

The Importance of Ethanol: Awareness and Outreach

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The Importance of Ethanol

This material will discuss the importance of ethanol and flexible fuel vehicles. The advantages and reasons to consider adopting ethanol vehicles will be explored, as well as a discussion of the health, environmental, economic, and energy security benefits associated with alternative fuel technology. Finally, suggested actions to support and resources to learn more about alternative fuels such as ethanol will be presented.

Objectives

- Describe how ethanol may help improve public health
- Describe the benefits of ethanol to the environment
- Explain how ethanol may help stimulate the economy
- Describe what energy security is and how using ethanol can help attain it
- Explain the future of ethanol
- Explain the suggested actions to support ethanol

Why Consider Ethanol?

Ethanol is a renewable fuel alternative to gasoline. Pure ethanol is nontoxic, biodegradable, and sulfur-free. Using ethanol can positively affect the health of U.S. citizens and the impact on the environment by contributing to cleaner air and energy independence.

There are many reasons to consider the use of ethanol. Overall, ethanol produces cleaner tailpipe emissions and is relatively harmless if spilled. Since ethanol is a renewable fuel that can be made from domestic crops, additional ethanol production would boost the U.S. economy by creating new jobs.

As shown in **Figure 1**, corn, sugarcane, and cellulosic ethanol are promising solutions for significantly reducing greenhouse gas emissions from transportation fuels.

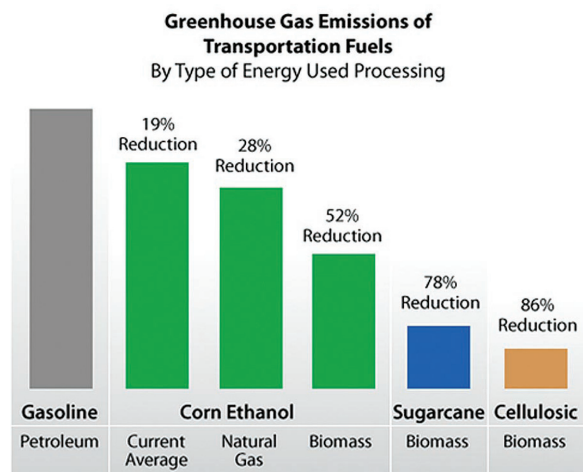


Figure 1: Emission reductions by type. Source: DOE Biomass Program.

Ethanol Benefits

There are also other benefits to using ethanol to fuel vehicles — for the betterment of human health and the environment, the economy, and national energy security, and to help reduce the dependence on foreign oil.



Health Benefits

According to the National Research Council, carbon monoxide (CO) emissions are responsible for as much as 20% of smog formation in the atmosphere. Carbon monoxide emissions are created when gasoline is not completely burned. Ethanol is a very high-octane fuel that contains about 35% oxygen by weight. This allows ethanol fuel mixtures to burn more completely, thus reducing harmful tailpipe emissions.

Ethanol is nontoxic, water soluble, and quickly biodegradable. It is a renewable fuel produced from plants, unlike petroleum-based fossil fuels that have a limited supply and are the major contributor of carbon dioxide (CO₂) emissions, a greenhouse gas (GHG). Ethanol displaces the use of toxic gasoline components such as benzene, a carcinogen. Research is ongoing to ensure exhaust aftertreatment systems address any harmful emissions from ethanol fuels that may differ from gasoline. Fortunately, the use of ethanol in transportation has proven to reduce CO₂ and GHG emissions, lessening the risks of respiratory illness and asthma.

By-products of ethanol production also can benefit the health of livestock. During drymill ethanol production, only the starch portion of the corn (about 70% of the kernel) is used. The remaining nutrients — fat, protein, vitamins, and minerals — are left in what is called distillers grain, which is a valuable and nutritious feed for livestock.



Environmental Benefits

Pure ethanol is highly biodegradable and, if spilled, poses much less of a threat than spilled petroleum, making it safe for the environment (see **Figure 3**). The Renewable Fuels Association (RFA) states that there is “no fuel available at scale today that matches ethanol’s ability to improve overall environmental quality compared to gasoline.”



Did You Know?

American Lung Association of Metropolitan Chicago credits ethanol-blended reformulated gasoline with reducing smog-forming emissions by 25% since 1990.

Source: American Coalition for Ethanol, 2011

Notes



Energy Security Benefits

The Renewable Fuels Association's 2011 Ethanol Industry Outlook report also calculated that in 2011 the ethanol industry replaced the gasoline produced from more than 485 million barrels of imported oil.

The U.S. is one of the greatest exporters of agricultural products in the world. American corn alone can be sold in other countries, with tariffs and taxes, for less than many countries may produce it for themselves. Unfortunately, this is not the case with many fuel stocks. Roughly half of U.S. oil was imported from overseas in 2010.

As crude oil prices continue to rise, it is imperative that alternative fuel options be explored. Ethanol can be manufactured using the existing industrial production capacity. Its use provides substantial opportunity for immediately addressing U.S. energy security issues. Taking advantage of the American feedstock production, the ethanol industry can provide a solution to dependency on foreign oil.

Since ethanol can be produced in the United States, widespread use of ethanol as an alternative fuel would decrease the country's reliance on foreign oil supplies.



Renewable Benefits

The renewability of a fuel is often referenced by the energy balance, or the ratio of how much energy is required to produce and distribute the fuel compared to the amount of energy the fuel releases when it is burned. A higher energy balance ratio indicates a lower environmental impact because less fossil energy is needed to produce, refine, and distribute the fuel.

Ethanol is a renewable fuel that can be made from domestic crops, therefore reducing U.S. dependence on foreign oil. Unlike oil and gasoline, it can be produced and replenished by actions, such as growing crops. Currently, ethanol is made primarily from corn, but it also can be produced from renewable **biomass** resources.



Did You Know?

For every barrel of ethanol produced (1 barrel = 42 gallons), 1.34 barrels of petroleum are displaced at the refinery.

Source: Argonne National Laboratory

Notes

Suggested Actions

Ethanol is an alternative fuel that is produced from corn, sugarcane, wheat, and other agricultural products (see **Figure 4**). This fuel is then added to gasoline in varying amounts depending upon the desired end-use. Since ethanol can be made from domestically grown crops, it has the potential to reduce the nation's dependence on foreign oil. This will not only boost the domestic agricultural sector, but it will also ensure access to a domestic fuel.

Today, there are millions of flexible fuel vehicles on the roads that are capable of using E85 as a fuel source. E85 is up to 83% ethanol. Manufacturers are beginning to produce more vehicles that are able to utilize E85, and several have laid out plans to introduce more models in the future.

Since ethanol has lower energy content than conventional gasoline, many consumers may be skeptical about its true potential as an alternative fuel. Any price or fuel mileage difference should be adjusted to gasoline gallon equivalent (GGE) for direct comparison with gasoline. By using ethanol instead of conventional gasoline, consumers can reduce their carbon footprint and greenhouse gas emissions.

There are more than 2,500 E85 stations across the U.S. This number increases each year as the number of flexible fuel vehicles on the road continues to increase.



Figure 5: Fuel pump label for fuels that contain up to 10% ethanol. Source: NAFTC.



Figure 4: Domestically grown sugar beet. Source: NAFTC.

Additionally, nearly all of the gasoline consumed in the U.S. contains at least some ethanol (see **Figure 5**). As demand for this fuel continues to increase, the need for additional feedstock and biomass growth will also expand. Also, as demand increases, new processing and production facilities will be needed.

Consumers should also be aware of flexible fuel vehicles in general. All FFVs can operate on gasoline alone, and most vehicle manufacturers offer flexible fuel versions of their models. While there are fewer E85 stations, check local stations that may offer any blend up to E85 and fill FFVs up with these blends whenever possible. Check the fuel cap to determine if the vehicle in use is compatible with E85 (see **Figure 6**).



Figure 6: E85 cap on a flexible fuel vehicle.
Source: NAFTC.

Flexible fuel vehicles are some of the most widely available alternative fuel vehicles on the road. Most manufacturers produce FFVs. Some of these include Chrysler, Ford Motor Company, General Motors Corporation, Mazda, Mercury, and Isuzu as well as others. In 2020, General Motors predicts to have more than 20 million ethanol capable vehicles on the road. Most FFVs have badges to show that they may utilize ethanol fuels (see **Figures 7 and 8**). When purchasing new vehicles, check for these badges or similar badges and fuel caps to ensure flexible fuel compatibility.



Figure 7: GM flexible fuel vehicle badge.
Source: GM.



Figure 8: Ford flexible fuel vehicle badge.
Source: Ford.

SPECIAL NOTE: The Energy Independence and Security Act of 2007 (EISA) requires use of 36 billion gallons of renewable transportation fuels in the U.S. by 2022. Of that quantity, 16 billion gallons must be cellulosic biofuels. Ethanol from corn is capped at 15 billion gallons.

Source: U.S. Dept of Energy (DOE)

Notes

Summary

Ethanol has the ability to dramatically change the atmosphere of the fueling landscape in the U.S. The biomass and feedstock that are used to create ethanol can be sourced domestically, and the processing that is required to turn these items into fuel can also be done within the U.S. While ethanol has a lower energy content than conventional gasoline, lower prices help maintain its economic advantage. Ethanol offers several benefits to the country's economy, environment, and overall health. Ethanol is already an integral part of the country's fueling infrastructure, and it continues to grow as production and demand increase.

Upon completing this material, can you

- Describe how ethanol may help improve public health?
- Describe the benefits of ethanol to the environment?
- Explain how ethanol may help stimulate the economy?
- Describe what energy security is and how using ethanol can help attain it?
- Explain the future of ethanol?
- Explain the suggested actions to support ethanol?



Test Your Knowledge

- 1) List four characteristics of ethanol as a fuel.
- 2) **True or False:** Ethanol made from corn today results in a GHG emission reduction of 10% compared to conventional gasoline.
- 3) **True or False:** Ethanol production has a positive energy balance.
- 4) **True or False:** Nearly all gasoline used in the U.S. contains some ethanol.

Answers: 1) Nontoxic, biodegradable, sulfur-free, renewable; 2) False — ethanol made from corn can reduce GHG emissions by up to about 19-20%; 3) True; 4) True

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www.naftc.wvu.edu/cleancitieslearningprogram
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