UNIVERSITY OF MINNESOTA EXTENSION

DEPARTMENT OF COMMUNITY DEVELOPMENT

Economic contribution of Minnesota's ethanol industry, 2024

A report of the Economic Impact Analysis Program

Authored by Brigid Tuck

Economic contribution of Minnesota's ethanol industry, 2024

A report of the Economic Impact Analysis Program

February 2025

Authored by Brigid Tuck, Senior Economic Impact Analyst

Editor:
Elyse Paxton, Senior Editor, Department of Community Development

Report Reviewers:
Aiden Opatz, Extension Educator, Department of Community Development
Bruce Schwartau, Program Leader, Department of Community Development
Liliana Tovar, Project Implementation Coordinator, Minnesota Bio-Fuels Association
Brian Werner, Executive Director, Minnesota Bio-Fuels Association

Partner:
Minnesota Bio-Fuels Association

Cover photo credit:
Heartland Corn Products

Table of contents

University of Minnesota Extension

Authored by Brigid Tuck, February 2025

Executive summary: Economic contribution of Minnesota's ethanol industry, 2024

In 2024, 18 plants produced ethanol in Minnesota. Ethanol production in the state stems from long-standing, private-public partnerships aimed at adding value to Minnesota-grown corn. To demonstrate the economic value of ethanol production, the Minnesota Bio-Fuels Association partnered with University of Minnesota Extension on an economic contribution study. Major findings from the analysis are included below.

Economic contribution in 2024: Minnesota's ethanol industry generated an estimated $5.2 billion in economic activity in the state in 2024. Of this, $1.2 billion was labor income, or income in the pockets of the state's residents. The industry supported employment for 18,434 people. The ethanol industry contributed $2.1 billion to Minnesota's gross domestic product (GDP).

Benefitting industries: The industries experiencing the highest benefits from ethanol production include wholesale trade (for example, local farmer's cooperatives), crop production, and real estate.

Tax contribution: In 2024, Minnesota's ethanol industry generated an estimated $157.6 million in state and local tax collections. This includes property, sales, and income taxes, along with other taxes and fees.

Ethanol production: Minnesota ethanol plants produced 1,401.3 million gallons of ethanol in 2024, a 3.5 percent increase from 2023. For comparison, average weekly Midwest ethanol production was 996,000 barrels per day, up 2.8 percent from the prior year (U.S. Energy Information Administration).

Revenues and expenditures: On average, Minnesota's ethanol plants posted net returns of $0.41 per gallon of ethanol, an increase from $0.31 per gallon the previous year. Overall, revenues per gallon declined to $2.41. Prices for ethanol, and its two co-products of Dried Distillers' Grain (DDGS) and corn oil, were generally lower in 2024 than in 2023 (U.S. Department of Agriculture).

Meanwhile, production expenses per gallon were also lower, primarily due to a decline in the price per bushel of corn and a decrease in the cost of natural gas. Production costs decreased by a higher rate than revenues, thus yielding a higher net return.

Prices also affect economic contribution calculations. This is particularly true in industries related to agricultural production, as prices for agricultural products tend to vary from season to season. Changes in the price of corn, for instance, affect the value of the ethanol industry's economic contribution from year to year.

Ethanol's co-products: In 2024, Minnesota's ethanol plants produced an estimated 4.13 million tons of DDGS. Minnesota's 2024 DDGS supply could support more than 2 million head of cattle, 2.5 million pigs, and 61.9 million turkeys and chickens. For context, Minnesota farms have 2.1 million head of cattle, 8.9 million pigs, and 39 million head of turkeys (U.S. Department of Agriculture).

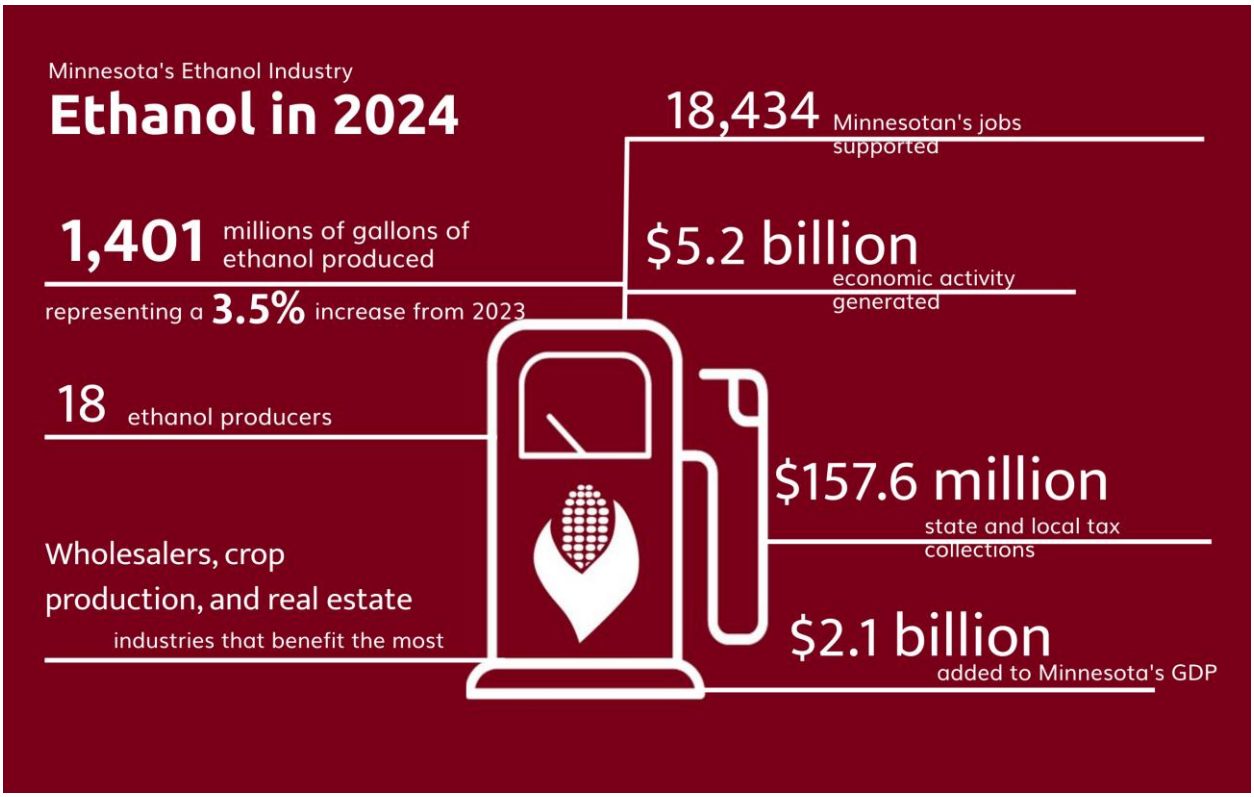
In 2024, Minnesota's ethanol plants produced an estimated 463.8 million pounds of corn oil. If all of Minnesota's 2024 distillers' corn oil had been used in biodiesel production, it would have generated 60.2 million gallons of biodiesel. This represents 70 percent of Minnesota 85.5 million gallons of biodiesel production capacity.

Ethanol industry in the United States: The ethanol industry experienced significant production disruptions and swings during the COVID-19 pandemic, particularly in 2020 and early 2021. In the last few years, however, production has steadied and generally increased.

Overall, ethanol demand increased in 2024. This was driven by record setting levels of exports. Ethanol exports were expected to reach 1.9 billion gallons for the year, representing 12 percent of all U.S. production. Top destinations for American ethanol included Canada, the United Kingdom, India, the European Union, and Colombia (*Ethanol Producer Magazine*).

Looking forward to 2025, the Energy Information Administration (EIA) is forecasting ethanol production to remain at similar levels to 2024. In its annual outlook, the EIA also expects export levels to be on par with 2024.

While strong exports and higher biofuel mandates from other countries may continue to provide stability for U.S. ethanol producers, uncertainty around domestic policy may spark concern in the marketplace. The new administration may make changes under the Renewable Fuel Standard and with approaches to Small Refinery Exemptions. There may also be changes in foreign trade policy that could affect the export market.

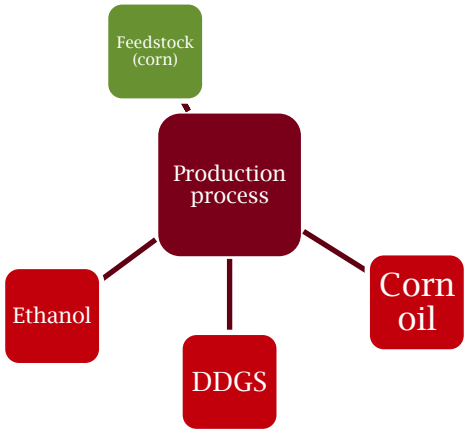


Introduction

In 2024, 18 plants produced ethanol in Minnesota. Ethanol production in the state stems from long-standing, private-public partnerships aimed at adding value to Minnesota-grown corn. Minnesota has long been recognized as a leader in the industry. In fact, the evolution of ethanol production in the state is known as the "Minnesota model" among national ethanol producers.[1] Key to the success of the "Minnesota model" was farmers willing to invest in new technologies and investments made by the state.

Ethanol plants produce ethanol as an alternative to petroleum-based fuels. The plants ferment and distill simple sugars from biological sources. In Minnesota, the primary source (often referred to as a feedstock) in ethanol production is corn. Ethanol is typically blended into motor vehicle fuel. In addition to ethanol, many plants also produce Dried Distillers' Grains (DDGS), which farmers feed as a protein to their livestock. Ethanol plants in Minnesota also produce corn oil.[2] These co-products, DDGS and corn oil, help diversify revenue streams and provide revenue stability for ethanol producers (Chart 1).

Chart 1: Ethanol plant production model



Minnesota is the fifth-largest ethanol producing state in the nation, as measured by production capacity. Total production capacity in the United States reached slightly more than 18 billion gallons in 2024. Minnesota's production capacity, at 1.44 billion gallons, accounted for 8 percent of national capacity. It also represented a 1.7 percent increase from 2023. Individual plant capacity varies in Minnesota, from a plant with a capacity of 30 million gallons per year to a plant with a capacity of 164 million gallons per year.

Nationally, ethanol production also increased in 2024. This was partially due to situations like in Minnesota, where existing plants increased production. It was also due to plants coming online.

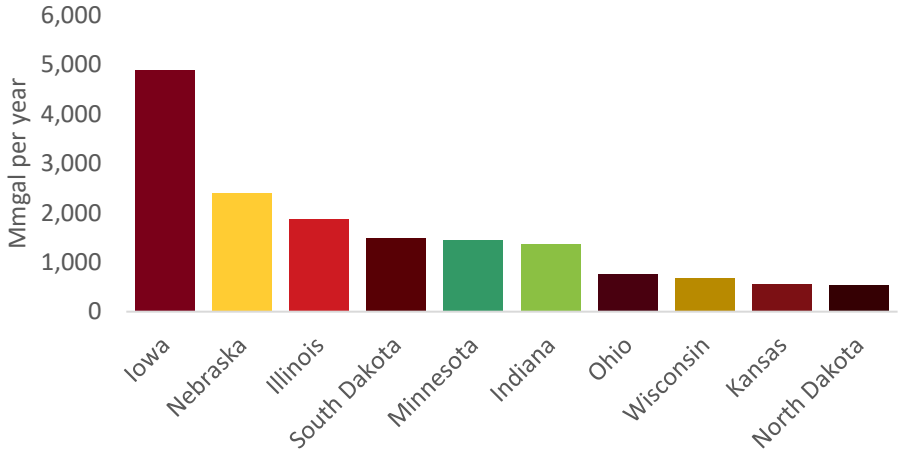
---

[1] Gustafson, C. (n.d.). *History of ethanol production and policy*. North Dakota State University. https://www.ag.ndsu.edu/energy/biofuels/energy-briefs/history-of-ethanol-production-and-policy

[2] Minnesota Department of Agriculture. (n.d.). *Ethanol basics and FAQs*. Minnesota Department of Agriculture. https://www.mda.state.mn.us/environment-sustainability/ethanol-basics-and-faqs

Wisconsin, for example, added a plant in 2024, which increased production capacity. Iowa, Nebraska, and Illinois continued to lead the nation in ethanol production (Chart 2).

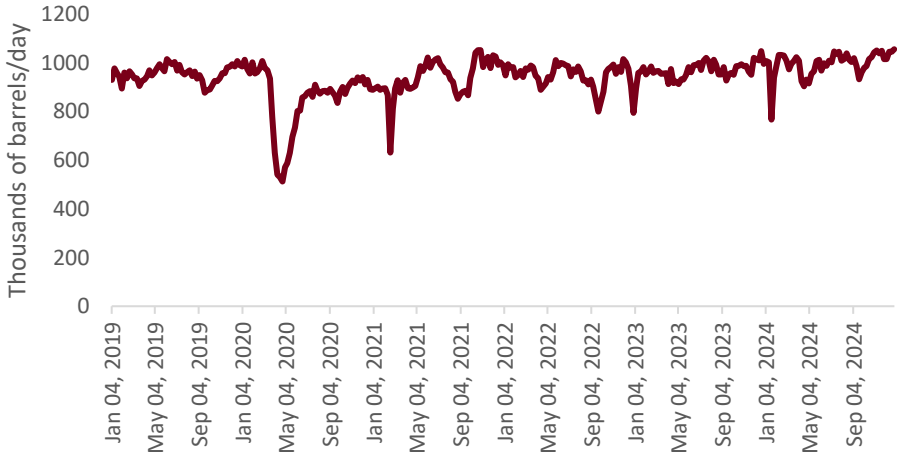
Chart 2: Top 10 states: Fuel ethanol production capacity, January 2024, Source: US Energy Information Administration



The ethanol industry in 2024

The ethanol industry experienced significant production disruptions and swings during the COVID-19 pandemic, particularly in 2020 and early 2021 (Chart 3). In the last few years, however, production has steadied and generally increased (beyond seasonal dips during periods of planned downtime). The five-year average ethanol production rate in the Midwest was 941,000 barrels per day.

Chart 3: Weekly Midwest plant production of fuel ethanol, 2019-2024, Source: US Energy Information Administration



Average weekly Midwest ethanol production in 2024 was 996,000 barrels per day, up 2.8 percent from 2023. Production declined at several points throughout the year, including mid-January, early April, and mid-September. From mid-September through the end of the year, ethanol production trended upward.

Ethanol production tends to follow demand. In the United States, ethanol is blended into motor vehicle fuel, so national consumption trends with fuel use. The pandemic introduced structural changes within the U.S. economy. These changes caused a decrease in the overall consumption of motor vehicle fuel domestically, along with the consumption of ethanol.

Overall, however, ethanol demand increased in 2024.[3] Increased demand was driven by record-setting levels of exports.[4] Ethanol exports were expected to reach 1.9 billion gallons for the year, representing 12 percent of U.S. production. Top destinations for American ethanol included Canada, the United Kingdom, India, the European Union, and Colombia.

Looking forward to 2025, the Energy Information Administration (EIA) is forecasting ethanol production to remain at similar levels to 2024. In its annual outlook, the EIA also expects export levels to be on par with 2024.[5]

While strong exports and higher biofuel mandates from other countries may continue to provide stability for U.S. ethanol producers, uncertainty around domestic policy may spark concern in the marketplace. The new administration may make changes under the Renewable Fuel Standard and with approaches to Small Refinery Exemptions. There may also be changes in foreign trade policy that could affect the export market.[6]

Ethanol production in Minnesota

Minnesota ethanol plants produced 1,401.3 million gallons of ethanol in 2024, a 3.5 percent increase from 2023 (Table 1). Ethanol plants are major consumers of Minnesota's annual corn crop. In 2024, an estimated 500.5 million bushels of corn went into ethanol production in the state, representing 34 percent of the 1.5 billion bushels harvested.

While Minnesota's ethanol production increased in 2024, the total value of feedstock (corn) purchased declined by 24 percent. This is because the price of corn dropped by nearly 27 percent in 2024 as compared to 2023. In addition, natural gas prices fell in 2024, which also reduced costs for ethanol producers.

As a result, the operating cost per gallon of ethanol produced was $2.00 in 2024. Revenues per gallon were $2.41. Thus, Minnesota ethanol plants posted average net returns of $0.41 per gallon. Comparatively, net returns per gallon in 2024 were at their second-highest level in the past five years.

---

[3] Troderman, J. (2024, November 6). *U.S. fuel ethanol exports rise on strong international demand and low U.S. prices.* U.S. Energy Information Administration. https://www.eia.gov/todayinenergy/detail.php?id=63644

[4] Renewable Fuels Association (2025, January 7). *2024 ethanol exports set new record – in just 11 months.* Media and news. https://ethanolrfa.org/media-and-news/category/news-releases/article/2025/01/2024-ethanol-exports-set-new-record-in-just-11-months

[5] Voegele, E. (2025, January 14). EIA maintains 2025 fuel ethanol production outlook, predicts continued strong exports through 2026. *Ethanol Producer Magazine.* https://ethanolproducer.com/articles/eia-maintains-2025-fuel-ethanol-production-outlook-predicts-continued-strong-exports-through-2026

[6] Voegele, E. (2024, December 17). CoBank: Political and regulatory uncertainty could impact US ethanol industry in 2025. *Ethanol Producer Magazine.* https://ethanolproducer.com/articles/cobank-political-and-regulatory-uncertainty-could-impact-us-ethanol-industry-in-2025

Table 1: Minnesota's ethanol industry statistics
Sources: Minnesota Bio-Fuels Association, USDA ERS, University of Minnesota Extension estimates, and Iowa State ethanol model

Category	2020	2021	2022	2023	2024	Percent change 2023-2024
Production (mill gallons)	955.5	1,271.5	1,341.9	1,353.4	1,401.3	3.5%
Feedstock purchases (millions)	$1,090.6	$2,454.2	$3,126.6	$2,788.0	$2,116.0	-24%
Operating costs per gallon	$1.55	$2.40	$2.95	$2.66	$2.00	-25%
Revenue per gallon	$1.65	$2.93	$3.30	$2.98	$2.41	-19%
Net returns per gallon	$0.11	$0.53	$0.35	$0.31	$0.41	27%

Revenues per gallon of ethanol produced decreased by 19 percent between 2023 and 2024. Prices for ethanol, DDGS, and corn oil were all mostly lower. Ethanol prices stayed in a range from $1.35 to $1.52 per gallon from January through April (Chart 4). Prices rose in the summer months, peaking at $1.91 per gallon in early June. Prices then declined slightly through the fall, with the last reported price for Minnesota at $1.52 per gallon in late November.

Chart 4: Minnesota ethanol prices, 2022-2024 (date format is month, week, year), Source: US Department of Agriculture

The average Minnesota price per ton of DDGS began at $196.25 in January and ended at $148.33 in December. The price per ton mostly declined on a month-over-month basis from January through August, hitting a low of $115 per ton. Prices then rallied slightly to finish out the year. Corn oil prices, meanwhile, varied between a high of $0.48 per pound in January 2024 to a low of $0.42 per pound starting in May. Corn oil continued to sell in the range of $0.42 to $0.44 per pound throughout most of the rest of the year.

For more information on how Extension estimated revenues, expenditures, and returns, please see Appendix 1.

Economic contribution

One reason Minnesota farmers wanted to add value to their corn crop was to create additional economic activity in their communities. The value of that activity can be measured through an economic contribution analysis. Economic contribution is comprised of three components: direct, indirect, and induced effects.

The direct effect of an industry is the spending by the industry to operate. In this analysis, it is the spending by ethanol producers on items such as corn, enzymes and yeasts, and utilities. As ethanol producers purchase these items, they cause their suppliers to increase production. Those suppliers then purchase more of their inputs, and so forth, along the supply chain. The sum of the impacts on the supply chain are known as indirect effects. Indirect effects can also be referred to as business-to-business impacts. Ethanol producers pay their workers, who spend their incomes, which creates additional economic production. The impacts spurred by the spending of ethanol employees are known as the induced effects. Induced effects can also be considered consumer-to-business impacts.

Economists use input-output models to measure economic contribution. The models measure the flow of goods and services within an economy. Once that flow is established, the model can determine how a change in one sector of the economy (say, manufacturing) affects other sectors of the economy (construction, for instance). Extension used the input-output model IMPLAN with the Type SAM multipliers for this analysis.

Direct effect

As stated, the direct effect is the spending by an industry to operate. In 2024, Minnesota ethanol producers spent an estimated $2.8 billion in operations (Table 2). Feedstock was the largest input into the production process, with corn purchases comprising 76 percent of all input costs. After factoring in purchases for items including enzymes and yeasts, labor, and transportation, ethanol producers spent $2.00 per gallon on average to function.

Table 2: Direct effects of Minnesota's ethanol industry: 2025
Sources: Minnesota Bio-Fuels Association, Iowa State Ethanol Production Profitability report, USDA ERS, Extension estimates

Operating Costs	2024 (Millions)
Production (mill gallons)	1,401.3
Feedstock (corn)	$2,116.0
Enzymes, yeasts, and chemicals	$97.1
Denaturant	$65.3
Utilities	$295.4
Direct labor	$98.1
Maintenance and repairs	$35.0
Transportation	$10.5
General & administrative expenses	$83.2
Total operating costs	$2,800.7
$/Gallon	$2.00

Revenues	2024 (Millions)
Ethanol	$2,200.0
Dried Distillers' Grain (DDGS)	$893.1
Corn oil	$278.3
Total revenue	$3,371.4
$/Gallon	$2.41
Net return over operating costs	$570.7
$/Gallon	$0.41

Minnesota ethanol producers earned an estimated $3.4 billion in revenues in 2024. At 65 percent, ethanol sales were the largest contributor to overall revenue. DDGS sales generated $893.1 million in

revenue while corn oil generated $278.3 million. On average, Minnesota ethanol producers received $2.41 per gallon in revenues.

Total economic contribution

In 2024, Minnesota's ethanol industry generated an estimated $5.2 billion in economic activity in the state (Table 3). Of this, $1.2 billion was labor income, or income in the pockets of the state's residents. The industry supported employment for 18,434 people.

Table 3: Total economic contribution of Minnesota's ethanol industry: 2024, dollar values are all in millions Source: Extension estimates

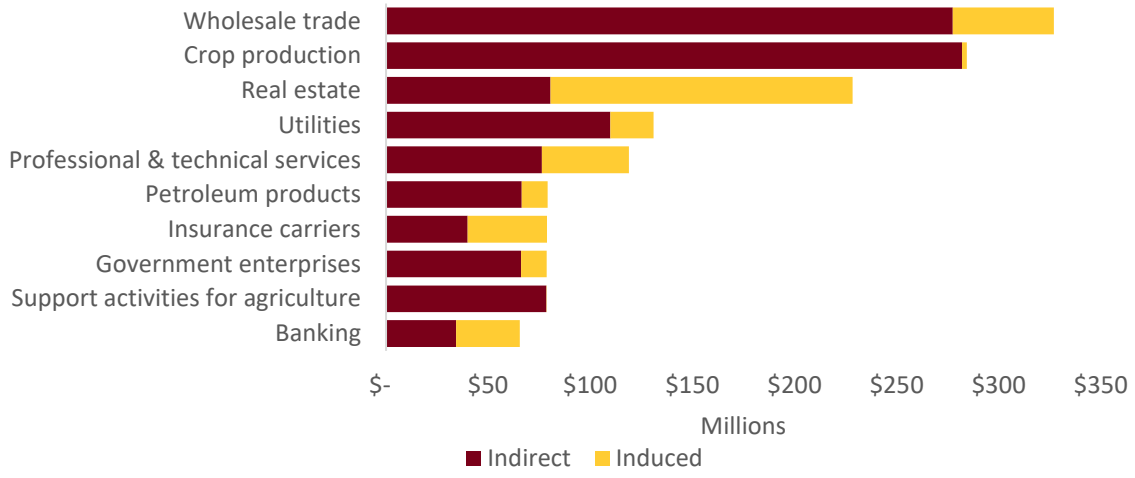
Category	Employment (FTE)	Output	Gross Domestic Product	Labor Income
Direct	7,581*	$2,800.7	$791.6	$408.9
Indirect	6,303	$1,529.2	$743.1	$448.7
Induced	4,550	$914.4	$568.0	$317.7
Total	18,434	$5,244.3	$2,102.7	$1,175.3

*This table reflects both ethanol plants and corn production. Ethanol plants employed 1,096 people in 2024.

The ethanol industry contributed $2.1 billion to Minnesota's gross domestic product (GDP). While GDP measures only sales to final users (consumers, for example), output measures all sales. For more on the economic terms used in this report, please see Appendix 2.

Of the $5.2 billion in economic activity generated, $2.8 billion stemmed directly from ethanol plants. Other businesses throughout the state realized the remaining $2.4 billion in activity. Chart 5 shows the top industries that benefited the most in Minnesota, either from indirect or induced effects. The industries experiencing the highest benefits include wholesale trade, crop production, and real estate.

Chart 5: Top industries impacted, Minnesota's ethanol industry, millions, 2024 (indirect and induced effects)



Indirect, or business-to-business, impacts were highest in the wholesale trade and crop production industries. These are industries that supply farmers. Businesses in the wholesale trade industry specialize in selling products in bulk to other businesses. For farmers, this includes the local

farmer's cooperative, which sells items such as fertilizer and also services such as fertilizer application. Impacts in the crop production industry include the sale of goods between farmers (such as one farmer purchasing seed from another) and the purchase of services by a farmer from another farmer (such as custom planting or harvesting).

Induced, or consumer-to-business, impacts are higher in industries such as real estate and banking. This reflects where households are spending their incomes.

State and local tax collections

Ethanol production also spurred tax collections in the state. In 2024, Minnesota's ethanol industry generated an estimated $157.6 million in state and local tax collections. This includes property, sales, and income taxes, along with other taxes and fees. It also includes taxes generated through the direct, indirect, and induced effects.

Table 4: State and local tax contribution of Minnesota's ethanol industry: 2024, dollar values are all in millions Source: Extension estimates

Category	Taxes
Property	$49.4
Sales	$55.1
Income	$43.3
Other	$9.8
Total	$157.6

There are two primary sources of economic activity associated with ethanol production. One is the production of corn. Given the volume of corn used in ethanol production, the impacts stemming from corn growing are significant. The other is the production of ethanol without corn purchases. There are many reasons for ethanol production, one of which is to add value to the corn crop, thus, looking at the impact above and beyond corn growing itself can be valuable.

Impact of ethanol production (excluding corn)

Ethanol production, excluding the feedstock purchases, generated $1.3 billion in economic activity in 2024 (Table 5). Ethanol plants employed an estimated 1,096 workers, paying $98.1 million in labor income. As a result, the ethanol production (without corn) supported 3,446 workers.

Table 5: Economic contribution of Minnesota's ethanol production (excluding corn): 2024, dollar values are all in millions Source: Extension estimates

Category	Employment (FTE)	Output	Gross Domestic Product	Labor Income
Direct	1,096	$684.7	$370.5	$98.1
Indirect	796	$258.5	$134.9	$78.5
Induced	1,554	$334.6	$207.8	$116.5
Total	3,446	$1,277.8	$713.2	$293.1

Impact of corn production

Ethanol plants purchased an estimated $2.1 billion of corn in 2024. These corn purchases helped support 14,989 jobs in the state, including 6,486 jobs on the farm (Table 6). In total, corn sales to ethanol plants generated nearly $4 billion in economic activity.

Table 6: Economic contribution of Minnesota's corn produced for ethanol: 2024, dollar values are all in millions Source: Extension estimates

Category	Employment (FTE)	Output	Gross Domestic Product	Labor Income
Direct	6,486	$2,116.0	$421.1	$310.8
Indirect	5,507	$1,270.7	$608.2	$370.2
Induced	2,996	$579.8	$360.2	$201.2
Total	14,989	$3,966.5	$1,389.5	$882.2

The role of ethanol's co-products

Ethanol's two primary co-products, DDGS and corn oil, help ethanol plants maintain consistent revenues. They also have practical uses that provide additional value in the economy.

DDGS as animal protein

In 2024, Minnesota's ethanol plants produced an estimated 4.13 million tons of DDGS. Much of the DDGS produced were fed to livestock. DDGS have a high content of fiber and protein, which is valuable for livestock nutrition and production. For example, research shows DDGS have 95 percent of the energy value of corn grain when fed to beef cattle.[7]

Farmers feed DDGS to a variety of animals. Usage statistics from 2023 showed that the majority of DDGS (75 percent) were fed to cattle (including beef and dairy), 18 percent were fed to swine, and 6 percent to poultry.[8]

The volume of DDGS produced by Minnesota's ethanol plants is significant. To understand how significant, one can estimate how many of Minnesota's animals could receive nutrition from DDGS.

Livestock producers can generally replace between 10 and 20 percent of their animal's daily ration with DDGS.[9] For cattle producers, this means one ton of DDGS can feed two-thirds a cow for a year (Chart 6). Similarly, one ton of DDGS could also provide a valuable food source for four pigs or 250 turkeys.

Based on these ratios, Minnesota's 2024 DDGS supply could support more than 2 million head of cattle, 2.5 million pigs, and 61.9 million turkeys and chickens. For context, Minnesota farms have 2.1 million head of cattle, 8.9 million pigs, and 39 million head of turkeys.[10]

[7] DiCostanzo, A. (2021). *Feeding distillers grains to beef cattle*. University of Minnesota Extension. https://extension.umn.edu/beef-feedlot/feeding-distillers-grains-beef-cattle
[8] Renewable Fuels Association (n.d.). *Ethanol co-products*. https://ethanolrfa.org/ethanol-101/ethanol-co-products
[9] Hoffman, L, & Baker, A. (2011). *Estimating the substitution of distillers' grains for corn and soybean meal in the U.S. feed complex*. Economic Research Service, U.S. Department of Agriculture. https://www.ers.usda.gov/publications/pub-details?pubid=36472
[10] Minnesota Department of Agriculture and United States Department of Agriculture

Chart 6: Animal's potential annual use of one ton of Dried Distillers' Grains (DDGS), Source: USDA, ERS

Distillers' corn oil

Distillers' corn oil is the other major co-product made by ethanol plants. In 2024, Minnesota's ethanol plants produced an estimated 463.8 million pounds of corn oil. The corn oil is mostly used for biodiesel production but is also blended into poultry and swine feed.[11]

If all of Minnesota's 2024 distillers' corn oil had been used in biodiesel production, it would have generated 60.2 million gallons of biodiesel.[12] This represents 70 percent of Minnesota 85.5 million gallons of biodiesel production capacity.[13]

[11]Moreau, R., & Hums, M. (2020). Corn oil and distillers corn oil. In F. Shahidi (Ed.), *Bailey's industrial oil and fat products.* https://onlinelibrary.wiley.com/doi/abs/10.1002/047167849X.bio007.pub2#:~:text=Distillers%20corn%20oil%20(DCO)%20is,a%20valuable%20poultry%20feed%20ingredient

[12]United States Department of Agriculture (n.d.*). Ethanol conversion factors.* United States Department of Agriculture Farm Service Agency. https://www.fsa.usda.gov/Internet/FSA_File/2002factorsnformulas.pdf

[13] Minnesota Department of Agriculture. (n.d.). *Minnesota biodiesel.* https://www.mda.state.mn.us/environment-sustainability/minnesota-biodiesel

Appendix 1: Methodology

This appendix outlines the basic methods and data sources used to arrive at the ethanol expenditures and revenues found in Tables 1 and 2.

Production

The Minnesota Bio-Fuels Association conducted a survey of ethanol producers to determine total production in 2024. They then provided these figures to Extension. Production data for 2020, 2021, 2022, and 2023 comes from previous analyses of the ethanol industry completed on behalf of the Minnesota Bio-Fuels Association and was collected in a similar manner.

Revenues

Extension calculated revenues from ethanol production primarily by using Iowa State's ethanol plant prices report which contains Minnesota data.[14] In authoring this report, University of Minnesota Extension used the average monthly price of ethanol per gallon for Minnesota, weighted for production by month. This approach yielded an average price of $1.57 per gallon for the year.

Iowa State's report also provides a price for DDGS and corn oil in Minnesota. Extension used that data to estimate DDGS and corn oil revenues in Minnesota, also weighted for monthly production. The average DDGS price using this model was $152.59 per ton and corn oil was $0.44 per pound.

Iowa State gets its price data for Minnesota from USDA's daily ethanol report produced by the Agricultural Marketing Service.

Expenditures

Extension calculated ethanol plant expenditures primarily using Iowa State's ethanol plant profitability model and its estimates of costs per gallon of ethanol produced. Extension used Minnesota corn prices, again weighted for production by month, resulting in an average corn price of $1.51 per gallon of ethanol.

Data from Minnesota's Department of Employment and Economic Development (DEED) indicates wages in the chemical manufacturing sector (where ethanol production is categorized) declined by 2 percent between 2023 and 2024, thus the wage figure reflects this change.

Corn production

This is an economic contribution study, so it examines the relationships and supply chain related to the production of ethanol. Thus, Extension included the impact of corn production. An economic impact study would take a different methodological approach.

[14] Iowa State University (n.d.). Ag decision maker. Iowa State University Extension and Outreach. https://www.extension.iastate.edu/agdm/energy.html

Appendix 2: Definitions and terms

Special models, called input-output models, exist to conduct economic contribution analysis. There are several input-output models available. IMPLAN is one such model. Many economists use IMPLAN for economic contribution analysis because it can measure output and employment impacts, is available on a county-by-county basis, and is flexible for the user. IMPLAN has some limitations and qualifications, but it is one of the best tools available to economists for input-output modeling. Understanding the IMPLAN tool, its capabilities, and its limitations helps ensure the best results from the model.

One of the most critical aspects of understanding economic contribution analysis is the distinction between the local and non-local economy. The local economy is identified as part of the model-building process. Either the group requesting the study or the analyst defines the local area. Typically, the study area (the local economy) is a county, or a group of counties, which share economic linkages. In this study, the study area is the entire state of Minnesota.

This distinction is important because the model will only capture the impact of spending within the defined region. If an ethanol producer, for example, buys items outside the state of Minnesota, this will not generate indirect effects.

A few definitions are essential to properly read the results of an IMPLAN analysis. These terms and their definitions are provided below.

Output

Output is the quantity of goods or services produced in a given time period by a firm or industry, whether consumed or used for further production. The concept of national output is essential in the field of macroeconomics.

Output represents the value of industry production. In IMPLAN, these are annual production estimates for the year of the data set and are listed in producer prices. Output is measured in dollars and is equivalent to total sales.

Output measures all sales in the economy, and therefore can, in essence, double count. Corn is a good example of this. A farmer sells corn to a local farmer's cooperative. This is one sale, and the value of the corn is counted in output. The farmer's cooperative then grinds that corn into dairy cattle feed and sells it to the local dairy farmer. That is a second sale, and the final price again includes the value of the corn. The dairy farmer, in turn, sells the milk produced from the cow fed with the feed. The value of the corn is built into that sale price, too.

Output is the figure most reported in economic contribution studies.

Gross Domestic Product (GDP)

GDP is similar to output, however, as it eliminates double counting by only counting the value at final demand (or final use of the product).

Employment

In this report, employment is listed as full-time equivalents. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric. This is particularly true in times of accelerating inflation—one employee producers the same amount of output, even if the value of that output is rising.

Labor income
Labor income includes all forms of employment income, including employee compensation (wages, salaries, and benefits) and proprietor income. Labor income measures the value added to the product by the labor component.

Direct impact
Direct impact is equivalent to the initial activity in the economy. In this study, it is the expenditures of the ethanol producers.

Indirect impact
The indirect impact is the summation of changes in the local economy that occur due to spending on inputs (goods and services) by the industry or industries directly impacted. For instance, if employment at the ethanol plant increases by 10 jobs, this implies a corresponding increase in output by the plant. As the plant increases output, it must also purchase more inputs, such as electricity, enzymes, and equipment. As the plant increases its purchase of these items, its suppliers must also increase production, and so forth. As these ripples move through the economy, they can be captured and measured. Ripples related to the purchase of goods and services are indirect impacts.

Induced impact
The induced impact is the summation of changes in the local economy that occur due to spending by labor; that is, spending by employees in the industry or industries directly impacted. For instance, if employment in an ethanol plant increases by 10 jobs, the new employees will have more money to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. This can be quantified and is called the induced impact.

Input-output, supply and demand, and size of market
Care must be taken when using regional input-output models to ensure they are being used in the appropriate type of analysis. If input-output models are used to examine the impact or the contribution of an industry that is so large that its expansion or contraction results in such major shifts in supply and demand that prices of inputs and labor change, input-output can overstate the impacts or contributions. This may be a concern in this study, as Minnesota's ethanol plants produce 8 percent of national production. If they all were to suddenly stop producing, it may affect the price of ethanol.