BIOFUELS

Corn-Based Ethanol Flunks Key Test

In setting state rules for low-carbon fuels, California officials have calculated that corn ethanol is worse than gasoline

A California regulatory agency charged with reducing greenhouse emissions from the state's cars has embraced a controversial approach for determining the true environmental impact of alternative transportation fuels. Its analysis could have broad implications for the future of corn-based ethanol or other fuels grown on U.S. cropland.

Last week, the California Air Resources Board (CARB) adopted a low-carbon fuel standard that requires greater use of fuels that cause lower greenhouse emissions, compared with gasoline (see graph). Corn-based ethanol doesn't meet that test and won't benefit from the new standard, CARB says, because diverting corn into ethanol production increases deforestation and the clearing of grasslands.

The biofuels industry has attacked the board's methodology, as well as similar conclusions in a regulation drafted last year by the U.S. Environmental Protection Agency (EPA) that is under review by the Obama Administration. Matt Hartwig, a spokesperson for the Renewable Fuels Association in Washington, D.C., says the California regulation will "have a tremendously chilling effect on future investment."

But such a pullback would please Timothy Searchinger, a biofuel critic at Princeton University. Searchinger says that much of the claimed environmental benefit from biofuels depends on "an accounting error. They treat land as free."

The debate was once confined to the pages of scientific publications. For example, Searchinger has found that corn ethanol produces twice the greenhouse gas emissions of gasoline, for every mile driven, once emissions from land conversion are counted (*Science*, 29 February 2008, p. 1238). Searchinger used a global model of agriculture to calculate the effects of increasing ethanol production. (About one-quarter of this year's U.S. corn crop will be turned into ethanol.) The model indicates that if U.S. farmers devote more land to growing corn for ethanol, food prices would increase, leading farmers around the world to convert grasslands and forests into crops. That shift, in turn, would release large amounts of greenhouse gases.

But other researchers expect farmers and agribusinesses to respond to higher food prices in less destructive ways. They foresee innovations that increase yields on existing land.

Government efforts to promote alternative fuels are now drawing regulators into the crossfire. California's new low-carbon fuel standard will require a 10% reduction in greenhouse gas emissions from the average liter of transportation fuel by 2020. To calculate that reduction, CARB's staff measured the "carbon intensity" of alternative fuels, including likely emissions from the ripple effects of biofuel production on global agriculture. At the federal level, a 2007 law requires EPA to calculate the "life cycle greenhouse gas emissions" of renewable fuels, to make sure they meet minimum standards.

CARB relied on a model, developed by researchers at Purdue University, that concluded that corn-based ethanol produces slightly greater greenhouse emissions than does gasoline, with about 30% of those emissions occurring as farmers clear land for crops.

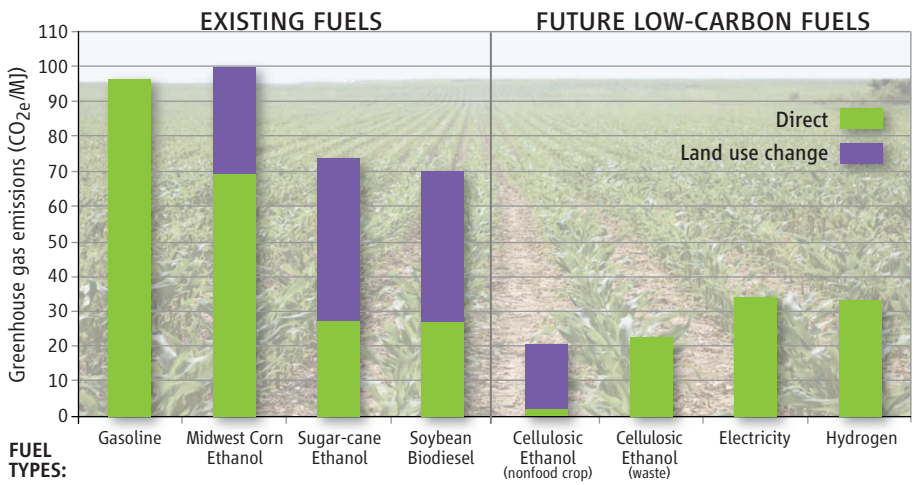
EPA has not yet released its studies, but some who have been briefed on them say the agency anticipates an even larger area of the world's forest and grassland being converted into food and ethanol production. Ethanol receives a better overall grade, however, because EPA assumes that current ethanol refineries are more efficient.

The analyses have infuriated biofuel advocates, who last week condemned the board's methodology as unfair, artificial, and lacking any real-world data. More than 100 scientists, many of them involved in biofuel research, have told CARB that the science of estimating emissions from land conversion is "far too limited and uncertain" to use in regulations. In Congress, a dozen farm-state senators want EPA to halt any effort to calculate the greenhouse effects of land-use change caused by biofuels. "It defies common sense that EPA would publish a proposed rulemaking with harmful conclusions for biofuels based on incomplete science and inaccurate assumptions," said Senator Charles Grassley (R–IA) in March.

CARB, for now, is sticking to its guns. "We feel that our recommended value [for greenhouse emissions from land-use change] is very reasonable," said CARB staffer Wes Ingram. However, the board promised a full review of the issue in January 2011, 1 year before the regulation takes effect.

Searchinger, for one, thinks that CARB's estimate is too low. He points out that CARB's model predicts that higher prices would lead to less food produced globally, which he says probably means more hunger. Efforts to avoid that fate would increase greenhouse emissions, he says.

Bruce Babcock, an economist at Iowa State University in Ames who is working with EPA, says broader consideration of land-use decisions could spark new controversies. The best way to reduce the clearing of land for crops, says Babcock, would be to impose a tax on meat consumption. "If we all turned into vegetarians, we could get by on one-tenth of the land," he says. **–DAN CHARLES**



Degrees of green. California officials say today's ethanol is no better than gasoline, but they're banking on cleaner biofuels by 2020.

CREDITS: ADAPTED FROM CALIFORNIA AIR RESOURCES BOARD; (IMAGE) PHOTOS.COM

Published by AAAS