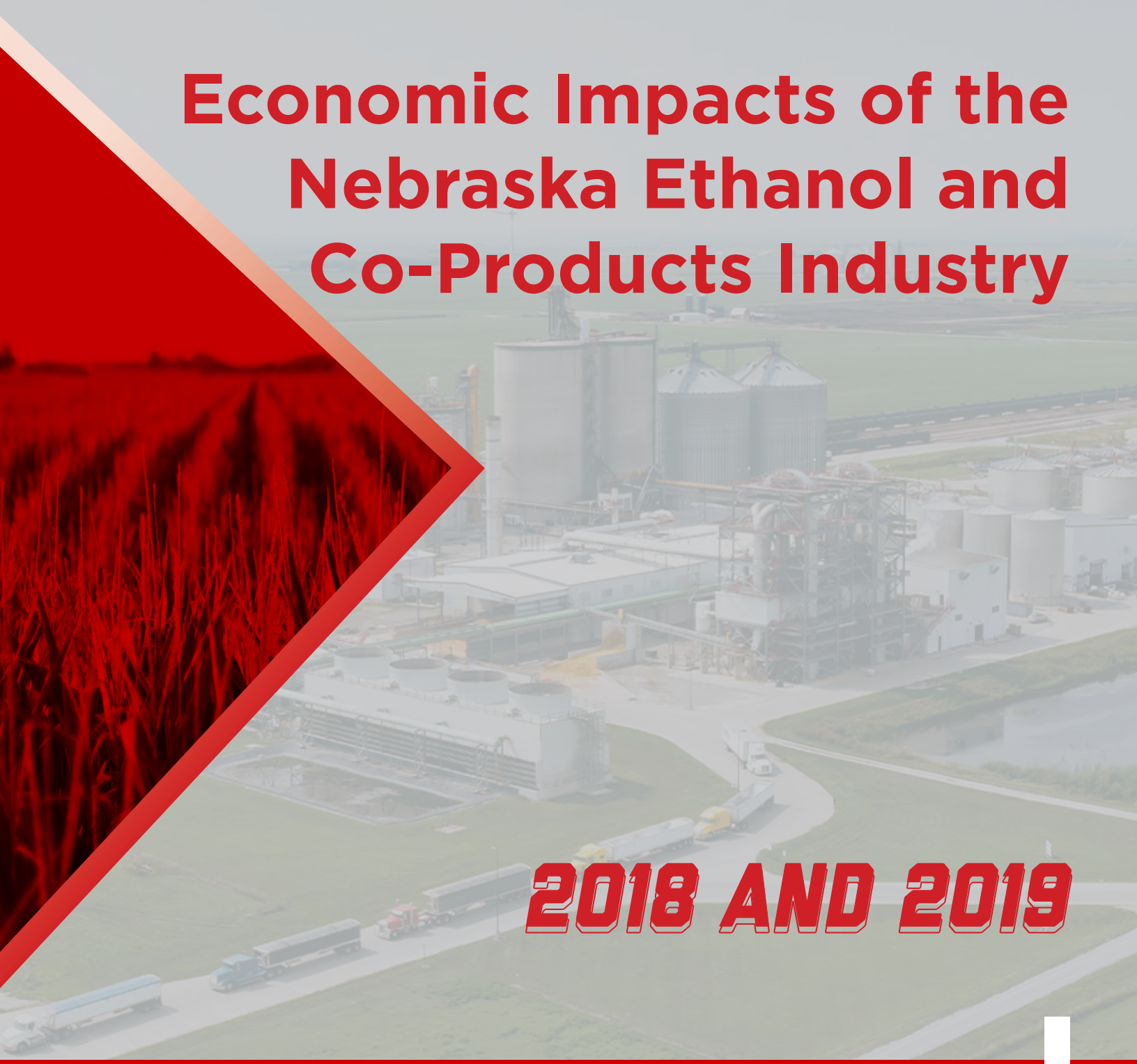
# Economic Impacts of the Nebraska Ethanol and Co-Products Industry



## 2018 AND 2019

**Kathleen Brooks, Tim Meyer and Cory Walters**
Department of Agricultural Economics
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln

**Eric Thompson**
Bureau of Business Research
College of Business
University of Nebraska-Lincoln

AGRICULTURAL ECONOMICS

University of Nebraska Lincoln

BUREAU OF BUSINESS RESEARCH
College of Business

# Abstract

This study estimates the overall economic impact of the Nebraska ethanol and co-proucts industry in 2018 and 2019. The study uses a quantitative measure (IMPLAN) as well as fundamental economic analysis to assess the harder-to-measure outcomes in the industry. The Nebraska ethanol industry remains an important market in Nebraska producing 2.253 billion gallons in 2019, resulting in the value of ethanol production at $4.042 billion, trailing only corn and cattle. While the industry has experienced weakened ethanol prices in 2018 and 2019, the Nebraska ethanol industry has shown resilience through continued expansion in total capacity and diversification of co-products.

# Acknowledgement

This report is produced in partnership with the Nebraska Ethanol Board and the Department of Agricultural Economics. The authors gratefully acknowledge the support of the Nebraska Ethanol Board.

# Contents

# Highlights

**Output, Employment, Labor Income, Indirect Business Taxes (2019)**

- Ethanol Production – 2,253 million gallons
- Value of Ethanol Production – $2,974 million
- Total Value – $4,042 million
- Employees – 1,460 full-time equivalents (FTEs)
- Labor Income – $125 million
- Indirect Business Taxes – $13 million

**Overall Economic Impact (2019)**

- Employment – 6,226 FTEs
- Total Labor Income – $443 million
- Total Output – $4,517 million

**Economic Impact from Cumulative Investments**

- Employment – 50 FTEs
- Total Labor Income – $2.9 million
- Total Output – $7.4 million

# Introduction

This report estimates the overall impact of the Nebraska ethanol and co-products industry in 2018 and 2019. The report focuses on the macroeconomic impact of the industry and updates the 2015 to 2017 report.[1] This report takes a scientific approach to analyzing the economic impact of ethanol and ethanol co-product production in Nebraska. IMPLAN, a research tool designed to capture multiple levels of economic activity associated with an industry, was used to calculate economic impact. The report concludes with an economic assessment of the harder-to-measure opportunities and market dynamics associated with the ethanol industry now and in the future.

# 2010-2017 Summary

Similar studies were conducted for the production years of 2010-2014 and 2015-2017. During this time, production of ethanol has ranged from a low of 1.77 billion gallons in 2013 to a high of 2.08 billion gallons in 2017. Production capacity in Nebraska continued to increase over this period.

While the average production of ethanol increased between the two reports, the price of ethanol declined and subsequently the overall value of both ethanol, and ethanol co-products fell. Over this period, the value of ethanol has ranged from a low of $1.38 per gallon in 2017 to the high of $2.55 per gallon in 2011. From 2010-2014 the average value of annual ethanol produced was $3.3 billion, and fell to $2.8 billion from 2015-2017. The same trend was shown in the value of ethanol co-products, which averaged $1.15 billion from 2010-2014, and $0.95 billion from 2014-2017.

Comparing the two reports shows a trend toward stability in ethanol production. In addition, it shows more complete co-product markets, with active markets in dried, wet, and modified distillers' grains, and corn oil. While lower prices have hindered the overall value, consistency and reliability have emerged in the ethanol coproduct markets.

Despite lower ethanol and co-product prices, the industry maintains its huge role in the Nebraska economy. The overall value of ethanol and ethanol co-products average 64% of corn production, 33% of cattle production, and 131% of soybean production, respectively; making the ethanol industry the clear third largest agricultural industry in the state.

From 2010-2014, the ethanol industry employed 1,301 full-time employees, and rose to 1,453 employees from 2015-2017. These jobs led to primary employee income of $71 million dollars from 2010-2014 and $97 million from 2015-2017. Proprietors' income tells a different story, as producer income averaged $34 million from 2010-2014 and only $11 million/year from 2015-2017, which were primarily caused by lower prices.

[1] https://agecon.unl.edu/research/2019-nebraska-ethanol-industry-report.pdf

# Nebraska Ethanol Production — An Overview

Nebraska continues to rank as the second largest ethanol producer in the United States. Ethanol capacity in Nebraska has continued to grow allowing for increases in production over the last decade (Figure 1). Total ethanol production was 2,223 billion gallons in 2018. Despite a 52 million gallon capacity ethanol plant not operating in 2019, ethanol production increased to 2,253 billion gallons in 2019.

Value of production for ethanol and co-products in Nebraska has increased since 2015 (Figure 2). Table 1 shows the total annual output with values of production for the ethanol industry for 2018 and 2019.[2] While, annual ethanol prices were down in 2018 and 2019 compared to the previous years, co-product prices were up along with total production values. These differences led to a total overall increase in the value of production.

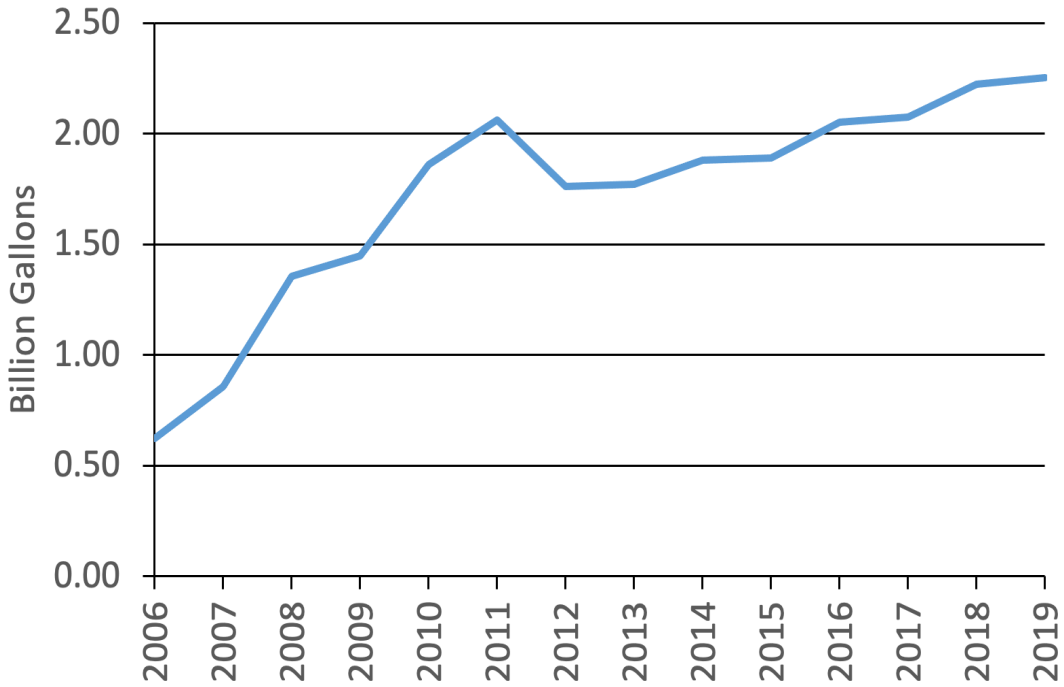



**Figure 1: Ethanol Production in Nebraska, 2006 – 2019[3]**

[2]Ethanol plants continue to assimilate technology that increases efficiency and diversifies the production portfolio. The production and sale of these products increase revenue and adds additional value to the grain processed at ethanol plants. Newer technologies such as carbon dioxide and other co-products of ethanol production are not included in the economic impacts report.

[3]Sources of data and information for all tables and figures are documented in Appendix.

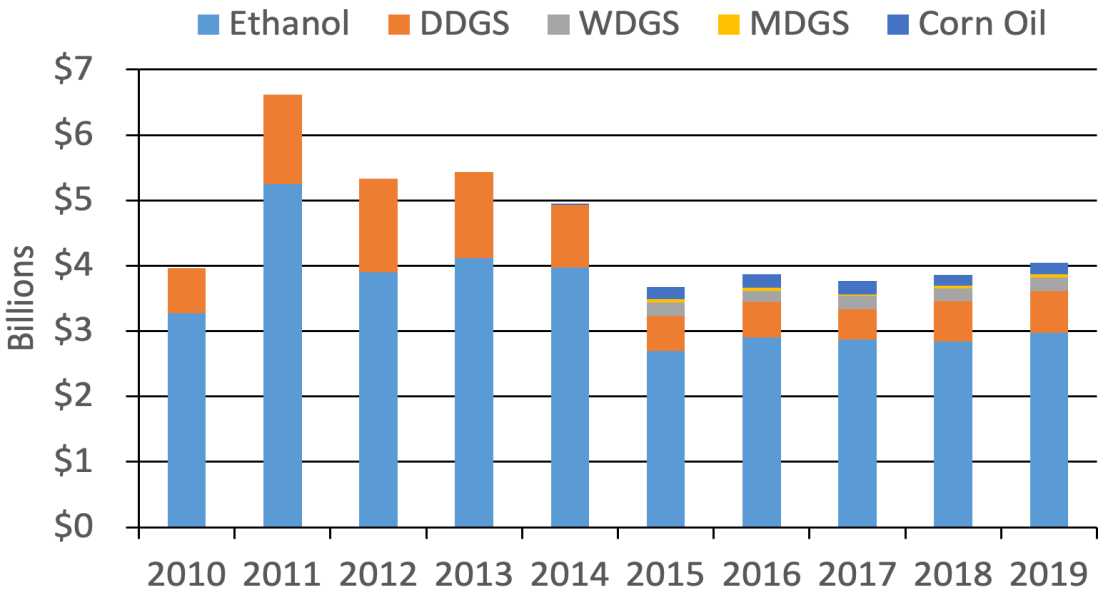



Figure 2. Value of Production for Ethanol and Co-products, 2010 - 2019

Table 1: Value of Production for Ethanol, Distillers' Grains and Corn Oil

| Annual Output | 2018 | 2019 |
|---|---|---|
| **Ethanol:** | | |
| Annual Production (mil gals) | 2,223 | 2,253 |
| Annual Average Price FOB Plant ($/gal) | $1.28 | $1.32 |
| Value of Ethanol Production (mil $) | $2,845 | $2,974 |
| **Dried Distillers' Grain (DDGS):** | | |
| Annual Production (mil tons) | 4.28 | 4.46 |
| Annual Average Price ($/ton) | $142.69 | $143.69 |
| Value of DDGs Production (mil $) | $611 | $641 |
| **Wet Distillers' Grain (WDGS):** | | |
| Annual Production (mil tons) | 4.19 | 4.24 |
| Annual Average Price ($/ton) | $46.62 | $48.42 |
| Value of DDGs Production (mil $) | $195 | $205 |
| **Modified Distillers' Grain (MDGS):** | | |
| Annual Production (mil tons) | 0.66 | 0.81 |
| Annual Average Price ($/ton) | $67.67 | $67.99 |
| Value of DDGs Production (mil $) | $45 | $55 |
| **Corn Oil:** | | |
| Annual Production as of 03/2015 (tons) | 330,808 | 335,857 |
| Annual Average Price ($/ton) | $509.83 | $496.17 |
| Value of Corn Oil Production (mil $) | $169 | $167 |
| **Total Value: (mil $)** | **$3,865** | **$4,042** |

# Comparative Values of Ethanol in Nebraska

Comparisons of the production value for ethanol and ethanol co-products to the values of corn production, cattle sales, and soybean production in Nebraska are in Table 2 and Figure 3. Over the last two years, the value of Ethanol and co-products have averaged 61% of corn value, 36% of cattle sales and over 150% of the soybean value. These are very similar to what we have seen over the last 5 years. However, we have seen an increase in the value of ethanol production relative to soybeans.

Table 2: Comparative Values of Ethanol and Co-products to Corn, Cattle, and Soybeans

| Product | 2018 | 2019 |
|---|---|---|
| **Ethanol, DDGS & Corn Oil (mil $)** | **$3,865** | **$4,042** |
| **Corn** | | |
| Corn Production (mil bu) | 1,786 | 1,785 |
| Annual Average Price ($/bu) | $3.46 | $3.70 |
| Value of Corn Production (mil $) | $6,169 | $6,606 |
| **Cattle** | | |
| Sales of Cattle (mil $) | $10,650 | $10,547 |
| **Soybeans** | | |
| Soybean Production (mil bu) | 324 | 283 |
| Annual Average Price ($/bu) | $8.93 | $8.11 |
| Value of Soybean Production (mil $) | $2,895 | $2,297 |

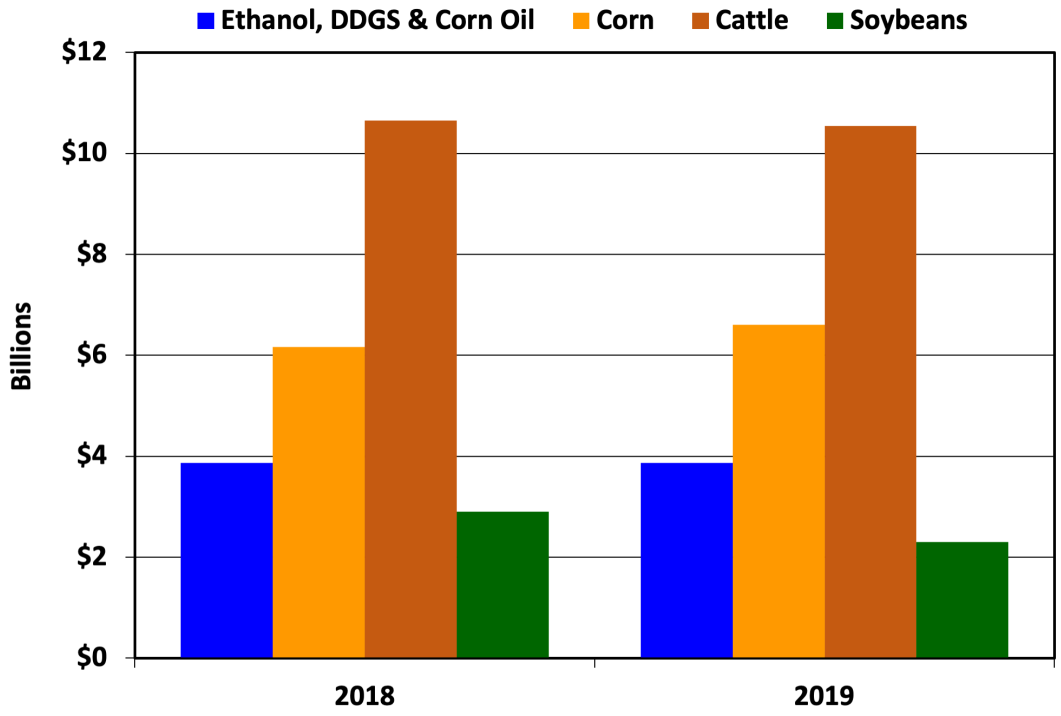



Figure 3. Comparative Values of Production

# Permitted Capacity and Employment

Table 3 lists the Nebraska Ethanol permitted capacities of anhydrous capacity from the Nebraska Department of Environment and Energy. Due to the expansion of ethanol plants, Nebraska's ethanol capacity is over 2.6 billion gallons. The total state employment, measured in full-time equivalents (FTEs), is 1,460.

### Table 3. Nebraska's Ethanol Production Capacity and Facility Employment

| Company | Nebraska Location | Facility Employment (FTE) | Permitted Capacity (MGY) |
|---|---|---|---|
| AltEn LLC | Mead | | 23.4 |
| ADM Co. (Dry Mill) (Vantage Corn Processors) | Columbus | 425 | 400 |
| Archer Daniels Midland Co. (Wet Mill) | Columbus | | 120 |
| Aurora Cooperative Ethanol LLC - East | Aurora | 40 | 52 |
| Aurora Cooperative Ethanol LLC - West | Aurora | 45 | 112 |
| Bridgeport Ethanol, LLC | Bridgeport | 27 | 59 |
| Cargill, Inc. | Blair | 30 | 240 |
| Chief Ethanol Fuels Inc. | Hastings | 58 | 78 |
| Chief Ethanol Fuels Inc. | Lexington | 51 | 31 |
| E Energy Adams, LLC | Adams | 52 | 93 |
| Green Plains Atkinson LLC | Atkinson | 43 | 50 |
| Green Plains Central City LLC | Central City | 50 | 128 |
| Green Plains Wood River LLC | Wood River | 59 | 141 |
| Green Plains York LLC | York | 43 | 60 |
| GreenAmerica Biofuels Ord LLC | Ord | 41 | 75 |
| Husker Ag, LLC | Plainview | 53 | 109 |
| KAAPA Ethanol Ravenna LLC | Ravenna | 50 | 144 |
| KAAPA Ethanol, LLC | Minden | 43 | 98 |
| Louis Dreyfus Norfolk LLC | Norfolk | 51 | 54 |
| Mid America Agri Products/Wheatland LLC | Madrid | 34 | 55 |
| Midwest Renewable Energy, LLC | Sutherland | 28 | 25 |
| Nebraska Corn Processing, Inc. | Cambridge | 40 | 60 |
| Flint Hills Resources Fairmont LLC ** | Fairmont | 60 | 128 |
| Siouxland Ethanol, LLC | Jackson | 40 | 92 |
| Trenton Agri Products, LLC | Trenton | 32 | 49 |
| Valero Renewable Fuels Co. LLC | Albion | 65 | 161.4 |
| **Total** | | **1,460** | **2,613** |

*Aurora Cooperative Ethanol LLC - East did not operate in 2019
** Purchased by POET in June 2021

# Corn Price Impacts

Ethanol production influences the local corn market's cash price through higher demand for corn. This can translate into higher prices for producers in the immediate area. To a lesser extent, producers outside the immediate area who feed corn into the ethanol plant through their local elevator may see higher prices. This value is not reflected in IMPLAN, therefore additional benefits exist from ethanol production beyond those presented in the overall economic impact numbers.

To identify the impacts on the local cash price in the immediate area, we investigated the difference in basis (the difference between the local cash price and the futures price) for locations with ethanol production and locations without. To identify the impact of ethanol on the local corn price we use corn price data provided by DTN.

The dataset contains basis for multiple Nebraska locations. Basis values were calculated between January 2015 to December 2020 for locations with and without ethanol production. Results identified an average increase of $0.213 per bushel in basis for locations with ethanol production. With the range varying from a low of $0.091 per bushel to a high of $0.269 per bushel.

Results suggest a positive impact on local basis from ethanol production. A producer near an ethanol facility producing 220 bushels of corn per acre could receive, on average, an additional $46.86 per acre. Producers farther from ethanol plants face higher transportation cost and would net a smaller amount. Ethanol production has a positive influence on corn producers in the surrounding area.

# Aggregate Economic Characteristics

Two other direct components are employment and associated labor income. Ethanol production is a capital and input-intensive process. This means billions of dollars of production is possible with a limited number of employees. In 2018 and 2019, there were an estimated 1,460 full-time equivalent employees at the 24 Nebraska plants.

In 2018 and 2019, Nebraska ethanol plants employed an estimated 1,460 people. There was between $111 and $113 million of labor income associated with those jobs. The estimated proprietor's income was $12 million. The total labor income was $123 million in 2018 and $125 million in 2019. Indirect business taxes were estimated at $13 million per year.

## Table 4: Annual Output, Employment, Labor Income and Indirect Business Taxes

| Annual Output | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ethanol: | | | | | | | | | | |
| Annual Production (mil gals) | 1,863 | 2,062 | 1,763 | 1,773 | 1,887 | 1,892 | 2,053 | 2,076 | 2,223 | 2,253 |
| Annual Average Price FOB Plant ($/gal) | $1.76 | $2.55 | $2.21 | $2.32 | $2.11 | $1.42 | $1.42 | $1.38 | $1.28 | $1.32 |
| Value of Ethanol Production (mil $) | $3,271 | $5,251 | $3,904 | $4,118 | $3,982 | $2,695 | $2,905 | $2,872 | $2,845 | $2,974 |
| Dried Distillers' Grain (DDGS): | | | | | | | | | | |
| Annual Production (mil tons) | 5.91 | 6.54 | 5.59 | 5.62 | 5.98 | 3.60 | 4.31 | 4.15 | 4.28 | 4.46 |
| Annual Average Price ($/ton) | $117.18 | $209.22 | $255.58 | $234.74 | $161.44 | $148.68 | $125.17 | $111.28 | $142.69 | $143.69 |
| Value of DDGs Production (mil $) | $692 | $1,367 | $1,428 | $1,319 | $966 | $535 | $539 | $462 | $611 | $641 |
| Wet Distillers' Grain (WDGS): | | | | | | | | | | |
| Annual Production (mil tons) | - | - | - | - | - | 4.09 | 3.90 | 4.77 | 4.19 | 4.24 |
| Annual Average Price ($/ton) | | | | | | $50.98 | $44.17 | $44.56 | $46.62 | $48.42 |
| Value of DDGs Production (mil $) | | | | | | $209 | $172 | $213 | $195 | $205 |
| Modified Distillers' Grain (MDGS): | | | | | | | | | | |
| Annual Production (mil tons) | - | - | - | - | - | 0.72 | 0.75 | 0.25 | 0.66 | 0.81 |
| Annual Average Price ($/ton) | | | | | | $70.91 | $60.39 | $52.42 | $67.67 | $67.99 |
| Value of DDGs Production (mil $) | | | | | | $51 | $45 | $13 | $45 | $55 |
| Corn Oil: | | | | | | | | | | |
| Annual Production as of 03/2015 (tons) | - | - | - | - | 22,314 | 271,173 | 302,792 | 310,643 | 330,808 | 335,857 |
| Annual Average Price ($/ton) | | | | | $739.48 | $682.69 | $703.26 | $657.91 | $509.83 | $496.17 |
| Value of Corn Oil Production (mil $) | | | | | $17 | $185 | $213 | $204 | $169 | $167 |
| Total Value: (mil $) | $3,963 | $6,619 | $5,332 | $5,437 | $4,964 | $3,675 | $3,875 | $3,764 | $3,865 | $4,042 |
| | | | | | | | | | | |
| Employees | 1,291 | 1,429 | 1,222 | 1,229 | 1,301 | 1,453 | 1,453 | 1,453 | 1,460 | 1,460 |
| | | | | | | | | | | |
| Labor Income (mil $) | $105 | $116 | $99 | $100 | $106 | $103 | $112 | $109 | $123 | $125 |
| Wages & Salaries including Benefits (mil $) | $71 | $78 | $67 | $67 | $72 | $93 | $99 | $99 | $111 | $113 |
| Proprietors' Income (mil $) | $34 | $38 | $32 | $33 | $35 | $10 | $13 | $10 | $12 | $12 |
| | | | | | | | | | | |
| Indirect Business Taxes, IBT, Effects (mil $) | $15 | $15 | $15 | $14 | $13 | $13 | $13 | $13 | $13 | $13 |

Almost all of Nebraska's ethanol and about half the state's dried distillers' grain and corn oil production is exported. This means most production results in a net positive impact for the state. The sales outside of Nebraska represent a direct economic impact to the state by bringing new money into Nebraska's economy.

A survey of Nebraska ethanol producers in 2015 and 2016 found that 94 percent of Nebraska ethanol production was exported. Fifty-one percent of dried distillers' grain was exported in 2015 and 44 percent in 2016. Most wet distillers' grain remained in the state with just three percent being exported in 2015 and 2016. Fourteen percent of modified distillers' grain was exported in 2015 and 13 percent in 2016. Fifty-six percent of corn oil was exported out of state in 2015 and 57 in 2016. Averages of 2015 and 2016 values are used for 2018 and 2019.

# Economic Impact Analysis and IMPLAN

The above aggregate economic characteristics are the first part of estimating the total economic impact on Nebraska. An additional multiplier impact occurs as money brought into the economy circulates within the state and leads to business sales, labor income and employment. These multiplier impacts are in two forms: indirect impacts and induced impacts.

Indirect economic impacts reflect additional economic activity due to business purchases. An example is the spending by ethanol plants on supplies and services. Induced economic impacts reflect additional economic activity due to household purchases. For example, workers at ethanol plants spend their wages and salaries at businesses throughout the economy. The IMPLAN model is used to estimate indirect and induced economic impacts.

The sum of the direct, indirect and induced economic impacts is the total economic impact. Appendix 1 provides a more complete discussion of the economic impact methodology.

# Input-Output Multipliers

Table 5 shows the relative size of the direct, indirect and induced impacts for the key economic concepts of output (sales), employment, labor income (wages, salaries, benefits and proprietor income) and indirect business taxes (primarily property taxes). Specifically, the table shows the impact associated with $1 million in industry sales. Data are displayed for the year 2019, the most recent year of analysis. Multiplier information varies modestly between 2018 and 2019.

The indirect economic impact from industry output is approximately 12.9 percent as large as the direct economic impact from output (see the Output row and the Indirect column entry of 0.1288 for 12.9 percent). The induced economic impact is approximately 6.4 percent of the direct economic impact. These relatively small indirect and induced impacts reflect the fact that corn is the primary input in producing ethanol. The impact flowing from corn utilized in Nebraska ethanol plants is not reflected in the economic multipliers below. However, the impact from additional corn grown in Nebraska due to ethanol plants in the state is addressed in Table 7 later in the report.

As noted for Table 4, ethanol production is a capital and input-intense industry so there are relatively little employment and wages for each $1 million of production. There is approximately $31,000 in labor income (Table 5, Labor Income row and Direct column multiplier of 0.0309 times $1 million) associated with each $1 million in ethanol plant sales. Likewise, there is one job associated with each $2.7 to $2.8 million in ethanol plant sales. The indirect labor income impact is $1.66 in labor income for each $1 in direct income. The induced impact is approximately $0.64 for each $1 in direct impact. Therefore, each dollar of direct labor income impact has a total labor income impact of $3.31.

The employment multiplier is similar. There are four total jobs associated with each one direct job in an ethanol plant. Large employment and labor income multipliers are common in high-wage, capital-intensive manufacturing industries like ethanol production.

**Table 5. Input-Output Multipliers Derived for Nebraska Ethanol Plants 2019**

| Multipliers[a] | Direct | Indirect | Induced | Total | Type I[b] | Type SAM[c] |
|---|---|---|---|---|---|---|
| Output (mil $) | 1.000 | 0.1288 | 0.0642 | 1.193 | 1.1288 | 1.193 |
| Employment | 0.3612 | 0.6551 | 0.4285 | 1.4448 | 1.0163 | 1.4448 |
| Labor Income (mil $) | 0.0309 | 0.0514 | 0.0199 | 0.1022 | 0.0823 | 0.1022 |
| Indirect Business Taxes (mil $) | 0.0032 | 0.0063 | 0.0032 | 0.0126 | 0.0095 | 0.0126 |

Multipliers are calculated from the Nebraska IMPLAN Model
[a] Direct, Indirect, Induced and Total effects per million dollars of output
[b] Type I = (Direct + Indirect) / Direct
[c] Type SAM = (Direct + Indirect + Induced) / Direct

# Direct Effects

Table 6 shows the estimated economic impacts of Nebraska's ethanol industry. These 2018 to 2019 figures are based on the aggregate economic characteristics in Table 4 and the input-output multipliers in Table 5. The impacts estimated for 2010 to 2017 are from previous reports.

In Table 6 under the row of Output Effects, the Direct Output figures represent out-of-state sales of ethanol, distillers' grain and corn oil. For example, the Direct Output figure of $3,206 million in 2019 is 79 percent of the Total Value: Ethanol, Distillers' Grain, and Corn Oil of $4,042 million reported in Table 4. This is because the vast majority of ethanol and roughly half of dried distillers' grain and corn oil produced in Nebraska were sold out of state, as well as a modest portion of modified distillers' grain and wet distiller's grain. In a similar manner, the figures in the rows for Direct Employment, Direct Labor Income and Direct Indirect Business Taxes show their portion of respective effects supported by out-of-state sales.

Table 6. Estimated Economic Impacts Associated with Nebraska's Ethanol Industry

| Effect | 2010 | 2011 | 2012 | 2014 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|---|
| **Employment Effects** | | | | | | | | | | |
| Direct Employment (FTE) | 1,147 | 1,268 | 1,026 | 1,058 | 1,150 | 1,185 | 1,196 | 1,206 | 1,160 | 1,158 |
| Indirect Employment | 1,772 | 1,960 | 1,585 | 1,634 | 1,777 | 1,415 | 1,271 | 1,246 | 1,882 | 2,100 |
| Inducted Employment | 1,511 | 1,672 | 1,352 | 1,394 | 1,516 | 1,141 | 1,074 | 1,056 | 1,102 | 1,374 |
| **Total Employment (FTE)** | **4,430** | **4,900** | **3,963** | **4,086** | **4,443** | **3,741** | **3,541** | **3,508** | **4,143** | **4,632** |
| | | | | | | | | | | |
| **Labor Income Effects (mil $)** | | | | | | | | | | |
| Direct Labor and Proprietors' Income | $93 | $103 | $83 | $86 | $93 | $82 | $89 | $88 | $99 | $99 |
| Indirect Labor Income | $166 | $184 | $149 | $153 | $167 | $133 | $142 | $139 | $111 | $165 |
| Induced Labor Income | $59 | $65 | $53 | $55 | $59 | $40 | $44 | $43 | $50 | $64 |
| **Total Labor Income (mil $)** | **$319** | **$352** | **$285** | **$294** | **$319** | **$255** | **$275** | **$270** | **$259** | **$328** |
| | | | | | | | | | | |
| **Output Effects (mil $):** | | | | | | | | | | |
| Direct Output | $3,519 | $5,873 | $4,476 | $4,679 | $4,377 | $2,918 | $3,104 | $3,041 | $3,070 | $3,206 |
| Indirect Output | $370 | $617 | $470 | $492 | $460 | $368 | $392 | $384 | $327 | $413 |
| Induced Output | $126 | $211 | $161 | $168 | $157 | $139 | $149 | $147 | $163 | $206 |
| **Total Output (mil $)** | **$4,015** | **$6,701** | **$5,107** | **$5,338** | **$4,994** | **$3,425** | **$3,645** | **$3,572** | **$3,560** | **$3,825** |
| | | | | | | | | | | |
| **Indirect Business Taxes Effects (mil $)** | | | | | | | | | | |
| Direct Indirect Business Taxes | $13 | $13 | $13 | $12 | $12 | $10 | $10 | $11 | $10 | $10 |
| Indirect Indirect Business Taxes | $25 | $25 | $24 | $23 | $22 | $13 | $14 | $13 | $23 | $20 |
| Indirect Induced Business Taxes | $9 | $9 | $8 | $8 | $7 | $6 | $6 | $8 | $11 | $10 |
| Total Indirect Business Taxes (mil $) | $47 | $47 | $45 | $43 | $41 | $29 | $30 | $30 | $44 | $41 |

# Total Output

In addition to the direct effects described above for Direct Output, the indirect and induced effects were estimated by applying the respective multipliers, such as those in Table 5, to the Direct Output figures in Table 4. For example, the Indirect, Output effect in 2019 was $413 million and the Induced, Output effect was $206 million. Combining the direct, indirect and induced effects results in a Total Output effect of $3,825 in 2019. From 2010 to 2019, the Total Output effect ranged from $3,572 to $6,701 due to the underlying variability in prices for ethanol distillers' grain and corn oil.

# Indirect Business Taxes, Labor Income and Employment

In 2019, the ethanol industry contributed $41 million in indirect business taxes to Nebraska. The ethanol industry also creates a substantial annual impact on the Nebraska labor market. In 2019, the total labor income impact was $328 million. This income was earned by an estimated 4,632 jobs shown as total employment (FTE), for average annual earnings of $70,800. The average earnings include direct jobs in the ethanol industry as well as multiplier jobs throughout the economy. Most of these jobs also are created in non-metropolitan Nebraska. Over the entire 2010 to 2019 time period, the annual labor income impact varied between $255 and $352 million per year, and the employment impact varied between 3,508 and 4,900 jobs. The results confirm that the ethanol industry provides a sustained economic impact on the labor market.

# Changes in Agricultural Production

The annual economic impact estimates of ethanol plant operation exclude any impact from corn production providing feedstock for the plants. This is because Nebraska was a significant corn production center prior to ethanol production.

However, increased ethanol production in Nebraska has increased local demand for corn. Ethanol is also an important part of the reason corn acreage has expanded in Nebraska in recent decades. It is difficult to determine the exact contribution of ethanol to increased corn acreage but a recent study attempted to do so.[4] This study identified the response of corn and total crop acres to the location of nearby ethanol plant capacity.

The study suggests that doubling regional ethanol production capacity would yield a 7 percent increase in the number of acres in corn production. However, it would not increase the number of acres devoted to crop production in general.[5] The latter finding is important since it implies that additional corn production would occur at the expense of other crops such as soybeans or hay (including alfalfa).

Using this estimate, a 350 percent increase in ethanol capacity since 2006 would yield a 25 percent increase in Nebraska corn acres. Based on 7.75 million harvested acres of corn, this translates to about 1.93 million more acres. This increase in corn acres came at the expense of production of other crops on the 1.93 million acres. Based on Nebraska crop patterns, we estimate soybeans would account for two-thirds of lost production. The remaining one-third would come from hay acres, including alfalfa. Matching these changes in acres with statewide average yields and prices gives the estimate of changes in values of production. Economic multiplier analysis was used to find the total economic impact of converting soybean and hay acres into corn acres.

[4]Changes in Agricultural Production 6 Motamed, Mesbah, Lihong McPhail, and Ryan Williams, 2016. "Corn Area Response to Local Ethanol Markets in the United States: A Grid cell Level Analysis," American Journal of Agricultural Economics, 98(3): 726-743.

[5]The estimate is based on elasticity response of corn production for nearby ethanol capacity at the 50 percent, 75 percent and 90 percent quintile of county corn acreage. These higher percentages are used because Nebraska is a major corn producing state, particularly in the regions of Nebraska where ethanol plants are most common.

Estimates of the economic impact for 2018 and 2019 are reported in Table 7. The additional Nebraska corn acres led to 1,594 jobs in 2019. This is the total employment impact, including the direct impact and the multiplier impact. There is also an additional $693 million output impact in 2019 and $116 million in labor income. There is a modest decline in indirect business tax revenue as soybean production generates more indirect business tax revenue than corn production per acre. There are similar impacts for 2018.

In Table 7, the total economic impacts from Table 6 are added to the total economic impacts from the reallocation of Nebraska acres to corn production. The total output impact for 2019 rises to $4.52 billion, including $443 million in labor income and 6,226 jobs. There are similar impacts in 2018. Overall, the additional economic impact due to changes in crop production makes a significant contribution to the annual economic impact of Nebraska's ethanol production industry.

### Table 7: Overall Annual Economic Impact of Nebraska's Ethanol Industry Including Changes in Crop Production

| | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|
| **Employment Effects** | | | | | |
| Ethanol Plant Operations | 3,710 | 3,509 | 3,476 | 4,143 | 4,632 |
| Rotation of Cropland into Corn | 2,189 | 1,628 | 1,690 | 1,710 | 1,594 |
| Total | 5,898 | 5,137 | 5,166 | 5,853 | 6,226 |
| **Labor Income Effect** | | | | | |
| Ethanol Plant Operations | $255 | $275 | $270 | $259 | $328 |
| Rotation of Cropland into Corn | $131 | $90 | $100 | $87 | $116 |
| Total | $386 | $365 | $370 | $346 | $443 |
| **Output** | | | | | |
| Ethanol Plant Operations | $3,425 | $3,645 | $3,572 | $3,560 | $3,825 |
| Rotation of Cropland into Corn | $744.49 | $509 | $581 | $769 | $693 |
| Total | $4,169 | $4,154 | $4,154 | $4,329 | $4,517 |
| **Indirect Business Taxes** | | | | | |
| Ethanol Plant Operations | $29 | $30 | $30 | $44 | $41 |
| Rotation of Cropland into Corn | -$3 | -$8 | -$6 | -$16 | -$15 |
| Total | $26 | $22 | $24 | $28 | $26 |

# Economic Impact from Investments

Job creation due to investment is an important part of the economic impact of any industry. This is especially true a capital-intensive industry like ethanol. The industry supports construction jobs and there are also multiplier impacts at businesses which provide construction materials and support services and the businesses where construction workers spend their paychecks.

Most survey respondents elected not to answer questions about firm investments. As a result, it is not feasible to estimate the full economic impact of ethanol industry investment for 2018 and 2019. However, two respondents did report their investment spending over the 2018 and 2019 period. Investments totaled about $6.3 million. Table 8 shows the cumulative economic impact of these industry investments. Employment impacts are listed by job-years since the jobs and related worker income were earned during the years when the investments took place. So, for example, 1,000 job-years of employment could mean 1,000 jobs which last one year or 500 jobs which last two years.

### Table 8. Estimated Economic Impacts from Cumulative Investment in Nebraska's Ethanol Industry

| | Cumulative Impact |
|---|---|
| **Employment Effects (Job-Years)** | |
| Direct Employment (FTE) | 30 |
| Indirect Employment (0.15169 of Direct) | 7 |
| Induced Employment (0.35292 of Direct) | 12 |
| **Total Employment (FTE)** | **50** |
| | |
| **Labor Income Effects (mil $)** | |
| Direct Labor Income | $1.9 |
| Indirect Labor Income (0.17831 of Direct) | $0.5 |
| Induced Labor Income (0.27335 of Direct) | $0.6 |
| **Total Labor Income Effects** | **$2.9** |
| | |
| **Output Effects (mil $)** | |
| Direct Output | $4.1 |
| Indirect, Output (0.23729 of Direct) | $1.4 |
| Induced, Output (0.40254 of Direct) | $1.9 |
| **Total Output** | **$7.4** |

Note that the direct economic impact in terms of output (i.e., business sales) is less than $6.3 million. This is because a portion of investment costs go to equipment and software rather than construction, site preparation, or construction engineering services. Only the wholesale mark-up portion of equipment and software spending is counted towards economic impact, given that equipment and software developed around the nation and world. The cumulative direct economic impact from investments in the Nebraska ethanol industry is $4.1 million.

The cumulative economic impact resulting from the $4.1 million in investment is $7.4 million. The multiplier impact, which is the sum of the indirect and induced impact, is $0.64 in business activity in industries throughout the economy for each $1 investment in the ethanol industry. Roughly 40 percent of the business sales is devoted to labor income, that is, the wages, salaries and benefits earned by workers or proprietor income. The direct labor income impact is $1.9 million while the multiplier impact is $1.0 million and the total cumulative impact on labor income is $2.9 million.

The cumulative labor income is earned in the years when investment activity took place. The labor income supported a total of 50 job-years of employment. The direct employment impact from investment was 30 job-years. The multiplier impact, which is the sum of the indirect and induced impact, was 20 job years. The employment multiplier was 0.40, indicating two indirect or induced job-years for every three direct job-years.

# Summary

This study evaluated the economic impact of the Nebraska ethanol industry for the state of Nebraska in 2018 and 2019. While the value of production for the ethanol and co-product industry was lower in 2018 and 2019 than during the first half of the decade, both ethanol capacity and employment increased over the years of study, indicating a positive long-term outlook. This future outlook could be bolstered by the new E15 rules. Since the 2014 study, ethanol producers have continued to diversify production to take advantage of new market opportunities and safeguard against unexpected adverse ethanol market movements. The Nebraska ethanol and co-products industry continues to provide a positive economic impact on the state of Nebraska. Since ethanol producers persisted through a period of low prices in the second half of last decade, it is the opinion of the authors' ethanol will continue to be a large driver of economic impact in the state of Nebraska for quite some time.

# Appendix 1: Economic Impact Methodology

The basic framework for analysis was the IMPLAN model of the Nebraska economy. For this analysis, IMPLAN data for 2018 and 2019 was used. IMPLAN is a widely-used input-output analysis software package and database. It can provide a detailed picture of the economy for any state and sub-state region. IMPLAN can model the economic impact of nearly 500 industries. Economic impact analysis includes the direct economic impact, the indirect economic impact, and the induced economic impact. The direct economic impact refers to out-of-state ethanol sales. Out-of-state sales bring new revenue into Nebraska and support jobs, wages, and business activity. The direct economic impact from Nebraska ethanol plants is nearly as large as total industry sales.

The indirect and induced economic impacts reflect additional economic activity in Nebraska as money attracted to the state (through the direct impact) circulates further within the state economy. The indirect economic impact is the additional economic activity driven by the purchases of the business sector. Ethanol plants, in particular, buy inputs and services such as water, energy, chemicals and accounting services from within Nebraska. These purchases provide revenue to other Nebraska businesses and generate indirect impacts on Nebraska's economy. There are also additional rounds of indirect economic impact as these suppliers in the water, energy, chemicals and accounting, industries, for example, buy their own goods and services from other Nebraska businesses. The summation of these additional rounds of indirect impact is estimated using the IMPLAN model. The IMPLAN model, utilizing its detailed accounting of the industries and businesses within the Nebraska economy, can model the cumulative impact of indirect purchases.

The induced economic impact reflects the additional economic activity in the household sector. Ethanol facilities are a capital-intensive business but each facility does provide dozens of high paying jobs. Additional economic activity is created in the state as well-paid ethanol plant employees spend their wages and salaries throughout the economy. Spent wages and salaries become revenue for businesses which provide the household goods and services, such as grocery stores, auto dealers, gasoline service stations, retail outlets, health care providers, insurance agencies, restaurants, and other recreation and entertainment businesses. This spending, in turn, supports part of the wages of employees at these businesses yielding additional rounds of the induced impact. The cumulative impact of these rounds of induced household spending also is captured in the IMPLAN model and referred to as the induced impact.

The total economic impact is the sum of the direct, indirect and induced economic impact. The indirect and induced impact also are collectively known as the multiplier impact. This report presents the economic impact of output, labor income, employment and indirect business taxes. The output is the increased sales (business receipts) of businesses in Nebraska. These businesses could be ethanol plants or businesses which have sales as the result of the indirect or induced impacts. The labor income impact refers to the wages, salaries and benefits earned by employees or the proprietors' income. The employment numbers (both direct and multiplier) reflect full-year jobs in a number of industries. Like jobs in the overall economy, most jobs generated due to the economic impact are full-time jobs. However, there is some part-time employment in industries like retail or entertainment and recreation. Indirect businesses taxes primarily refer to the property taxes paid by ethanol plants or by businesses with additional sales due to the indirect and induced impacts.

# Appendix 2: Sources of Data and Information for Tables and Figures

**Figure 1. Ethanol Production in Nebraska**

2010 to 2014 Numbers

2014 Economic Impacts of the Ethanol Industry in Nebraska Report: https://agecon.unl.edu/research/economic-impacts-ethanol-industry-nebraska.pdf

2015 to 2017 Numbers

Economic Impacts of the Nebraska Ethanol and Ethanol Co-Products Industry: 2015-2017: https://agecon.unl.edu/research/2019-nebraska-ethanol-industry-report.pdf

2018 to 2019 Numbers

Nebraska Department of Environmental Quality

University of Nebraska, Department of Agricultural Economics, Ethanol Survey

**Figure 2 and Table 1. Value of Production for Ethanol, Distillers' Grain and Corn Oil**

Ethanol Production and Distillers' Grain Production

Nebraska Department of Environmental Quality
University of Nebraska, Department of Agricultural Economics, Ethanol Survey

Corn Oil Production

Estimated by the authors using 0.78 pounds of corn oil per bushel of corn used. University of Nebraska-Lincoln survey of plants revealed on average plants that reported stated they produced 0.78 pounds of corn oil per bushel of corn used in 2016, therefore this was used for 2018 and 2019.

Prices of Ethanol

USDA, AMS, Nebraska Ethanol Corn and Co-Products Processing Values NW_GR213
Custom report from: https://www.ams.usda.gov/market-news/custom-reports

Prices of Distillers' Grain

USDA, AMS, Corn Belt Feedstuffs Report SJ_GR115
Custom report from: https://www.ams.usda.gov/market-news/custom-reports

Prices of Corn Oil

USDA, AMS Weekly Crude Corn Oil Summary GX_GR115
Custom report from: https://www.ams.usda.gov/market-news/custom-reports

**Figure 3 and Table 2. Comparative Values of Ethanol, Distillers' Grains & Corn Oil to Corn, Cattle and Soybeans**

Corn Production and Prices (calendar year months)

https://quickstats.nass.usda.gov/results/189A7AD7-2206-35D6-BFA4-4AAB4CC00C97
https://quickstats.nass.usda.gov/results/968554A7-7F48-3693-9ACC-369A76FABB1C

Sales of Cattle

https://quickstats.nass.usda.gov/results/9B2224A4-0460-3A3B-8470-C782C762E0C4

Soybean Production and Prices (calendar year months)

https://quickstats.nass.usda.gov/results/58348507-FF9B-37A8-A86D-15449345A778
https://quickstats.nass.usda.gov/results/4C06BF7E-B75D-35F6-BE35-F64E719A5C44

**Table 3. Nebraska's Ethanol Production Capacity and Facility Employment**

Nebraska Department of Environmental Quality: http://www.deq.state.ne.us/
Nebraska Ethanol Board
University of Nebraska, Department of Agricultural Economics, Ethanol Survey

**Table 4. Annual Output, Employment, Labor Income and Indirect Business Taxes**

Labor Income Effects estimated by the authors based on a survey of Nebraska ethanol producers.

Indirect Business Taxes, IBT, Effects estimated using data from a report by the Nebraska Department of Revenue Property Assessment Division, "Nebraska Ethanol and Bio-Fuels Plant Valuations Compiled from Assessment Records for Tax Years 2010 – 2011 and updated Community Redevelopment Tax Increment Financing Projects for Tax Year 2016," Nebraska Department of Revenue.

**Table 5. Input-Output Multipliers Derived for Nebraska Ethanol Plants 2019**

Calculated using data from the Nebraska IMPLAN model.

**Table 6. Estimated Economic Impacts Associated with Nebraska's Ethanol Industry**

Computed from the data in Tables 4 and 5, and from the Nebraska IMPLAN input-output model.

**Table 7. Overall Annual Economic Impact of Nebraska's Ethanol Industry Including Changes in Crop Production**

Computed from the data in 6 and estimates from Motamed, Mesbah, Lihong McPhail, and Ryan Williams (2016) and crop production data from the National Agricultural Statistics Service of the United States Department of Agriculture.

**Table 8. Estimated Economic Impacts from Cumulative Investment in Nebraska's Ethanol Industry**