FOCUS FORWARD

2020 ETHANOL INDUSTRY OUTLOOK

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RENEWABLE FUELS ASSOCIATION

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FOCUS FORWARD

RFA
RENEWABLE FUELS ASSOCIATION

Without a doubt, 2019 proved to be a challenging year. An unprecedented number of small refinery waivers crippled RFS demand and led to more than 20 ethanol plants shutting down temporarily or permanently. Export demand has been undermined by growing protectionism across the globe. And while the Administration did finally allow the year-round blending of E15, expanding that market has been challenged by low RIN prices and strong opposition to higher ethanol blends from an incumbent oil industry that continues to protect its monopoly at the pump.

But at the dawn of a new decade, there are optimistic signs on the horizon. President Trump seems committed to limiting the damaging impact of small refinery exemptions. Increased global demand for low carbon octane is beginning to chip away at trade barriers. And drivers across the country are demanding higher octane lower cost E15. Thus, this Outlook indeed has put the **Focus Forward**. As has been the hallmark of the RFA and the industry for decades, we will do the work necessary to open markets here and abroad, providing savings to consumers, value-added markets for farmers, and energy and environmental security for all of America.

The Renewable Fuels Association will continue to lead. We are working with our allies on Capitol Hill to move legislation providing greater certainty for the future, building upon the success of the RFS, seizing the low carbon high octane benefits of ethanol, and assuring further growth. We are working with industry allies and the U.S. government to expand export markets in China, Mexico, India, and anywhere consumers could benefit from increased biofuels. And we are continuing to build consumer understanding of ethanol's superior performance with market development efforts focused on rebutting the mythology the oil industry has created about our fuel.

As you review the pages that follow, you will see an industry that is maturing and an association that is firing on all cylinders as we truly Focus Forward—not just reducing our weaknesses and threats; but maximizing our strengths and opportunities—as we forge our bright and clear path into 2020 and beyond.

Sincerely,

Geoff Cooper

Geoff Cooper, President & CEO

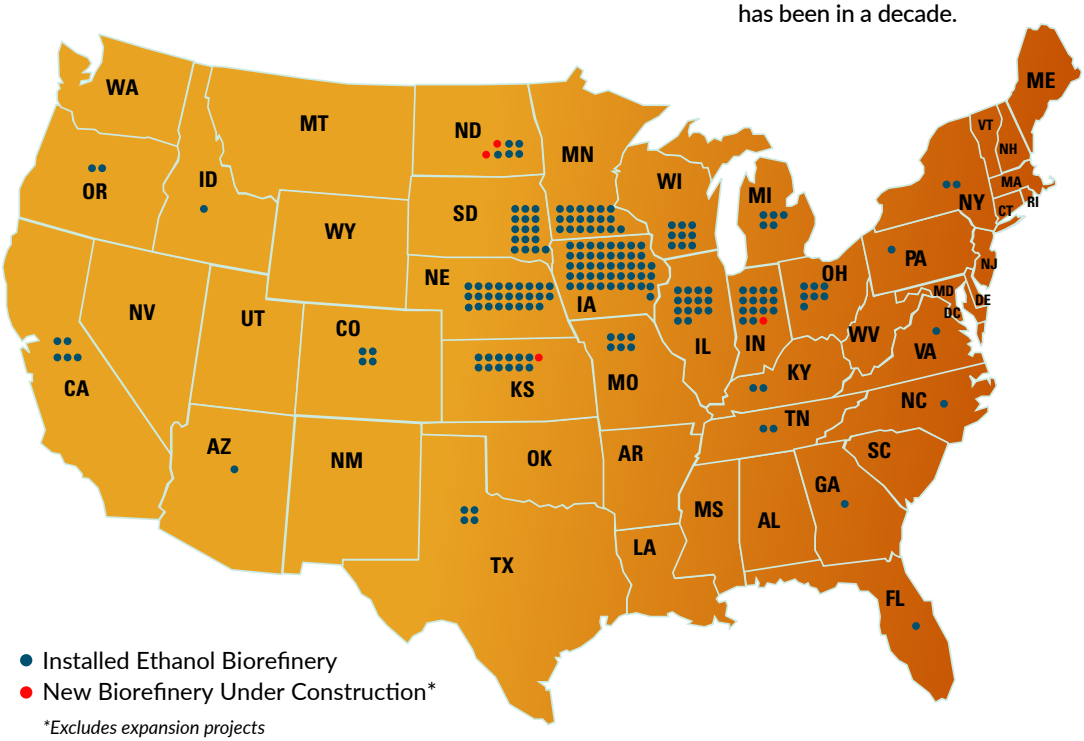
Focusing Forward, From Challenge to Opportunity

2019 was most assuredly the most challenging year for the U.S. ethanol industry in decades. The Environmental Protection Agency's indiscriminate use of small refinery waivers under the Renewable Fuel Standard reduced domestic demand while growing global protectionism limited ethanol markets abroad. As a result, ethanol prices plummeted, causing many ethanol production facilities to reduce output. Twenty plants closed their doors either permanently or temporarily, and U.S. ethanol production fell to 15.8 billion gallons, 300 million gallons below 2018—despite new production capacity coming on line.

The Administration did provide a boost to the ethanol market last year by finalizing a rule allowing the year-round use of E15, potentially increasing near-term ethanol demand by approximately 40 million gallons. Despite that action, the domestic ethanol blend fell below 10 percent at times during the winter and spring as the market responded to demand destruction caused by small refinery exemptions, recovering only in the fall after President Trump announced he would direct EPA to fix the loophole causing so much damage to America's farmers.

Thankfully, as we focus forward into 2020 the picture brightens. With a growing E15 market, some movement to curtail rampant small refinery waivers and account for projected waived gallons in annual RVO regulations, and optimistic signs that trade barriers in China, Mexico, and other critical international markets will soon be addressed, the outlook for ethanol production and marketing in 2020 is as bullish as it has been in a decade.

U.S. Fuel Ethanol Biorefineries by State



- Installed Ethanol Biorefinery
- New Biorefinery Under Construction*

**Excludes expansion projects*

U.S. Ethanol Production Capacity by State

(Million Gallons per Year)

	Existing Production Capacity	Operating Production	Under Construc-tion/	Total Capacity
Iowa*	4,495	4,445	-	4,495
Nebraska	2,274	2,176	-	2,274
Illinois	1,887	1,718	-	1,887
Minnesota	1,308	1,266	-	1,308
Indiana	1,198	991	80	1,278
South Dakota	1,179	1,179	-	1,179
Ohio	676	626	-	676
Wisconsin	648	598	-	648
Kansas	543	518	70	613
North Dakota	487	487	33	520
Texas	375	335	-	375
Michigan	338	283	-	338
Missouri	276	261	-	276
Tennessee	230	230	-	230
California	218	218	-	218
New York	165	165	-	165
Colorado	125	125	-	125
Georgia	120	120	-	120
Pennsylvania	110	110	-	110
Idaho	60	60	-	60
North Carolina	60	-	-	60
Arizona	50	-	-	50
Kentucky	48	48	-	48
Oregon	42	42	-	42
Florida	8	-	-	8
Virginia	4	4	-	4
TOTAL U.S.	**16,924**	**16,005**	**183**	**17,107**

Source: RFA

Production Facilities

Installed Ethanol Biorefineries	Operating Ethanol Biorefineries	Biorefineries Under Constr./ Expansion
44	43	-
26	23	-
14	13	-
19	18	-
14	12	1
16	16	-
7	6	-
9	9	-
12	11	1
5	5	2
4	3	-
5	4	-
6	6	-
2	2	-
5	5	-
2	2	-
4	4	-
1	1	-
1	1	-
1	1	-
1	-	-
1	-	-
2	2	-
2	2	-
1	-	-
1	1	-
205	**190**	**4**

**Data includes one operating plant with unknown or undisclosed production volumes.*

"Today, we honor America's cherished farming heritage. We salute your commitment to American energy independence, and we celebrate the bright future that we are forging together powered by clean, affordable American ethanol."

—President Trump at RFA member plant Southwest Iowa Renewable Energy, June 2019

Focusing on the Rural Economy

With trade policy decisions that hampered global crop marketing and bad weather wreaking havoc across the Corn Belt, 2019 was a year that many in rural America are glad to have in the rear-view mirror. As in 2018, 2019 brought on another year of reduced cash receipts, as a trade dispute with China continued to be felt, bolstered only in part by a series of direct farm program payments. In its own 2020 outlook, CoBank reports that rural America will continue to lag behind the rest of the country; GDP growth in rural counties has averaged nearly 1 percent less than in urban counties since 2014.

This is why growing the ethanol industry remains of vital importance to rural America. In 2019, there were 68,684 U.S. jobs directly associated with the ethanol industry, and it supported an additional 280,327 indirect and induced jobs across all sectors of the economy. The industry created $23.3 billion in household income and contributed $43 billion to the national Gross Domestic Product. Moreover, the ethanol industry spent over $27 billion on raw materials, inputs, and other goods and services.

Just as U.S. ethanol production has contributed to America's energy independence, so too have many of those working at ethanol plants and supporting operations: Almost one-quarter of the men and women employed by the industry are veterans of the U.S. military, and we salute them.

Ethanol's Value-Added Proposition

Based on average prices and product yields in 2019, a typical dry mill ethanol plant was adding roughly $1.20 of additional value--or 31%--to every bushel of corn processed.

CORN COST PER BUSHEL
$3.90

VALUE OF OUTPUTS PER BUSHEL

Ethanol	$3.82
Distillers Grains	$1.11
Corn Distillers Oil	$0.17
TOTAL	**$5.10**

In 2019, the production of 15.8 billion gallons of ethanol and 39.6 million metric tons of co-products and distillers oil had substantial economic impacts, including:

- **68,684 direct jobs**
- **280,327 indirect and induced jobs**
- **$43 billion contribution to GDP**
- **$23.3 billion in household income**

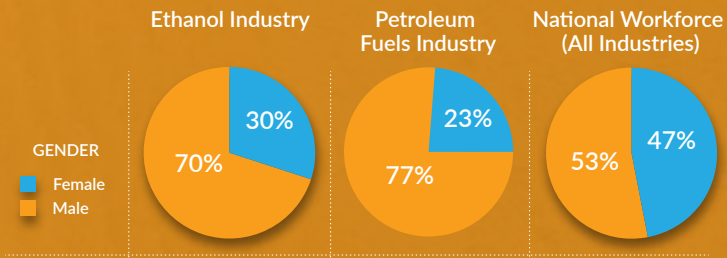
Gross Value of U.S. Ethanol Industry Output

Source: RFA based on U.S. Dept. of Agriculture data

** Estimated*

Ethanol Industry Workforce Demographics

Sources: National Association of State Energy Officials & Energy Futures Initiative



	Ethanol Industry	Petroleum Fuels Industry	National Workforce (All Industries)
55 AND OVER	27%	22%	23%
UNIONIZED	8%	2%	11%
MILITARY VETERANS	21%	10%	6%

Energizing Global Markets

The United States is the world leader in the production, consumption and export of ethanol. The nearly 16 billion gallons of ethanol produced here in 2019 represents 54 percent of global output. In comparison, Brazil accounted for only 30 percent of global production, despite significant growth over the last two years.

U.S. ethanol exports declined modestly in 2019 to an estimated 1.5 billion gallons, second only to the record 1.7 billion gallons shipped in 2018 and representing approximately 10 percent of the ethanol produced in the United States.

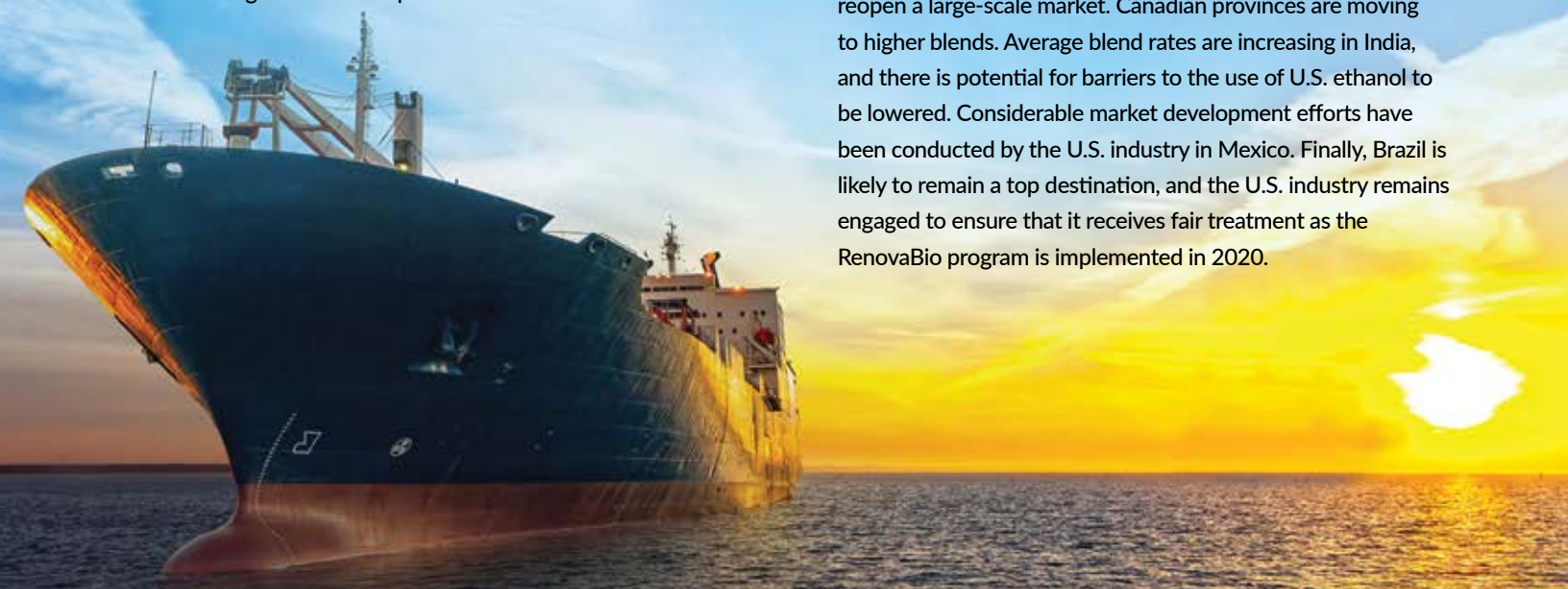
For the fifth straight year, Brazil and Canada remained the top two destinations for U.S. ethanol, taking nearly half of our exports. Shipments to Canada have been fairly stable in recent years. However, exports to Brazil fell in 2019 as a result of sizable inventories early in the year, higher ethanol production, the continued implementation of a tariff rate quota, and the restriction of quota volumes during the September-February period. The decline in shipments to Brazil was the main factor causing overall U.S. exports to recede in 2019.

Prohibitive tariffs imposed by China in connection with the trade conflict with the United States caused shipments to fall to negligible levels for most of 2019. On the other hand, longstanding antidumping duties by the European Union, which the U.S. industry had actively worked to overturn, were allowed to end.

Exports to a large majority of the top-ten destinations for U.S. ethanol were higher in 2019. There were notable increases in shipments to India, the third-largest market, as well as to Colombia and South Korea.

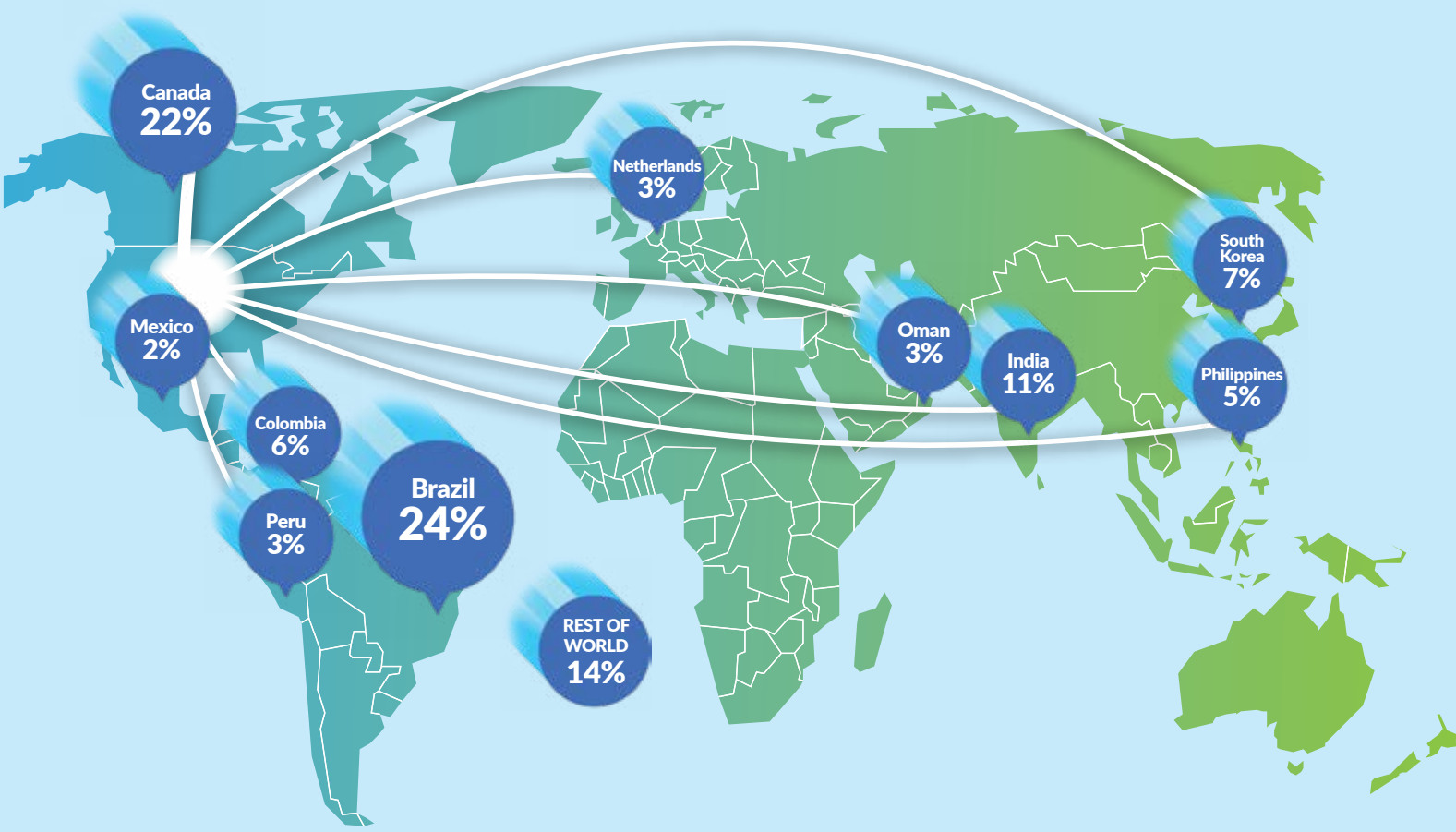
U.S. ethanol imports more than doubled from the nearly 80 million gallons received in 2018. Brazilian sugarcane-based ethanol benefitted from the high prices of credits toward the California Low Carbon Fuel Standard and from widening price spreads among categories of RFS credits (RINs) that resulted from small refinery exemptions doled out by the EPA.

Multiple opportunities exist to regain momentum in export growth. A resolution of the trade conflict with China could reopen a large-scale market. Canadian provinces are moving to higher blends. Average blend rates are increasing in India, and there is potential for barriers to the use of U.S. ethanol to be lowered. Considerable market development efforts have been conducted by the U.S. industry in Mexico. Finally, Brazil is likely to remain a top destination, and the U.S. industry remains engaged to ensure that it receives fair treatment as the RenovaBio program is implemented in 2020.



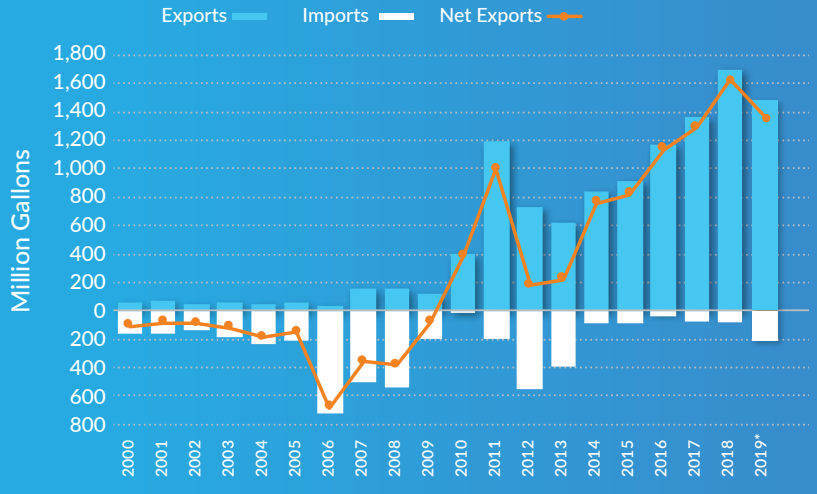
Global fuel ethanol production hit a new record of 29 billion gallons in 2019, with the United States again accounting for over half of the world's production.

Top Destinations for U.S. Ethanol Exports in 2019



*Source: RFA based on data from U.S. Dept. of Commerce & U.S. Census Bureau *Estimated based on Jan.-Nov. 2019 data*

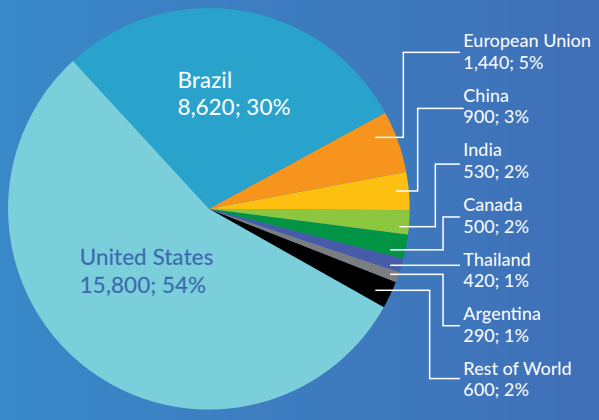
U.S. Ethanol Exports and Imports



Source: RFA based on data from U.S. Dept. of Commerce & U.S. Census Bureau
**Estimated based on Jan.-Nov. 2019 data*

2019 Global Fuel Ethanol Production by Country

(Country, million gallons, share of global production)



Source: RFA analysis of public and private data sources

Progressive Processors Unlock New Products

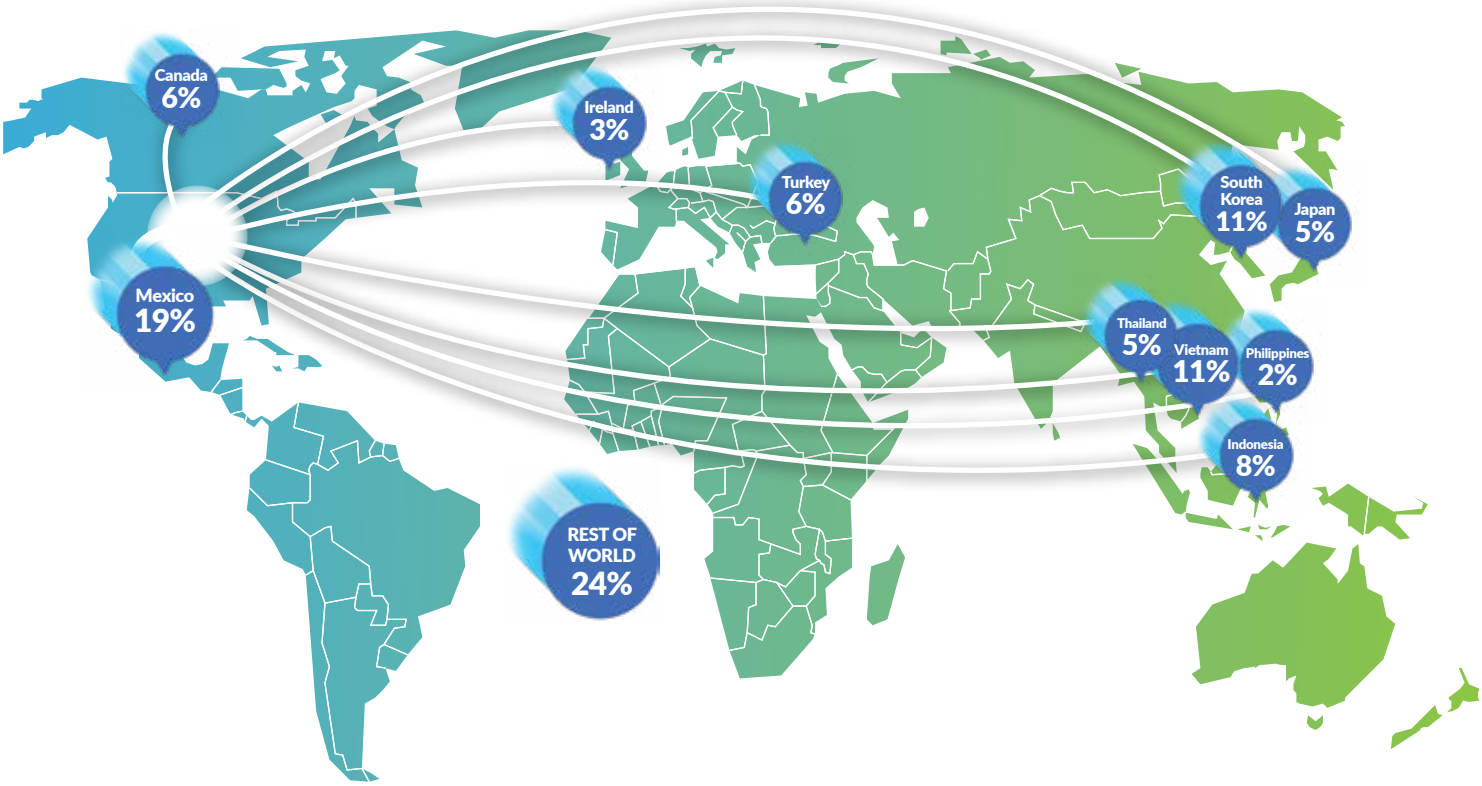
Sophisticated ethanol production facilities have been using engineering and design enhancements, new process technologies, automation upgrades, and other advances to make remarkable gains in efficiency to extract more out of each bushel of corn and generate multiple product streams. Industry is leaping forward to develop potential new feed definitions to green-light the next generation of ethanol co-products.

In 2019, U.S. ethanol producers generated 39.6 million metric tons (mmt) of distillers grains, gluten feed, and gluten meal. These bio-products are valuable corn and soybean meal substitutes in rations used around the world to feed beef and dairy cows, pigs, chickens, turkeys, fish, and other animals. Ethanol plants extracted 3.8 billion pounds of corn distillers oil—a nearly $1 billion market underpinning the production of biodiesel and animal feed.

In September, the U.S. Food and Drug Administration gained full authority to enforce the Food Safety Modernization Act Preventive Controls for Animal Food Rule. FDA oversight lends formal assurance to domestic and international customers that American-made ethanol co-products are safe feed ingredients.

U.S. ethanol producers also captured 5.8 billion pounds of high-grade biogenic CO_2 in 2019 for North American food/beverage and industrial markets. Further, the industry is actively engaged in promoting the groundbreaking deployment of carbon capture and sequestration in a pivotal step toward fighting climate change.

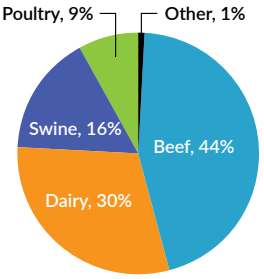
Top Destinations for U.S. Distillers Grains Exports in 2019



Source: RFA based on data from U.S. Dept. of Commerce & U.S. Census Bureau

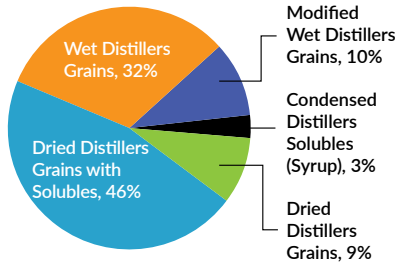
**Estimated based on Jan.-Nov. 2019 data*

Distillers Grains Consumption by Species



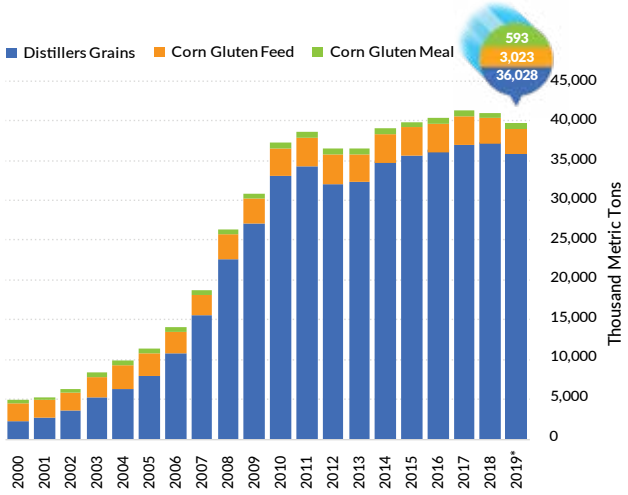
Source: Distillers grains marketing companies

Distillers Grains Production by Type, As-Is Basis



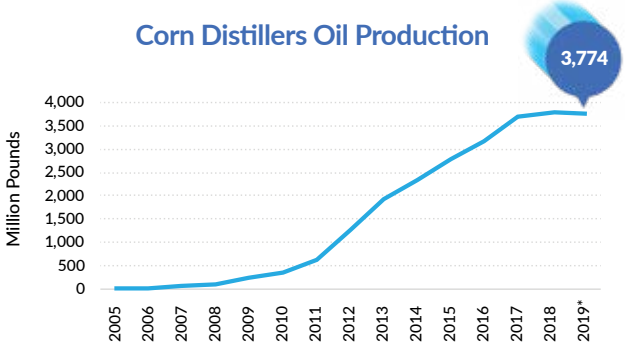
Source: RFA based on U.S. Dept. of Agriculture data

U.S. Ethanol Industry Co-product Animal Feed Output



Source: RFA based on data from U.S. Dept. of Agriculture. **Estimated*
Note: All co-products converted to 10% moisture basis.

Corn Distillers Oil Production



Source: RFA based on U.S. Dept. of Agriculture data **Estimated*

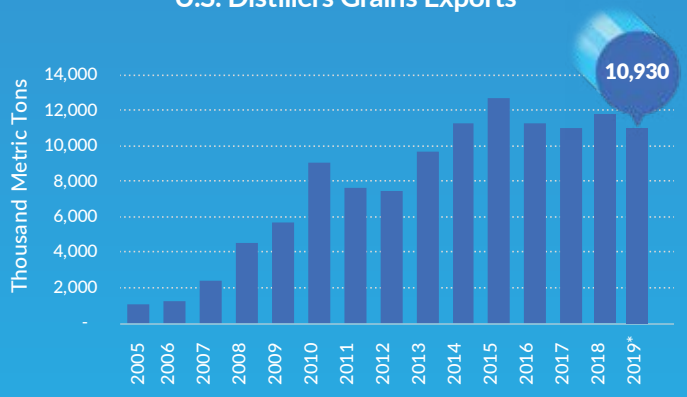
A DIVERSIFIED TRADE PORTFOLIO

U.S. biorefineries satisfied growing domestic animal food needs while also exporting at least one of every four tons of distillers grains produced. Broadened educational and B2B outreach helped to grow the U.S. bio-product customer base into the most diverse mix in our industry's history.

In 2019, 53 countries purchased a cumulative 10.9 mmt of U.S. distillers grains. Half of these exports landed in Southeast and East Asia, despite China's decision in June to maintain anti-dumping and anti-subsidy tariffs on U.S. distillers grains imports. Another quarter of sales were transborder shipments, with Mexico extending its position as our top distillers grains customer for a third consecutive year.

The Renewable Fuels Association anticipates that mounting demand and geographic diversity lie ahead as countries around the globe embrace the use of these safe and economical ethanol bio-products.

U.S. Distillers Grains Exports



Source: RFA based on data from U.S. Dept. of Commerce & U.S. Census Bureau
**Estimated based on Jan.-Nov. 2019 data*

A Clean Source for Octane

Octane continues to be in high demand, and ethanol is a clean, affordable source. To meet corporate average fuel economy requirements and consumer preferences, automakers are increasingly using turbocharged, higher-compression engines in which the use of high-octane gasoline is recommended or required. As a result, premium gasoline sales in the United States has been strong over the last five years.

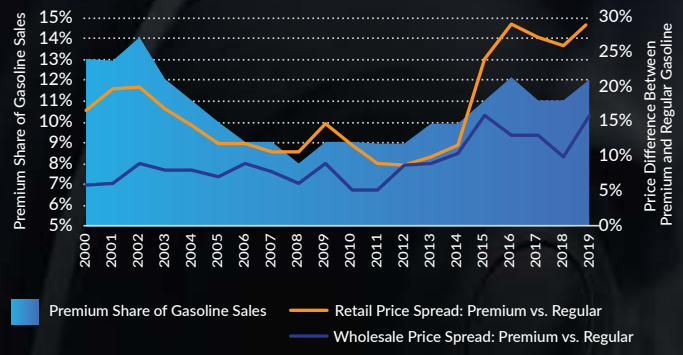
This higher demand has driven up the price spread between premium and regular gasoline. In 2019, premium gasoline was 16 percent more expensive than regular gasoline in the wholesale market and a lofty 29 percent more expensive at retail – reaching the highest levels in at least two decades.

However, ethanol is helping to hold down the cost of both regular and premium gasoline. According to a study by Dr. Philip K. Verleger, Jr., consumers saved an average of 22 cents per gallon from 2015 through 2018 as a result of the use of ethanol.

Moreover, ethanol has the highest octane-blending value of any major source of octane while having among the lowest market prices. Ethanol has a blending octane rating of 114, which is higher than the ratings of the main petroleum-based components. In 2019, ethanol traded at the largest discount to its blending value, as its market price remained subdued while the prices of other components rebounded. As a result, ethanol retained the title of being the most competitive source of octane in the world.

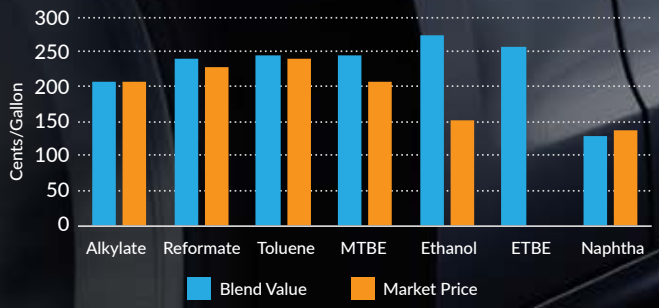
At the same time, supplies of petroleum-based components have become constrained as a result of the increasing availability of lighter shale oils, the configuration of refineries, and restrictions on the sulfur content in fuel. Additionally, aromatic hydrocarbons such as benzene are toxic and worsen air pollution.

Premium Gasoline:
Share of Sales and Price Difference vs. Regular



Source: RFA based on U.S. Energy Information Administration data

Octane Blending Value vs. Market Price



Source: Argus Media

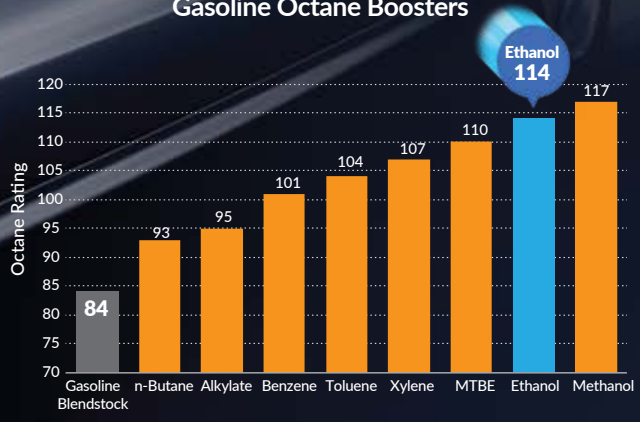
Refiners have optimized operations to reduce hydrocarbon octane production in order to take advantage of ethanol's properties. Today, most regular gasoline in the United States is produced using blendstock with an octane rating of 84, which is then upgraded to a rating of 87 by adding 10 percent ethanol. This allows refiners to increase their throughput of hydrocarbon blendstock at a lower cost.

A recent analysis by Baker & O'Brien, Inc. for the U.S. Energy Information Administration researched prices at the distribution terminal, where ethanol is blended, and "failed to find any significant change since 2010 to account for the increasing regular-to-premium retail gasoline price spread."

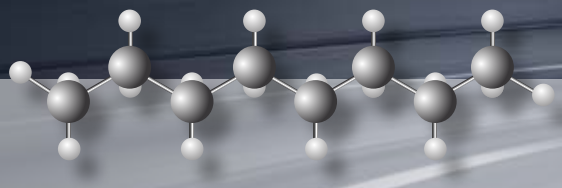
A key development in 2019 was the Trump administration's issuance of a rule allowing E15 (gasoline containing 15 percent ethanol) to be sold year-round throughout the country. E15 sales volumes increased in response, as restrictions on offering E15 in the summertime were lifted and as the number of retail stations carrying the fuel expanded. E15 sold at retail typically has an octane rating of 88, giving consumers an added boost at a lower cost.

The demand for octane looks set to continue to grow. It is being driven in the United States by the use of advanced vehicle engines, tighter gasoline specifications, and the expansion of E15—and could be propelled further by the need for midlevel ethanol blends (e.g., E25-E30) to meet future fuel economy and emissions standards.

Blending Octane Ratings of Various Gasoline Octane Boosters



Source: U.S. Department of Energy



A fuel's octane rating is the measure of its ability to resist "knocking" in the engine, which is caused when the air/fuel mixture detonates prematurely during combustion. According to the U.S. Department of Energy, "Using a lower octane fuel than required can cause the engine to run poorly and can damage the engine and emissions control system over time. It may also void your warranty."

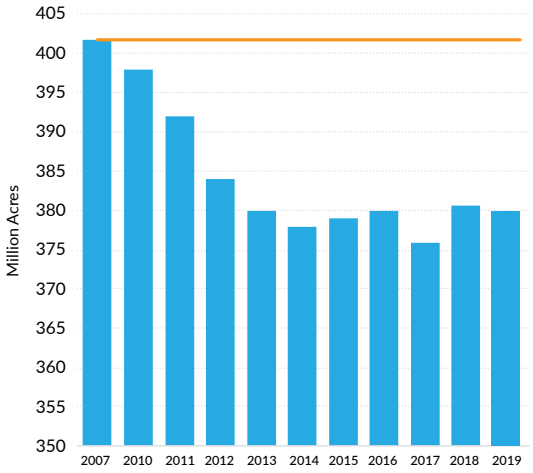
The Low Carbon Solution

2014 through 2018 ranked as the earth's five warmest years on record, and 2019 is likely to top them all. Moreover, unprecedented fires in Australia, record ice melt in the Arctic, and increasingly volatile weather patterns have sparked a global dialogue about the growing imperative to reduce carbon.

From RFA's perspective, the ethanol industry should be helping to lead the conversation because we have a great story to tell. The U.S. Department of Energy, California Air Resources Board (CARB), Oregon Department of Environmental Quality, U.S. Department of Agriculture (USDA) and others already recognize that grain-based ethanol reduces greenhouse gas (GHG) emissions by 35 to 50 percent compared to gasoline. Emerging technologies promise to boost that reduction to around 70 percent in just the next few years, according to USDA. Further, CARB data show that ethanol is responsible for 22 million metric tons of GHG reduction from California's transportation sector since 2011—more than any other low carbon fuel.

Thankfully, the United States already has a framework in place to drive future policy. The Renewable Fuel Standard has been an important and effective policy reducing greenhouse gas emissions from fuels for 15 years and has reduced CO_2-equivalent GHGs by an astounding 600 million metric tons since its implementation. That is the equivalent of removing roughly half of the cars on the road in America for an entire year or eliminating the annual emissions from 13 coal-fired power plants. With ethanol, we don't have to wait and hope for major technological or economic breakthroughs; the fuel is available now at a low cost to drive decarbonization of our liquid fuels.

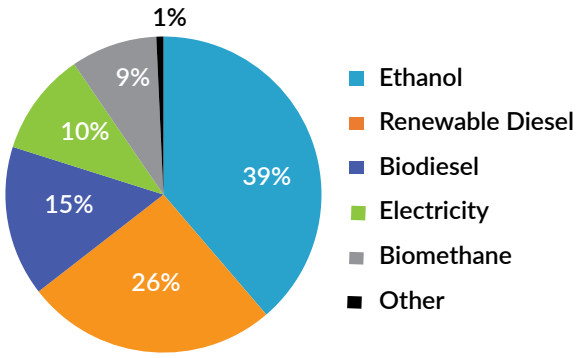
U.S. EPA Determination of Agricultural Land Use vs. 2007 Baseline



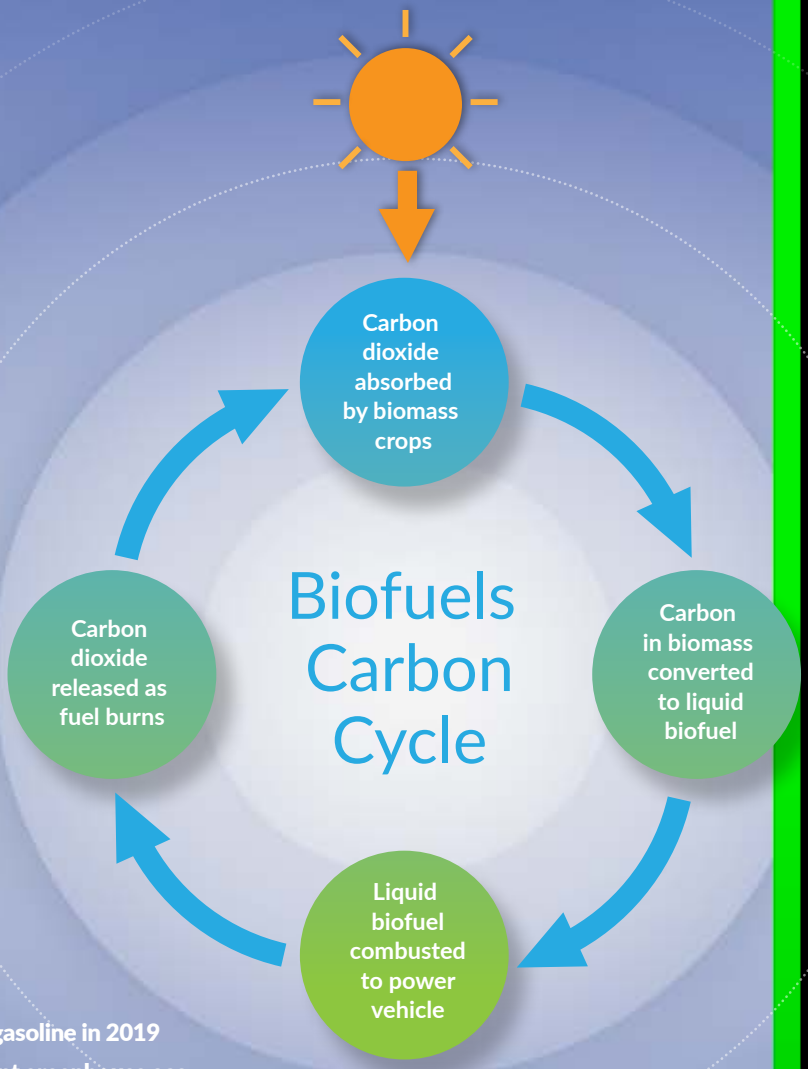
Overall agricultural land use has dropped significantly since EPA established the 2007 baseline with the expansion of the Renewable Fuel Standard.

Source: RFA using U.S. Environmental Protection Agency data

California LCFS Credit Percentage by Fuel, Q1 2011 - Q2 2019



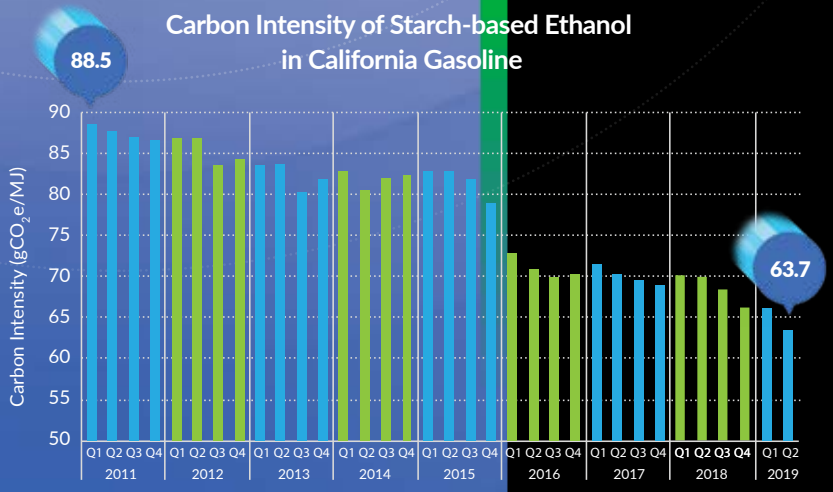
Source: RFA using California Air Resources Board data



The use of ethanol in gasoline in 2019 reduced CO_2-equivalent greenhouse gas emissions from the transportation sector by 54.1 million metric tons. That's equivalent to removing 11.5 million cars from the road for an entire year, or eliminating the annual emissions from 13 coal-fired power plants.

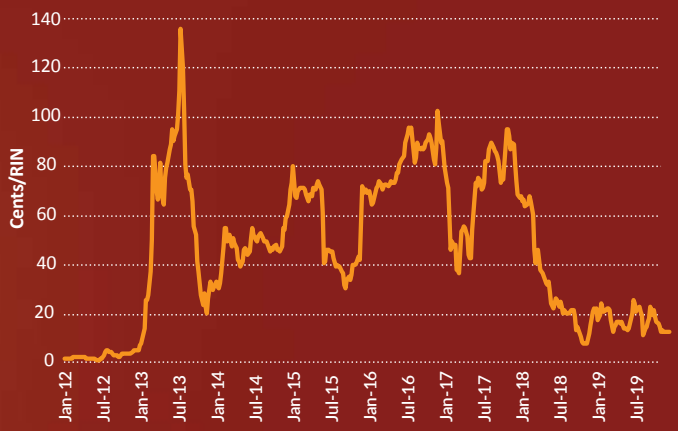
Source: RFA analysis using U.S. Dept. of Energy GREET model

Carbon Intensity of Starch-based Ethanol in California Gasoline



Source: RFA using California Air Resources Board data

Average Weekly Ethanol (D6) RIN Price



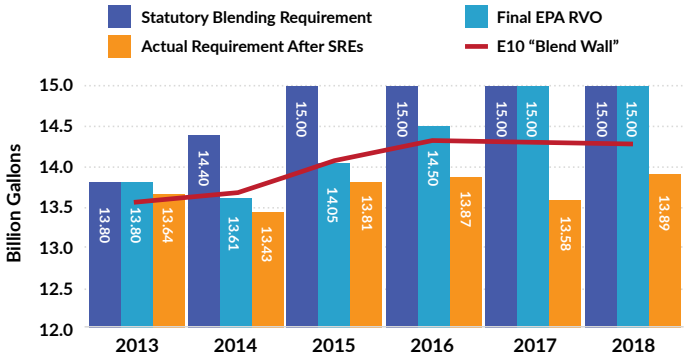
Source: OPIS

The price of ethanol (D6) renewable identification numbers (RINs) started 2019 at a relatively low level, due to swelling RIN inventories that resulted from small refinery exemptions (SREs) granted roughly a year earlier. However, prices plunged further following the August announcement that 31 SREs had been granted for the 2018 compliance year and again after the release of the supplemental proposal for the 2020 RFS renewable volume obligations, in which the EPA assumed that future SREs would conform to Department of Energy recommendations rather than historical practices.

"As we travel through our districts in Iowa, we hear first-hand from farmers, renewable fuel producers, and rural communities about the harm caused by the explosion of small refinery exemption applications that EPA has approved in recent years. … Without a binding commitment that EPA will account for exemptions granted by EPA, this rule fails to keep the RFS whole."

— Iowa Reps. Dave Loebsack, Cindy Axne and Abby Finkenauer

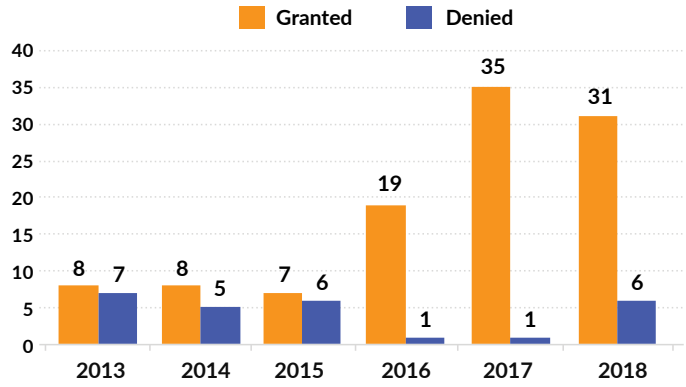
RFS Conventional Renewable Fuel Blending Requirements: Statutory Levels vs. Actual Levels After EPA Waivers



EPA used a "general waiver" to set final RVOs below statutory levels in 2014-2016. The courts struck down and vacated EPA's 2014-2016 final RVOs and remanded them back to EPA to address.

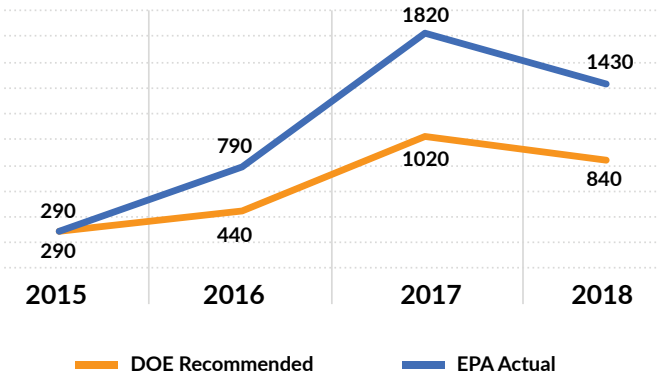
Source: RFA using U.S. Environmental Protection Agency data

Small Refinery Exemptions



Source: RFA using U.S. Environmental Protection Agency data

SRE Applications Waived vs. DOE Recommendations



Source: RFA using U.S. Environmental Protection Agency and U.S. Department of Energy data

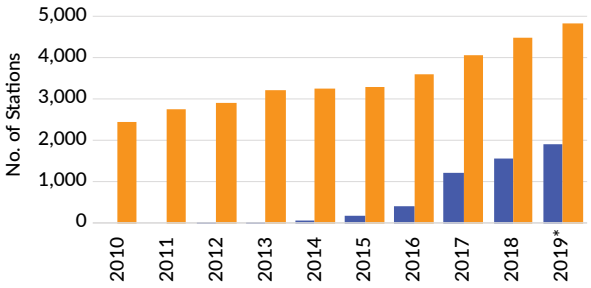
Focusing Beyond E10

After years of working to reverse a 2012 decision by the U.S. Environmental Protection Agency (EPA) to limit E15 to winter fuels, the agency in June finally promulgated a rule allowing the year-round use of the less expensive, higher octane ethanol fuel blend. As a result, E15 sales grew significantly, to about 450 million gallons. That growth was fueled by a better than 10% increase in retail stations offering E15 and more auto manufacturers providing warranty coverage for the higher ethanol blend. Today E15 stations number near 2,000, and better than 95% of the vehicles sold in the U.S. are legally approved for E15. As a result, in 2019 E15 sales surpassed E85 sales for the first time.

E85 and other flex fuels encountered challenges in 2019, even as the number of E85 blender pumps increased and market economics provided a significant incentive for consumers. E85 sales were estimated at 425 million gallons but would have been higher if not for decreased production of flex fuel vehicles and historically low RIN prices.

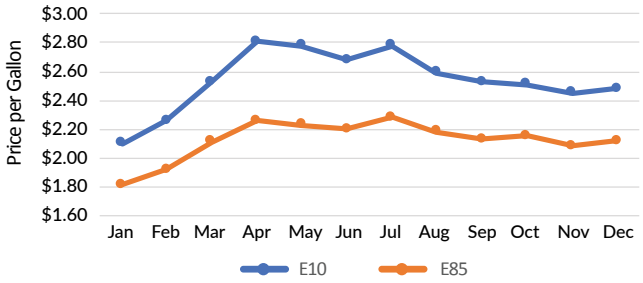
The Trump administration has promised a package of incentives to encourage increased sales of E15 and flex fuels in 2020. Those include streamlining labeling and removing other barriers to E15 and financial assistance for infrastructure projects facilitating higher ethanol blends. Assuming those measures are taken, the RFA remains highly optimistic the market will continue to move beyond E10 in 2020.

Expansion of U.S. Retail Stations Offering E15 and E85



Source: RFA **Estimated*

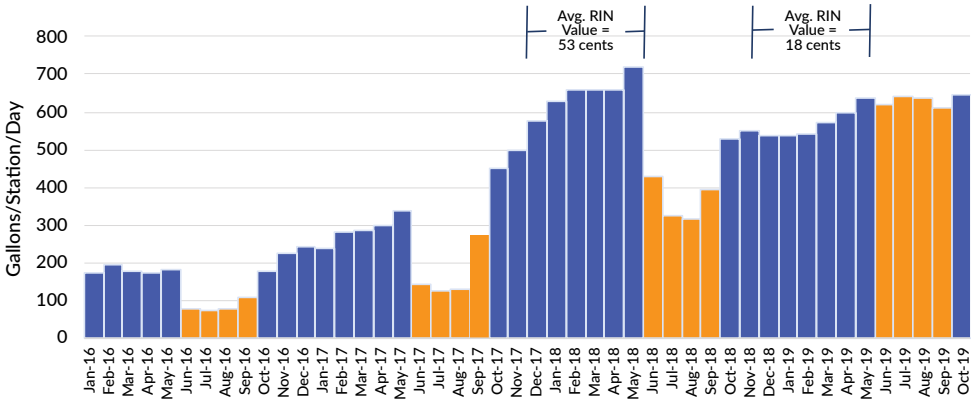
2019 National Average Retail Prices for E10 & E85



Source: RFA based on data from E85prices.com

In the seven years since E15 was formally approved for use by EPA, American drivers have logged over 10 billion miles on the fuel without a single reported case of "engine damage," misfueling, or inferior performance.

Minnesota Average E15 Sales



Source: RFA based on Minnesota Dept. of Commerce data

"Year-round E15 sales is a win for consumers and our economy (more options and lower costs). It's a win for the environment (cleaner fuel). It's a win for our nation's energy security (reduces dependence on foreign countries). And it's a huge win for our nation's agriculture industry (stronger commodity market)."

—U.S. Senator John Thune, South Dakota

CAN YOU FLEX FUEL ?

The following model year 2020 vehicles are available as Flex Fuel Vehicles (FFVs):

Chevrolet Express (6.0L)
Chevrolet Impala (3.6L)*
Chevrolet Silverado (5.3L)
Ford Explorer (3.3L)
Ford F-150 (3.3L, 5.0L)
Ford F-250/F-350 Super Duty (6.2L)
Ford Transit (3.5L)
Ford Transit Connect (2.0L)
GMC Savana (6.0L)
GMC Sierra (5.3L)

Available for Fleet Purchase Only:
Chevrolet Suburban (5.3L)
Chevrolet Tahoe (5.3L)
Ford Police Interceptor (3.3L)
GMC Yukon (5.3L)
GMC Yukon XL (5.3L)

E15 APPROVAL STATUS FOR CONVENTIONAL LIGHT-DUTY VEHICLES

MODEL YEAR :	2012	2013	2014	2015	2016	2017	2018	2019	2020	U.S. Market Share
BMW Group*										
BMW										**1.8%**
Mini										**0.2%**
Daimler Group (Mercedes-Benz)										**2.0%**
FCA (Chrysler, Dodge, Fiat, Jeep, RAM)										**13.1%**
Ford Motor Co. (Ford, Lincoln)										**14.3%**
General Motors (Buick, Cadillac, Chevrolet, GMC)										**17.0%**
Honda Motor Co. (Honda, Acura)										**9.6%**
Hyundai Motor Co. (Hyundai, Kia)										**7.7%**
Mazda										**1.7%**
Mitsubishi Motors Corp.										**0.8%**
Nissan Motor Co.										
Infiniti										**0.7%**
Nissan†										**7.6%**
Subaru‡										**4.2%**
Tata Motors (Jaguar, Land Rover)										**0.7%**
Toyota Motor Corp.										
Lexus										**1.7%**
Toyota										**12.5%**
Volkswagen Group										
Audi										**1.3%**
Porsche										**0.4%**
Volkswagen										**2.2%**
Volvo Car Group										**0.6%**
All Others										**0.2%**

E15 Approved by Automaker in ALL Models
E15 Approved by Automaker in SOME Models
E15 Approved by EPA only; NOT Approved by Automaker

* Approves the use of up to 25% ethanol blends
† Approves the use of E15 for all models except Armada & Frontier
‡ Approves the use of E15 for all models except BRZ, Forester & WRX

Sources: Approval Status: Auto Manufacturer Owner's Manuals; U.S. Market Share: GCBC (Jan.-Sept. 2019)

Fueling Value

Ethanol production and use has a long history of helping farmers and others by adding value to corn at the same time as it saves drivers at the gas pump. Henry Ford and Alexander Graham Bell were among the first to recognize that the plentiful sugars found in plants could be easily and inexpensively converted into clean-burning, renewable fuel. Bell himself referred to ethanol as a "clean, beautiful, and efficient fuel" more than a century ago.

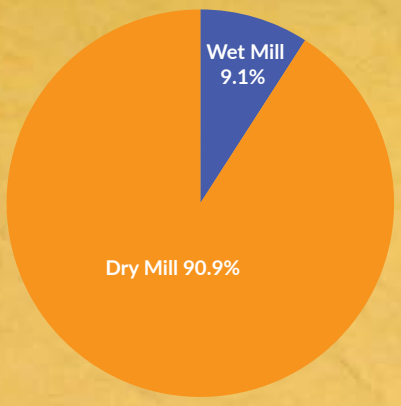
Today's industry uses state-of-the-art technologies to produce ethanol and valuable bio-products from the starches and sugars found in grains, beverage and food waste, and cellulosic biomass, and American farmers themselves are often actively involved in many of these ethanol plants through ownership or leadership positions.

More than 90 percent of U.S. fuel ethanol is produced using the dry mill process, with the remaining amount coming from wet mills. The main difference between the two processes is in the initial treatment of the grain.

In **DRY MILLING**, the entire grain kernel is first ground into "meal," then slurried with water to form a "mash." Enzymes are added to the mash to convert starch to sugar. The mash is cooked, then cooled and transferred to fermenters. Yeast is added and the conversion of sugar to alcohol begins. After fermentation, the resulting "beer" is separated from the remaining "stillage." The ethanol is then distilled and dehydrated, then blended with about 2% denaturant (such as gasoline) to render it undrinkable. It is then ready for shipment. The stillage is sent through a centrifuge that separates the solids from the solubles. These co-products eventually become distillers grains, as well as corn distillers oil.

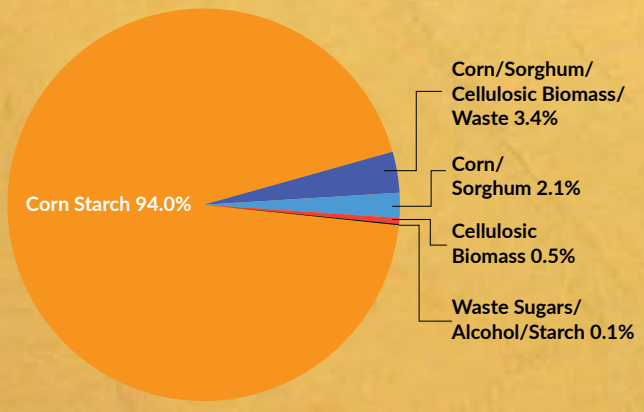
In **WET MILLING**, the grain is first separated into its basic components through soaking. After steeping, the slurry is processed through grinders to separate the corn germ. The remaining fiber, gluten and starch components are further segregated. The gluten component (protein) is filtered and dried to produce animal feed. The remaining starch can then be fermented into ethanol, using a process like the dry mill process.

U.S. Ethanol Production by Technology Type



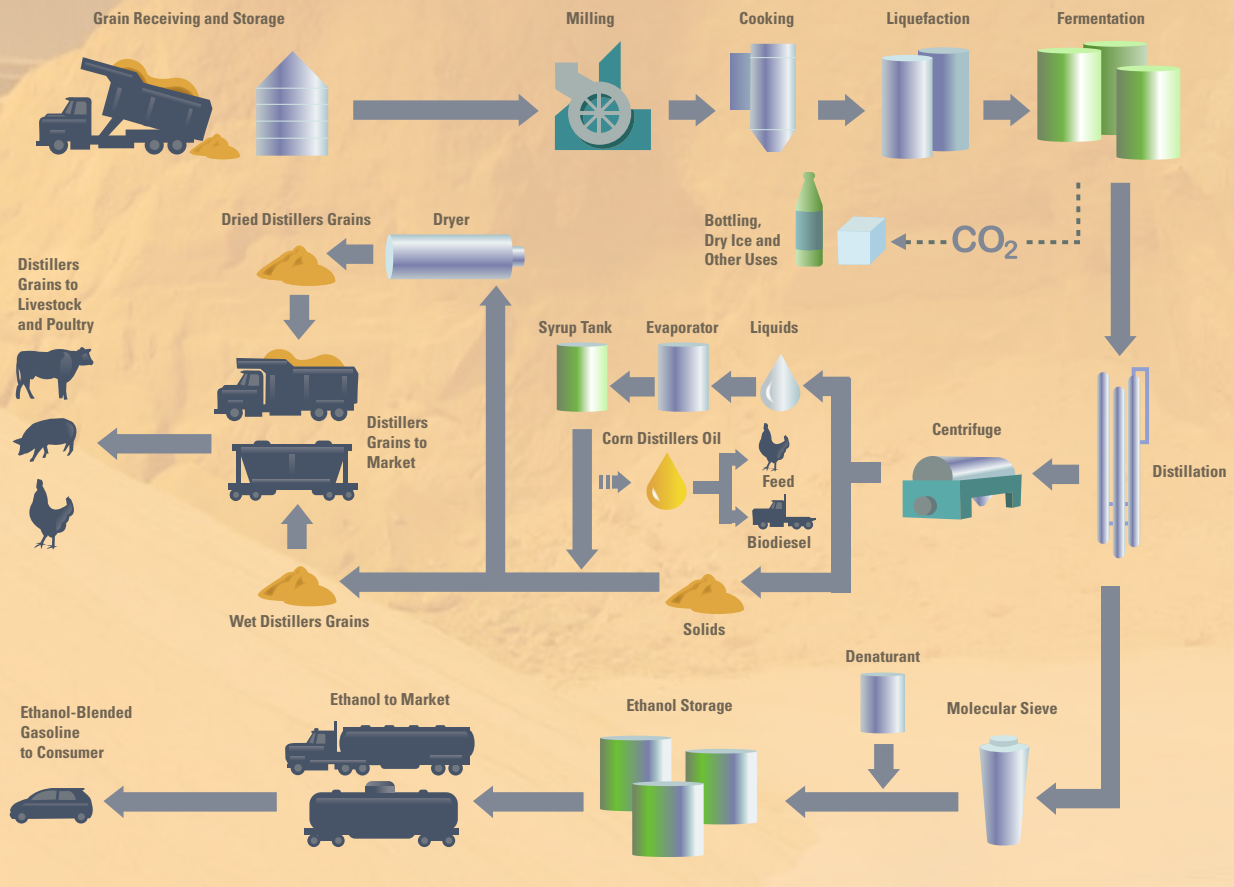
Source: RFA based on U.S. Dept. of Agriculture data

U.S. Ethanol Production by Feedstock Type



Source: RFA

Dry Mill Ethanol Process



On average,
1 bushel of corn
(56 pounds)

processed by a dry mill ethanol biorefinery produces:

- *2.92 gallons of denatured fuel ethanol*
- *15.86 pounds of distillers grains animal feed (10% moisture)*
- *0.80 pounds of corn distillers oil*
- *16.5 pounds of biogenic carbon dioxide*

Source: RFA

Innovating for the Future

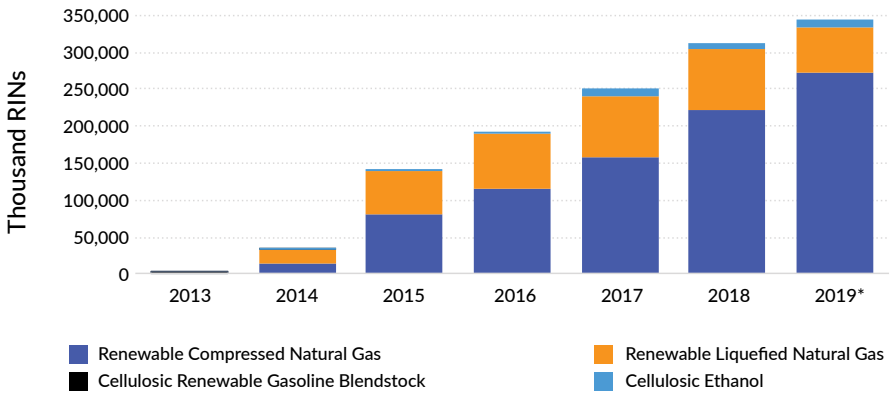
Innovation continues to be the hallmark of U.S. ethanol producers. Over the past year, ethanol production facilities helped to commercialize a variety of new technologies, from co-product diversification to engineered yeast. These advances further increase ethanol yields and reduce the energy intensity of the process, leading to reduced greenhouse gas emissions.

One area of particular focus has been co-product diversification—including dry grind separation, dry fractionation and fiber separation. These technologies result in higher valued and tailored feed products with enhanced feeding aspects for ruminants, swine and poultry. Aquaculture is also an area of growth for our co-products.

Driven in part by state low carbon fuel standards, plant efficiencies also continue to improve. New technologies that reduce carbon, like advanced motors, anaerobic digesters, co-generation of energy and carbon sequestration, are being adopted by facilities around the country. Enzyme manufacturers also continue to innovate, offering products with better properties that help producers control costs and reduce or even eliminate use of other chemicals.

The U.S. ethanol industry has come a long way since 1980 and is looking forward to continuing to grow the industry. Utilizing specialty enzymes, producers can be next-generation facilities fermenting fiber into cellulosic ethanol. And yeast has been modified to produce less glycerol and produce their own glucoamylase during fermentation. Beyond production, new uses for ethanol are also on the horizon. New technology allows ethanol to be used as feedstock for aviation fuel, and the industry is researching using ethanol as a diesel substitute and to generate electricity.

Total D3 RINs Generated



Source: RFA based on U.S. Environmental Protection Agency data

**Jan.-Nov.*

Two of our nation's newest ethanol plants are models of innovation. Since its opening in spring 2019, Ringneck Energy's facility in Onida, South Dakota, quickly reached its nameplate capacity of 80 million gallons. Among its priorities are to improve access to the West Coast ethanol market with data collection to develop its carbon intensity score, increasing the value of its ethanol for blenders serving California and Oregon.

Not pictured: The Andersons and ICM, Inc. partnered together to create ELEMENT, LLC, a joint venture that in August 2019 completed a 70-million-gallon-per-year bio-refinery in Colwich, Kansas. The combination of ICM's next-generation technologies and The Andersons' merchandising, risk management and logistics expertise has the potential to produce high-efficiency, low-carbon-intensity ethanol.

Photos: Dakota Film Co.

A Secure Energy Source

Energy security remains an enduring concern, a reminder of which was provided by the September 2019 attacks on two key Saudi Arabian oil installations. While the expansion of U.S. petroleum production in recent years has been widely touted, we still import more than 200 million barrels of oil every month, highlighting the continuing linkage between the world oil market and the U.S. market.

In 2019, the U.S. still sent an estimated $35 billion to OPEC countries for oil—$275 per American household—including $12 billion to Saudi Arabia alone. In fact, California, the largest gasoline-consuming state, has been importing increasing quantities of crude oil, more than two-thirds of which come from OPEC.

On the other hand, homegrown ethanol is a secure source of transportation fuel that has helped the nation limit its oil imports and thus its susceptibility to developments in the world market. According to a recent study by energy economist Dr. Philip K. Verleger, Jr. that looked at oil market shocks starting with the 1973 Arab Oil Embargo, even "a modest amount of renewable fuels can significantly moderate the price impact of market disruptions."

In 2019, U.S. dependence on imported crude oil and petroleum products fell to just 4 percent on a net basis (i.e., imports minus exports), due to the increase in domestic production of both crude oil and biofuels. Yet, without the inclusion of ethanol in the domestic fuel supply, the U.S. would have been dependent on imports for 10 percent of its needs.

The use of ethanol specifically reduced the need for crude oil imports by 514 million barrels. More broadly, the 15.8 billion gallons of ethanol produced for the domestic and export markets displaced 559 million barrels of crude oil.

"America remains far from energy independent. While net exports show a decreasing reliance on imports, the country continues to buy oil from other nations in part to meet the needs of its refiners. The US refining industry is generally configured to process heavier crude, for example, from Saudi Arabia, than that produced in its domestic shale fields."

—Financial Times editorial, January 2020

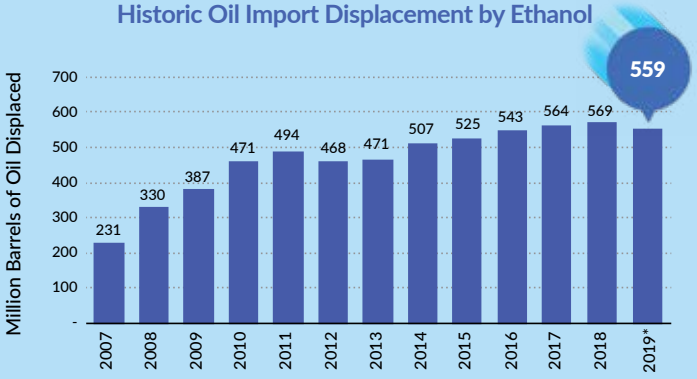
Transferring American Wealth to OPEC

Even though U.S. oil production has increased in recent years, our nation's economy still transfers tens of billions of dollars every year to the OPEC cartel. In 2019 alone, the U.S. sent some $35 billion—or $275 per American household—to OPEC nations to pay for crude oil imports.

OPEC Nation	U.S. Spending on Crude Oil Imports *(Billion $)*
Saudi Arabia	$12.3
Iraq	$7.8
Nigeria	$4.7
Ecuador	$4.4
Venezuela	$1.9
Libya	$1.4
Kuwait	$1.1
Other OPEC	$1.8
TOTAL	**$35.3**

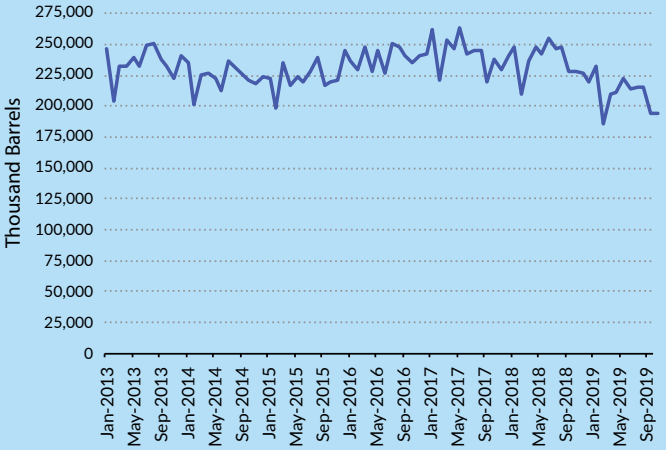
Source: RFA based on U.S. Dept. of Energy data

Historic Oil Import Displacement by Ethanol



Source: RFA based on U.S. Dept. of Energy data **Estimated*

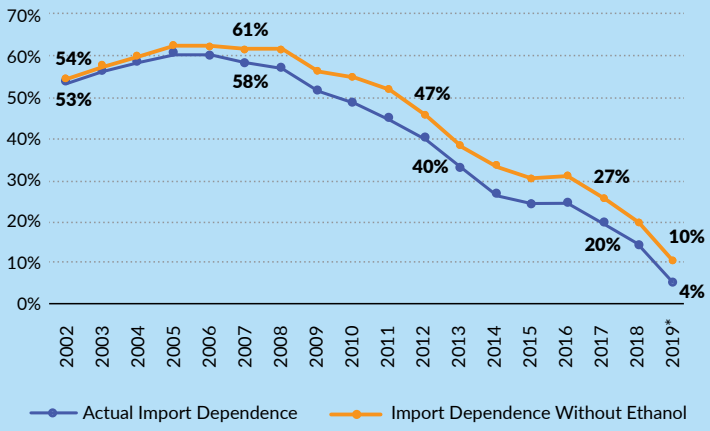
U.S. Crude Oil Imports



While U.S. crude oil production has increased, our nation still imports over 200 million barrels per month on a gross basis.

Source: U.S. Dept. of Energy

U.S. Petroleum Net Import Dependence with and without Ethanol



On a net basis (i.e., after accounting for U.S. exports), the United States relied on imports to meet 4% of its petroleum demand in 2019. Without the contribution of 15.8 billion gallons of ethanol, U.S. import dependence would have been equivalent to 10% of petroleum demand.

Source: RFA based on U.S. Dept. of Energy data **Estimated*

Advancing Sustainability and Efficiency

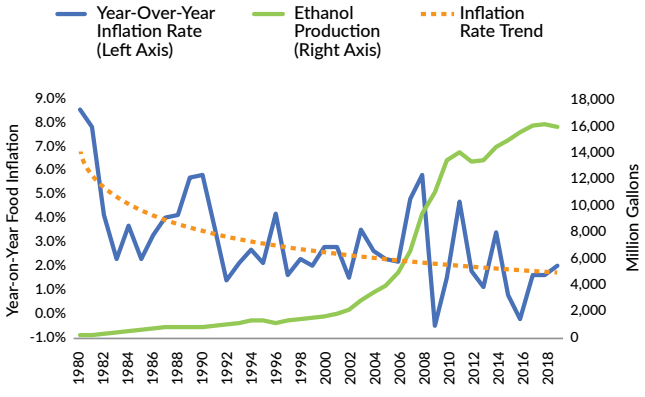
Renewable fuels have been under attack for years with assertions from critics that never rang true, or that have been addressed over time as the ethanol industry has grown in sustainability and efficiency. Here's a review of some key points that prove many of these accusations are wrong.

1.

Ethanol Does Not Raise Food Prices

One of the longest running attacks on ethanol is also one of the most incorrect. As a food ingredient, corn is extremely inexpensive, even when it was above $4 per bushel. And the total percentage of the "farm share" of every dollar spent on food has remained at less than 15 cents. In addition, as the ethanol industry has grown over the years, overall food inflation has decreased.

U.S. Food Price Inflation and Ethanol Production



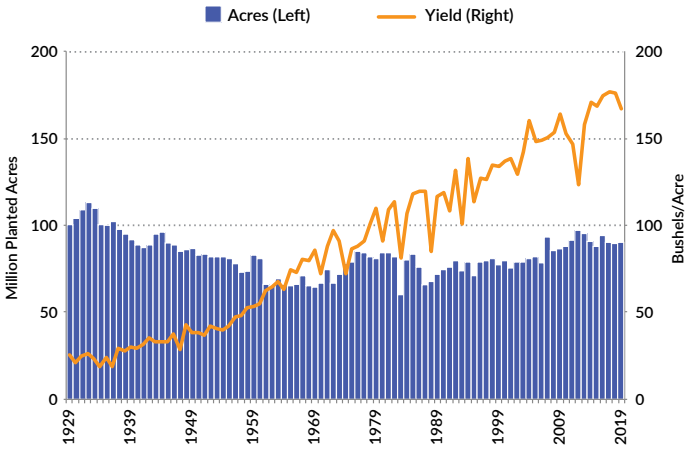
Source: RFA and U.S. Bureau of Labor Statistics; 2019 data estimated

2.

Cropland Has Not Expanded Because of Ethanol Production

Ethanol critics often assume that growing more corn involves planting more cropland. In reality, there has been little overall corn acreage increase with the advent of ethanol because farmers are growing so much more corn per acre. Even more, In the decade since the Renewable Fuel Standard was updated in 2007, total U.S. cropland actually decreased by 7%.

U.S. Corn Acreage and Average Yield



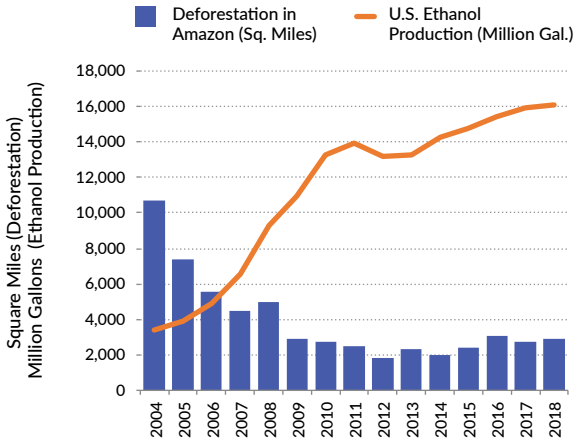
Source: RFA using U.S. Dept. of Agriculture data

3.

Amazon Deforestation Isn't Tied to U.S. Ethanol

Related to No. 2, some try to blame the destruction of the Amazon rainforest on biofuels production in the United States, under the guise of "indirect land use change." Again, the data tell a different story. There is no statistical correlation between Amazon deforestation and U.S. ethanol production. As with food inflation, the opposite appears to be true.

Amazon Deforestation Rates vs. U.S. Ethanol Production



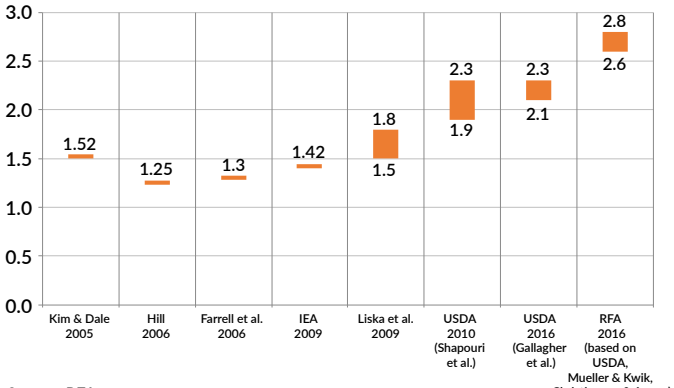
Source: RFA using Brazil National Institute for Space Research & U.S. Energy Information Administration data

4.

Ethanol is Energy Positive

The average energy balance of corn ethanol is in the range of producing 2.6 to 2.8 units of energy for every unit of energy used, with the top quartile of dry mill biorefineries averaging 3.2 to 3.4 and some plants very likely achieving 4.0. As far back as 2007, Professor Bruce Dale of Michigan State University attacked the idea of "net energy," pointing out further that "Gasoline's net energy is actually worse than that of ethanol." Attacks on ethanol need to be balanced with research into the ramifications of its removal from the fuel supply.

Dry Mill Corn Ethanol Average Energy Balance Ratio Estimates, 2005-2016



Source: RFA

Advocacy and Industry Support

The RFA has been the voice of the U.S. ethanol industry for almost 40 years. Effective advocacy in Washington today requires a strong technical foundation, effective messaging across numerous platforms, and passionate grassroots. With a combined 175 years of ethanol industry experience, the RFA staff brings unmatched industry knowledge and unrivaled dedication to every forum where biofuels are being discussed. Over the past year, the RFA testified before Congress, participated in regulatory hearings, argued in federal and district courts, and spoke at countless national and international events.

The RFA is far more than its staff, of course. As a producer-led organization where every company has a voice and a vote on policy, it is the membership that has driven our industry's success. By hosting policy makers at their facilities and participating in Washington Fly-ins, RFA member companies effectively deliver the ethanol industry's message to key decisionmakers. Through its various Committees, RFA member companies direct the association's technical, safety, research, marketing and regulatory priorities. And with regular interaction at RFA Board meetings and the National Ethanol Conference, RFA Members stay abreast of the policy, marketing, and technology developments that affect their bottom line.

If past is prologue, the coming months and years will bring dramatic change to ethanol policy and marketing. Count on the RFA and its membership to continue to lead the conversation, to develop the technical underpinnings, and to shape the message that will assure future growth.

Photo: MANDEL NGAN/AFP via Getty Images

RFA Committees

The RFA Technical Committee focuses on fuel specifications and standards development by ASTM International, National Conference of Weights and Measures, regulatory bodies, and other organizations. Committee members monitor technical issues impacting day-to-day plant operations, such as storage and handling, transportation, and fuel quality, as well as state and regional regulations and international blending practices.

Committee Chair: Cathy Woodliff, The Andersons, Inc.

The RFA Co-Products Committee focuses on issues relevant to co-products from ethanol production, including distillers grains, corn distillers oil, corn gluten, carbon dioxide and other products. Committee members address operational and regulatory issues concerning production, storage and handling, transportation, international trade, animal nutrition, and animal feed safety.

Committee Chair: Matt Fitzthum, CHS, Inc.

The RFA Environmental, Health and Safety Committee examines and educates industry stakeholders on the implementation of environmental regulations for production, storage and handling, and transportation of ethanol. The committee tackles complex regulatory issues and provides guidance to members. This committee also leads the industry in advocating safe practices in ethanol production, storage and handling, transportation, and use. Committee members monitor and share information on hazardous materials, safety standards, and federal and state safety regulations. The Committee also supports continuing education for every link of the ethanol supply chain.

Committee Chair: Steve Schleicher, Pinnacle Engineering, Inc.

The Renewable Fuels PAC builds a stronger voice for American-made renewable fuels on Capitol Hill. Organized and operated by RFA members and staff, this Political Action Committee promotes consistent and forward-looking public policy essential to the growth and evolution of the industry by focusing on federal election activity.

*Committee Chair: Randy Doyal, Al-Corn Clean Fuel LLC*LLC

Creatively Reaching Unique Audiences

Reaching audiences that often hear contrary ethanol messaging is important to the Renewable Fuels Association, and we do this in several powerful and creative ways, especially when it comes to boating and motorcycle enthusiasts who often are wary about ethanol blends. RFA's goal is to change consumer perceptions before they reach the fuel dispenser and note that it is more than just the gallons that run through those engines, they all own other vehicles and engines at home.

For the past few years, for example, RFA and the National Corn Growers Association have served as co-title sponsors for the Crappie Masters Tournament Trail, a group of tournaments spread across the country throughout the year, as a way to reach professional and recreational boaters. In June 2019, Crappie Masters President Mike Vallentine and Crappie Masters TV host Brian Sowers were featured in a national podcast and showcased the role ethanol plays in the tournament trail and how they educate participants on using E10 on the water and higher blends of ethanol on the road. At every tournament, each weekend, the winners have used E10 in their boats to bring home the trophy. RFA was featured at the first tournament of the year, along with the National Championship, which was host to over 150 fishing teams.

The RFA E85 Chopper remains a key element in several promotions since its creation in 2018, and Builder Paul Teutul, Jr. and was featured at the 2019 National Ethanol Conference. It was also featured at numerous consumer and member events throughout the year and found its way back to the annual Sturgis Motorcycle Rally. RFA has maintained a presence there for more than a decade.

At the 2019 Sturgis event, RFA sponsored the 12th annual Legends Ride with Twisted Sister's Dee Snider as the ride captain. RFA also hosted Free Fuel Happy Hours at the rally, providing a free tank of 93 octane E10 for nearly 1,000 motorcycles along with a ceremonial t-shirt. RFA enjoyed a clear presence throughout the 600+ acre campground with daily promotions, banners, videos on the jumbotrons, and addressing the concert crowd each night.

2019 Crappie Masters National Champions Robert Carlile and Craig Nichols found ethanol a clear and powerful winner for their tournament boat for that tournament and throughout the year.

In 2019, RFA partnered with Kenny Hauk to build a powerful E85 Jeep Wrangler with more than 1,100 horses under the hood and featured on television via Amazon Prime

Strong Endorsements for RFA and Ethanol

Finally, RFA kicked off a bold new project with legendary Jeep designer Kenny Hauk of Hauk Designs to bring ethanol back to global television, who built a custom Flex Fuel E85 Jeep Wrangler sporting more than 1,100 horsepower on E85. This build was featured at the 2019 SEMA show in Las Vegas and on the second season of "Hauk Machines," featured on Amazon Prime Video. The Jeep will be taken on tour by Hauk Designs throughout 2020 to consumer events across the country.

From their fishing boats to motorcycles to off-road vehicles, American consumers spend a lot of time and money on their recreational vehicles. When they see the value of putting ethanol into these prized possessions, they can be expected to seek it out for their everyday vehicles as well—and to promote its value to others. RFA is making a clear difference when it comes to ethanol and these high-profile consumers.

"When we are filling up our boat before coming to the tournaments, we never think twice about filling up with E10. We will continue to put ethanol in our boat."

- 2019 Crappie Masters National Champion Robert Carlile

"We are proud to use E10 in our boat and be a part of the group of winning teams who use ethanol. Our engine runs great when using ethanol-blended fuel. We see the benefits of running ethanol in our engine first-hand."

- 2019 Crappie Masters National Champion Craig Nichols

"I usually run ethanol in my bike. It runs better on ethanol and we get much better mileage. Yesterday, we filled up here in the morning and went 130 miles; she still had a quarter tank. The bikes run better on it."

- Buddy Merk, Biker at Sturgis

"Our goal was to build the most powerful JL Wrangler ever built that not only functions on road and off, but looks good while doing it. We have found E85 to be an outstanding fuel option that gives us the power and performance we have been looking for in an economical package and a fuel that can be bought at the local fuel station."

- Legendary Jeep Designer Kenny Hauk

Clockwise, from top:

Onstage at Sturgis, RFA enjoyed an audience of thousands and the opportunity to share important messages daily.

RFA's 2018 E85 Chopper remains a show-stopper wherever it's parked.

At the 2019 Sturgis Motorcycle Rally in South Dakota, RFA's Free Fuel Happy Hours led not just to happy bikers, but conversations about ethanol's suitability for their treasured motorcycles.

RFA MISSION

Drive expanded demand for American-made renewable fuels and bio-products worldwide.

RFA EXPERTISE

Regulation & Public Policy
Research & Economic Analysis
Ethanol/Co-product Production & Use
EHS Management
Safety & Emergency Preparedness
Air Quality & Health Effects
Global Market Development
Marketing & Promotion
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RFA STAFF

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Jackie Pohlman	Manager of Member Relations
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Missy Ruff	Director of Safety & Technical Programs
Robert White	Vice President of Industry Relations

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Tony Dennis	Office Manager
Bob Dinneen	Senior Strategic Advisor
Mary Giglio	Director of Special Projects & Events
Connor Hamburg	Director of Government Affairs
Edward S. Hubbard, Jr.	General Counsel

Find Bios & Contact Info at **EthanolRFA.org/staff**

RFF MISSION

Meet the research and education needs of the U.S. fuel ethanol industry.

RFF FOCUS

Collaboration with academia, industry, and public policymakers on new uses, feedstocks, and technologies to promote a growing and sustainable renewable fuels industry.

RFF BOARD OF DIRECTORS

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agmotion.com

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fcsamerica.com

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fluidquiptechnologies.com

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fremontind.com

The Greenbrier Companies Inc.
gbrx.com/home/

GROWMARK Inc.
growmark.com

Hawkeye Gold LLC, a subsidiary of J.D. Heiskell & Co.
heiskell.com

ICM Inc.
icminc.com

Illinois Corn Marketing Board
ilcorn.org

Indiana Corn Marketing Council
incorn.org/icmc

Innospec Fuel Specialties LLC
innospecinc.com

INTL FCStone Inc.
intlfcstone.com

Iowa Corn Growers Association
iowacorn.org

Iowa Renewable Fuels Association
iowarfa.org

Kansas Corn Commission
kscorn.com/kcc

Kansas Corn Growers Association
kscorn.com/kcga

KATZEN International Inc.
katzen.com

K•Coe Isom
kcoe.com

Kentucky Corn Promotion Council
kycorn.org/ky-corn-promotion-council

Kentucky Corn Growers Association
kycorn.org

Lallemand Biofuels & Distilled Spirits
lallemandbds.com

Lesaffre Advanced Fermentations—Leaf
lesaffreadvancedfermentations.com

Merjent Inc.
merjent.com

Minnesota Bio-Fuels Association
mnbiofuels.org

Minnesota Corn Growers Association
mncorn.org

Minnesota Corn Research & Promotion Council
mncorn.org

Missouri Corn Growers Association
mocorn.org

Missouri Corn Merchandising Council
mocorn.org

MoistTech Corp.
moisttech.com

Mole•Master Services Corp.
molemaster.com

Murex LLC
murexltd.com

NALCO Water
ecolab.com/nalco-water

National Corn Growers Association
ncga.com

Nebraska Corn Board
nebraskacorn.gov

Nebraska Corn Growers Association
nebraskacorn.org

Nebraska Ethanol Board
ethanol.nebraska.gov

Novozymes
novozymes.com/en/advance-your-business/bioenergy

Ohio Corn Marketing Program
ohiocornandwheat.org

Phibro Ethanol Performance Group
ethanolperformancegroup.com

Pinnacle Engineering Inc.
pineng.com

Protec Fuel Management LLC
protecfuel.com

The ProExporter Network
prxgeo.com

Renewable Fuels Nebraska
renewablefuelsne.com

Renew Kansas
renewkansas.com

RPMG LLC
rpmgllc.com

RSM US LLP
rsmus.com

SUEZ Water Technologies
suezwatertechnologies.com

Syngenta US
syngenta-us.com

TrinityRail
trinityrail.com

USD Group LLC
usdg.com

Whitefox Technologies Ltd.
whitefox.com

Wisconsin BioFuels Association
wibiofuels.org

RFA Supporting Members

Agricultural Retailers Association
aradc.org

Bemidji (MN) State University
bemidjistate.edu

Bismarck State College
bismarckstate.edu

Colorado Corn Growers Association
coloradocorn.com/ccga

Colorado Farm Bureau
coloradofarmbureau.com

Corn Marketing Program of Michigan
micorn.org/cmpm

Distillers Grains Technology Council
distillersgrains.org

Great Falls (MT) Development Authority Inc.
gfdevelopment.org

Iowa Central Fuel Testing Laboratory
iowafuellab.com

Jamestown/Stutsman County Development Corp.
growingjamestown.com/jsdc

Kentucky Energy & Environment Cabinet—Office of Energy Policy
energy.ky.gov

Maryland Grain Producers Utilization Board
marylandgrain.org

Michigan State University Dept. of Agricultural, Food & Resource Economics
canr.msu.edu/afre

Minnesota Dept. of Agriculture
mda.state.mn.us

Mississippi State University Dept. of Forestry
cfr.msstate.edu/forestry

Morton College
morton.edu

National Corn-to-Ethanol Research Center
ethanolresearch.com

National Sorghum Producers
sorghumgrowers.com

North Dakota Corn Council
ndcorn.org/corncouncil

South Dakota Corn Growers Association
sdcorn.org

South Dakota Corn Utilization Council
sdcorn.org

Steele-Waseca Cooperative Electric
swce.coop

Texas Renewable Energy Industries Alliance
treia.org

United Association
ua.org

United Sorghum Checkoff Program
sorghumcheckoff.com

Wisconsin Pipe Trades
wipipetrades.org

2020 U.S. ETHANOL PRODUCTION CAPACITY BY PLANT

Company	Location	State	Feedstock	Production Capacity (mgy)	Operating Production (mgy)	Under Construction/ Expansion Capacity (mgy)
Absolute Energy LLC	St. Ansgar	IA	Corn	125	125	-
Ace Ethanol LLC	Stanley	WI	Corn/Cellulosic Biomass	54	54	-
Adkins Energy LLC	Lena	IL	Corn	60	60	-
Aemetis Inc.	Keyes	CA	Corn/Sorghum	60	60	-
Al-Corn Clean Fuel LLC	Claremont	MN	Corn	125	125	-
Alliance Bio-Products Inc.	Vero Beach	FL	Cellulosic Biomass	8	-	-
Archer Daniels Midland Co.	Clinton	IA	Corn	238	238	-
Archer Daniels Midland Co.	Decatur	IL	Corn	300	300	-
Archer Daniels Midland Co.	Marshall	MN	Corn	40	40	-
Archer Daniels Midland Co.	Peoria	IL	Corn	185	85	-
Archer Daniels Midland Co. Plant 1	Cedar Rapids	IA	Corn	300	300	-
Archer Daniels Midland Co. Plant 2	Cedar Rapids	IA	Corn	240	240	-
Archer Daniels Midland Co. Plant 1	Columbus	NE	Corn	100	100	-
Archer Daniels Midland Co. Plant 2	Columbus	NE	Corn	313	313	-
Arkalon Energy LLC	Liberal	KS	Corn	110	110	-
Attis Biofuels, Inc.	Fulton	NY	Corn	100	100	-
Badger State Ethanol LLC	Monroe	WI	Corn	90	90	-
Big River Resources Boyceville LLC	Boyceville	WI	Corn	57	57	-
Big River Resources Galva LLC	Galva	IL	Corn	110	110	-
Big River Resources West Burlington LLC	West Burlington	IA	Corn	105	105	-
Big River United Energy LLC	Dyersville	IA	Corn	110	110	-
Blue Flint Ethanol LLC	Underwood	ND	Corn	70	70	-
Bonanza BioEnergy LLC	Garden City	KS	Corn/Sorghum	55	55	-
Bridgeport Ethanol LLC	Bridgeport	NE	Corn	50	50	-
Bushmills Ethanol Inc.	Atwater	MN	Corn	90	90	-
Butamax Advanced Biofuels LLC	Scandia	KS	Corn	10	10	-
Calgren Renewable Fuels LLC	Pixley	CA	Corn	55	55	-
Carbon Green BioEnergy LLC	Woodbury	MI	Corn	40	40	-
Cardinal Ethanol LLC	Union City	IN	Corn	100	100	-
Cargill Inc.	Blair	NE	Corn	210	210	-
Cargill Inc.	Eddyville	IA	Corn	35	35	-
Cargill Inc.	Ft. Dodge	IA	Corn	115	115	-
Center Ethanol Company LLC	Sauget	IL	Corn	54	-	-
Central Indiana Ethanol LLC (CIE)	Marion	IN	Corn	55	55	-
Chief Ethanol Fuels Inc.	Hastings	NE	Corn	70	70	-
Chief Ethanol Fuels Inc.	Lexington	NE	Corn	50	50	-
Chippewa Valley Ethanol Co.	Benson	MN	Corn	50	50	-
CHS Inc.	Annawan	IL	Corn	125	125	-
CHS Inc.	Rochelle	IL	Corn	133	133	-
Commonwealth Agri-Energy LLC	Hopkinsville	KY	Corn	45	45	-
Corn LP	Goldfield	IA	Corn	60	60	-
Corn Plus	Winnebago	MN	Corn	42	-	-
Dakota Ethanol LLC	Wentworth	SD	Corn	52	52	-
Dakota Spirit AgEnergy LLC	Spiritwood	ND	Corn	65	65	-
DENCO II LLC	Morris	MN	Corn	24	24	-
Diamond Ethanol LLC (Conestoga Energy Partners LLC)	Levelland	TX	Corn	40	-	-
Didion Ethanol LLC	Cambria	WI	Corn	50	50	-
E Energy Adams LLC	Adams	NE	Corn	80	80	-
East Kansas Agri-Energy LLC	Garnett	KS	Corn	42	42	-
ELEMENT LLC	Colwich	KS	Corn/Sorghum/Cellulosic Biomass	-	-	70
Elite Octane LLC	Atlantic	IA	Corn	120	120	-
ESE Alcohol Inc.	Leoti	KS	Waste Seed Corn	2	2	-
Flint Hills Resources LLC	Arthur	IA	Corn	120	120	-

Company	Location	State	Feedstock	Production Capacity (mgy)	Operating Production (mgy)	Under Construction/ Expansion Capacity (mgy)
Flint Hills Resources LLC	Camilla	GA	Corn	120	120	-
Flint Hills Resources LLC	Fairbank	IA	Corn	120	120	-
Flint Hills Resources LLC	Fairmont	NE	Corn	120	120	-
Flint Hills Resources LLC	Iowa Falls	IA	Corn/Cellulosic Biomass	120	120	-
Flint Hills Resources LLC	Menlo	IA	Corn	120	120	-
Flint Hills Resources LLC	Shell Rock	IA	Corn/Cellulosic Biomass	120	120	-
Fox River Valley Ethanol LLC	Oshkosh	WI	Corn	65	65	-
Front Range Energy LLC	Windsor	CO	Corn	40	40	-
Gevo Inc.	Luverne	MN	Corn	20	20	-
Glacial Lakes Energy LLC	Aberdeen	SD	Corn	53	53	-
Glacial Lakes Energy LLC	Huron	SD	Corn	32	32	-
Glacial Lakes Energy LLC	Mina	SD	Corn	100	100	-
Glacial Lakes Energy LLC	Watertown	SD	Corn	120	120	-
Golden Grain Energy LLC	Mason City	IA	Corn	145	145	-
Golden Triangle Energy LLC	Craig	MO	Corn	20	5	-
Grain Processing Corp.	Muscatine	IA	Corn	20	20	-
Grain Processing Corp.	Washington	IN	Corn	20	20	-
Granite Falls Energy LLC	Granite Falls	MN	Corn	65	65	-
Green Plains Inc.	Atkinson	NE	Corn	55	55	-
Green Plains Inc.	Central City	NE	Corn	116	116	-
Green Plains Inc.	Fairmont	MN	Corn	119	119	-
Green Plains Inc.	Fergus Falls	MN	Corn	55	55	-
Green Plains Inc.	Hereford	TX	Corn	105	105	-
Green Plains Inc.	Madison	IL	Corn	90	90	-
Green Plains Inc.	Mount Vernon	IN	Corn	90	90	-
Green Plains Inc.	Obion	TN	Corn	120	120	-
Green Plains Inc.	Ord	NE	Corn	65	65	-
Green Plains Inc.	Shenandoah	IA	Corn	82	82	-
Green Plains Inc.	Superior	IA	Corn	60	60	-
Green Plains Inc.	Wood River	NE	Corn	121	121	-
Green Plains Inc.	York	NE	Corn	50	50	-
Guardian Energy LLC	Janesville	MN	Corn	149	149	-
Guardian Hankinson LLC	Hankinson	ND	Corn	149	149	-
Guardian Lima LLC	Lima	OH	Corn	70	70	-
Heartland Corn Products	Winthrop	MN	Corn	120	120	-
Heron Lake BioEnergy LLC	Heron Lake	MN	Corn	65	65	-
Highwater Ethanol LLC	Lamberton	MN	Corn	65	65	-
Homeland Energy Solutions LLC	Lawler	IA	Corn	200	200	-
Husker Ag LLC	Plainview	NE	Corn	76	76	-
ICM Biofuels LLC	St. Joseph	MO	Corn	50	50	-
Ingredion Inc.	Cedar Rapids	IA	Corn	45	45	-
Iroquois Bio-Energy Co. LLC	Rensselaer	IN	Corn	50	50	-
KAAPA Ethanol LLC	Minden	NE	Corn	80	80	-
KAAPA Ethanol Ravenna LLC	Ravenna	NE	Corn	125	125	-
Kansas Ethanol LLC	Lyons	KS	Corn	80	80	-
Lincolnland Agri-Energy LLC	Palestine	IL	Corn	60	60	-
Lincolnway Energy LLC	Nevada	IA	Corn	50	50	-
Little Sioux Corn Processors LLC	Marcus	IA	Corn	160	160	-
Louis Dreyfus Commodities LLC	Grand Junction	IA	Corn/Cellulosic Biomass	125	125	-
Louis Dreyfus Commodities LLC	Norfolk	NE	Corn	45	45	-
Marquis Energy LLC	Hennepin	IL	Corn	400	400	-
Marquis Energy-Wisconsin LLC	Necedah	WI	Corn	100	50	-
Marysville Ethanol LLC	Marysville	MI	Corn	50	50	-
Maumee Express Inc.	Abingdon	VA	Waste Alcohol	4	4	-

Company	Location	State	Feedstock	Production Capacity (mgy)	Operating Production (mgy)	Under Construction/ Expansion Capacity (mgy)
Merrick & Company Inc.	Aurora	CO	Waste Alcohol	3	3	-
Mid-America BioEnergy LLC	Madrid	NE	Corn	46	46	-
Mid-Missouri Energy Inc.	Malta Bend	MO	Corn	50	50	-
Midwest Renewable Energy LLC	Sutherland	NE	Corn	28	-	-
Nebraska Corn Processing LLC	Cambridge	NE	Corn	44	44	-
New Energy Spirit Biomass Refinery LLC	Jamestown	ND	Wheat Straw	-	-	16
NuGen Energy LLC	Marion	SD	Corn	130	130	-
One Earth Energy LLC	Gibson City	IL	Corn	120	120	-
Pacific Ethanol Inc.	Boardman	OR	Corn	40	40	-
Pacific Ethanol Inc.	Burley	ID	Corn	60	60	-
Pacific Ethanol Inc.	Madera	CA	Corn/Sorghum	40	40	-
Pacific Ethanol Inc.	Stockton	CA	Corn/Sorghum/Cellulosic Biomass	60	60	-
Pacific Ethanol Inc. (ICP)	Pekin	IL	Corn	90	75	-
Pacific Ethanol Inc. Plant 1	Aurora	NE	Corn	45	-	-
Pacific Ethanol Inc. Plant 2	Aurora	NE	Corn	100	100	-
Pacific Ethanol Inc. Plant 1	Pekin	IL	Corn	100	100	-
Pacific Ethanol Inc. Plant 2	Pekin	IL	Corn	60	60	-
Parallel Products	Louisville	KY	Waste Sugars/Alcohol	3	3	-
Parallel Products	Ontario	CA	Waste Sugars/Alcohol	3	3	-
Pennsylvania Grain Processing LLC	Clearfield	PA	Corn	110	110	-
Pinal Energy LLC	Maricopa	AZ	Corn	50	-	-
Pine Lake Corn Processors LLC	Steamboat Rock	IA	Corn	38	38	-
Plymouth Energy LLC	Merrill	IA	Corn	50	50	-
POET Biorefining - Alexandria LLC	Alexandria	IN	Corn	68	68	-
POET Biorefining - Ashton LLC	Ashton	IA	Corn	56	56	-
POET Biorefining - Big Stone LLC	Big Stone City	SD	Corn	79	79	-
POET Biorefining - Bingham Lake LLC	Bingham Lake	MN	Corn	35	35	-
POET Biorefining - Caro LLC	Caro	MI	Corn	53	53	-
POET Biorefining - Chancellor LLC	Chancellor	SD	Corn	110	110	-
POET Biorefining - Cloverdale LLC	Cloverdale	IN	Corn	92	-	-
POET Biorefining - Coon Rapids LLC	Coon Rapids	IA	Corn	54	54	-
POET Biorefining - Corning LLC	Corning	IA	Corn	65	65	-
POET Biorefining - Emmetsburg LLC	Emmetsburg	IA	Corn	55	55	-
POET Biorefining - Fostoria LLC	Fostoria	OH	Corn	68	68	-
POET Biorefining - Glenville LLC (Agra Resources LLC)	Albert Lea	MN	Corn	42	42	-
POET Biorefining - Gowrie LLC	Gowrie	IA	Corn	69	69	-
POET Biorefining - Groton LLC	Groton	SD	Corn	53	53	-
POET Biorefining - Hanlontown LLC	Hanlontown	IA	Corn	56	56	-
POET Biorefining - Hudson LLC	Hudson	SD	Corn	56	56	-
POET Biorefining - Jewell LLC	Jewell	IA	Corn	69	69	-
POET Biorefining - Laddonia LLC	Laddonia	MO	Corn	50	50	-
POET Biorefining - Lake Crystal LLC	Lake Crystal	MN	Corn	56	56	-
POET Biorefining - Leipsic LLC	Leipsic	OH	Corn	68	68	-
POET Biorefining - Macon LLC	Macon	MO	Corn	46	46	-
POET Biorefining - Marion LLC	Marion	OH	Corn	150	150	-
POET Biorefining - Mitchell LLC	Mitchell	SD	Corn	68	68	-
POET Biorefining - North Manchester LLC	North Manchester	IN	Corn	68	68	-
POET Biorefining - Portland LLC	Portland	IN	Corn	68	68	-
POET Biorefining - Preston LLC	Preston	MN	Corn	46	46	-
POET Biorefining - Shelbyville LLC	Shelbyville	IN	Corn	-	-	80
POET Research Center	Scotland	SD	Corn	11	11	-
Prairie Horizon Agri-Energy LLC	Phillipsburg	KS	Corn	45	45	-
Pratt Energy LLC	Pratt	KS	Corn	57	57	-
Project LIBERTY	Emmetsburg	IA	Cellulosic Biomass	20	-	-
Quad County Corn Processors Cooperative	Galva	IA	Corn/Cellulosic Biomass	38	38	-
Red River BioRefinery LLC	Grand Forks	ND	Waste Sugars/Starch	-	-	17
Red River Energy LLC	Rosholt	SD	Corn	35	35	-

Company	Location	State	Feedstock	Production Capacity (mgy)	Operating Production (mgy)	Under Construction/ Expansion Capacity (mgy)
Red Trail Energy LLC	Richardton	ND	Corn	50	50	-
Redfield Energy LLC	Redfield	SD	Corn	60	60	-
Reeve Agri-Energy Inc.	Garden City	KS	Corn/Sorghum	12	12	-
Ringneck Energy & Feed LLC	Onida	SD	Corn	80	80	-
Russell Ethanol Inc.	Russell	KS	Corn/Sorghum/Waste Starch	55	55	-
Show Me Ethanol LLC	Carrollton	MO	Corn	60	60	-
Siouxland Energy Cooperative	Sioux Center	IA	Corn	90	90	-
Siouxland Ethanol LLC	Jackson	NE	Corn	80	80	-
South Bend Ethanol LLC	South Bend	IN	Corn	102	102	-
Southwest Iowa Renewable Energy LLC	Council Bluffs	IA	Corn	140	140	-
Spectrum Business Ventures Inc.	Mead	NE	Corn	25	-	-
Sterling Ethanol LLC	Sterling	CO	Corn	42	42	-
Summit Natural Energy LLC	Cornelius	OR	Waste Sugars/Starch	2	2	-
Synata Bio Inc.	Hugoton	KS	Cellulosic Biomass	25	-	-
Tate & Lyle PLC	Loudon	TN	Corn	110	110	-
Tharaldson Ethanol LLC	Casselton	ND	Corn	153	153	-
The Andersons Albion Ethanol LLC	Albion	MI	Corn	140	140	-
The Andersons Clymers Ethanol LLC	Clymers	IN	Corn	135	135	-
The Andersons Denison Ethanol LLC	Denison	IA	Corn	65	65	-
The Andersons Marathon Ethanol LLC	Greenville	OH	Corn	135	135	-
Three Rivers Energy LLC	Coshocton	OH	Corn	50	-	-
Trenton Agri Products LLC	Trenton	NE	Corn	45	45	-
Tyton NC Biofuels LLC	Raeford	NC	Corn/Tobacco	60	-	-
United Ethanol LLC	Milton	WI	Corn	62	62	-
United Wisconsin Grain Producers LLC	Friesland	WI	Corn	60	60	-
Valero Renewable Fuels Co. LLC	Albert City	IA	Corn	135	135	-
Valero Renewable Fuels Co. LLC	Albion	NE	Corn	135	135	-
Valero Renewable Fuels Co. LLC	Aurora	SD	Corn	140	140	-
Valero Renewable Fuels Co. LLC	Bloomingburg	OH	Corn	135	135	-
Valero Renewable Fuels Co. LLC	Bluffton	IN	Corn	115	-	-
Valero Renewable Fuels Co. LLC	Charles City	IA	Corn	140	140	-
Valero Renewable Fuels Co. LLC	Fort Dodge	IA	Corn	140	140	-
Valero Renewable Fuels Co. LLC	Hartley	IA	Corn	140	140	-
Valero Renewable Fuels Co. LLC	Jefferson	WI	Corn	110	110	-
Valero Renewable Fuels Co. LLC	Lakota	IA	Corn	110	110	-
Valero Renewable Fuels Co. LLC	Linden	IN	Corn	135	135	-
Valero Renewable Fuels Co. LLC	Mount Vernon	IN	Corn	100	100	-
Valero Renewable Fuels Co. LLC	Riga	MI	Corn	55	-	-
Valero Renewable Fuels Co. LLC	Welcome	MN	Corn	140	140	-
VERBIO North America Corp.	Nevada	IA	Cellulosic Biomass	30	*	-
Western New York Energy LLC	Medina	NY	Corn	65	65	-
Western Plains Energy LLC	Campus	KS	Corn/Sorghum	50	50	-
White Energy Inc.	Hereford	TX	Corn/Sorghum	130	130	-
White Energy Inc.	Plainview	TX	Corn	100	100	-
Yuma Ethanol LLC	Yuma	CO	Corn	40	40	-
U.S. TOTAL				**16,964**	**16,045**	**183**

** Actual operating production unknown; not included in total.*

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