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Potential Economic Impact and Basis Analysis of a Soybean Crush and Biodiesel Facility near Crookston, Minnesota

A REPORT OF THE ECONOMIC IMPACT ANALYSIS PROGRAM

Authored by Brigid Tuck, Edward Usset, and Rani Bhattacharyya



IN PARTNERSHIP WITH: CROOKSTON HOUSING AND ECONOMIC DEVELOPMENT AUTHORITY

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January 2019

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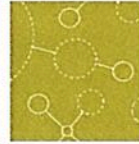
Crookston Housing and Economic Development Authority

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EXECUTIVE SUMMARY: POTENTIAL ECONOMIC IMPACT AND BASIS ANALYSIS OF A SOYBEAN CRUSH AND BIODIESEL FACILITY NEAR CROOKSTON, MINNESOTA

On May 1, 2018, Minnesota's state biodiesel mandate increased to 20 percent (B20) during the summer months. This means number two diesel (commonly used in trucking) must contain at least 20 percent biodiesel. Soybeans are a primary source for biodiesel, and Minnesota is a leading soybean producing state. Currently, however, it does not produce enough biodiesel to meet the state mandate. Investors in Crookston, Minnesota have identified the potential for constructing a new soybean crush and biodiesel plant, primarily using soybeans grown in northwest Minnesota. University of Minnesota Extension, on behalf of the Crookston Housing and Economic Development Authority (CHEDA), completed an analysis of the economic and basis impact of the proposed new plant.

Soybean Production and Biodiesel Demand: Soybean production in Northwest Minnesota has more than tripled since 1997. Polk County farmers planted 326,000 acres of soybeans in 2018, the highest acreage of any Minnesota county. The Minnesota Department of Agriculture, meanwhile, estimates current state biofuel production will only provide 53 percent of the biodiesel required to meet Minnesota's B20 market demand. Crookston's location in Polk County, then, may be ideal for constructing a soybean crush and biodiesel plant to help meet the state's biodiesel demand.

Effect on Soybean Basis: From August 2015 through August 2018, soybean bids in Crookston and Argyle, Minnesota averaged 53 cents per bushel less than bids in the towns of Fairmont and Savage. A fully operational soybean crushing plant in Crookston will raise the basis by an estimated 10 to 20 cents per bushel.

Economic Impact of Soybean Crush and Biodiesel Plant Construction: In total, construction of the plant will generate \$134.0 million of economic activity in Polk County. This includes \$43.1 million in labor income. The plant's construction will support 820 jobs in the county. Industries experiencing the largest employment impacts include food and drinking places, wholesale trade, and professional and technical services. These impacts will be short term and dissipate when construction is complete.

The direct output associated with the plant's construction is \$106.7 million. The IMPLAN model used in Extension's analysis estimates there will be 590 people employed directly during the construction process. They will be paid \$35.1 million.

Economic Impact of Soybean Crush and Biodiesel Plant Operations: Operations of the plant in Polk County will generate \$322.8 million of new economic activity. This includes \$17.2 million in labor income. The plant will support 330 new jobs. In addition, soybean purchases will support 180 farm-related jobs. Soybean purchases will also support \$58.9 million in farm-related output, including \$12.2 million in labor income. Industries experiencing the largest impacts include agricultural support services, real estate, and food and drinking places.

Economic Impact In 11-County Region: Operations of a new crush and biodiesel plant will generate \$323.9 million of new economic activity in the 11-county region. This includes \$18.1 million in labor income. The plant will also support 330 new jobs. In addition, soybean purchases will support 980 farm-related jobs and \$257.8 million in farm-related output, including \$67.3 million in labor income. The 11-county region includes Becker, Clay, Clearwater, Kittson, Mahnommen, Marshall, Norman, Pennington, Polk, Red Lake, and Roseau counties.

INTRODUCTION

On May 1, 2018, Minnesota's state biodiesel mandate increased to 20 percent (B20) during the summer months, doubling the previous requirement. This means number two diesel (commonly used in trucking) must contain at least 20 percent biodiesel. Soybeans are the primary source for biodiesel, and Minnesota is a leading soybean producing state. Under this increased mandate, the Minnesota Department of Agriculture estimated biodiesel would contribute \$1.5 billion to the state's economy (Steil, 2018).

Currently, however, Minnesota does not produce enough biodiesel to meet the mandate. Fortunately, this situation presents a business opportunity. Investors in Crookston, Minnesota have identified the potential of constructing a new soybean crush and biodiesel plant, primarily using soybeans grown in northwest Minnesota. The proposed plant will produce 30 million gallons of biodiesel per year. The facility will crush soybeans into soybean oil and soybean meal. The oil will be a feedstock into the biodiesel process, and the meal will be processed for animal feed. The facility will operate 24 hours per day, seven days per week.

The Crookston Housing and Economic Development Authority (CHEDA) is interested in understanding the potential economic impact of the proposed new crush and biodiesel plant. The economic impact of the plant includes both the annual impact of its operations and the short-term impact of its construction. University of Minnesota Extension completed an analysis of the proposed plant's economic impact and explored the effect of increased demand on the region's soybean basis. This report summarizes the results.

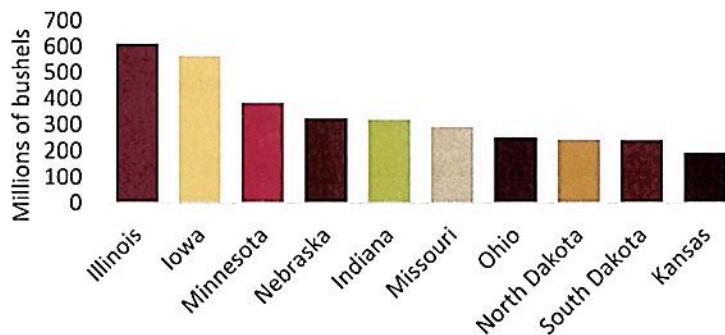
SOYBEANS AND BIODIESEL IN MINNESOTA

Trends in soybean and biodiesel production indicate the potential opportunity for a biodiesel plant in Northwest Minnesota.

Soybean Production, Trends, and Prices

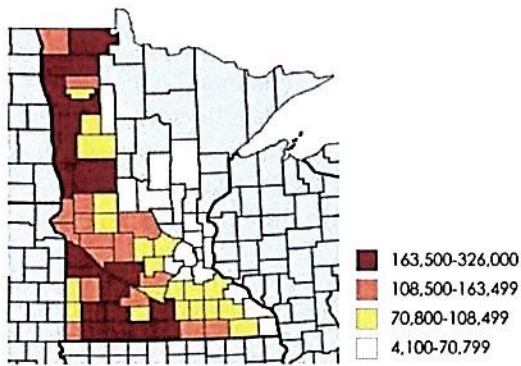
In 2017, Minnesota farmers harvested 384 million bushels of soybeans. This made Minnesota the third largest soybean producing state in the United States (Chart 1).

Chart 1: Top Soybean Producing States, 2017



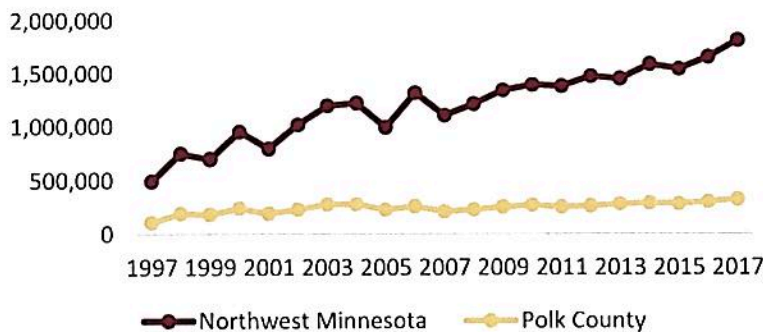
Soybean production is primarily in western and southern Minnesota. Planted acreage in 2018 was highest in northwest and southwest counties of the state (Map 1). Polk, Marshall, Renville, Redwood, and Norman counties had the highest number of planted acres.

Map 1: Planted Soybean Acreage, 2018



Soybean acreage is increasing in northwestern Minnesota (Chart 2). In 1997, the region had slightly less than 500,000 acres of planted soybeans. By 2017, this number had increased to 1.8 million acres (a 260 percent increase). Planted acreage is also increasing in Polk County. In 2017, Polk County had 326,000 planted acres of soybeans.

Chart 2: Planted Soybean Acreage, 1997-2017



Currently, soybean prices vary across the state of Minnesota. As of October 4, 2018, the cash price for soybeans delivered by October 31 was \$7.84 in Mankato and \$6.94 in Crookston. This is a difference of \$0.90. The cash price for soybeans delivered in November was \$7.99 in Mankato and \$7.23 in Crookston, for a difference of \$0.76.¹ These price differentials are consistent with research done by IPMC consultants during a feasibility study. That particular study found a \$0.50 differential, primarily due to transportation.

Biodiesel Mandate and Production

Minnesota established a biodiesel content mandate in 2005, requiring all diesel to be blended with 2 percent biodiesel fuel. The legislation also stipulated that, with time, the blend percent would increase. On May 1, 2009, it increased to 5 percent. On May 1, 2012, it increased to 10 percent (during summer months). Finally, on May 1, 2018, Minnesota’s state mandate on biodiesel increased to 20 percent (B20) from May to September. This

¹ Mankato prices from http://www.chsag.com/markets/cash.php?location_filter=26199. Crookston prices from <https://chsnorthlandgrain.com/grain/cash-bids/>.

doubled the previous blend ratio. During the winter months, the requirement reverts back to 5 percent (The Office of the Revisor of Statutes, 2018).²

The biodiesel content mandate legislation also stipulates that 1) a sufficient supply of biodiesel (from the United States or Canada) must be available and 2) blending infrastructure and regulatory protocols must be in place. If either of these requirements are not met, the mandate can be waived. This happened multiple times in 2018, primarily due to a limited biodiesel supply. The Commissioner of the Minnesota Commerce Department issued a temporary order (in effect from May 21 to June 30, 2018) when Minnesota's largest biodiesel plant in Brewster went off-line and temporarily halted production. When this happened, the plant was producing 47 percent of Minnesota's biodiesel (Minnesota Commerce Department, 2018).

According to the Minnesota Department of Agriculture (Patten & Hennessy, 2018), Minnesota's current biodiesel plants produced 74 million gallons in 2016. This amount was expected to increase to 85.5 million gallons in 2017 (Table 1).

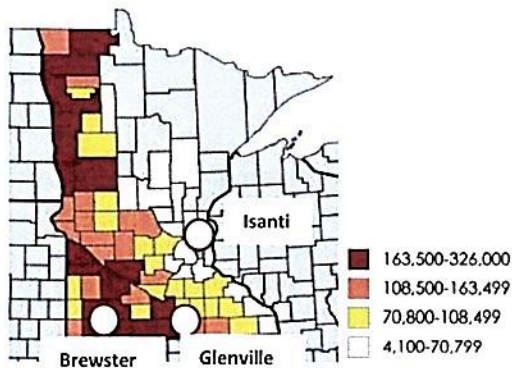
Table 1: Minnesota Biodiesel Plant Permitted Production Capacities

Plant	Location	2017 Permitted Capacity*
Ever Cat Fuels	Isanti	3.0
Minnesota Soybean Processors	Brewster	40.5
Renewable Energy Group	Glenville	42.0

Source: Minnesota Department of Agriculture, *Millions of gallons

Both of Minnesota's major biodiesel plants are located in southern Minnesota, leaving northern Minnesota without biodiesel production capacity (Map 2).

Map 2: 2018 Planted Soybean Acreage with Biodiesel Production Facilities



The Department of Agriculture found the state's 2016 biodiesel production would meet 53 percent of the demand created when the mandate increased to 20 percent (Table 2). Even with increased capacity, however, it is clear demand will significantly outstrip supply in the state.

² If technology advances to improve the use of biodiesel during cold weather months, the legislation allows the 20 percent mandate to be applied year round.

Table 2: Projected Biodiesel Demand and Supply from April to September, Minnesota 2016

	Diesel Demand	Biodiesel Gallons Needed	Current Production Maximums	Production Versus Need
Total	430,651,395	86,130,280	45,554,001	52.9%

Source: Minnesota Department of Agriculture

EFFECT ON SOYBEAN BASIS IN THE REGION

Basis is the price difference between the cash price of soybeans at a specific location and the price of soybeans on a particular futures contract market.³ Basis links a local cash price to the futures contract price. While futures contracts and cash prices are affected by world events, local issues are also very important. Those that have a significant impact on local prices and basis include the following:

- **Transportation costs and availability.** A grain elevator that transports bushels by train or truck may not have railcars or trucks available. This is not an issue for the soybean world market, but it may influence the local soybean price (the basis portion) for a period.
- **Local supply and demand.** From a worldview, when a soybean crushing plant opens in a town, it is one among hundreds of other plants. The impact on the futures contract price will be small. The plant, however, will have an impact on the demand for soybeans in the local area. This, in turn, will impact the local soybean price and basis.
- **Availability of local storage.** Harvest season and a bumper crop filling local elevators is not likely a big concern in the global soybean market, but again, these events will affect the local soybean price and basis.

Cash and futures contract prices are very difficult to predict. Basis, however, shows a seasonal pattern and is more predictable. Cash and futures contract prices must come together during the delivery month. This process, known as convergence, occurs because a futures contract is an actual contract for delivery. Therefore, basis can be used to estimate potential changes in farm income resulting from the plant.

Basis math is simple:

$$\begin{aligned} \text{Cash price} - \text{futures contract price} &= \text{basis} \\ \$6.60 - \$6.95 &= -\$0.35 \text{ (or 35 cents "under")} \end{aligned}$$

Or alternatively:

$$\begin{aligned} \text{Cash price} &= \text{futures contract price} + \text{basis} \\ \$6.60 &= \$6.95 + (-\$0.35) \end{aligned}$$

In the grain industry, the practice of using basis quotes during day-to-day trading activities rather than prices goes back more than 100 years. The grain trade—comprised of merchandisers, processors, and exporters—is dominated by hedgers. Hedgers, by definition, offset cash positions with a futures position. Hedgers are not

³ A futures contract is an agreement to buy or sell an asset (in this case, soybeans) at a future date at an agreed upon price. One party agrees to buy a certain quantity of the commodity and take delivery on a set date. The other party agrees to provide the commodity. Farmers often use futures contracts as a hedge against price changes.

very concerned with price levels (e.g., \$5 versus \$8 corn) because they do not trade price. Hedgers trade basis, and they typically quote cash prices as a basis of so many cents "under" or "over" the futures contract price.

Crookston's proposed crushing plant will process 60,000 bushels of soybeans per day. While this production capacity is less than that of the six current commercial-size crushing plants in the state (which process an estimated 80,000 to 175,000 bushels per day), the plant will still have an impact on basis levels in Crookston and the surrounding areas.

To measure the proposed plant's impact on basis levels, Extension compared it to other plants in Minnesota. The grain shuttle facility in Argyle was chosen for analysis because shuttle facilities move a lot of grain. A 110-car shuttle train carries about 400,000 bushels of soybeans and, if the trains move efficiently, a facility may be able to load 2.5 trains in a month. This works out to be 1,000,000 bushels per month, or just over 30,000 bushels per day.

With 60,000 bushels of soybeans processed per day, the proposed plant will need to purchase twice as many soybeans as a well-run shuttle loading facility. These calculations, however, do not always depict an accurate situation. A shuttle loading facility can choose to stop buying soybeans for a period and change shipments to corn or wheat. A crushing plant must maintain a consistent buying presence in the local market.

The crushing plant in Fairmont is probably the largest in Minnesota, with a rumored crush of 175,000 bushels per day—nearly three times the capacity of the proposed plant in Crookston. The basis analysis shows that bids in Fairmont are routinely 15 to 30 cents per bushel greater than grain elevators located within 10 to 30 miles of the town.

While a crushing plant in Crookston will affect the local basis, its impact will not be as large as that of a much larger plant in southern Minnesota. Processing 60,000 bushels per day will raise the local soybean basis by an estimated 10 to 20 cents per bushel. When fully operational, the Crookston basis—which historically averaged a 53-cent discount compared to Fairmont and Savage—will change to an average discount of 33 to 43 cents per bushel. For more information on this data and the calculations used, please see Appendix 1.

ECONOMIC IMPACT IN POLK COUNTY

A new soybean crush and biodiesel plant will contribute to the economy in two ways. First, it will contribute on an annual basis through its daily operations. These impacts will be ongoing as long as the facility operates at projected levels. Second, the plant will contribute through its construction activity. These impacts will be short term and dissipate once construction is complete. Given the temporal differences between these two economic contributions, this report presents the results separately.

Economic contribution is measured in output (sales), employment, and labor income. Employment is measured as one job, regardless if the job is full-time, part-time, or seasonal. The study area of this analysis is Polk County, Minnesota.

Economic contribution is comprised of direct, indirect, and induced effects. Direct effects include spending and employment by the crush and biodiesel plant itself. Indirect and induced effects are the "ripple effects" felt in other industries as the result of the company's spending. The total effect is the sum of direct, indirect, and induced effects.

Indirect effects are those associated with a change in economic activity due to spending for goods and services directly tied to the company. As the new crush and biodiesel plant makes purchases, this creates an increase in purchases across the supply chain. Indirect effects are the sum of these changes across an economy.

Employment Defined

In this analysis, one job is one job, regardless if it is part-time, full-time, or seasonal.

Induced effects are those associated with a change in economic activity due to spending by the employees of businesses (labor) and by households. These are economic changes related to spending by people directly employed by the new crush and biodiesel plant. Induced effects are the sum of these changes across an economy. They also include household spending related to indirect effects.

Input-output models trace the flow of dollars throughout a local economy and capture the indirect and induced, or secondary, effects of an economic activity. To quantify the indirect and induced effects of a new crush and biodiesel plant for this analysis, the direct effects were entered into the input-output model IMPLAN. This analysis uses IMPLAN version 3.0 with SAM multipliers.⁴

Map 3: Polk County, Minnesota



Economic Impact of Construction

The building of a new crush and biodiesel plant in Polk County will impact the economy during the construction phase. These effects will be short term and will dissipate once construction is complete. This section of the report details the direct and total effects of the plant's construction.

Direct Effects

Development plans for the new crush and biodiesel plant currently estimate \$149.0 million of spending on plant construction. This includes purchasing the land, developing the site, constructing the building, purchasing and installing equipment, and establishing initial organizational and pre-operation costs (Table 3). The most significant costs include constructing the building and purchasing and installing equipment.

Table 3: Direct Construction Effect of 30 Million Gallon Soybean Crush and Biodiesel Plant in Polk County, Minnesota

Category	Total Budgeted Expenditures (millions)	Local Expenditure Expenditures in the Model (millions)
Land and site work	\$3.3	\$3.0
Building	\$85.2	\$73.2
Equipment	\$40.4	\$10.4
Organizational costs	\$20.1	\$20.1
Total	\$149.0	\$106.7

Source: Epitome Energy, LLC

Of the \$149.0 million, it is estimated \$106.7 million will contribute to **local economic activity**. Site acquisition costs are not included in the economic impact analysis, as the purchase of land is considered an exchange of assets—land for money—and does not create additional economic activity in the economy. Additionally, not all expenditures would occur in Polk County. All building construction costs are local since as the construction is

⁴ www.implan.com

expected to occur in the region. Equipment, however, is often specialized and not all purchases will be sourced from local manufacturers or wholesalers.⁵

Total Effects

In total, the construction of a crush and biodiesel plant in Crookston will generate an estimated \$134.0 million of economic activity (Table 4). This includes \$43.1 million in labor income. The plant construction will support 820 jobs in the county.

The direct output associated with the plant’s construction is \$106.7 million, as detailed above. The IMPLAN model estimates there will be 590 people employed directly during the construction process. They will be paid \$35.1 million in labor.

Table 4: Total Economic Impact of the Construction of a 30 Million Gallon Soybean Crush and Biodiesel Plant in Polk County, Minnesota

	Output (millions)	Employment	Labor Income (millions)
Direct	\$106.7	590	\$35.1
Indirect	\$9.8	70	\$3.0
Induced	\$17.5	160	\$5.0
Total	\$134.0	820	\$43.1

Estimates by University of Minnesota Extension

Top Industries Affected

The construction of a soybean crush and biodiesel plant will support 230 jobs in other industries across the county. These industries provide goods and services to those directly involved in the construction process. The industries experiencing the largest employment impacts include food and drinking places, wholesale trade, and professional and technical services (Chart 3).

The largest indirect effects (those reflecting the supply chain) include wholesale trade, professional and business services, and trucking. The largest induced effects (those reflecting spending by employees) include food services and drinking places, social assistance, and hospitals. In the IMPLAN dataset, one job is one job, regardless if it is full-time, part-time, or seasonal. Therefore, it is not unusual to see higher impacts in sectors with more part-time employment, such as restaurants.

⁵ Based on previous analyses of biofuels and biobased products, Extension estimated 25 percent of equipment could be purchased from local businesses.

Chart 3: Top Industries Impacted, Construction of a 30 Million Gallon Soybean Crush and Biodiesel Plant in Polk County, Minnesota, Sorted by Employment



Economic Impact of Operations

The building of a new crush and biodiesel plant in Polk County will impact the economy through its operations. Unlike construction effects, operational effects will be ongoing as long as the plant operates at projected levels. The plant is expected to increase production slowly over a period of years. This analysis focuses on the plant at full production in an estimated five years. The following section of the report details the direct and total effects of operations.

Direct Effects

The proposed crush and biodiesel plant will cost \$281.4 million annually to operate (Table 5). The largest expense will be purchasing soybeans for the plant, accounting for 84 percent of expenditures. Not all soybeans, however, will be available within Polk County. If Polk County farmers were to send their entire harvest to the facility, it would still only fill about 70 percent of total demand. For purposes of this analysis, Extension assumed 20 percent of the total need would be satisfied from local (within Polk County) operations. This assumption is based on conversations with industry experts.

Table 5: Direct Operational Effect of 30 Million Gallon Crush and Biodiesel Plant in Polk County, Minnesota

Category	Expenditures (millions)
Soybeans	\$236.1
Inputs	\$41.5
Trucking*	\$19.6
Labor	\$3.8
Total	\$281.4

Source: Epitome Energy, LLC *Estimated by Extension based on food products manufacturing

Other operational expenditures related to the facility include inputs (such as chemicals and electricity), trucking, and labor. The firm considering the development of the facility estimated costs for soybeans, inputs, and labor. Extension estimated trucking cost based on a similar-sized food products manufacturing plant.⁶

Operations of a new crush and biodiesel plant will create new economic activity and support current activity in the county. Operational input purchases (e.g., electricity, chemicals, and trucking) are new dollars in the economy. This economic activity would not occur in the county but for the presence of the facility. This, then, creates true economic impact.

Since Polk County farmers already produce soybeans, operation of a new crush and biodiesel plant will **not increase the number of farmers** growing them. There may be substitution of a crop for soybeans (e.g., wheat for soybeans). Overall, however, farmers will not be selling “new” beans. They will simply be switching market channels. Therefore, spending for soybeans will not create new economic activity.

Spending for soybeans, however, will support farmers and their income in Polk County. As demonstrated by the soybean basis analysis, local soybean growers can anticipate a price increase of 10 to 20 cents per bushel. For purposes of this analysis, Extension assumed a 10-cent-per-bushel increase. In 2017, Polk County farmers produced 12.3 million bushels of soybeans. An increase of 10 cents per bushel would result in an increase of \$1.2 million of farm income in Polk County alone. This increase is also part of the new economic activity generated by the plant. To measure the impact of increased farm income, Extension modeled an increase in farm and non-farm expenditures related to soybeans. For more information on the data and calculations used, please see Appendix 2.

Total Effects

The operation of a new crush and biodiesel plant in Polk County will generate an estimated \$322.8 million of new economic activity. This includes \$17.2 million in labor income (Table 6). The plant will also support an estimated 330 new jobs. Additionally, soybean purchases will support 180 farm-related jobs and \$58.9 million in farm-related output, including \$12.2 million in labor income.

Table 6: Total Economic Impact of the Operation of a 30 Million Gallon Soybean Crush and Biodiesel Plant in Polk County, Minnesota

	Output (millions)	Employment	Labor Income (millions)
Direct	\$282.6	140	\$9.1
Indirect	\$37.6	165	\$7.3
Induced	\$2.6	25	\$0.8
Total (new economic activity)	\$322.8	330	\$17.2
Soybeans	\$58.9	180	\$12.2
Total (new and supported economic activity)	\$381.7	510	\$29.4

Estimates by University of Minnesota Extension

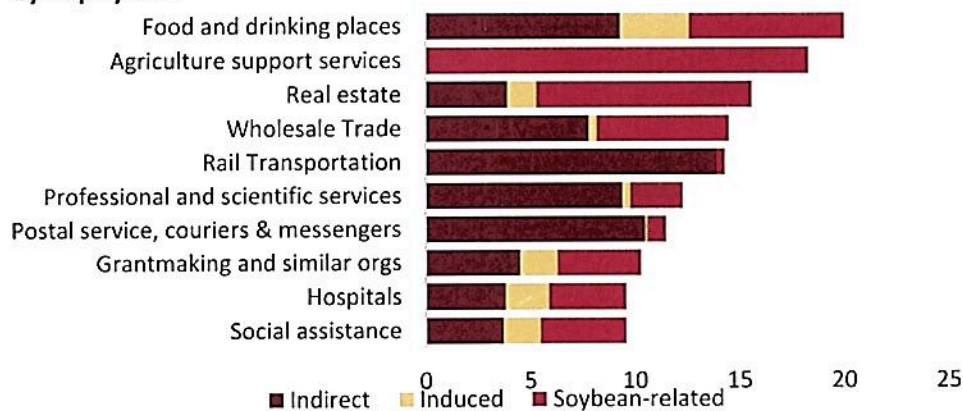
⁶ Soybean crushing is included in the food products manufacturing sector.

Direct employment (140 jobs) includes both anticipated jobs at the facility and jobs for transporting soybeans to the facility. Likewise, labor income includes payments to plant workers and truckers. The anticipated number of jobs and labor income, based on current plans for the facility, was provided to Extension. The IMPLAN model estimated trucking effects. Direct output in Table 6 includes operations, trucking, and new farm income from the increased soybean basis.

Top Industries Affected

The operation of a new crush and biodiesel plant in Polk County will support 190 new jobs across all industries. It will also support 180 farm-related jobs. The industries experiencing the largest impacts include food and drinking places, agriculture support services, and real estate (Chart 4). Indirect effects are anticipated to be highest in agriculture support services and rail transportation. Induced effects are expected to be highest in food and drinking places, hospitals, and real estate.

Chart 4: Top Industries Effected, Operations of a 30 Million Gallon Soybean Crush and Biodiesel Plant in Polk County, Minnesota, Sorted by Employment

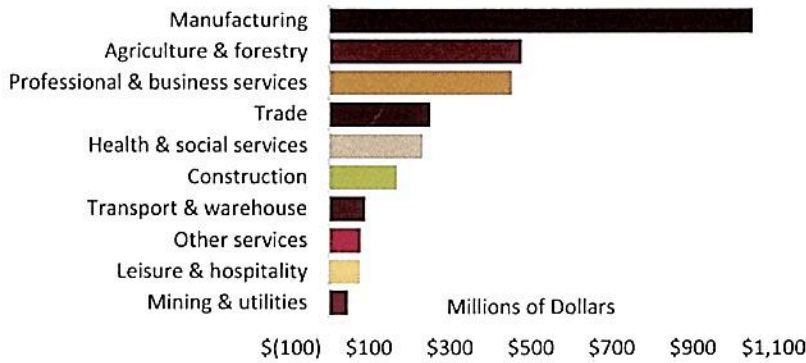


ECONOMIC IMPACT IN THE CONTEXT OF POLK COUNTY’S ECONOMY

In 2016, Polk County businesses created \$3.1 billion of output.⁷ Manufacturers produced one-third of total output (Chart 5). Agriculture and forestry created the second highest level of output.

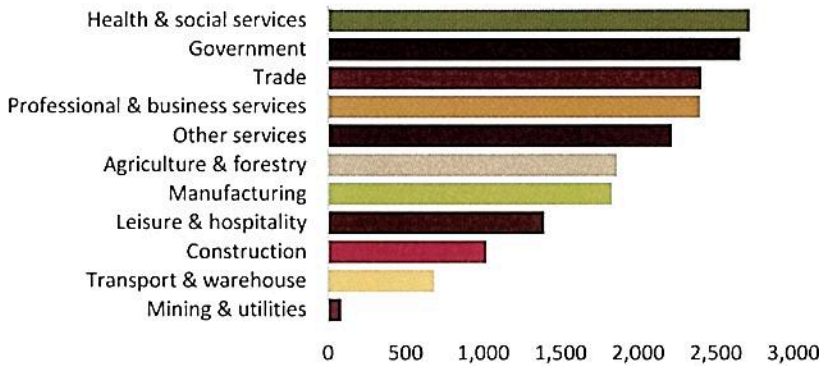
⁷ Data from 2016 is the most current available.

Chart 5: Output by Industry, Polk County, Minnesota, 2016



In 2016, Polk County businesses had 19,300 jobs. The health and social services industry employed 14 percent of these workers (Chart 6). Other major industry employers included government, trade, and professional and business services.

Chart 6: Employment by Industry, Polk County, Minnesota, 2016



ECONOMIC IMPACT IN THE 11-COUNTY REGION

The focus of this analysis, so far, has been on Polk County—the proposed home of the new crush and biodiesel facility. However, the effect of the new plant will extend to a larger region as well, primarily through the purchase of soybeans from neighboring counties. Project developers anticipate the plant will draw soybeans for processing within a 50-mile radius. In Minnesota, soybeans will likely be sourced from Becker, Clay, Clearwater, Kittson, Mahnomon, Marshall, Norman, Pennington, Polk, Red Lake, and Roseau counties.

This section of the report presents the proposed plant’s economic contribution in the 11-county region. The methodology for this analysis is the same as for Polk County. It is assumed 80 percent of soybeans are sourced in the region.

In total, the construction of a crush and biodiesel plant will generate an estimated \$144.0 million of economic activity in the 11-county region (Table 7). This includes \$46.1 million in labor income. The plant construction will support 880 jobs in the region.

Table 7: Total Economic Impact of the Construction of a 30 Million Gallon Soybean Crush and Biodiesel Plant in Northwest Minnesota (11-county region)

	Output (millions)	Employment	Labor Income (millions)
Direct	\$106.7	590	\$35.1
Indirect	\$17.0	110	\$5.2
Induced	\$20.3	180	\$5.8
Total	\$144.0	880	\$46.1

Estimates by University of Minnesota Extension

The operation of a new crush and biodiesel plant will generate an estimated \$323.9 million of new economic activity in the 11-county region. This includes \$18.1 million in labor income (Table 8). The plant will also support 330 new jobs. In addition, soybean purchases will support 980 farm-related jobs and \$257.8 million in farm-related output, including \$67.3 million in labor income.

Table 8: Total Economic Impact of the Operation of a 30 Million Gallon Soybean Crush and Biodiesel Plant in Northwest Minnesota (11-county region)

	Output (millions)	Employment	Labor Income (millions)
Direct	\$282.6	140	\$9.1
Indirect	\$38.9	165	\$8.2
Induced	\$2.4	25	\$0.8
Total (new economic activity)	\$323.9	330	\$18.1
Soybeans	\$257.8	980	\$67.3
Total (new and supported economic activity)	\$581.7	1,310	\$85.4

Estimates by University of Minnesota Extension

NOTES ON THE ANALYSIS

The data, analysis, and findings described in this report are specific to the geography, period, and project requirements of Crookston's proposed soybean crush and biodiesel plant. Findings are not transferable. University of Minnesota Extension neither approves nor endorses the use or application of findings and other content in this report by other jurisdictions or businesses.

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APPENDIX 1: SOYBEAN BASIS CALCULATION, DATA, AND METHODS

Methodology

Three years of daily price data was purchased from GeoGrain, a market monitoring service based in Montana. The information covered the period of August 2015 through August 2018. All basis quotes noted in this document refer to the nearby basis, or the spot soybean price relative to the nearby futures contract. Data was gathered on the following markets.

Fairmont, MN: Fairmont is home to a CHS Incorporated soybean crushing plant. While crushing capacity figures are not made public, industry insiders believe the plant crushes upwards of 175,000 bushels per day, which would make it the largest crushing plant in the state.⁸ The crushing plant in Fairmont is generally recognized as having the highest price for soybeans in southern Minnesota, with bids on par with two large crushing plants in Mankato and competitive with bids at another plant in Savage.

St. James, Blue Earth, Winnebago, and Trimont, MN: These towns are all within 10-15 miles of Fairmont. Quotes from five grain handling facilities in the four towns should provide a sense of soybean prices relative to a nearby crushing plant.

Jackson and Windom, MN: Both towns are about 30 miles from Fairmont. Data on these towns was gathered to determine if the large crushing facility in Fairmont influences prices as far as 30 miles away.

Savage, MN: Minnesota exports a lot of soybeans, and a good number of them run through barge loading facilities located in Savage. The town is located on the Minnesota River just south of the Twin Cities. While price data was gathered from three different facilities, it was common for one or two of them to not offer quotes during the winter months when barge trading came to a halt.

Crookston and Argyle, MN: There is a CHS Incorporated-affiliated elevator located in Crookston and a shuttle loading facility located in Argyle. Argyle is 40 miles north of Crookston on MN-75. Both Crookston and Argyle are strong markets for soybeans in the Red River Valley. Soybean bids during the period in question were often within 5 cents of each other.

Results in Regard to Relative Prices (August 2015- August 2018)

Fairmont, MN: The price of soybeans averaged \$9.23 per bushel during the three-year period in question. The highest price recorded was \$11.19 (July 2016) and the lowest was \$7.71 (July 2018). The highest basis was 75 cents over in August 2015. The lowest basis was 75 cents under in January 2017.

St. James, Blue Earth, Winnebago, and Trimont, MN: During the period in question, the best price quote in these four towns averaged 21 cents less per bushel compared to Fairmont's average. For a brief 10-day period in June 2016, the best quote in these cities was actually higher than Fairmont by one to six cents per bushel. The premium in Fairmont has been as high as 55 cents per bushel. A broad look at the history, however, indicates Fairmont's premium is routinely within the 15- to-25 cent range.

Jackson and Windom, MN: The best soybean price in the two towns (each approximately 30 miles from Fairmont) averaged 25 cents less per bushel compared to Fairmont and just four cents less than the best basis for towns within 15 miles. A broad look at the history, however, indicates the Fairmont premium is routinely within the 20- to 30-cent range.

⁸ While crushing capacity is not public information, a plant's permitted biodiesel production is a known figure. Using industry estimates of the ratio of soybeans to biodiesel production can provide an estimate of total soybean crush.

The basis does not change much as the distance from Fairmont increases. This is not surprising since Southern Minnesota has some interesting dynamics in play. First, there is a large crushing facility in Brewster, Minnesota, 55 miles west of Fairmont. Second, there are two crushing facilities in Mankato, 52 miles north of Fairmont. Third, there are several crushing facilities in Iowa. The further the distance from Fairmont, the more these other crushing facilities become the dominant draw for farmers marketing soybeans. Finally, there are a number of shuttle loading facilities in the region that also compete for soybeans.

Savage, MN: From August 2015 to August 2018, the best soybean bids in Savage, on average, equaled the Fairmont bids. The range was wide, however, with Fairmont bidding 30 to 48 cents above Savage in June and July of 2016 and bidding as low as a 60-cent discount. These were extremes, though. In general, Fairmont and Savage bids were often within 10 cents of each other.

Crookston and Argyle, MN: During the period in question, the best soybean price in these two towns averaged 53 cents less than in Fairmont and Savage. As with Savage, again the range was wide. As recently as March 2018, the best soybean bid was just 25 to 30 cents less than Fairmont. In August 2015, however, the discount was as great as 135 to 168 cents per bushel.

Many of the soybeans produced in northwestern Minnesota are destined for export from the Pacific Northwest. The country's ongoing trade dispute with China, however, is having a negative impact on the soybean basis in Minnesota. The impact in northwestern Minnesota is even greater, where shipments to China are critical to the market. At the end of August 2018, the best bid in Crookston and Argyle was 105 cents less than Fairmont—the greatest discount since the beginning of September 2015 (as of October 26, the Crookston discount is 93 cents). A broader look at history, however, indicates the Crookston/Argyle average discount to Fairmont is in the range of 40- to 60-cents per bushel.

APPENDIX 2: FARM INCOME IMPACT DATA AND CALCULATIONS

An increase in soybean basis will translate into increased farm income. This analysis assumes increased farm income will be spent, either as family income or through reinvestment in the farm. It also assumes spending for production activities (seed, fertilizer, fuel, etc.) holds constant. If production expenses are constant, then increased farm income will be spent on farm investments (e.g., buildings and equipment) and taken from the farm as family income.

To model this spending, Extension created a production function for increased farm income spending. The underlying data is from the FINBIN database for crop farms in Minnesota.⁹ The data comes from the whole farm cash flows report. Net spending is reported. For example, farmers may sell a truck to purchase a new truck. The expenses in the table below show the net spending from these transactions.

On average, Minnesota farmers put \$142,911 into farm-level investments and toward their own family income in 2017 (Table A1). Of this, the largest components were family income (43.3 percent), machinery and equipment purchases (28.9 percent), and farm buildings spending (13.1 percent). This expenditure pattern was used to determine the economic impact of an increase in the soybean basis.¹⁰

Table A1: Ratio of Expenditures of Increased Farm Income

Category	Average Net Spending	Percent of Total
Machinery and equipment	\$41,293	28.9%
Titled vehicles	\$5,326	3.7%
Farm buildings	\$18,740	13.1%
Other farm assets	\$4,358	3.0%
Other nonfarm assets	\$9,918	6.9%
Family income	\$61,921	43.3%
Gifts given	\$1,355	0.9%
Total	\$142,911	

Estimates by University of Minnesota Extension, based on FINBIN database

⁹ FINBIN provides "benchmark financial information for farm producers, educators, lenders, and other agricultural professionals." Financial information comes from thousands of producers who use the FINPACK software. FINPACK was developed and is supported by the Center for Farm Financial Management at the University of Minnesota. For more information, visit <https://finbin.umn.edu/Home/AboutFinbin>.

¹⁰ Following input-output theory, land purchases were not included in this analysis.

APPENDIX 3: TERMS AND DEFINITIONS

Special models, called input-output models, exist to conduct economic impact analysis. There are several input-output models available. IMPLAN (Impact Analysis for PLANning, Minnesota IMPLAN Group)¹¹ is one such model. Many economists use IMPLAN for economic impact 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 impact 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 that share economic linkages. In this analysis, the primary study area is Polk County. The impact on the region is also presented.

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

Output

Output is measured in dollars and is equivalent to total sales. The output measure can include significant “double counting.” Think of corn, for example. The value of the corn is counted when it is sold to the mill, again when it is sold to the dairy farmer, again as part of the price of fluid milk, and yet again when it is sold as cheese. The value of the corn is built into the price of each of these items and then the sales of each of these items are added up to get total sales (or output).

Employment

Employment includes full- and part-time workers and is measured in annual average jobs, not full-time equivalents (FTE's). IMPLAN includes total wage and salaried employees, as well as the self-employed, in employment estimates. Because employment is measured in jobs and not in dollar values, it tends to be a very stable metric.

Labor Income

Labor income measures the value added to the product by the labor component. So, in the corn example, when the corn is sold to the mill, a certain percentage of the sale goes to the farmer for his/her labor. Then when the mill sells the corn as feed to dairy farmers, it includes some markup for its labor costs in the price. When dairy farmers sell the milk to the cheese manufacturer, they include a value for their labor. These individual value increments for labor can be measured, which amounts to labor income. Labor income does *not* include double counting.

Direct Impact

Direct impact is equivalent to the initial activity in the economy. In this study, it is spending by the soybean crush and biodiesel plant on operating expenses—soybeans, electricity, and salaries, wages, and benefits—are major expenditures.

¹¹ IMPLAN Version 3.0 was used in this analysis. The trade flows model with SAM multipliers was implemented.

Indirect Impact

The indirect impact is the summation of changes in the local economy that occur due to **spending for inputs** (goods and services) by the industry or industries directly impacted. For instance, if employment in a manufacturing plant increases by 100 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, steel, and equipment. As the plant increases purchases 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. In this study, indirect impacts are those associated with spending by the soybean crush and biodiesel plant for operating items.

Induced Impact

The induced impact is the summation of changes in the local economy that occur due to **spending by labor**. For instance, if employment in a manufacturing plant increases by 100 jobs, the new employees will have more money to spend to purchase housing, buy groceries, and go out to dinner. As they spend their new income, more activity occurs in the local economy. Induced impacts also include spending by labor generated by indirect impacts. So, if the soybean crushing facility purchases services from a local tax preparer, spending of the tax preparer's wages would also create induced impacts. Primarily, in this study, the induced impacts are those economic changes related to spending by the soybean crush and biodiesel plant's employees.

Total Impact

The total impact is the summation of the direct, indirect, and induced impacts.

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 the models are used to examine the impact of an industry so large that its expansion or contraction results in major supply and demand shifts, causing the price of inputs and labor to change, then input-output can overstate the impacts or impacts. While the soybean crush and biodiesel plant has the potential to contribute to Polk County's economy, it is not likely that its existence has an impact on national prices for its inputs. Hence, the model should estimate the impacts reliably. However, the large purchases of soybeans does have the potential to affect feed prices within the local region. While difficult to quantify the potential impact, it could range from \$0.10 to \$0.20 per bushel of soybeans, as explained. This should be noted when considering this analysis.