt the impact of volatile commodity price swings and the worst economic turmoil in decades. Temporary plant closures and falling gas prices have resulted in lower actual production figures and declining sales among consumers.

The Renewable Fuel Standard (RFS2), expanded by the federal Energy Independence and Security Act (EISA) of 2007, requires nationwide production of 36 billion gallons of biofuels by 2022—including 15 billion gallons of ethanol from corn and 21 billion gallons of biofuels from other biomass feedstocks.⁸ Until recently, only blends of up to 10 percent ethanol were legally allowed for use in non-flex fuel vehicles. Assuming that the United States consumes about 140 billion gallons of gasoline, the exclusive use of E10 would utilize as much as 14 billion gallons of ethanol, or more likely, around 11.5 to 12.2 billion gallons—slightly less than the projected 13 billion gallon ethanol production capacity.⁹ This is commonly referred to as the 10 percent “blend wall”—the point at which the ethanol market would no longer accommodate production capacity. In October 2010, the EPA approved the use of E15 in 2007

⁵ Laws of Minnesota for 2005, Chapter 52, which established the requirement in Minnesota Statutes §239.791, subd. 1a.

⁶ Chapter 1, Article 1, Section 71 of the 2005 Special Session, which amended Minnesota Statutes §41.09 to include subd. 9

⁷ Minnesota Department of Agriculture, July 2010.

⁸ EISA is Public Law 110-140.

⁹ Renewable Fuels Association estimate for January 2010. Plants that are either expanding or under construction would provide another 1.4 billion gallons of production capacity.

and newer vehicles, but the impact will likely be very limited given the small market segment of vehicles to which it applies.

Without additional outlets for ethanol and other biofuels, there may not be a sufficient market to encourage or accommodate ethanol production from corn or other biomass-based feedstocks. Such a situation will create even greater potential pressure on ethanol prices. E85 and midlevel ethanol blends still represent promising options to increased market penetration, but E20 may offer the best venue for addressing the regulatory hurdles confronting the general use of midlevel blends and meeting federal RFS2 goals. Current data suggests that attaining the 20 percent requirement through E85 and E10 alone would call for extraordinary growth in these markets; thus, Minnesota continues to pursue the use of E20 as a general fuel.

E20 Use and Issues

EPA Waiver

Until recently, only gasoline containing up to 10 percent ethanol was certified as legal for general use in gasoline engines. Higher blends—including E20—must be approved by the EPA through a waiver to section 211(f)(4) of the Clean Air Act.¹⁰ A waiver application must be filed by industry that includes data demonstrating E20 will not cause significant problems in the following areas:

- Fuel system materials compatibility;
- Vehicle drivability/engine operation characteristics;
- Exhaust and evaporative emissions;
- Fuel and emissions systems and engine durability; and,
- Health effects.

During the EPA’s certification process, vehicle, dispenser and equipment manufacturers will register an opinion with the EPA on the suitability of E20 for use in their products. This process requires the EPA to review data presented by interested parties, take relevant issues into consideration and make a decision that ensures minimal impact on consumers of E20 and the environment.

Minnesota’s Ethanol Content Mandate

In 2005, Minnesota implemented legislation mandating that “all gasoline sold or offered for sale in the state of Minnesota” contain 20 percent ethanol by August 30, 2013.¹¹ The provision would expire, however, if 20 percent of gasoline sold in Minnesota was already ethanol (for instance, through the expanded use of E10 and E85), or if the EPA had not already approved E20 for general use, by December 31, 2010.¹²

In 2009, the legislature modified the ethanol mandate to require any higher ethanol-gasoline blends authorized by an EPA Clean Air Act waiver to automatically become mandatory in Minnesota. The 2010 Minnesota Legislature made additional changes: first, it changed the statute expiration date to December 31, 2012, thereby extending by two years the de facto “deadline” by which EPA must approve a higher ethanol blend; second, the legislature clarified that federally-approved higher blends

¹⁰ Title 42, U.S.C. §7545 of the Clean Air Act.

¹¹ MS §239.791, subd. 1a.

¹² MS §239.791, subd. 1a(c).

would only become mandatory in Minnesota if the EPA granted a waiver for all vehicles, “irrespective of model year.”¹³

E20 Testing and Certification

The 2005 Minnesota Legislature appropriated funds for the Minnesota Department of Agriculture, with support from the Minnesota Corn Growers Association and the Council of Great Lakes Governors, to initiate E20 studies with the University of Minnesota Mechanical Engineering Department on drivability and with Minnesota State University-Mankato on materials compatibility. The work was completed and reports for these studies were posted on the Minnesota Department of Agriculture website in March of 2008 (<http://www.mda.state.mn.us/renewable/ethanol/default.htm>). The studies generally concluded that vehicles operating on E20 performed as well as those running on E10 or pure gasoline. The tests also found that using the higher E20 ethanol blends did not cause significant problems for a wide range of materials, including metals, plastics, rubbers and fuel pumps used in these vehicle fuel systems.

Subsequent to the passage of the 2007 EISA, the U.S. Department of Energy (DOE) along with the EPA, the U.S. Department of Agriculture (USDA), and others launched a \$40 million research program on “Mid-Level Ethanol Blends.” The extensive program, pursuant to EPA certification of E20, involves testing many aspects of vehicles; small non-road engines including lawn equipment and generators; and specialty engines such as marine, snowmobile and motorcycle engines. As of fall 2010, DOE had completed testing on materials compatibility, drivability, emissions and durability for 2007 model year and newer vehicles; completion of testing for 2001 through 2006 model year vehicles is anticipated by the end of 2010. DOE is also purportedly conducting testing on older vehicles, which it plans to complete in spring 2011. Testing on health effects is being conducted by Growth Energy and the Renewable Fuels Association, in partnership with a nonprofit research organization called the Southwest Research Institute.

Growth Energy E15 Application

In March 2009, an ethanol industry group called Growth Energy applied for a Clean Air Act waiver from the EPA to allow for an increase in ethanol blends of up to 15 percent. The application included studies on materials compatibility, drivability, emissions and durability; it did not include data on health effects. Notably, five E20 studies from Minnesota were submitted in support of Growth Energy’s request.

In October 2010, after several delays, EPA announced its decision to allow E15 in 2007 and newer vehicles; EPA intends to issue a subsequent decision on 2001 and newer vehicles by late 2010 or early 2011, after completion of additional DOE testing. EPA’s decision document on E15 cited a lack of data on vehicles manufactured before 2001 as well as other applications (e.g., non-road products, heavy-duty engines and vehicles, and motorcycles), and thus denied the waiver request for these market segments.

Minnesota’s E20 Strategy

Minnesota continues to pursue its E20 mandate. Numerous studies—including those from Minnesota—have found that E20 performs well in both new and older vehicles. Small engines are also being tested by the DOE and others. Before E20 can be approved for general use, the results of these studies will be reviewed to evaluate any impact from general usage of the fuel. In the meantime, the Minnesota

¹³ Laws of Minnesota for 2010, Ch. 333, Sec. 19, subd. 2a.

Department of Agriculture (MDA) is actively engaged in discussions with industry and other stakeholders about submitting an application for E20, in accordance with Minnesota's statute.

Since Growth Energy submitted its waiver application, a number of other testing reports have been issued—including one from Minnesota State University-Mankato in late March 2009 on fuel pump durability (“An Examination of Fuel Pumps and Sending Units During a 4000 Hour Endurance Test in E20”).¹⁴ DOE also issued its “Report #2” on mid-level ethanol blends subsequent to Growth Energy’s application. These tests could be included as additional support for a Minnesota E20 waiver application.

The Example of Brazil

The products of many vehicle and small engine companies common to the U.S. market are being used in Brazil, where gasoline/ethanol blends have fluctuated between 20 and 26 percent since 1978. These include manufacturers of:

- a. Vehicles including GM, Ford, Chrysler, Toyota, Honda, Nissan, Suzuki, Mitsubishi, Subaru, Lexus, Hyundai, VW, Fiat, Alfa Romeo, Audi, BMW, Mercedes Benz, Porsche, Ferrari, Jaguar, Land Rover, Maserati, Peugeot, Citroen, Renault, and Volvo;
- c. Small and specialty engines including Honda, Toyama, Shindaiwa, Briggs, Murray, MTD;
- d. Boat engines (Honda, Yamaha, Suzuki, Kawasaki, Mercury, Toyama, PCM, Crusader Marine, Sea Doo, Evinrude); and,
- e. Flex Fuel Vehicles (GM, Ford, VW, Fiat, Peugeot, Citroen, Renault, Toyota, Honda and Mitsubishi. Nissan is also expected to launch a model).

The fact that so many manufacturers familiar to U.S. consumers manufacture equipment for Brazil suggests that compatibility and operability issues could be addressed in the U.S. market over time. Brazil’s environmental regulations are not as strict as those in the United States; however, their vehicles are equipped with catalytic converters, and their existing emission limitations apply to light trucks and are getting tighter.

As in Brazil, various issues associated with midlevel ethanol blends can be addressed in the United States, as they continue being addressed across the country with the growing use of E10. Prior to E10 implementation, some vehicle and small engine manufacturers and environmentalists suggested that the blend was not compatible with equipment or environmental regulations. As time progressed, however, E10 has proven to be a fuel that functions well in virtually all applications, has helped make gasoline burn cleaner, and has become a crucial part of EPA’s reformulated gasoline program (designed to reduce ambient ozone levels in the country’s largest metropolitan areas).

Impact on Minnesota’s Ethanol Industry

As of October 2010, Minnesota’s ethanol production industry included 21 plants capable of producing about 1.1 billion gallons of fuel ethanol per year. The implementation of higher blends in Minnesota, along with continued use of E85 and other mechanisms for market expansion, could positively impact Minnesota’s ethanol industry—particularly if allowed to penetrate a significant portion of the vehicle market.

¹⁴ This report can be found on MDA’s website at <http://www.mda.state.mn.us/renewable/ethanol/e20testresults.aspx>.

Potential Market Impact of E15 and E20

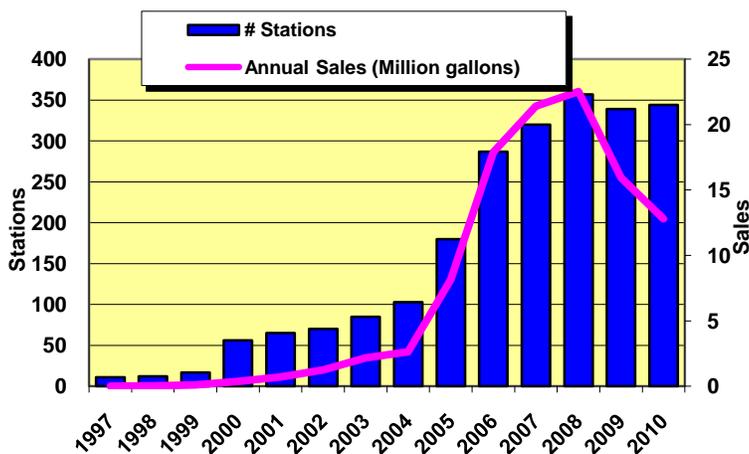
As discussed, Minnesota law does not require the use of federally-allowable blends above E10 unless approved by EPA for use in all vehicles; thus, while blends of up to E15 are *allowed* for use in 2007 and newer vehicles in Minnesota (and nationally), such blends are not *mandated* by state law. EPA’s decision to allow blends of up to 15 percent ethanol in 2007 and newer vehicles is unlikely to have much, if any, impact on the state’s market. Not only do vehicles from 2007 and later represent just 15 percent of the private fleet in Minnesota (18 percent nationally), but retailers are not likely to dedicate pumps solely for use by such a small percentage of their customers. EPA’s decision also requires explicit labeling of E15 pumps that may de-incentivize the use of that blend. Even if the EPA approves E15 in 2001 and newer models (about 50 percent of the fleet in Minnesota and nationally), impact may still be limited.

Approving E15 for all vehicles and blending it into the entire U.S. gasoline supply would represent approximately 21 billion gallons of the nearly 140 billion gallons of gasoline consumed annually. In Minnesota, a full E15 mandate could increase total state ethanol sales to approximately 375 million gallons through E15 sales alone, plus additional gallons through sales of E85 and other mid-level blends. At an E20 level of blending, Minnesota could consume more than 480 million gallons of ethanol—still well within the state’s production capacity, and with an annual net export capacity of over 600 million gallons.¹⁵

Market Impact of E85 and Blender Pumps

The estimated national consumption of E85 and other midlevel blends, between 300 and 350 million gallons per year, is relatively small but could provide a significant additional market for ethanol.¹⁶ Minnesota has approximately 360 E85 pumps—more than any other state—representing approximately 15 percent of the state’s service stations. At the end of August 2010, estimated E85 sales for Minnesota totaled approximately 11 million gallons—a decline in sales for the first time since pumps were installed beginning in 1997. Use of E85 declined in 2009 due to the comparatively low price of gasoline by about 30 percent from 2008 (*see Figure 1*).

Figure 1. Minnesota’s E85 Sales, 1997-2010¹⁷



Source: MDA, AMS

¹⁵ Based on Minnesota Department of Agriculture 2010 projections.

¹⁶ Growth Energy and the American Lung Association in Minnesota, 2010.

¹⁷ “Economic Impact of the Corn and Ethanol Industry in Minnesota,” Minnesota Department of Agriculture, 2008.

Blender pumps are another potential market for greater ethanol use in the United States. These pumps deliver various ethanol blends including E10, E20, E30, E40, E50 or E85. There are currently about 68 blender locations in Minnesota. A strong increase in the use of blender pumps could also provide a significant additional market for ethanol. Similarly, the use of blender pumps could increase with the certification and use of E20 in conventional vehicles.

In October 2010, U.S. Secretary of Agriculture Tom Vilsack instructed USDA Rural Development officials to use existing resources to provide financial assistance and matching funds to help install 10,000 blender pumps and storage systems over the next 5 years. This program is yet to be implemented, but may represent a significant opportunity for Minnesota to increase its number of blender pumps.

Discussion

As of August 2010, approximately 85 percent of the nation's gasoline contained 10 percent ethanol.¹⁸ The EPA and others estimate that the maximum level of U.S. ethanol use in the nation's 140 billion gallons of gasoline as E10 could be as much as 14 billion gallons but is more likely to be 11.5 to 12.2 billion gallons per year.¹⁹ At the same time, the annualized national ethanol production capacity estimate for January 2010 was approximately 13 billion gallons.²⁰

Nonetheless, the U.S. market for ethanol will likely be saturated soon unless higher blends (like E15 or E20) are approved for a general use in the majority of U.S. vehicles. Without continued market expansion the entire ethanol industry could experience extreme ethanol price depression; Minnesota's industry would be no exception. General use of E20, however, would double the potential U.S. market for ethanol, thereby accommodating existing ethanol production and future advanced ethanol production facilities—including cellulosic and other advanced fuels—in Minnesota and across the country.²¹

Impact on Minnesota Consumers

The benefits of Minnesota's ethanol industry and E20 requirement will be passed onto consumers in the form of lower fuel prices, increased tax revenues, and more jobs.

Ethanol and Gasoline Prices

The average net price of a gallon of ethanol has generally been less than a gallon of 87 octane unleaded regular gasoline²². Specifically, over the past 10 years, the average net price of one gallon of ethanol to a commercial blender in the Twin Cities was 30 cents less than a gallon of 87 octane unleaded regular gasoline, and in 2010, the net price of ethanol averaged 88 cents per gallon less than unleaded regular (see *Figure 2*).

¹⁸ ProExporter Network, November 2010.

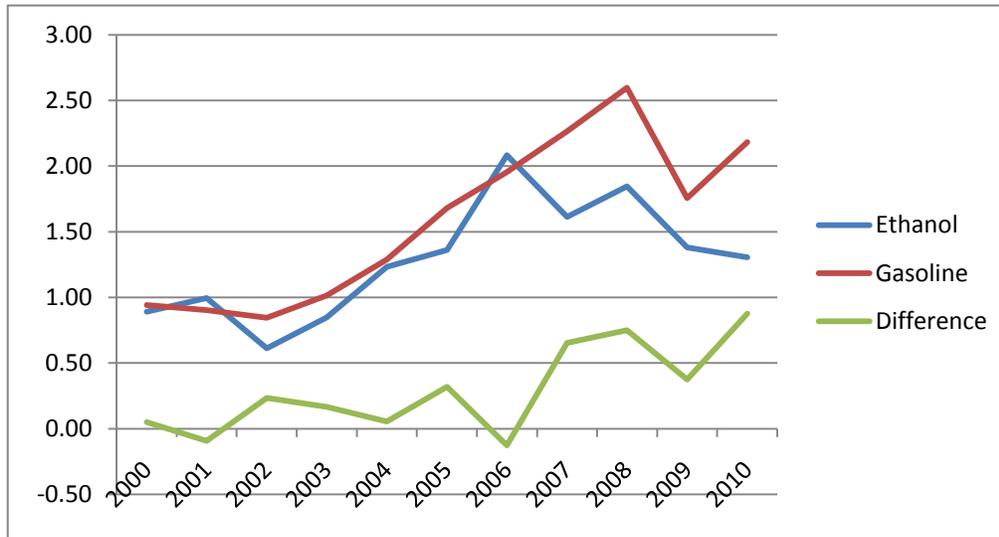
¹⁹ The current RFS exempts "small refiners" from the obligation to blend ethanol in their gasoline. Thus, under these provisions, the EPA and others have estimated that the total actual volume of ethanol required by the RFS to be blended with gasoline at 10 percent would be somewhat lower than exactly 10 percent of total nationwide gasoline consumption.

²⁰ Renewable Fuels Association, 2010.

²¹ Although Minnesota does not currently have any cellulosic ethanol plants, several facilities are exploring the feasibility of future advanced biofuels production.

²² Net ethanol rack (E100, wholesale) price to the blender, after tax credit; 87 octane gasoline rack (wholesale) price.

Figure 2. Minnesota's 10-Year Ethanol²³ vs. Gasoline²⁴ Price Trends, 2000-2010²⁵



Source: MDA, AMS

It is important to note that the period from 2008 to 2010 was particularly volatile for commodity prices, and ethanol and gasoline were no exception. Fluctuations in the ethanol and gasoline markets—along with corn, crude oil and many other commodities—caused considerable turmoil for consumers and businesses alike.

Ethanol also reduces the cost of gasoline by increasing its octane value: one gallon of ethanol adds two points to the octane value of nine gallons of the gasoline with which it is blended. For instance, one gallon of ethanol blended with nine gallons of 87 octane regular unleaded gasoline results in 10 gallons of an E10 blend of 89 octane “super unleaded” gasoline. Twin Cities retail stations have traditionally sold super unleaded for 10 cents per gallon more than unleaded regular gasoline. Therefore, lower-cost, higher-octane ethanol reduces the cost of gasoline at the blender level and provides an opportunity to pass savings onto the customer.

Employment and Other Economic Indicators

As discussed, ethanol is currently equivalent to about 10 percent of Minnesota’s gasoline consumption. This reduces the amount of crude oil required to meet the state’s gasoline needs and keeps jobs and tax revenue in the state.

It is estimated that Minnesota’s ethanol industry provided an economic impact of approximately \$2.5 billion dollars and more than 6,800 good paying jobs in 2009—with projections of \$3 billion and nearly 8,400 jobs for 2010 (see Figure 3).²⁶

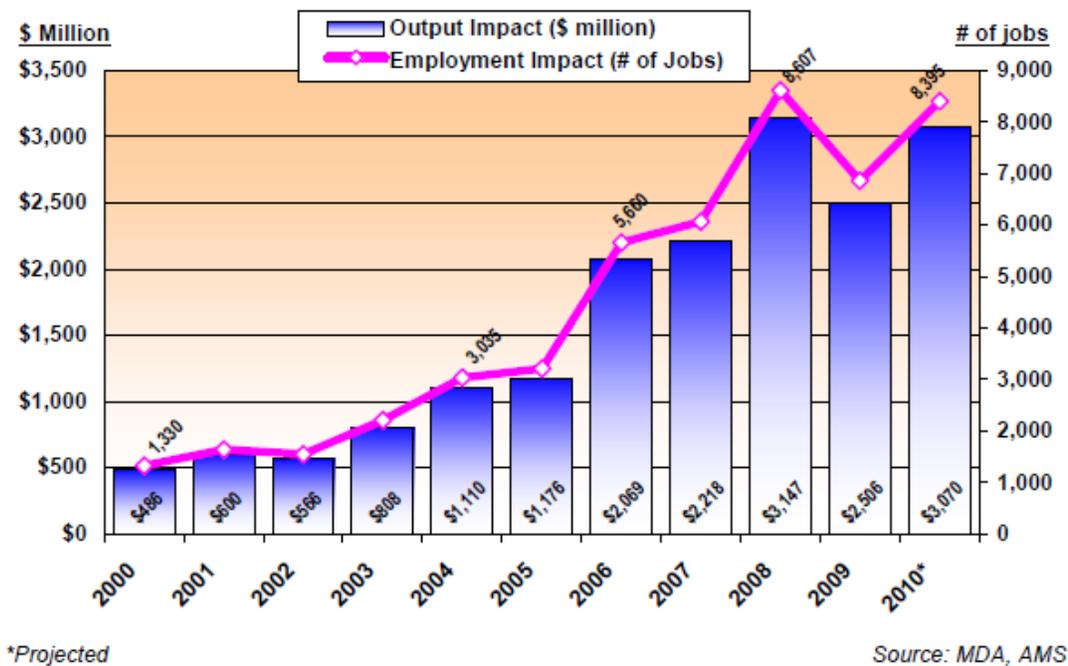
²³ Net ethanol rack (E100, wholesale) price to the blender, after tax credit.

²⁴ 87 octane gasoline rack (wholesale) price.

²⁵ Data for 2010 is through the week of July 23, 2010.

²⁶ Minnesota Department of Agriculture, July 2010.

Figure 3. Economic Impact of Minnesota's Ethanol Industry, 2000-2010^{27, 28}



Conclusions

Minnesota—a national leader in the ethanol industry—is poised to take another step forward by implementing statewide use of E20. Many challenges must first be overcome, such as obtaining a waiver from the EPA ensuring an E20 blend of ethanol in gasoline will not adversely affect vehicles and the environment. The attainment of Minnesota's E20 requirement would lead to state and nationwide expansion of the ethanol market. The state's economy and its consumers would no doubt reap the benefits of such an effort for years to come.

²⁷ "Minnesota Ethanol Industry," Minnesota Department of Agriculture, 2010.

²⁸ Economic impact figures include direct impacts (the effect of ethanol production output), indirect impacts (the effect on all other economic sectors due to purchases by the ethanol industry to generate the aforementioned output), and induced impacts (the effect on all economic sectors due to the expenditures of new income generated by the direct and indirect impacts).