



Report to the Legislature

Annual Report on Biodiesel



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Pursuant to Minnesota Statutes, section 3.197, the cost of preparing this report was approximately \$1,200.

Executive Summary

As required by the Biodiesel Content Mandate statute, Minnesota Statutes, section 239.77, subd. 5(a), this report contains information on:

- Implementation of the minimum content requirements of the statute;
- The price and supply of biodiesel fuel; and
- The impacts of the biodiesel mandate on:
 - The development of biodiesel production capacity in the state; and
 - The use of feedstock grown or raised in the state for biodiesel production.

Biodiesel is defined in Minnesota Statutes, section 239.77, subd. 1(b) as:

“...a renewable, biodegradable, mono alkyl ester combustible fuel that is derived from agricultural and other plant oils or animal fats that meets American Society of Testing and Materials (ASTM) specification D6751-11b for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels...”

Biodiesel in Minnesota is produced from soybeans, corn, and recycled fats, oils, and greases. In general practice, biodiesel is blended with diesel fuel.

Implementation of the minimum content requirements of the statute

Through its Biodiesel Content Mandate statute, Minnesota has a requirement for all No. 2¹ diesel fuel sold or offered for sale to have a certain minimum biodiesel content. The initial mandate, passed in 2002 and implemented in 2005, was two-percent biodiesel (B2).

The statute was amended in 2008 to add provisions for moving the blending requirement to 5, 10, and 20 percent (B5, B10, and B20). The B10 and B20 mandated content levels are effective only during the warm-weather months of April through September. The content level reverts to B5 during cold-weather months of October through March, when changes in viscosity of diesel fuels (known as “gelling” or “waxing”) can cause performance problems in engines.

The statute also provides that, before the B10 or B20 content levels can be implemented, the Commissioners of the Minnesota Department of Agriculture, Minnesota Department of Commerce,

¹ There are three different classes of diesel fuel based on the ability of the fuel to flow (“viscosity” and “pour point”). No. 2 diesel (often shown as “#2”) is standard diesel fuel used in warm-weather months. No. 1 (#1, a.k.a. kerosene) diesel is a lighter fuel which is often mixed with No. 2 diesel in winter months. No 1 diesel is exempt from the biodiesel content mandate. No. 4 (#4) diesel is a heavy fuel not typically used in vehicles.

and the Minnesota Pollution Control Agency must determine whether four statutory conditions have been met. These conditions involve federal standards for blend specifications, the production capacity of biodiesel in Minnesota, the amount of infrastructure and regulatory protocol for biodiesel blending, and the source of feedstocks.

B5 was implemented in 2009, B10 was implemented in 2014.

B20 was implemented May 1, 2018. That first year saw problems with supply such that the mandate was set back to B10 soon after it began, resuming on July 1. For 2019 the minimum blending requirement operated as specified in statute.

Price and supply of biodiesel fuel

The price of diesel fuel offered for sale in Minnesota is affected by multiple factors, including the price of components (petroleum diesel and biodiesel), and state and federal policies. Most important among federal policies are the Renewable Fuel Standard and the Biodiesel Blenders Tax Credit. This report describes the pricing of petroleum diesel and biodiesel components of diesel fuel, and the net wholesale price of diesel as affected by federal policies.

The supply of biodiesel is affected by blending requirements, federal policy, and the demand for biodiesel from retailers, driven in part by the state mandate. This report describes the policy effects and the resulting estimated supply.

Impacts of the biodiesel mandate

It is not possible to demonstrate a cause-and-effect relationship between the mandate and production capacity or feedstock use. It is, however, reasonable to assume that the mandate has had a significant effect on both production and feedstock use.

Production capacity and feedstock use in 2016 were summarized in the Minnesota Department of Agriculture's May 2017 report, *Economic Impact of the Minnesota Biodiesel Industry*.² According to the report:

- Production had increased from the amount represented by the initial B2 mandate—16 million gallons per year (mgy)—to 74 mgy in 2016.
- Production was from diverse feedstocks: soybeans were the feedstock of 45 percent of biodiesel in the state, while other oils, fats and greases comprised the remaining 55 percent of the feedstock.

² *Economic Impact of the Minnesota Biodiesel Industry*, Minnesota Department of Agriculture, May 2017 (find on the MDA Biodiesel webpage at: www.mda.state.mn.us/renewable/biodiesel/).

- Biodiesel consumption in Minnesota in 2016 was 77 mg, representing nearly 8 percent of the 1 billion gallons per year of diesel consumption in Minnesota. The amount of biodiesel produced in Minnesota was 74 mg, representing 96 percent of consumption.

Introduction

This report is submitted pursuant to Minnesota Statutes, section 239.77, subd. 5(a):

“Beginning in 2009, the commissioner of agriculture must report by January 15 of each year to the chairs and ranking minority members of the legislative committees and divisions with jurisdiction over agriculture policy and finance regarding the implementation of the minimum content requirements in subdivision 2, including information about the price and supply of biodiesel fuel. The report shall include information about the impacts of the biodiesel mandate on the development of biodiesel production capacity in the state, and on the use of feedstock grown or raised in the state for biodiesel production. The report must include any written comments received from members of the biodiesel fuel task force by January 1 of that year designated by them for inclusion in the report.”

Background

Minnesota has a requirement for all diesel fuel sold or offered for sale to have a certain minimum biodiesel content. The minimum content percentages are specified in law (Minnesota Statutes, section 239.77, subd. 2):

| | | |
|-----|--------------------|------------|
| (1) | September 29, 2005 | 2 percent |
| (2) | May 1, 2009 | 5 percent |
| (3) | May 1, 2012 | 10 percent |
| (4) | May 1, 2018 | 20 percent |

The 10 percent and 20 percent (B10 and B20) minimum content levels go into effect only after the Commissioners of the Minnesota Department of Agriculture (MDA), Minnesota Pollution Control Agency (MPCA) and Minnesota Department of Commerce (Commerce) have consulted with the Biodiesel Task Force and determined that four conditions specified in the law are met, notice is published in the State Register, and notice is provided to certain specified legislative chairs. These conditions in statute are:

(1) an American Society for Testing and Materials specification or equivalent federal standard exists for the next minimum diesel-biodiesel blend;

(2) a sufficient supply of biodiesel is available and the amount of biodiesel produced in this state from feedstock with at least 75 percent that is produced in the United States and Canada is equal to at least 50 percent of anticipated demand at the next minimum content level;

(3) adequate blending infrastructure and regulatory protocol are in place in order to promote biodiesel quality and avoid any potential economic disruption; and

(4) at least 5 percent of the amount of biodiesel necessary for that minimum content level will be produced from a biological resource other than an agricultural resource

traditionally grown or raised in the state, including, but not limited to, algae cultivated for biofuels production, waste oils, and tallow.

Minnesota Statutes, section 239.77, subd. 2(b)(1) to (4).

The Biodiesel Task Force was established by the MDA in 2003 to help the state carry out its biodiesel mandate. Since then, the Task Force has met on an ad-hoc basis to discuss issues related to biodiesel production and its use. Sub-teams have been formed to address more specific issues such as cold weather operability.

The Biodiesel Task Force members are appointed by the Commissioner of Agriculture. Current membership was appointed August 2019 and expires June 30, 2021. Task Force members apply through the Minnesota Secretary of State's Open Appointments process which is now conducted entirely online.

The current members include:

- Bart Giangiacomo, Transport America (Fuel User Group Member)
- Tim Gross, Minnesota Petroleum Marketers Association (Petroleum Industry Representative)
- Dustin Haaland, CHS Inc. (Petroleum Industry Representative)
- Scott Hedderich, REG Company, Chairperson (Processing Industry Representative)
- Bruce Heine, Magellan Midstream Partners, LP (Petroleum Industry Representative)
- Chris Hill, Minnesota Soybean Growers Association (Grower's Organization Representative)
- Jon Hunter, American Lung Association in Minnesota (Environmental Organization Representative)
- Ronald Marr, Minnesota Soybean Processors (Processing Industry Representative)
- Julie Quinn (At Large Member)
- Kevin Paap, Minnesota Farm Bureau (Farm Organization Representative)
- Steve Rupp, Ever Cat Fuels (Processing Industry Representative)
- Michael W. Stutelberg, AURI (Research Institution Representative)
- Brett Webb, Flint Hills Resources, LP (Petroleum Industry Representative)
- Gary Wertish, Minnesota Farmers Union (Farm Organization Representative)
- Darrick Zarling, University of Minnesota (Research Institution Representative)

Background on biodiesel

Biodiesel is defined in Minnesota Statutes, section 239.77, subd. 1(b) as:

“...a renewable, biodegradable, mono alkyl ester combustible fuel that is derived from agricultural and other plant oils or animal fats that meets American Society of Testing and Materials (ASTM) specification D6751-11b for Biodiesel Fuel (B100) Blend Stock for Distillate Fuels...”

In general practice, biodiesel is blended with diesel fuel. The ASTM³ specification of diesel fuel (ASTM D975) can contain up to five percent biodiesel. A separate standard exists for blends of B6 to B20 (ASTM D7467).

Biodiesel in Minnesota is produced from soybeans, corn, and recycled fats, oils and greases. Biodiesel production adds value to all these commodities.

Biodiesel is considered an advanced biofuel as well as “biomass-based diesel” in the Renewable Fuel Standard’s classification of renewable fuels. Advanced biofuels under that classification must demonstrate at least a 50 percent greenhouse gas benefit over the fossil fuel that it replaces. Biodiesel has a positive energy balance, producing 5.54 units of energy for every unit of fossil energy consumed over its lifecycle.⁴ Biodiesel produced from waste and recycled oils has some of the lowest carbon intensity ratings in the California Air Resources Board (CARB) system because of its ability to reduce greenhouse gas emissions.

Economic, health, and environmental benefits

The MDA’s 2017 study, *Economic Impact of the Minnesota Biodiesel Industry*, determined that the economic impact of Minnesota’s 2016 biodiesel production, including direct, indirect, and induced impacts, was \$1.7 billion. The total employment impact was estimated as 5,397 jobs. Every one million gallons of biodiesel production was found to contribute \$2.8 million in statewide economic output, supporting 73 jobs.⁵

According to the study, Minnesota currently ranks eleventh among U.S. states in biodiesel production. Due to improved efficiencies at the plants, total Minnesota biodiesel plant capacity has increased from an original nameplate capacity of 63 million gallons per year (mgy) to 87.6 mgy.⁶

According to the National Soybean Board, biodiesel increased the value of a bushel of soybeans by 63 cents between 2006 and 2015. This increased the value of soybean oil to U.S. farmers by \$18.8 billion and decreased the price of soybean meal (primarily used as a protein source in animal feeds) by up to \$48 per ton.⁷

The use of biodiesel and biodiesel/diesel blends reduces almost all forms of air pollution compared to petroleum diesel, with the most important reductions being air toxics and cancer-causing compounds. Biodiesel also reduces greenhouse gas emissions due to its production from recently-grown plant

³ ASTM International, formerly known as the American Society of Testing and Materials, is an international standards organization.

⁴ A. Pradhan et al. *Energy Life-Cycle Assessment of Soybean Biodiesel Revisited*. Transactions of the ASABE, Vol. 54(3), pages 1031-1039.

⁵ *Economic Impact of the Minnesota Biodiesel Industry*, Minnesota Department of Agriculture, May 2017 (find on the MDA Biodiesel webpage at: www.mda.state.mn.us/renewable/biodiesel/).

⁶ As reported from representatives of the three Minnesota biodiesel plants

⁷ United Soybean Board website (<https://unitedsoybean.org/media-center/issue-briefs/biodiesel/>).

materials, in contrast to fossil fuels that have been sequestered in the earth for millions to billions of years.⁸

Performance of biodiesel in vehicles

B5 has been used in winter months since it was first implemented in Minnesota in 2009. The current standard for diesel fuel, ASTM D975, includes up to 5 percent biodiesel content.

The current blending requirement for B20 was implemented on May 1, 2018. It is in effect for the warm-weather months of April⁹ through September, and then reverts to B5 for the cold-weather months of October through March, when changes in viscosity of diesel fuels (known as “gelling” or “waxing”) can cause performance problems in engines.

The Diesel Help Line is a privately-operated service available to Minnesotans who experience problems with diesel fuel of any type. Anyone experiencing a problem with diesel fuel is encouraged to call and, if needed, arrange to submit samples to the Help Line. Diesel fuel problems are analyzed to determine the root cause, and, when possible, are traced to a specific fueling source. A summary of calls to the Diesel Help Line can be found in Appendix D.

The MDA publishes a brochure entitled *Understanding Minnesota’s Biodiesel Requirement: A user’s guide for biodiesel blends from B5-B20*. Available in paper copy and on the MDA’s website (www.mda.state.mn.us/renewable/biodiesel), the brochure provides information to consumers on use of higher biodiesel blends.

The MDA also publishes a booklet entitled *Minnesota B20 Handling Guide*. It too is available in paper copy and on the MDA’s website (www.mda.state.mn.us/renewable/biodiesel). The booklet provides useful information for retailer for getting ready for both the B20 and winter biodiesel blend seasons.

Implementation of the Biodiesel Mandate

The original Biodiesel Content Mandate, adopted in 2002,¹⁰ specified blending of at least 2 percent biodiesel fuel oil with all diesel transportation fuel sold or offered for sale in Minnesota. The implementation date was September 29, 2005.

In 2008, the Minnesota Legislature amended Minnesota Statutes, section 239.77 to add provisions for moving the blending requirement to 5, 10, and 20 percent¹¹. All three dates were set to May 1: 2009 for B5, 2012 for B10, and 2015 for B20. B5 was implemented on May 1, 2009.

⁸ Biodiesel-Clean, Green Diesel Fuel. U.S. DOE by the National Renewable Energy Laboratory. July, 2015 (<https://www.afdc.energy.gov/fuels/biodiesel.html>).

⁹ In 2018 B20 took effect on May 1; in succeeding years B20 takes effect on April 15 after a short period of April 1 through April 14 at B10.

¹⁰ Laws of Minnesota 2002, chapter 244

¹¹Laws of Minnesota 2008, chapter 297, article 1, section 51

B10 and B20 mandates

As stated previously, before a new mandate could be implemented, the Biodiesel Content Mandate statute (Minnesota Statutes, section 239.77, subd. 2 (b)), requires the commissioners of MDA, Commerce, and the MPCA to determine whether four statutory conditions have been met. These conditions involve federal standards for blend specifications, the production capacity of biodiesel in Minnesota, the adequacy of infrastructure and regulatory protocol for biodiesel blending, and the source of feedstocks.

The B10 blending date was postponed in 2011 due to inadequate blending infrastructure, specifically in the southwest region of the state, and also due to inadequate regulatory protocol. The opening of a biodiesel blending site in Sioux Falls, SD, in late 2012, and the institution of new regulatory protocol that tracked the biodiesel content in all shipments of fuel, cleared the way for the B10 blending level to be approved. B10 was implemented on July 1, 2014.

In July 2017, after an interagency review, and in consultation with the Minnesota Biodiesel Task Force, stakeholders, and technical experts, the three agency commissioners (MDA, Commerce, and MPCA) determined that the four conditions had been met, and that Minnesota was prepared to move to the next scheduled minimum content level of 20 percent (B20) on May 1, 2018.

A problem with biodiesel supply arose shortly after the May 1, 2018 implementation date of the B20 mandate. In response, the Commissioner of Commerce, pursuant to Minnesota Statutes, section 239.77, subdivision 2 (d), temporarily suspended the B20 minimum content requirement, allowing the content requirement to revert to B10 until July 1, 2018.

Legislation was adopted in 2018 that designated April 1 through 14 as a B10 ramp-up time, with the 20% minimum blending requirement in No. 2 diesel beginning on April 15. The sunset date was also removed from the exception for No. 1 diesel from the biodiesel content mandate in 2018.

This past year the minimum blending requirement rose to 10% biodiesel in No. 2 diesel¹² on April 1, and then to B20 on April 15, in accordance with the 2018 legislation.

Price and Supply of Biodiesel

The price of diesel fuel offered for sale in Minnesota is affected by multiple factors, including the price of components (petroleum diesel and biodiesel), and state and federal policies. Most important among federal policies are the Renewable Fuel Standard and the Biodiesel Blenders Tax Credit. This section

¹² There are three different classes of diesel fuel based on the ability of the fuel to flow (“viscosity” and “pour point”). No. 2 diesel (often shown as “#2”) is standard diesel fuel used in warm-weather months. No. 1 (#1, a.k.a. kerosene) diesel is a lighter fuel which is often mixed with No. 2 diesel in winter months. No 1 diesel is exempt from the biodiesel content mandate. No. 4 (#4) diesel is a heavy fuel not typically used in vehicles.

describes the pricing of petroleum diesel and biodiesel components of diesel fuel, and the net wholesale price of diesel as affected by federal policies.

The supply of biodiesel is affected by blending requirements, federal policy, and the demand for biodiesel from retailers, driven in part by the state mandate. This section describes the policy effects and the resulting estimated supply.

Federal policy and its influence on biodiesel price and supply

As stated above, the most important federal policies affecting price are the Renewable Fuel Standard and the Biodiesel Blenders Tax Credit.

The Renewable Fuel Standard (RFS), Renewable Identification Numbers (RINS), and Renewable Volume Obligations (RVOs)

In 2007 the federal Energy Independence and Security Act (EISA) was passed by Congress and signed by President George W. Bush, revising the Renewable Fuel Standard (RFS, now RFS2) that was already in place. This law requires refiners and/or importers of petroleum (also known as obligated parties) to blend increasing volumes of biofuels on an annual basis. Volumes (Renewable Volume Obligations or RVOs), set by Congress and modified by the USEPA, are divided proportionally among all obligated parties, giving each obligated party a total amount of biofuel that they will need to show compliance for blending.

Every gallon of biofuel produced that qualifies for RFS2 carries with it a Renewable Identification Number, or RIN. The RIN is used by the obligated party to show compliance with RFS2. RINs can be used (or “retired”) by an obligated party in two ways:

1. Gallons of biofuel are blended with petroleum fuels. Once biofuel is blended, the RIN can be “separated” from the fuel with which it is associated and retired.
2. RINs can be purchased in the RIN market. Obligated parties that blend more fuel than their obligation requires, or fuel distributors that are not refiners and/or importers of petroleum (also referred to as “third party blenders”), can sell RINs into the market after fuel is blended.

In the second case above, the value obtained by selling the RIN represents another income stream for the obligated party who has met their obligation, or a third party blender who has no obligation under RFS2.

RVOs have been increased fairly consistently over the years, from 1.00 billion gallons in 2012 to 2.43 billion gallons in 2020/21. The 2018 and 2019 RVO for biodiesel has been 2.10 billion gallons.

Biodiesel can also be used to satisfy an obligated party’s requirement in the advanced biofuel category. The advanced biofuel blending volume under RFS2 was decreased slightly in 2018, with a total of 1.969

billion gallons set for non-cellulosic advanced biofuel. It was set at 2.402 billion gallons for 2019, and currently is proposed at the reduced number of 2.07 million for 2020.

Federal Biodiesel Blenders Tax Credit

The federal Biodiesel Blenders Tax Credit was first implemented in 2005. This allowed blenders of biodiesel and renewable diesel (renewable diesel being ASTM D975 specification renewable fuel) to claim \$1 per gallon against their federal tax liability. The tax credit expired at the ends of 2009, 2011, 2013, and 2016. In each of 2009, 2011, 2013, and 2018 the tax credit was reinstated late in the next year (or very early in the following year) and made retroactive, such that all years from 2005 through 2017 were covered by the credit. On December 17, 2019, Congress approved the tax credit with the President signing the bill on December 23, making the credit retroactive for 2018 and 2019, and extending through 2022.

Rack pricing

Fuel terminals often exist at refineries or at points along oil pipelines. Information in this section on diesel and biodiesel blend pricing is based on fuel terminal prices, also known as “rack pricing,” or prices “at the rack.”

Since initial implementation of the Biodiesel Content Mandate in 2005, the price difference of the blended product from No. 2 diesel fuel has been as high as a 10-cent difference (in 2011) and as low as 0.006 cents in 2017 (where the blend was cheaper than diesel fuel without biodiesel). Detailed information on rack pricing is contained in Appendix B.

Third party blending and impact of RINs

The Biodiesel Blenders Tax Credit and RIN effectively lower the net price of unblended biodiesel fuel (B100), and consequently have the potential to lower costs for the third-party blender (the net cost of biodiesel to the blender is dependent on a number of factors in addition to Biodiesel Blenders Tax Credit and RIN. Other factors can include negotiated fuel contracts).

Figure 1 shows the pricing trends for No. 2 diesel and B100. The B100 prices are the net Iowa and Illinois/Indiana/Ohio averages price from the biodiesel plants surveyed by AMS.

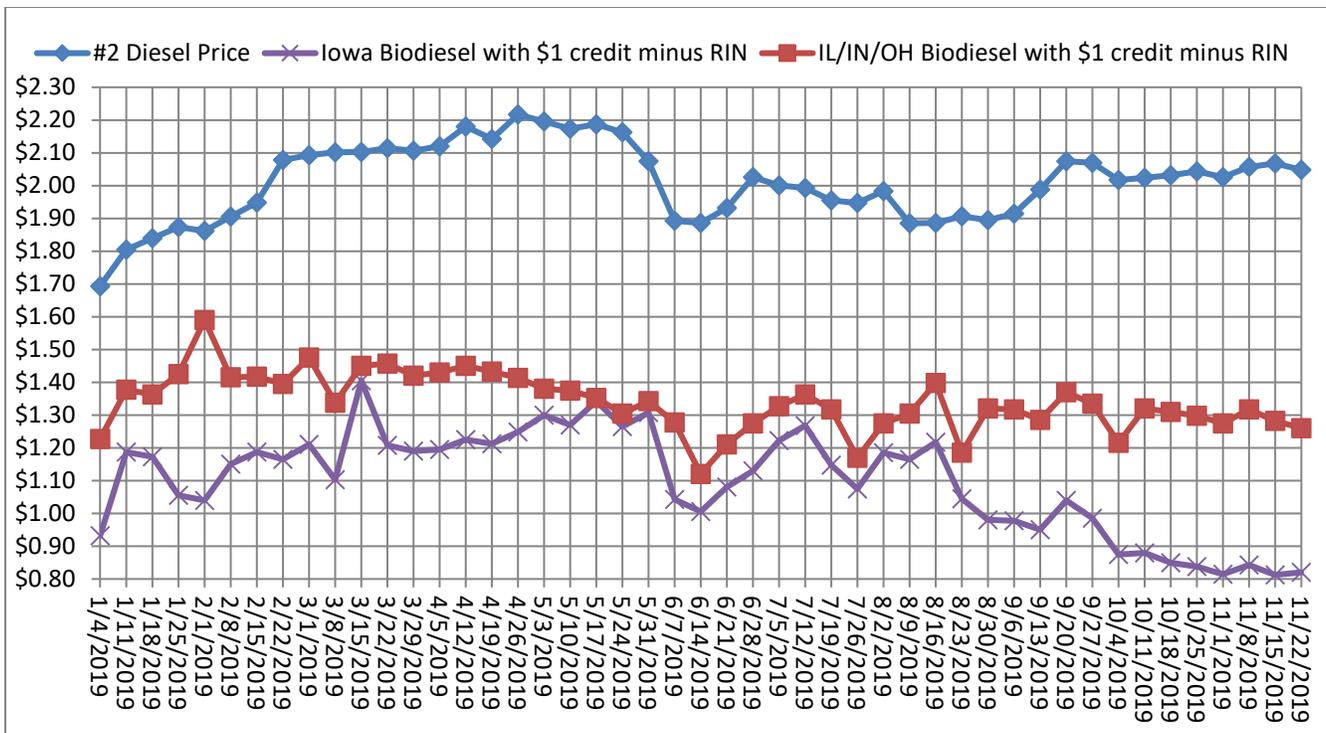


Figure 1 #2 Blended diesel price factors for 2019 including: Diesel price (MSP Rack), the Iowa B100 price minus the \$1 tax credit and the RIN value, and the IL/IN/OH B100 price (B100 prices as reported by the biodiesel plants to AMS) with the tax credit and the RIN subtracted.

As stated above, the \$1 federal biodiesel blending tax credit has been reinstated by Congress retroactively for 2018 and 2019 and into the future through 2022. Figure 2 shows the trends of pricing factors for blended diesel fuels with the tax credit retroactively reinstated for 2019. The graph shows B100 minus the tax credit only, and B100 minus the tax credit and RIN because the obligated and the third party blender can use the tax credit, while the obligated party cannot use the RIN unless its obligation under the RFS has been met (the third party blender has no obligation to retire RINs and so can sell their RINs into the market).

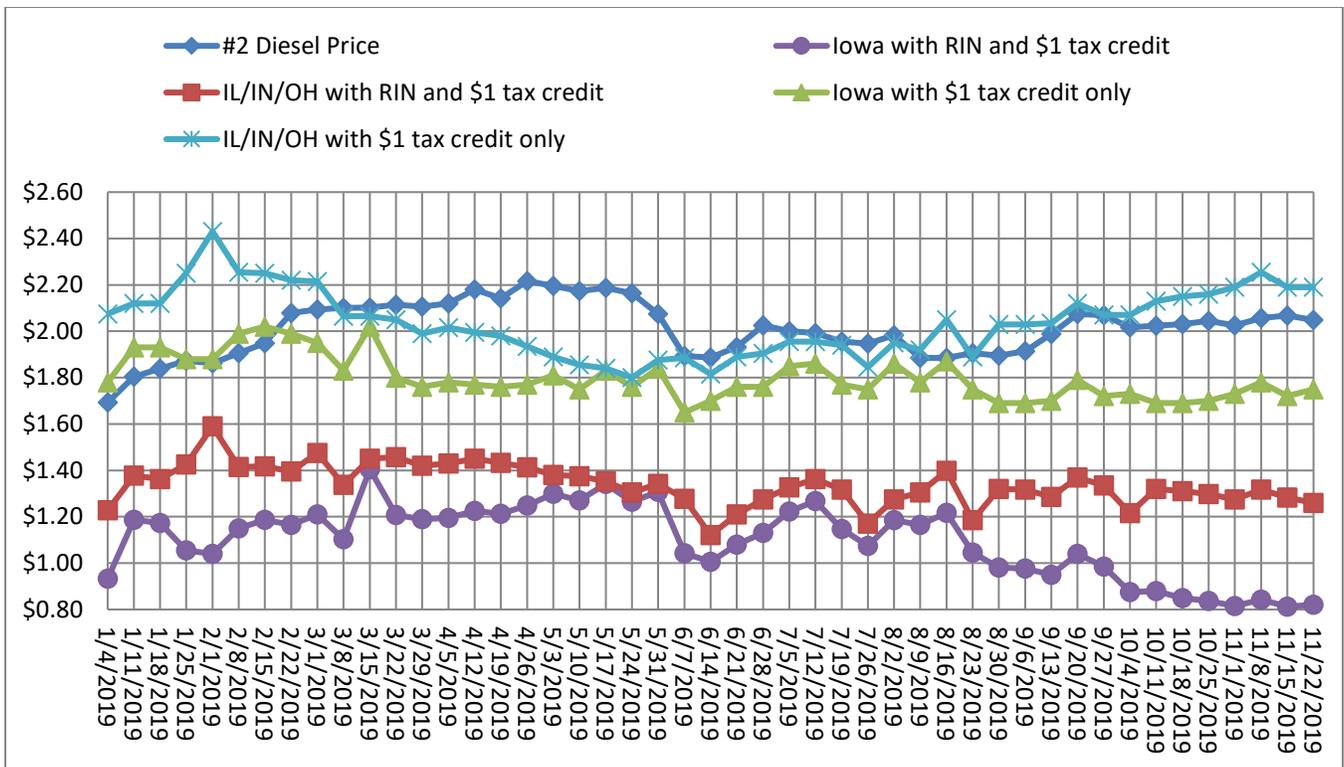


Figure 2 No. 2 Diesel price factors for 2019 including RIN and the federal biodiesel blending tax credit. Diesel price (MSP Rack), the Iowa B100 price with the \$1 tax credit only and with RIN subtracted, and the IL/IN/OH B100 price with the \$1 tax credit only and with the RIN subtracted (B100 prices as reported by the biodiesel plants to AMS).

Biodiesel supply

The nameplate capacity (the capacity that the three Minnesota biodiesel plants were constructed to originally produce) is 63 mgy. Recent expansion and efficiency improvements have allowed the plants to increase production levels. The plants are permitted by the Minnesota Pollution Control Agency to produce a total of 87.6 mgy in 2019.

Table 1 shows a breakdown of these capacities by plant. The overall trend is increased production capacities for Minnesota facilities.

Table 1 Current Minnesota biodiesel plant production capacities.

| Plant – Location | 2019 Production Capacity (mgy) |
|---|--------------------------------|
| Ever Cat Fuels – Isanti | 3.1 |
| Minnesota Soybean Processors – Brewster | 40.5 |
| Renewable Energy Group (REG) – Albert Lea | 44.0 |
| Total | 87.6 |

Minnesota Statutes, section 239.77, subd. 2 (b)(4) specifies:

“At least five percent of the amount of biodiesel necessary for that minimum content level will be produced from a biological resource other than an agricultural resource traditionally grown or raised in the state, including, but not limited to, algae cultivated for biofuels production, waste oils, and tallow.”

Where the majority of biodiesel was produced from soybeans in the early days of Minnesota’s minimum biodiesel blending requirement, production now uses a variety of feedstocks. Minnesota Soybean Producers is a full-crush soybean processing facility and uses soybean oil exclusively for its biodiesel production. Ever Cat Fuels’ 3 mgy plant uses a high temperature, high pressure catalytic transesterification process, and uses alternative feedstocks such as recycled oils. REG upgraded its plant to process a wide variety of oil feedstocks. In recent years REG has used distiller’s corn oil with a minority amount of used cooking oil (UCO) and other alternative feedstock. The overall trend for Minnesota facilities has been increased diversification of feedstocks, such that non-traditional agricultural oil feedstock is currently higher than five percent for the total biodiesel produced.

Occasionally, there are disruptions in biodiesel supply, typically related to equipment or tank maintenance. Low biodiesel supplies at terminals can cause outages for individual distributors, which can cause distributors to purchase biodiesel at another terminal, or outside the terminal distribution system through a third-party blender or by going directly to the biodiesel plants. Minnesota Statutes, section 239.77, subd. 2 (d) provides for fuel suppliers to obtain a waiver from the Minnesota Department of Commerce should there be a period of biodiesel fuel shortage or a problem with biodiesel quality.

Twenty-four waivers were issued by the Department of Commerce in 2019. Ten were issued during B5 mandate periods. Three were issued during the B10 mandate period. Eight of the waivers lasted a day or more. Seven of the waivers lasting a day or more occurred during B5 mandate periods. Worth noting is that the Department of Commerce only started receiving automated notification of outages from terminals in late 2017. Previous years’ notifications were at the discretion of terminal operators. A list of all biodiesel waivers in 2019 is included in Appendix C.

Impacts of Biodiesel Mandate on Production Capacity and Feedstocks

It is not possible to demonstrate a cause-and-effect relationship between the mandate and production capacity or feedstock use. It is, however, reasonable to assume that the mandate has had a significant effect on both production and feedstock use.

Production capacity and feedstock use in 2016 were summarized in the Minnesota Department of Agriculture's May 2017 report, *Economic Impact of the Minnesota Biodiesel Industry*. According to the report:

- Production had increased from the amount represented by the initial B2 mandate (16 mgy) to 74 mgy in 2016.
- Production was from diverse feedstocks: soybeans were the feedstock of 45 percent of biodiesel in the state, while other oils, fats and greases comprised the remaining 55 percent of the feedstock.
- Biodiesel consumption in Minnesota in 2016 was 77 mg, representing nearly 8 percent of the 1 billion gallons per year of diesel consumption in Minnesota. The amount of biodiesel produced in Minnesota was 74 mg, representing 96 percent of consumption.

Over the time period since the B20 mandate has been in effect, the amount of biodiesel produced exceeded 50 percent of biodiesel consumption in the state.

Appendix A: Comments from Biodiesel Task Force Members

No comments were submitted for the 2020 report.

Appendix B: Rack Pricing

Diesel prices at terminals statewide and across Minnesota’s borders—to the south (Omaha, Nebraska) and west (Denver, Colorado)—have shown remarkably close pricing historically. Table 2 compares average yearly prices for ultra-low sulfur diesel and displays the yearly ranges over the past 11-year period.

Table 2 Diesel pricing by city (average of terminals reporting), 2009-2019

| City, State | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|--------------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
| Alexandria, MN | 1.7600 | 2.2860 | 3.1357 | 3.1954 | 3.1503 | 2.9433 | 1.7246 | 1.4461 | 1.7546 | 2.2168 | 2.0120 |
| Denver, CO | 1.7377 | 2.2975 | 3.1170 | 3.1985 | 3.1201 | 2.9420 | 1.7002 | 1.4229 | 1.8021 | 2.2475 | 2.0859 |
| Duluth, MN | 1.7532 | 2.3006 | 3.1639 | 3.2095 | 3.1617 | 2.9719 | 1.7318 | 1.4784 | 1.7752 | 2.2444 | 2.0697 |
| Fargo, ND | 1.7660 | 2.2941 | 3.1459 | 3.2117 | 3.1614 | 2.9619 | 1.7372 | 1.4542 | 1.7716 | 2.2197 | 2.0177 |
| Grand Forks, ND | 1.7628 | 2.2899 | 3.1424 | 3.2086 | 3.1591 | 2.9593 | 1.7364 | 1.4516 | 1.7613 | 2.2105 | 2.0116 |
| Mankato, MN | 1.7515 | 2.2740 | 3.1190 | 3.1843 | 3.1437 | 2.9271 | 1.7130 | 1.4381 | 1.7451 | 2.2042 | 2.0030 |
| Marshall, MN | 1.7538 | 2.2811 | 3.1223 | 3.1874 | 3.1407 | 2.9334 | 1.7134 | 1.4369 | 1.7429 | 2.1948 | 1.9996 |
| Omaha, NE | 1.7268 | 2.2513 | 3.0991 | 3.1711 | 3.1069 | 2.8957 | 1.7047 | 1.4250 | 1.7439 | 2.1947 | 2.0050 |
| Rochester, MN | 1.7437 | 2.2714 | 3.1198 | 3.1795 | 3.1388 | 2.9259 | 1.7097 | 1.4321 | 1.7367 | 2.1971 | 1.9980 |
| Sioux Falls, SD | 1.7375 | 2.2617 | 3.1084 | 3.1776 | 3.1204 | 2.9100 | 1.7071 | 1.4173 | 1.7339 | 2.1867 | 1.9957 |
| Superior, WI | 1.7616 | 2.3087 | 3.1755 | 3.2040 | 3.1565 | 2.9707 | 1.7197 | 1.4730 | 1.7780 | 2.2759 | 2.1077 |
| Mpls.-St. Paul, MN | 1.7456 | 2.2741 | 3.1236 | 3.1832 | 3.1298 | 2.9357 | 1.7116 | 1.4480 | 1.7459 | 2.1991 | 2.0148 |
| Low | 1.7268 | 2.2513 | 3.0991 | 3.1711 | 3.1069 | 2.8957 | 1.7002 | 1.4173 | 1.7339 | 2.1867 | 1.9957 |
| High | 1.7660 | 2.3087 | 3.1755 | 3.2117 | 3.1617 | 2.9719 | 1.7372 | 1.4784 | 1.8021 | 2.2759 | 2.1077 |
| Difference -Range | 0.0391 | 0.0574 | 0.0764 | 0.0405 | 0.0548 | 0.0762 | 0.0370 | 0.0611 | 0.0683 | 0.0891 | 0.1121 |

Source: Minnesota Department of Agriculture summary of Axxis pricing data through December 31, 2019.

Table 3 shows rack pricing of #2 diesel and biodiesel blends at the Minneapolis-St. Paul (MSP) terminals since 2009. 2009 is the year when the first step-up in the state mandate occurred with the move from B2 to B5 on May 1, 2009. These are the average of prices reported through the MDA’s subscription to AXXIS.

Table 3 MSP rack diesel and biodiesel average prices with net price impact of blends.

| Year (Blend Mandate) | Average Rack Diesel Price | Rack B2 Price | Rack B5 Price | Rack B10 Price | Rack B20 Price | Rack Average Mandate Blend Price | Net Impact Price of Biodiesel Blend |
|--|---------------------------|---------------|---------------|----------------|----------------|----------------------------------|-------------------------------------|
| 2009(B2/B5) | \$1.7456 | | | | | \$1.7891 | \$0.0435 |
| 2009 (1-4 to 4-30) B2) | \$1.4120 | \$1.4421 | | | | | \$0.0302 |
| 2009 (5-1 to 12-31) (B5) | \$1.9176 | | \$1.9679 | | | | \$0.0503 |
| 2010 (B5) | \$2.2741 | | \$2.3372 | | | | \$0.0631 |
| 2011(B5) | \$3.1236 | | \$3.2266 | | | | \$0.1030 |
| 2012(B5) | \$3.1832 | | \$3.2488 | | | | \$0.0656 |
| 2013(B5) | \$3.1298 | | \$3.1703 | | | | \$0.0405 |
| 2014(B5/B10) | \$2.9357 | | | | | \$2.9539 | \$0.0181 |
| 2014 (1-2 to 6-30, 10-1 to 12-31) (B5) | \$2.9300 | | \$2.9476 | | | | \$0.0176 |
| 2014 (7-1 to 9-30) (B10) | \$2.9529 | | | \$2.9724 | | | \$0.0195 |
| 2015 B5/B10) | \$1.7138 | | | | | \$1.7433 | \$0.0294 |
| 2015 (1-2 to 3-30, 10-1 to 12-31) (B5) | \$1.6227 | | \$1.6473 | | | | \$0.0246 |
| 2015 (4-1 to 9-30) (B10) | \$1.8042 | | | \$1.8384 | | | \$0.0342 |
| 2016 B5/B10) | \$1.4480 | | | | | \$1.4312 | -\$0.0168 |
| 2016 (1-2 to 3-30, 10-1 to 12-31) (B5) | \$1.3833 | | \$1.3876 | | | | \$0.0043 |
| 2016 (4-1 to 9-30) (B10) | \$1.5122 | | | \$1.5152 | | | \$0.0031 |
| 2017 (B5/B10) | \$1.7459 | | | | | \$1.7463 | \$0.0004 |
| 2017 (1-4 to 3/31, 10-2 to 12-29) (B5) | \$1.8061 | | \$1.8054 | | | | -\$0.0007 |
| 2017 (4-3 to 9/29) (B10) | \$1.6852 | | | \$1.6867 | | | \$0.0015 |
| 2018 (B5/B10/B20) | \$2.2137 | | | | | \$2.1410 | -\$0.0727 |
| 2018 (1-1 to 3-30, 10-1 to 12-31) (B5) | \$2.1412 | | \$2.1410 | | | | -\$0.0002 |
| 2018 (4-2 to 6-29) (B10) | \$2.2521 | | | \$2.2671 | | | \$0.0150 |
| 2018 (7-2 to 9-28) (B20) | \$2.3215 | | | | \$2.3491 | | \$0.0276 |
| 2019 (B5/B10/B20) | \$2.0148 | | | | | \$2.0394 | \$0.0246 |
| 2019 (1-1 to 3-29, 10-1 to 12-31) (B5) | \$2.0011 | | \$2.0007 | | | | -\$0.0004 |
| 2019 (4-1 to 4-12) (B10) | \$2.1502 | | | \$2.1694 | | | \$0.0192 |
| 2019 (4-15 to 9-30) (B20) | \$2.0184 | | | | \$2.0703 | | \$0.0519 |

Appendix C: Minnesota Department of Commerce Weights and Measures Division Waivers for 2018

| Mandate Level | Start Date | Duration (hrs) | Duration (days) |
|---------------|------------|----------------|-----------------|
| 5% | 1/28/2019 | 98:30:00 | 4.1 |
| 5% | 1/29/2019 | 77:17:00 | 3.2 |
| 5% | 1/30/2019 | 49:31:00 | 2.1 |
| 5% | 1/30/2019 | 45:36:00 | 1.9 |
| 5% | 1/31/2019 | 4:15:00 | 0.2 |
| 5% | 2/26/2019 | 240:00:00 | 10.0 |
| 10% | 4/6/2019 | 12:19:00 | 0.5 |
| 10% | 4/11/2019 | 2:43:00 | 0.1 |
| 10% | 4/11/2019 | 83:41:00 | 3.5 |
| 20% | 4/25/2019 | 0:30:00 | 0.0 |
| 20% | 5/13/2019 | 0:21:00 | 0.0 |
| 20% | 5/20/2019 | 3:14:00 | 0.1 |
| 20% | 6/6/2019 | 4:05:00 | 0.2 |
| 20% | 6/15/2019 | 12:00:00 | 0.5 |
| 20% | 6/22/2019 | 12:00:00 | 0.5 |
| 20% | 6/24/2019 | 3:00:00 | 0.1 |
| 20% | 8/7/2019 | 21:59:00 | 0.9 |
| 20% | 8/12/2019 | 4:38:00 | 0.2 |
| 20% | 8/14/2019 | 5:03:00 | 0.2 |
| 20% | 9/24/2019 | 5:45:00 | 0.2 |
| 5% | 10/26/2019 | 24:52:00 | 1.0 |
| 5% | 11/20/2019 | 8:00:00 | 0.3 |
| 5% | 12/8/2019 | 23:46:00 | 1.0 |
| 5% | 12/24/2019 | 12:55:00 | 0.5 |

Appendix D: Summary of Calls to the Diesel Help Line

The Diesel Help Line is a privately-operated service available to Minnesotans who experience problems with diesel fuel of any type. The following summary was provided by MEG Corp fuel consulting, who operates the Diesel Help Line.

The Minnesota Diesel Helpline is a resource available to assist both individuals and businesses to answer diesel fuel questions, provide guidance regarding fuel storage and handling best practices and investigate the cause of fuel-related issues through testing and analysis. Diesel fuel suppliers and end-users are encouraged to contact the Helpline regarding any cold weather or other diesel fuel questions and issues.

As more fuel suppliers and end users become aware of and are utilizing the Minnesota Diesel Helpline over the years, a greater number of fuel issues are being identified and provided with prevention recommendations, and fuel issue trends throughout the state are noted. In addition to diagnosing fuel problems, questions received by the Helpline in 2019 often involved guidance for blending transitions in spring and fall and application of additives. The Helpline continues to see many persistent misconceptions about biodiesel's characteristics with end-users, often leading to self-misdiagnosis of the problem and automatic blame for biodiesel.

Following is a summary of the causes of fuel issues handled by the Minnesota Diesel Helpline in 2019 as determined by testing and analysis:

| | |
|--|-----|
| High water | 52% |
| No problem with fuel | 24% |
| Microbial (without the presence of water) | 6% |
| Other | 6% |
| Oxidation | 5% |
| Fuel not blended for Winter | 5% |
| Sediment | 1% |
| Could not determine with sample provided | 1% |
| Biodiesel Contaminants | 0% |

For the cases submitted to the Helpline in 2019, water contamination was indicated in more than half of the fuel issues overall, including samples submitted by end-users (fleets, farmers, individuals) and samples from fuel distributor or retail locations. Water in diesel fuel can lead to a variety of fuel issues and filter plugging problems, including icing, microbial growth, fuel degradation, corrosion, and stripping of glycerin from biodiesel. Checking tank bottoms annually is an important practice to prevent water contamination and the corresponding issues that result from it.

Of the many issues the Helpline did troubleshoot in 2019, 24% did not indicate a problem with the fuel sample submitted, suggesting the problem may be mechanical, present in another fuel source not submitted, or due to another factor not attributed to the fuel characteristics, such as fueling infrastructure set up, filter type, etc.

The Helpline received feedback from several fuel distributors that they did not see an increase in fuel issues attributable to biodiesel in 2019, commenting that there will always be problems, but that there haven't been more than in previous years. Most of the issues described above can be prevented by

following recommended best practices. The Minnesota Diesel Helpline continues to provide best practices education and training for fuel suppliers and end users and encourages interested parties to contact the Helpline at (800) 929-3437 or info@megcorpnmn.com.