



Ethanol Today & Tomorrow

AHB ENERGY LITERACY INFOSHEET #1

Ethanol Basics

Ethanol is an alcohol fuel made by fermenting the sugar of plant material. Almost all gasoline sold in the U.S. is blended with up to 10% ethanol. Flex fuel vehicles can run on 85% ethanol (E85).

Currently, most ethanol is made from corn (in the U.S.) or sugarcane (in Brazil).

The Corn Ethanol Debate

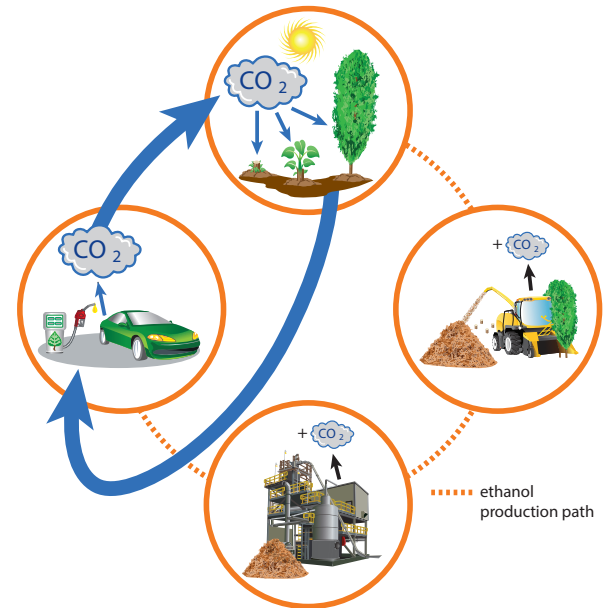
Benefits of corn ethanol include:

- Increased energy security.
- Economic opportunities for farmers.
- Moderate reductions in net greenhouse gas emissions (GHG).

Concerns over corn ethanol include:

- Reductions in net GHG are minimal.
- Corn production is energy intensive, reducing the energy return on fuel.
- Environmental concerns associated with corn production include nutrient and chemical runoff, erosion, and water use.
- Additional demand for corn can lead to land use changes linked to climate change and habitat loss, and may impact food prices.

Carbon Cycle of Ethanol





Plants take in CO₂ and turn it into sugar (photosynthesis). The sugar is extracted, converted into ethanol, and, when burned, the CO₂ is released. Because this carbon was taken from the atmosphere by the plant (and will be taken up again by new plants), there is no net increase in atmospheric CO₂.

Some new CO₂ is added to the atmosphere due to crop production, energy use at the biorefinery, and transportation of the fuel, resulting in net GHG emissions.

Cellulosic Ethanol: a new generation of biofuels

Cellulosic ethanol, made from agricultural residues and non-food energy crops, is emerging as a more sustainable fuel. Feedstocks such as wood, corn stover, wheat straw, and switchgrass have less-intensive farming practices, resulting in greater reductions in net greenhouse gas emissions.

Corn — Cellulosic Ethanol Comparison

	<i>Reductions in net greenhouse gas emissions compared to gasoline</i>	<i>Conversion process</i>	<i>Conversion efficiency</i>	<i>Feedstock sustainability</i>
 Corn Ethanol	21-49%	Fermentation by yeast	110 gal per ton corn	High rates of erosion, and fertilizer and chemical inputs
 Cellulosic Ethanol	64% for corn stover 89% for wood	Hydrolysis then fermentation by yeast or bacteria	82-142 gal per ton wood	Fewer inputs; agricultural by-product or grown on marginal land

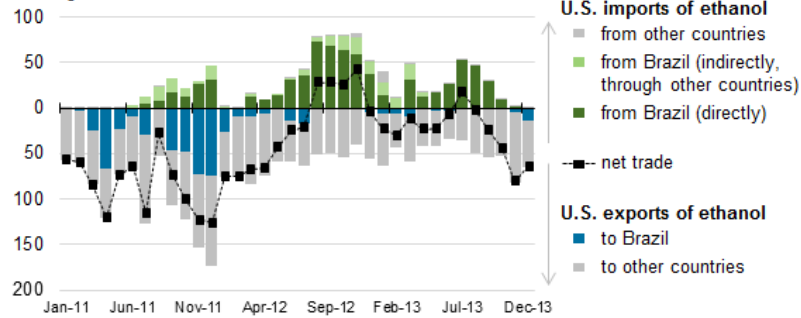
Ethanol's Global Market

In 2013, the U.S. produced over 13 billion gallons of ethanol. As the world's largest ethanol producer, the U.S. exports ethanol to Brazil, Europe, Canada, the Middle East, and Asia.

Monthly U.S. ethanol trade with Brazil and other countries

January 2012 to December 2013

million gallons



Source: U.S. Energy Information Administration

Note: Light green areas represent Brazilian ethanol converted from hydrous to anhydrous ethanol in other countries before entering the United States.

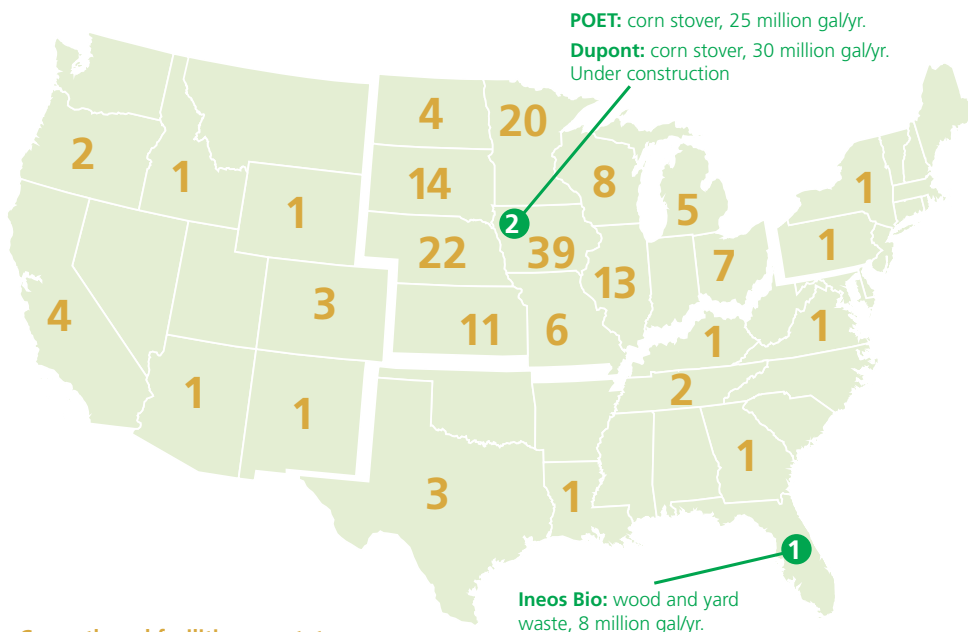


Low Carbon Fuel Standards (LCFS) in states such as California may inadvertently be driving ethanol to move around the globe. Brazilian sugarcane ethanol is considered to have a lower carbon intensity than corn ethanol, so it is imported from Brazil to meet LCFS goals. Simultaneously, U.S. corn ethanol is exported to other countries and back to Brazil to replace the market share imported to the U.S. This "fuel shuffle" promotes the transport of ethanol further distances than necessary, increases its overall carbon emissions.

What's next for Clean Fuel Standards?

Developing local markets for low-carbon renewable fuels is an important step for energy security and reducing our global carbon footprint.

Ethanol production facilities in the U.S.



Corn ethanol facilities per state

Cellulosic ethanol facilities

2014 marked the first year for commercial scale harvests of agricultural residues for cellulosic ethanol. As the market grows there may be opportunities for dedicated cellulosic energy crops such as poplar and switchgrass.



Did you know?

The Ford Model T was designed to run on ethanol.



The Need for Policy

Corn ethanol is strongly supported by government policies and subsidies. In order for cellulosic ethanol to be competitive, policies must shift toward alternative feedstocks. The government has invested generously into R&D of cellulosic biofuels, but incentives must be put into place to allow for commercialization and long-term sustainability.

hardwoodbiofuels.org

This project is supported by Agriculture and Food Research Initiative (AFRI) Competitive Grant no. 2011-68005-30407 from the USDA National Institute of Food and Agriculture (NIFA).



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