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U.S. Biofuels: Climate Change and Policies

Over the last decade, biofuels have been championed in the United States as a new source of income for rural communities, as a way to reduce dependence on foreign oil, and most recently as a solution to the country's energy and climate change problems. But as the market for biofuels expands, so too do the social, economic, and environmental impacts.

Global production of ethanol and biodiesel increased from some 4.8 billion gallons in 2000 to 21 billion gallons in 2008. In the United States, producers generated some 2.1 billion gallons of ethanol in 2002, and demand barely topped 2 billion gallons. By 2008 production was estimated at 9 billion gallons, and demand topped 9.6 billion gallons, including some 500 million gallons of imports.

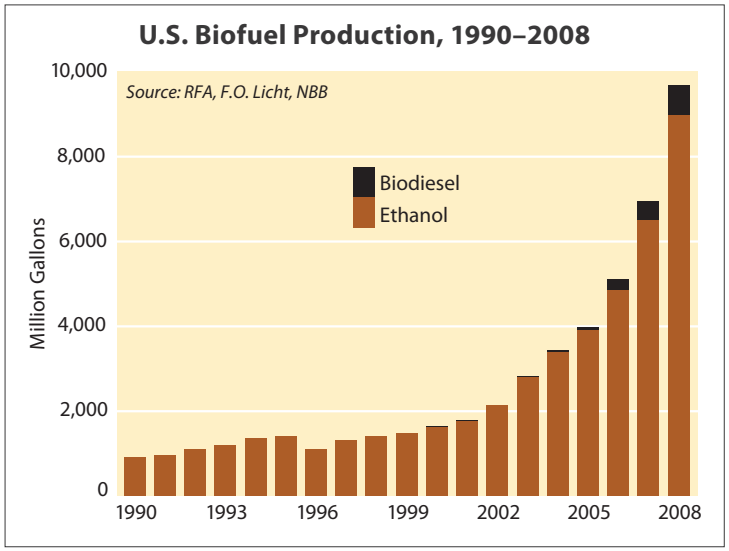
This increase in ethanol consumption reduced U.S. demand for motor gasoline by about 5 percent in 2008. But ethanol's share of U.S. gasoline use is expected to remain small: about 10 percent by 2020 and 15–17 percent by 2030.

Estimates indicate that more than 24 of the nearly 200 U.S. ethanol plants were shut down or idled between late 2008 and March 2009, accounting for about 21 percent of annual capacity. The trend is expected to continue through 2009.

First-Generation Fuels Damage the Climate

Current best estimates suggest that corn ethanol provides only a 12–18 percent net reduction in greenhouse gas emissions, on average, compared to gasoline. As a result, ethanol use reduced total U.S. transportation emissions by only 0.7 percent in 2008. In contrast, best estimates for soy biodiesel show a 41 percent net reduction.

Clearing land for new crop production can release large amounts of greenhouse gases, especially when carbon-rich ecosystems such as forests, savannahs, and grasslands are converted. One study estimates that clearing tropical forests for palm oil biodiesel will incur a "carbon debt" of 75 to 93 years—the amount of time needed for the biofuels to offset the greenhouse gas emissions released during land clearing. For corn ethanol, including land use changes in the calculation could shift emissions from a nearly 20 percent reduction to doubling them instead.

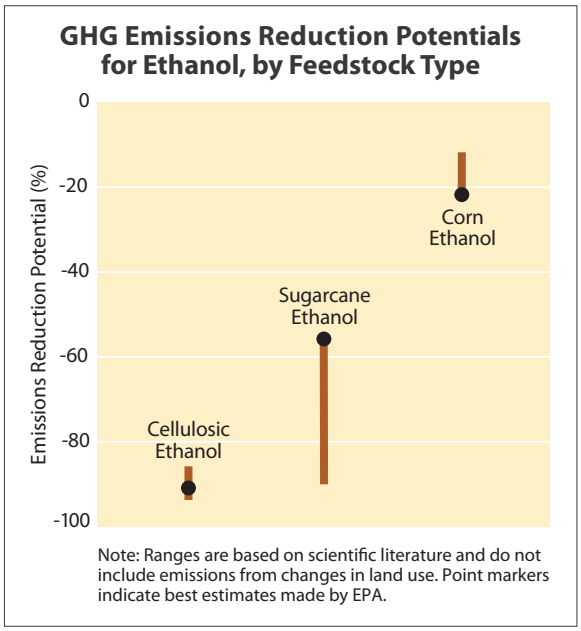


Advanced Biofuels Offer More Promise

Advanced biofuels rely on non-food feedstocks and offer dramatically improved energy and greenhouse gas profiles over conventional biofuels such as corn ethanol. While many of these feedstocks and technologies are promising, the broad economic and environmental effects of the fuels when produced at a commercial scale are not yet known.

The most widely cited second-generation biofuels are "cellulosic" biofuels, derived from the fibrous—or cellulosic—material in plants. Poten-

tial cellulose sources include perennial grasses and fast-growing trees, some of which are being developed as dedicated "energy crops" that can be converted to ethanol or biodiesel. Another advanced feedstock is algae for biodiesel.



Current estimates suggest that fueling vehicles with cellulosic ethanol could reduce emissions by 86–94 percent compared to gasoline. Research also shows that some perennial crops may store enough carbon in the soil and root mass to overcompensate for carbon released during the rest of the lifecycle, meaning they could help take carbon dioxide out of the air on a net basis.

In April 2009, there were 25 cellulosic ethanol demonstration or pilot plants in operation, although only nine were producing at a significant level. Unlike corn ethanol refineries that are concentrated in the Midwest, cellulosic ethanol refineries are located across the country.

Current Policies Need to be Transformed

Several policies currently in place in the United States promote expanded production and use of biofuels. The revised Renewable Fuel Standard (RFS) passed in 2007 calls for the increased blending of biofuels into conventional motor fuels. The RFS mandates the production of 36 billion gallons of biofuels annually by 2022, derived from a mix of both conventional biofuels and second-generation biofuels.

The RFS requires that biofuels produced under the mandate meet greenhouse gas reduction targets. Compared to the petroleum fuels they would replace, corn ethanol must achieve at least a 20 percent reduction in lifecycle emissions, biodiesel and advanced biofuels a 50 percent reduction, and cellulosic biofuels at least a 60 percent reduction.

However, because the capacity of current U.S. ethanol plants is estimated at 12 billion gallons annually, it appears that the target of 15 billion gallons of renewable fuels by 2015 will be met largely with corn ethanol produced in "grandfathered" facilities, without any required emissions reductions.

jimparkin/stockxpert

An ethanol production plant surrounded by corn in South Dakota.

The United States now faces a choice: continue with the current policies and hope for the best, or learn from past mistakes and rethink the role of biofuels for the future. If the wrong decisions are made today, the nation—and the world—could miss out on important opportunities for change for years to come. *But can the country reach its goal of 36 billion gallons of biofuels by 2022, while also ensuring environmentally and socially sustainable growth?*

Three broad efforts in U.S. policy would make biofuel production more sustainable and ensure that the use of biofuels contributes to the global effort to reduce greenhouse gas emissions without sacrificing environmental or social standards:

1. Spur the rapid development of cellulosic and other advanced biofuels that significantly

reduce greenhouse gas emissions, using existing economic instruments and other tools.

- Use existing and new economic instruments, such as blending tax credits, to spur development of advanced biofuels, and phase out incentives for corn ethanol.
- Base tax credits for ethanol and biodiesel on performance, with fuels that achieve deeper greenhouse gas emissions reductions eligible for greater support. Or, set a floor for government support that requires lifecycle reductions of at least 50 percent or better.
- Revisit the Renewable Fuel Standard mandate to ensure that it will promote second-generation biofuels instead of propping up first-generation biofuels.
- Lower or eliminate the ethanol import tariff for fuels that meet sustainability criteria.

2. Develop sustainability standards and make government support conditional on meeting these standards.

- Adopt a federal low-carbon fuel standard that reduces the carbon content of transportation fuels over time.
- Work with ongoing multi-stakeholder processes to establish internationally accepted sustainability standards and certification mechanisms for biofuels.
- Create incentives for sustainable production of biofuel feedstocks in current and future farm support and other programs by making government support conditional on performance and compliance with sustainability standards.
- Acknowledge production of sustainable biofuels through labeling at the retail level.

3. Create a holistic energy policy across all transportation-related sectors.

- Create a broad transportation policy that looks beyond biofuels to more-efficient vehicles, electric/plug-in vehicles, better urban design, and investments in good public transportation systems and rail.
- Increase investment in electric vehicle technologies, including a national smart-grid to encourage vehicle-to-grid net metering and development of improved batteries.
- Reconsider the best use of biofuels and biomass, looking specifically at lifecycle greenhouse gas studies on biomass used for electricity and heat.
- Adopt ambitious national renewable energy targets and advanced feed-in laws that enable small producers to sell their surplus electricity into the grid at a fair price and set a carbon performance standard for electricity.

Bonnie Hames, NREL

Advances in technology can help improve current biofuels and develop new alternatives. This near-infrared spectrometer, promoted by the National Renewable Energy Laboratory, enables researchers to chemically analyze plants and trees in the field, increasing the speed of the analysis and cutting down costs.

For source information as well as more comprehensive data and analysis of biofuels in the United States, please see the report *Red, White, and Green: Transforming U.S. Biofuels*, available online at www.worldwatch.org.

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