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Federal Policy

The Rift Between Environmentalists and Biofuelers

A close look at proposed energy legislation pending in Congress reveals the beginning of a crack in federal policymakers' until-now unalloyed support for ethanol, biodiesel and other biofuels. Buried amid the tax incentives, research grants and loan guarantees is a series of requirements for environmental studies on the effects of vastly increasing biofuels production.

"There's been a ready, fire, aim mentality in dealing with these additives among everyone, including members of Congress. There's a rush to judgment without fully ascertaining the environmental effects," says William Becker, executive director of the National Association of Clean Air Agencies (NACAA), which represents state and local government air pollution control agencies.

Now environmental groups, including the NACAA, Clean Air Watch, the Natural Resources Defense Council (NRDC) and Friends of the Earth, are pushing for a more cautious approach. So far, they've convinced lawmakers in the House and Senate to include, in pending energy legislation, requirements for more-stringent government oversight, aimed mostly at the ethanol industry.

"Environmental groups want to make sure that if ethanol is used, it is used in as environmentally responsible way as possible," says Frank O'Donnell, president of the nonprofit Clean Air Watch in Washington, DC.

Long viewed as allies of the biofuels industry, environmentalists are eager to reassure that they aren't abandoning support for ethanol. "I don't think it's an attempt to derail the use of ethanol, but to make sure that in this rush to flood the market with ethanol, we don't create new problems that aren't even being studied," says O'Donnell. "Our baseline concern is pollution."

As a result, upcoming energy legislation isn't likely to give a free pass to the ethanol industry. The bill that has passed the House of Representatives, for example, requires that fuel blends of more than 10% ethanol be subject to approval from the EPA. The agency would have 270 days to decide whether to or not issue a waiver, following official notice, public comment and an environmental assessment. Currently, new ethanol blends are automatically given a waiver if EPA takes no action on the request within 180 days.

"Obviously, that's not really a meaningful waiver if there's no federal action, given all the risks and

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MARKET FORECASTS

	Source	July 2007	Sept. 2007	Analysis
↓	Corn (per bushel)	$3.30	$3.00	Supply fears fade, and prices follow as a bumper corn crop matures.
↓	Ethanol (per gallon)	$2.20	$2.05	Supply is meeting demand today, and more capacity is coming on-line, further weakening prices.
↑	Biodiesel (per gallon)	$3.19	$3.29	Rising price of soybean oil boosts prices while pinching profits of biodiesel makers.
↑	Crude Oil (per barrel)	$73.00	$76.00	Supply disruptions abroad (Nigeria, Iraq, Norway and Venezuela) are buoying prices.
↓	Regular Gasoline (per gallon)	$3.05	$2.95	Climbing to $3.20 before retreating in Sept.
↑	Diesel Fuel (per gallon)	$2.95	$3.10	Prices increasing due to peak demand by truckers, rising crude prices, higher costs to make cleaner diesel.
↓	Natural Gas (per MMBtu at wellhead)	$6.65	$6.30	Ample supplies and continued moderate prices are. likely, but possibility of a Gulf of Mexico hurricane will keep the market on edge.
↔	Coal (per MMBtu sub-bituminous)	$1.50	$1.50	Prices per ton will stay mostly even, then rise slightly in 2008. Higher shipping costs could add to the increase.

In This Issue

On the Horizon

Algae: The Alternative-Energy Dream Fuel

What needs only sunlight, water and carbon dioxide to grow, can quadruple in a day, helps remove pollutants from the air and water and has the potential to fuel every vehicle in the U.S.? Algae. In fact, using algae as a feedstock for biofuels has so many advantages over other biomass sources that some experts believe it will eventually eclipse all others, though large-scale commercial production is still about five years off.

Algae are highly efficient converters of solar energy into chemical energy—fuel for cars, homes, power generators and so on. Some strains are over 50% oil, and their yield per acre is tremendous. Average per-year, per-acre oil yield for firms that grow algae for use in the food and pharmaceutical industries today is sufficient to make about 5,000 gallons of biodiesel. An acre of soybeans typically yields enough oil to make about 70 gallons of biodiesel, while an acre of corn converts into about 420 gallons of ethanol.

"Your bang for your buck is just bigger because you can really do this on a much smaller amount of land and yet yield much, much higher biomass," says Michael S. Atkins, CEO of **Ocean Technology & Environmental Consulting** (OTEC), a San Francisco bay-area firm that is developing photobioreactors—enclosed systems that produce algae in layer upon layer of tubes or shallow ponds.

> ***"…you can really do this on a much smaller amount of land and yet yield much, much higher biomass."***

Algae have another powerful appeal as a biomass source. The aquatic organisms thrive on harmful emissions such as nitrogen from wastewater and carbon dioxide from power plants. So growing them can help solve other environmental problems and provide an additional income stream.

OTEC, for example, is working with the **Mohave Generating Station** in Laughlin, Nev., to get the plant, which is majority-owned by a Calif. company, in compliance with Calif. clean air standards and back online. OTEC will install about 10 photobioreactors to capture the carbon emissions from the plant. The CO_2 will then help feed algae production at a nearby site.

Similarly, **GreenFuel Technology Corp.** of Cambridge, Mass., is working with power plants in Arizona, Louisiana and Germany to build algae producing photobioreactors. Recent tests by GreenFuel show its system captured about 80% of the CO_2 emitted during the day when sunlight is available.

Between that and the tremendous potential yields algae production offers—according to the Department of Energy's National Renewable Energy Laboratory, up to 15,000 gallons of biodiesel a year from a saltwater pond—the financial outlook for algae-based biodiesel is rosy.

Open, outdoor ponds are relatively cheap to build and run—from $16,000 to $32,000 an acre, with annual operating costs of about $4,800 per acre. But with current technology and high-oil algae strains, ponds are a commercial crapshoot. Temperature and light variations affect growth. So do water levels, salinity and pH, all at the mercy of wind, rain and evaporation. Undesirable strains can infiltrate and contaminate ponds.

The initial capital cost of enclosed photobioreactors is high—from $5 million to $10 million—but super efficient production and higher oil yields help offset the costs. They offer continuous harvest, extended production cycles and significantly higher output. Research is underway to overcome barriers to large scale photobioreactors: overheating, oxygen accumulation, biofouling and shear stress. According to research done in England, industrial photobioreactors operate at a production cost of about $91 per pound of algae.

At least one company, **Green Star Products Inc.** [GSPI] of Chula Vista, Calif., is working on a hybrid system, which the company claims has a capital cost similar to an open pond system. Green Star says it has had success with a small demonstration system in Montana and is negotiating to build a 100-acre production facility in California, Missouri or Utah.

Over the course of the next few years, ongoing research will help shave costs in a variety of ways. Startup companies such as **Solazyme Inc**. of South San Francisco, Calif., **LiveFuels Inc.** of Menlo Park, Calif., and others are working on new algae strains genetically engineered for higher oil content and resistance to environmental variances. Solazyme, **Solix Biofuels** of Fort Collins, Colo., and **Aurora Biofuels** of Berkeley, Calif., are working on improving production, harvesting and oil extraction methods.

"At the end of the day it's going to make the most sense," says Atkins. "Everyone is going to realize this eventually. Right now, the excitement is about using all of this waste material or material that we grow on land. But eventually economics are going to shift this industry to microbial output." ■