

Economic Impact of the U.S. Ethanol Industry



2024

The Contribution of the Ethanol Industry to the U.S. Economy in 2024

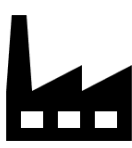
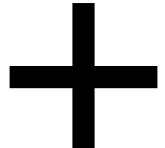
Executive Summary

Ethanol production approached a record 16.1 billion gallons (bg) in 2024, in response to solid domestic consumption and exports that significantly exceeded the previous peak. Yet, industry revenues and expenses declined because of lower commodity prices.

Reflecting these market conditions, the ethanol industry's contribution to the U.S. economy remained robust. The industry added \$53 billion to gross domestic product (GDP), generated \$28 billion in employment-related income, and supported more than 310,000 full-time equivalent jobs (Figure 1). This included 56,000 direct jobs, along with 258,000 indirect and induced jobs across all sectors of the economy. Additionally, the industry generated tax revenues of more than \$10 billion.

The largest share of the ethanol industry's economic impact was in the agriculture sector, as 5.5 billion bushels of corn valued at \$23 billion were processed into renewable fuel and coproducts.

Figure 1: Summary of the Ethanol Industry's Economic Contribution in 2024

	 Agriculture	 Ethanol Production	 Exports	 Total
GDP	\$26.4B	\$12.7B	\$13.0B	\$53.0B
Income	\$15.4B	\$5.7B	\$6.7B	\$28.3B
Employment	206.0K	68.4K	33.4K	313.9K

Source: RFA

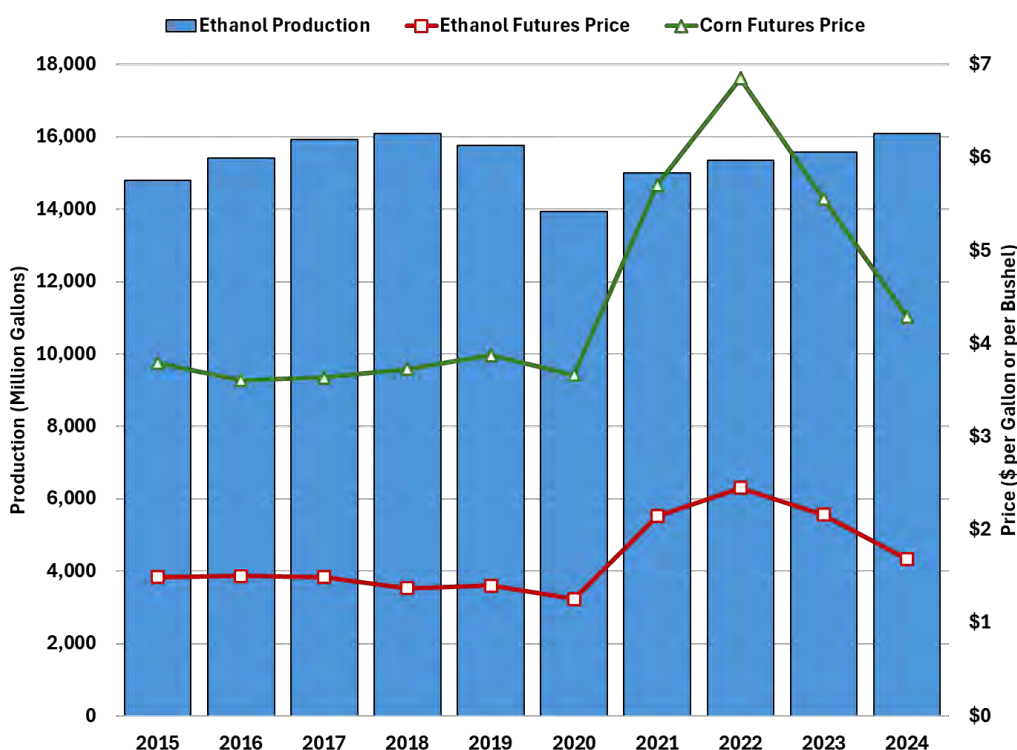
Note: Total also includes economic contribution from construction and R&D activities

The Markets for Ethanol and Related Commodities

The U.S. ethanol industry had a banner year in 2024. Domestic consumption was bolstered by the expanded availability of mid- and high-level ethanol blends, such as E15 and E85. Meanwhile, U.S. ethanol exports surged to 1.9 bg—a record by far. Responding to strong demand, production approached a record 16.1 bg.

From the standpoint of volume, the industry’s presence in domestic and global fuel and agriculture markets has never been greater. Yet, corn prices fell as the U.S. harvested a bumper crop for the third time in four years, which also contributed to lower ethanol prices (Figure 2). As a result, industry revenues and expenses declined, though not to the comparatively low levels that were experienced in the years prior to the pandemic.

Figure 2: Ethanol Production and Commodity Prices Over the Last Decade



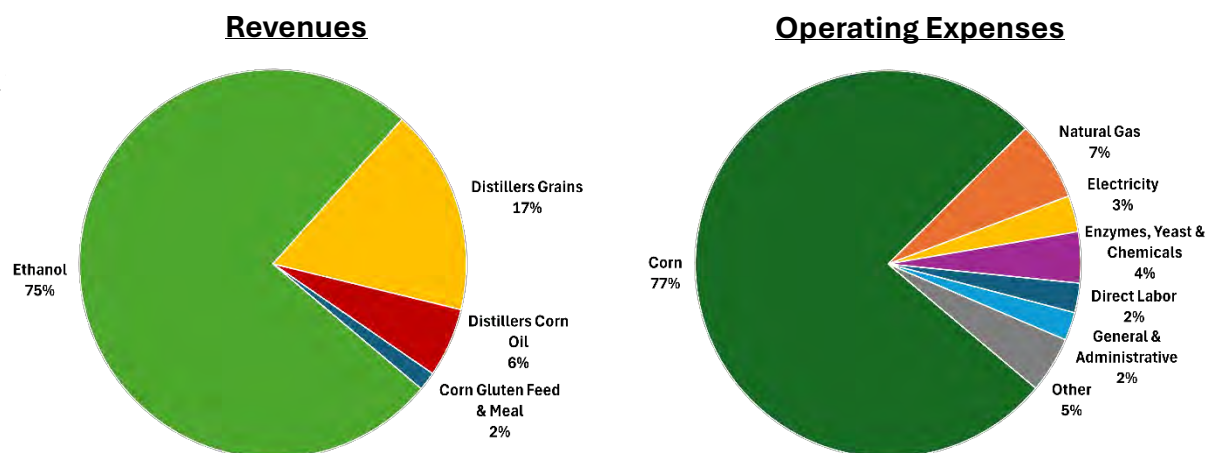
Sources: U.S. Energy Information Administration (historical ethanol production), RFA (2024 forecast), CME via Barchart (prices)

Ethanol Industry Revenues and Expenses

The ethanol industry had revenues of \$34 billion in 2024, consisting of \$26 billion in ethanol sales and \$8 billion in sales of coproducts (Figure 3). The coproducts included feed

ingredients such as distillers grains, as well as distillers corn oil, which is used mainly in the production of biomass-based diesel.¹

Figure 3: Composition of Ethanol Industry Revenues and Operating Expenses in 2024



Source: RFA using U.S. Energy Information Administration and U.S. Department of Agriculture data

Note: Corn costs encompass grain sorghum as well

Operating expenses totaled \$30 billion, of which more than three-quarters was for the purchase of feedstock, predominantly corn.² Energy costs ranked a distant second, including \$2 billion for natural gas and \$900 million for electricity. Direct labor costs were an additional \$750 million. The remaining 11% of expenses consisted of enzymes, yeast, and chemicals; denaturant; water; maintenance and repairs; transportation; and general and administrative costs.

The industry had earnings before interest, taxes, depreciation and amortization (EBITDA) of \$4 billion, or \$0.26 per gallon. That was down more than 40% from 2023 due to the compression of commodity prices. However, for context, it should be noted that per-gallon margins in 2023 were the highest for any year since 2014. Viewed historically, margins in 2024 were above their 2015-2023 average.

¹ Excludes carbon dioxide that is captured for sale, as well as food-grade corn oil produced by wet mills.

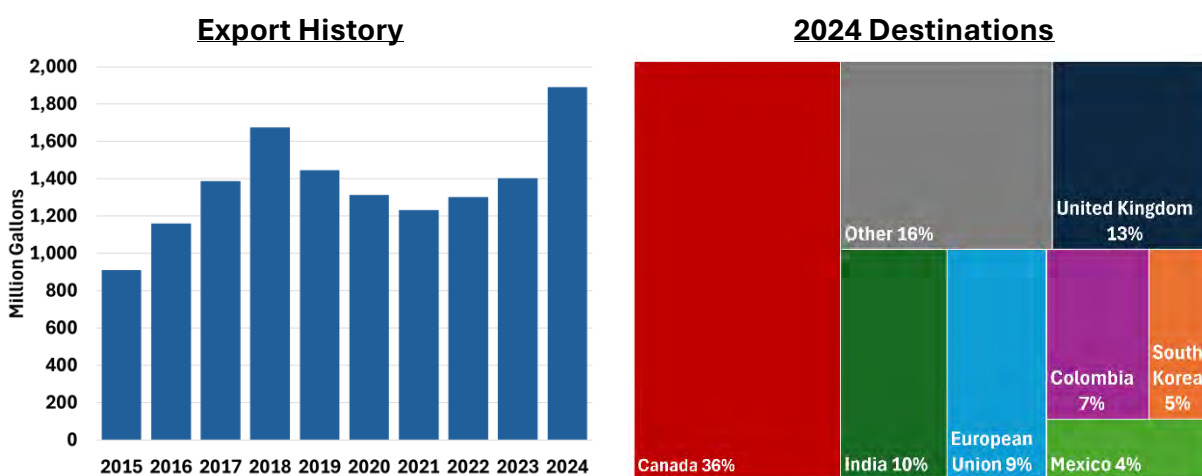
² Operating expenses were modeled for dry mills, which accounted for more than 90% of production. Depreciation was excluded from expenses, since it does not generally reflect a cash outlay in the year being analyzed.

Ethanol and Coproduct Exports

Because the incremental economic impact of exports is estimated separately from ethanol production activity in this analysis, it is worth taking a moment to recap developments in this market segment.

As mentioned above, exports hit a record 1.9 bg in 2024. Impressively, this not only topped the previous high-water mark by approximately 200 million gallons (mg) but also exceeded the 2023 level by more than 450 mg (Figure 4). The strong performance can be attributed to a combination of favorable policies in major destination countries and the cost-competitiveness of U.S. ethanol.

Figure 4: U.S. Ethanol Export History and 2024 Destinations



Source: U.S. Census Bureau (historical data), RFA (2024 forecast)

Note: Destination shares are through November

It was also a strong year for exports of distillers dried grains (DDGS), which were on track to reach 12 million metric tons for only the second time in history.

More information about ethanol and DDGS exports is available in RFA's annual Trade Summary [publications](#).

Economic Analysis: Background and Methodology

RFA developed estimates of ethanol industry volumes, revenues, and expenditures as described above, and then modeled the industry's contribution to the U.S. economy utilizing the IMPLAN database.³ As described by the developer of IMPLAN:

IMPLAN is a regional economic analysis software and data application that is designed to estimate the impact or ripple effect of a given economic activity or the contribution of some existing activity within a specific geographic area.

IMPLAN utilizes an economic modeling technique called Input-Output analysis ... which is a type of applied economic analysis that tracks the interdependence among various producing and consuming industries of an economy and the spending of households.⁴

RFA analyzed the impact of the ethanol industry on three aspects of the U.S. economy: value added, income, and employment. Value added is the difference between the value of an industry's output and the cost of the intermediate inputs it uses; GDP is the sum of the value added by all industries in the economy. In IMPLAN, income encompasses "all forms of employment income, including employee compensation (wages and benefits) and proprietor income," which is the "current-production income of sole proprietorships, partnerships, and tax-exempt cooperatives."

For this analysis, multipliers for value added, income, and employment were applied to RFA's estimates of industry expenditures and the value of certain other activities by the industry (e.g., exports). Three types of economic effects are quantified in the multipliers: direct, indirect, and induced effects.

- **Direct Effects:** As IMPLAN notes, these are "initial effects to [an] industry or industries due to the activity ... being analyzed."
- **Indirect Effects:** These are the "effects stemming from business-to-business purchases in the supply chain." Indirect effects include only backward linkages to suppliers from which goods and services are bought. For example, ethanol producers buy corn for use as a feedstock, and corn growers, in turn, purchase inputs such as fertilizer and crop protection chemicals.

³ IMPLAN® model, 2023 Data, using inputs provided by RFA and IMPLAN Group LLC, IMPLAN System (data and software), 16905 Northcross Dr., Suite 120, Huntersville, NC 28078 www.IMPLAN.com.

⁴ Clouse, Candi. "IMPLAN Report Toolkit." IMPLAN Support Site, IMPLAN Group, LLC, 30 August 2023, <https://support.implan.com/hc/en-us/articles/360044985833-IMPLAN-Report-Toolkit>.

- **Induced Effects:** These are effects “stemming from household spending of income, after removal of taxes, savings,” and activity that occurs outside the region being examined. For example, people shop at retail stores, eat at restaurants, and use various services.

It is worth noting that IMPLAN does not have an industry code specific to ethanol production. Rather, RFA’s analysis primarily utilized multipliers for IMPLAN’s other basic organic chemical manufacturing industry, which encompasses dry-mill ethanol production.⁵

It should also be noted that an adjustment was made to avoid overstating the economic impact on the agriculture sector. In connection with this, the analysis took into account that IMPLAN started using a new methodology for estimating farm sector employment in its most recent data release, in order to make year-to-year changes more reflective of changes in commodity production volumes rather than price fluctuations.

Finally, although the IMPLAN database was utilized for most of the analysis, agricultural trade multipliers from the U.S. Department of Agriculture’s Economic Research Service (USDA-ERS) were used for exports, since ERS provides multipliers specific to ethanol and DDGS exports.⁶ Given that the economic contribution of ethanol production is already included in the analysis, only the incremental activity associated with exports (e.g., transportation and wholesale services) is estimated in this step, in order to avoid double-counting.

The Economic Contribution of the Ethanol Industry

In 2024, the ethanol industry contributed \$53 billion to U.S. GDP, generated \$28 billion in employment-related income, and supported more than 310,000 full-time equivalent jobs (Table 1). The agriculture sector accounted for half of the contribution to GDP and incomes, along with two-thirds of the jobs that were supported. This is reflective of the fact that ethanol facilities processed 5.5 billion bushels of corn (and grain sorghum) valued at \$23 billion, and, in turn, feedstock costs represented more than three-quarters of operating expenses.

⁵ Multipliers for IMPLAN’s wet corn milling industry were used in part of the analysis, but wet mills account for less than 10% of ethanol output.

⁶ <https://ers.usda.gov/data-products/agricultural-trade-multipliers>

Table 1: Economic Contribution of the Ethanol Industry in 2024

	GDP Contribution (Mil. \$)	Income (Mil. \$)	Employment (FTEs)
Ethanol Production	\$12,744	\$5,677	68,372
Direct	\$2,543	\$1,052	11,761
Indirect	\$7,099	\$2,948	31,882
Induced	\$3,102	\$1,677	24,729
Agriculture	\$26,400	\$15,387	205,986
Direct	\$4,932	\$3,187	41,914
Indirect	\$13,059	\$7,651	105,500
Induced	\$8,410	\$4,548	58,572
Exports	\$13,015	\$6,722	33,448
Construction	\$279	\$158	2,050
Research & Development	\$578	\$373	4,044
Total	\$53,016	\$28,317	313,899
Direct	\$7,804	\$4,467	55,810
Indirect	\$33,410	\$17,468	172,521
Induced	\$11,802	\$6,382	85,568

Source: RFA

Together, ethanol production (net of impacts via the agriculture sector) and exports accounted for most of the remainder of the contribution to the U.S. economy. As noted previously, ethanol exports exceeded their prior record by a considerable amount in 2024, and DDGS exports were at the top end of their historical range.

The economic contribution from construction and research-and-development activities was also significant, but smaller. Industry capacity expanded by just over 1% in 2024. However, this capacity-based estimate might not adequately reflect the construction and renovation activity that took place in the industry during the year, as some facilities undertook initiatives to reduce their carbon footprint to take advantage of programs such as California’s Low Carbon Fuel Standard and the new Clean Fuel Production Credit (45Z). For example, companies installed combined heat and power systems, incorporated renewable energy, and took steps toward being able to capture and sequester carbon dioxide.⁷ Thus, this report’s estimates of the jobs and economic activity associated with construction and research-and-development should be viewed as conservative.

⁷ <https://ethanolrfa.org/media-and-news/category/news-releases/article/2023/06/rfa-sees-progress-as-ethanol-industry-advances-toward-net-zero-carbon-emissions>

Indirect effects accounted for a majority of the industry’s economic contribution, reflecting the considerable activity generated along the supply chain. As the developer of IMPLAN explains:

The first round of Indirect Effects are triggered by the Intermediate Inputs purchased by the Direct business or businesses. ... Further rounds of Indirect Effects reflect the ripple effect through the local Supply Chain. The local businesses affected in the first round of Indirect Effects also purchase Intermediate Inputs from local businesses, and so on.

The industry supported approximately 56,000 direct jobs and 258,000 indirect and induced jobs. That is, for every job directly associated with the industry, another 4.6 positions were supported elsewhere in the economy.⁸

Additionally, the increased economic activity led to higher revenues for local, state, and federal governments. The ethanol industry generated tax revenues of more than \$10 billion in 2024, including nearly \$6 billion at the federal level and nearly \$5 billion at the state and local levels.

Conclusion

The use of ethanol has multiple benefits, including enhancing America’s energy security, supporting agricultural markets, and cutting emissions of greenhouse gases and tailpipe pollutants. The industry’s significant economic impact is apparent to those involved in ethanol production and the agriculture sector, and it has been felt most profoundly in rural America. However, just as ethanol is present in almost all gasoline sold across the U.S., the ethanol industry also makes a substantial contribution to the broader U.S. economy, adding more than \$50 billion to GDP and supporting more than 310,000 jobs. And, the industry’s contribution can continue to grow, given the increasing availability of mid- and high-level

⁸ The jobs estimate is lower than in the 2023 report. This is due to a combination of market developments and IMPLAN revisions. Industry revenues and margins decreased, as did expenditures on grain; on its own, this would have led to a reduction in jobs. However, there were also two key revisions embedded in the annual dataset recently released by IMPLAN. First, the dataset incorporated the latest benchmark tables (for 2017) issued by the Bureau of Economic Analysis. Such tables are updated every five years, and the value of grain purchases accounted for a lower percentage of the output of the other basic organic chemical manufacturing industry than in 2012. Second, IMPLAN started using a new methodology for estimating farm sector employment, in order to make year-to-year changes more reflective of changes in production. (See <https://support.implan.com/hc/en-us/articles/31304600127899-2023-U-S-Data-Release-Notes>) For past editions of this report, an adjustment has been made to avoid overstating the ethanol industry’s impact on the agriculture sector; this year, RFA’s analysis also took into account the changes to IMPLAN’s methodology.

blends, prospects for further development of export markets, and new uses such as sustainable aviation fuel on the horizon.

Afterword: A Note of Thanks

For many years, John Urbanchuk conducted an annual analysis of the ethanol industry's economic contribution, on behalf of the RFA. This work began at a time when the ethanol industry was considerably smaller, and it encompassed a period of rapid growth. As a result, a more rigorous examination of what ethanol meant to the overall U.S. economy was needed, and John stepped in to provide expert analysis and insights. We thank him for this contribution to the industry, as well as for generously sharing his time as the analysis transitioned to RFA's in-house research and analysis team this year.