Global Warming Intensity: An Opportunity and Threat

By Tyler Krutzfeldt

Recently the technology journal *Science* released papers that called the economic and environmental benefits of corn ethanol into question. Economists asserted that corn ethanol's excessive dependence on indirect land use change will lead to more greenhouse-gas emissions than petroleum-based fuels. Although the papers have been criticized as highly speculative scenarios, land use change is a real issue which has spurred opposition to corn ethanol in the environmental community. How can the ethanol industry respond?

The first response is that ethanol producers must model and understand the global warming intensity of ethanol fuel sold directly from their plant.

The term global warming intensity was originated from the California Low Carbon Fuel Standard, which itself was born largely from the U.K. Renewable Transport Obligation. Global warming intensity is defined as a carbon dioxide equivalent per energy unit of fuel sold. All greenhouse gases, including nitrogen oxide and methane, are measured in terms of a carbon dioxide equivalent. Carbon dioxide has a global warming potential of 1:1, while more potent gases such as methane have a factor of 25:1.

Global warming intensity is measured by a process called lifecycle analysis, which is an analytical process of determining environmental impacts of products and processes. Lifecycle analysis follows specific standards so that the model itself and results are transparent and easily verified. However, there is no international lifecycle analysis standard.

Lifecycle analysis includes greenhouse gas emissions from combustion of fuels in the production process due to required steam and electricity consumption in the plant, transport of feedstock to the plant and to the fuel blending location, and cultivation of lands to produce feedstock.

Ethanol producers and investors have a vested interest in making sure this work is done now. For corn ethanol producers, the conclusions reached by some in the academic and environmental community threaten their survival. There is wide discrepancy in what policymakers are hearing, reading and acting upon. According to an article in the magazine *Chemistry & Industry (C&I),* German proposals indicate ethanol made from U.S. corn offers lifecycle carbon savings of more than 40 percent. In the same article, the USDA concludes a 22 percent saving while the U.K. assessed corn ethanol at 20 percent carbon negative. A European Union executive has suggested that biofuels must deliver a lifecycle carbon dioxide savings of 35 percent to count toward their 10 percent blending target.

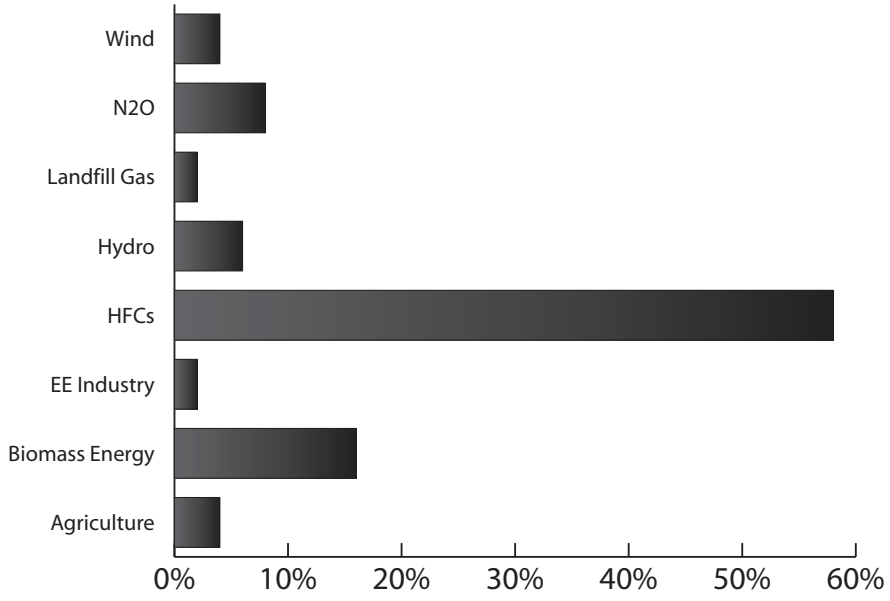
A second step is lowering the global warming intensity of ethanol fuels. Carbon abatement strategies should be financially modeled prior to investment, taking into consideration the value of carbon emission reduction credits. Carbon abatement strategies include:

Fuel switching Switching a plant's thermal energy source from coal or natural gas to solar, wind or biomass gasification

decreases lifecycle emissions. For example, a Brazilian sugarcane project switched to bagasse cogeneration and generated carbon emission reduction credits. Over a seven-year crediting period, approximately 196,000 tons of carbon emission reductions resulted in approximately $2.5 million of revenue, which helped finance the project. This analysis helped meet the requirement of financial additionality (economically non-viable project becoming viable as a direct result of carbon emission reduction credit revenues).

Energy efficiency Lowering the energy usage and increasing efficiency of plant operations via investment in process engineering improvements lowers lifecycle emissions. Whitefox Technologies Limited, a process engineering firm and membrane-based systems integrator, claims lower energy requirements. Quantifying and verifying energy efficiency improvements such as membrane technology are important in the carbon value creation process.

Carbon capture and sequestration Capturing carbon at the end of the distillation process and sequestering in underground oil and gas formations enhances oil and gas recovery while mitigating carbon dioxide. Sequestration was highlighted at the recent United Nations meeting in Bali as having significant promise in lowering greenhouse gas emissions. Archer Daniels Midland Co., near its ethanol plant in Decatur, Ill., is scheduled to begin drilling a 6,500-foot injection well to inject carbon dioxide into porous sandstone deposits.



At Stake for Ethanol Producers

Producers will be paid a premium for low global warming intensity fuel, at least in the short term. Under the California Low Carbon Fuel Standard, ethanol will be classified according to its' global warming intensity. The standard requires fuel suppliers to lower the global warming intensity by 10 percent in 2020. The EPA will likely follow suit at a national level, and lifecycle analysis will be an important foundation. The 2007 Energy Independence and Security Act encouraged fuel production which meets "lifecycle greenhouse gas emission" stan-

dards. "Advanced biofuels" are defined to have a global warming intensity less than or equal to 50 percent of that of petroleum-based fuel.

The act also redefines cellulosic ethanol to be ethanol from "renewable biomass" with a global warming intensity at least 60 percent less than that of gasoline. Gasoline has a baseline global warming intensity which was established in the Argonne Labs Greenhouse Gases, Regulated Emissions and Energy Use in Transportation (GREET) model. One example as defined is a Mont Vista Capital client in Florida, U.S. EnviroFuels, who is developing a cellulosic project which will produce low global warming intensity ethanol with zero fossil fuel use. U.S. EnviroFuels was awarded a $7 million grant from the Florida Department of Agriculture and Consumer Services in January 2008, and we expect Florida to follow California in implementing a low-carbon fuel standard.

The Energy Independence and Security Act will require close to 15 billion gallons of corn ethanol, but it does not prohibit additional corn ethanol above 15 billion gallons if the ethanol meets the lifecycle emission standards. This is a key consideration for corn ethanol producers.

Investments in low global warming intensity fuels will generate carbon emission reduction credits. However, the methodology needs to be validated and registered before the carbon benefit can be realized.

Lifecycle methodologies for ethanol have not been approved under the Clean Development Mechanism of the Kyoto Protocol, a regulatory carbon market valued at more than $6 billion in 2007. As of November 2007, 828 projects have been registered by the Clean Development Mechanism Executive Board as qualifying projects. These projects reduce greenhouse gas emissions by an estimated 171 million tons of carbon dioxide-equivalent per year.

However, we expect lifecycle analysis will be approved by the Clean Development Mechanism Executive Board in the near future, creating a path to value creation for low global warming intensity ethanol producers in developing countries. This may also set precedence for U.S. policymakers. Lifecycle analysis was the proposed methodology in Clean Development Mechanism proposal No. NM0253 for an ethanol project in Sinaloa, Mexico. Although the proposal has shortcomings (similar to those highlighted in *Science* papers), the methodology itself is transparent and encourages critique.

In conclusion, rigorous analysis of sustainability standards such as global warming intensity of ethanol is needed. We believe corn ethanol producers have more to gain than lose. However, producers will need to be proactive and make strategic investments in anticipation of such standards in a regulatory carbon market. This is a time to conserve cash or raise external financing, and spend wisely. EP

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