

Biofuels UPDATE

Report on U.S. Department of Energy Biofuels Technology

Florida Kids and Keys Benefit from Biodiesel



This 500-gallon biodiesel tank fuels NOAA patrol boats at the Florida Keys National Marine Sanctuary.

Florida-based NOPEC Corporation has joined forces with the Florida Restaurant Association to recycle used cooking oil into biodiesel. In return, NOPEC gives 10 cents per gallon to the association's School-to-Work fund that pays for local school children's scholarships, books, and computers. NOPEC also provides an environmental and energy education curriculum that emphasizes recycling for the state's schools.

The Lakeland plant has a capacity of 20 million gallons of biodiesel per year; current production uses about 50% virgin soybean oil and 50% waste oil. By working with the state's restaurants, NOPEC's goal is to increase its waste oil feedstock use to about 90%.

Using waste oil could help bring biodiesel's cost closer to that of conventional diesel. "Biodiesel from virgin soybean oil costs about \$3.77 per gallon, but that price could drop as low as \$2.50 or \$2.00 if made completely from waste oil," said NOPEC spokesman Mark Nordby. The higher cost is less noticeable when used in lower blends, which still offer substantial performance benefits.

NOPEC's main customers are boat owners in the environmentally sensitive waters of the Florida Keys and Maryland's Chesapeake Bay. The fuel was first offered in Florida last year in 20% blends as premium diesel, priced about 20 cents more than regular diesel. When Russ Teall, a nautical

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Food Oil Distributor Turns Waste into Biodiesel

A Chicago-based food-grade oil distributor is contributing to the city's redevelopment efforts while recycling waste vegetable oil into biodiesel.

The project began when Michael Gagliardo, president of Columbus Foods (a 60-year old, family-owned business), was inspired by Chicago's demonstration of biodiesel in buses and police patrol boats. "As an oil distributor, the company thought it made a lot of sense to take back

the waste oil and make something out of it."

"Since then, the pieces have fallen into place like a jigsaw puzzle," Gagliardo said. He initiated a project to build a \$500,000 biodiesel plant, which is expected to open later this fall. It will be an efficient 200,000-gallon-per-year production center to test a variety of feedstocks, including virgin soybean oil, animal fats, waste oil, and sludge from the city's sanitation district.

To help with this project, the City of Chicago donated a building in its "brownfield" program, which is designed to clean up environmentally degraded urban lands. The building site is in a federally designated "empowerment zone," an economically disadvantaged urban area, which generates federal tax credits for every job created; Columbus Foods' early 25-employee biodiesel demonstration facility could lead to the

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Beer Spillover Used to Produce Clean Fuel

To ensure there is no air in its beer, Coors Brewing Company overfills each can it sends from its Golden, Colorado, facility. This results in 22 million gallons per year of wasted 7% alcohol condensate.

This fall, Coors will join forces with Merrick & Company and Total Petroleum to recycle the condensate to produce more than 1.5 million gallons of 100% fuel-grade ethanol, which Total will market as an oxygenate in cleaner-burning gasoline.

The win-win-win partnership began when Total asked Merrick to construct an ethanol plant at Total's Denver refinery. The costs of transporting the feedstock to the site made it unfeasible, according to Steve Wagner, vice president of Merrick Management, Inc. Instead, Merrick is leasing land from Coors to build a continuous production process plant that includes a fractionation train, a molecular sieve dehydration unit, and a product

handling facility. Merrick will own the ethanol plant. "By doing it this way, we disposed of the high transportation costs and made it a true value-added product for Coors," Wagner said.

Total Petroleum has a 7-year commitment to purchase the fuel-grade ethanol from Merrick for blending with its gasoline, which is distributed along Colorado's front range. Colorado requires gasoline stations to sell oxygenated fuel during the winter to combat carbon monoxide pollution.

Recycling the alcohol on-site has many benefits. As many as seven trucks each day are now required to transport the waste alcohol out of the brewery. When ethanol production starts this fall, Coors hopes to reduce that to one truck every other day. Project engineers estimate that this waste reduction will eliminate 70 tons per year of volatile organic compound emissions.



This mole sieve dehydration unit is part of the plant within Coors Brewery that recycles waste alcohol condensate and produces ethanol.

Senate Hearing Addresses Benefits of Renewables

The use of domestically produced, renewable fuels to replace oil imports was highlighted at a hearing of the U.S. Senate Committee on Agriculture, Nutrition, and Forestry held before the 104th Congress adjourned in October. "There is a price tag on military operations as surely as on tax exemptions," said Committee Chairman Senator Richard Lugar (R-IN). "In 1995, petroleum accounted for nearly 30% of the U.S. merchandise trade deficit. Last year, the U.S. sent a net \$47 billion abroad to purchase petroleum and related products."

"I challenge you to redirect our efforts, our tax policies, and our research dollars to the promotion of domestic energy sources, including ethanol," said Jack Higgins, president of Pekin Energy. "We are going in the wrong direction to protect our energy and economic future."

A nationwide reformulated gasoline (RFG) program, an extension of renewable fuel tax incentives, and tax credits to investors financing biofuels were some of the methods suggested by panelists. The RFG program is currently required for areas with ozone air quality problems and accounts for

about 30% of the gasoline sold in the nation.

Because RFG uses oxygenates such as ethanol and its ether (ethyl tertiary butyl ether), it is largely responsible for the fuel's recent market growth. "Credible studies, such as the recent report by the General Accounting Office done at Senator [Tom] Daschle's request, have concluded that the single measure of a nationwide RFG standard could reduce reliance on imported oil by nearly 10%," said Lee Butler, former director of strategic plans and policy for the nation's armed forces and current chairman of the board for BioClean Fuels Inc.

Biofuels Role in Greenhouse Gas Reduction Goals

The environmental and economic benefits of ethanol and biodiesel are well known, but they are receiving new attention as part of an evolving strategy to combat global warming and the greenhouse effect. This term describes the theory that certain gases—carbon dioxide, methane, non-methane hydrocarbons, carbon monoxide, oxides of nitrogen, and ozone—trap heat that emanates from the Earth's surface and increase global temperatures. These gases occur naturally, but humans are undoubtedly responsible for their increasing levels.

Our energy consumption practices may be changing our atmosphere in a crucial way. According to the U.S. Environmental Protection Agency, fossil-fueled motor vehicles comprise the single largest source of carbon monoxide emissions in the United

States—about 84% in 1994—and are significant contributors of nitrous oxides and nonmethane volatile organic compounds.

The U.S. Department of Energy (DOE) recently reported that greenhouse gas reductions—especially carbon dioxide emissions—will be greatest in a tax scenario that favors ethanol. Based on this scenario, the report predicted about a 10% reduction in light-duty vehicle emissions and a net 4% reduction in total U.S. greenhouse gas emissions.

Bioethanol production, which uses feedstocks that can include underutilized wood and logging residues, agricultural residues, municipal solid waste, industrial waste, and specially selected energy crops such as trees and grasses, could significantly reduce greenhouse gases. DOE researchers examined the potential

of a lignocellulosic ethanol market in the year 2010. They showed that, with advanced technology, more than 90% of the carbon dioxide emissions associated with reformulated gasoline could be avoided by replacing it with 95% ethanol blends (E95). The bioethanol production process can also generate electricity by burning lignin—a by-product of the process—which burns much cleaner than coal. So E95 production could also mean significant reductions in nitrous oxides, sulfur, and particulate emissions.

“At the heart of the climate change issue is a strong consensus among economists that a strong research and development effort is an essential part of the approach and makes a significant contribution to reducing costs,” said Howard Gruenspecht, director of Economic, Electricity and Natural Gas Analysis at DOE.

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cartographer and president of the Marine Industries Association of Florida, performed a pre-market biodiesel evaluation last year, the main response from consumers was, “How much does it cost, and where can I get it?”

Local dive boat operations are especially interested, according to Nordby. “Divers are very aware of water pollution issues and may appreciate biodiesel’s cleaner-burning and biodegradable attributes.” The National Oceanic and Atmospheric Administration’s patrol boats in the Florida Keys National Marine Sanctuary are running on biodiesel, as are forklifts at several dry dock storage

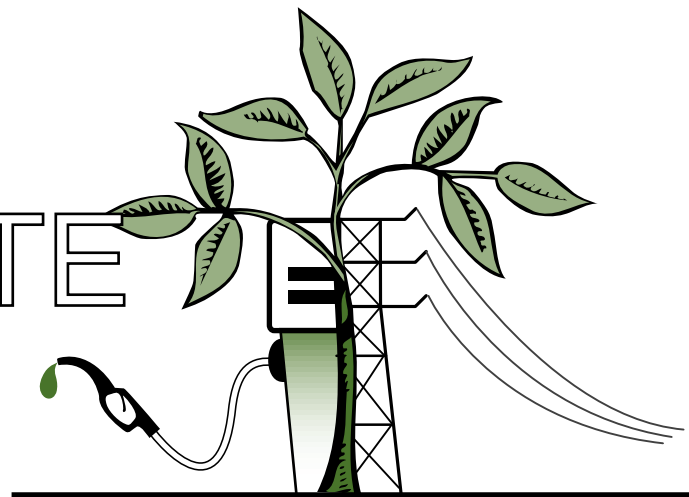
areas. According to Teall, Florida alone offers a potential biodiesel market of 2–3 million gallons per year.

Later this fall, boat operators in the Chesapeake Bay will also be able to blend their own biodiesel by purchasing it under the brand name BioBlend from the tank, or running it neat as BioBoost off the shelf, at eight marinas NOPEC will refer to as BioPorts. So far biodiesel has been well received by boat operators. Working with the Maryland Soybean Association and Coastal Property Management, NOPEC started educating Chesapeake Bay boat owners by offering free fuel over two

weekends. Consumers generally reported less black smoke and better engine performance because of biodiesel’s increased lubricity and higher cetane, said Henry Rehberg, NOPEC’s marine advisor. Within 3 years NOPEC hopes to open its second biodiesel production facility in the Chesapeake Bay region.

BioBoost will also be available through BoatUSA’s catalog, which reaches the association’s 500,000 members. Biodiesel cleans out sludge and varnish in the fuel system, so consumers are advised to check their fuel filters to prevent the old residue from clogging.

Biofuels UPDATE



Special Report

RBEP Supports Motor Fuel Projects

The U.S. Department of Energy's (DOE) Regional Biomass Energy Program (RBEP) is undertaking numerous innovative projects in an effort to cost-share renewable fuel and power developments. These include turning used restaurant grease into fuel to power ferry boats in the Northeast, converting wastepaper into ethanol in the Midwest, and taking hazardous forest residues to fuel power plants in the West.

As part of DOE's reorganization, the RBEP is stepping up its support for transportation fuel initiatives, specifically biodiesel.

"One of the main initiatives under the program this year is to identify waste oil supplies from sources such as restaurants to help offset the cost of biodiesel production," says Mike Voorhies, DOE RBEP Manager. "This will support ongoing research by the Department to identify biomass resources for potential energy use."

The program has been appropriated \$3 million dollars for FY 1997, which will be distributed to the states to be spent equally among transportation biomass fuel and power projects. Historically, the RBEP has successfully leveraged \$2 (nonfederal) for every federal dollar, which makes it a \$9 million dollar program. This article highlights the motor fuel projects of the RBEP program.

Northeast Regional Program

This year, the Northeast Regional Biomass Energy Program will fund a preliminary assessment of waste in a five-county area around Philadelphia to identify biomass energy sources, specifically wastepaper and vegetable oil. Currently, the recycled paper market is saturated, and leaves significant

amounts of wastepaper pulp that could be converted to ethanol or used to produce electricity.

"Because of RBEP, Ingram Howell (a cellulosic ethanol plant scheduled to open soon) is using an abandoned biomass power plant to generate the energy needed to convert wood to ethanol. This is saving local jobs and creating 80 new ones," said Rick Handley, manager of the Northeast Regional Biomass Program. "These are the types of partnerships we are trying to foster under this program."

Western Regional Program

The Western Regional Program cost shares biodiesel and ethanol projects.

- In North Dakota, we are supporting the state's participation in the Governors' Ethanol Coalition (GEC)
- In South Dakota, we have supported the pilot-scale demonstration of wastepaper to ethanol at South Dakota State University-Brookings
- The State of Nebraska has used the money to market the benefits of E85 vehicles, the conversion of corn stover to ethanol, E85 and E95 vehicle demonstrations, engine testing of biodiesel, and support of GEC
- Kansas has fleet demonstrations of biodiesel from beef tallow
- Texas is using DOE funds to host a workshop on the use of biomass as a feedstock for transportation fuels
- Arizona is supporting research to convert rice hulls to biodiesel.

Program goals for 1997 have not been determined, as the region is in the process of finding a host organization.


Great Lakes Regional Program

The Great Lakes Regional Biomass Energy Program (GLRBEP), in the heart of the corn belt, leads the program in transportation research. Next year, this region will cost-share nine biofuel-related activities.

Examples of recent projects, partially funded by the GLRBEP, include:

- An effort to reduce the cost of ethanol production through the use of waste sugar instead of corn in Illinois
- Evaluating the economic and agricultural feasibility of converting switchgrass into electricity and liquid fuel in Wisconsin
- Developing more efficient commercial ethanol production techniques in Indiana
- Creating a bioblended fuel (a combination of biodiesel fuel with ethanol) for use in light-duty compression ignition engines in Minnesota
- Assessing the technical and economic feasibility of forest harvest residue recovery operations in Michigan
- Evaluating ethanol blends on small engine research at the University of Wisconsin–Milwaukee
- Evaluating a heavy-duty Cummins L10 engine that uses E95 fuel ethanol
- Demonstrating 12 E85 vehicles in each Great Lakes state
- Converting corn fiber to ethanol and other by-products.

“The GLRBEP projects have lead to the increased use of ethanol in this region. For example, the E85 demonstration resulted in several states independently purchasing these vehicles for their fleets,” said Fred Kuzel, GLRBEP manager.

 Reports that describe the outcome of completed projects and other publications that concern biomass energy issues are available by contacting the GLRBEP's homepage at <http://www.cglg.org> or by calling 312-407-0177.

Southeast Regional Program

The Southeast Program predominantly funds power-related research and development. However, it has sponsored a few biodiesel projects. This winter, the RBEP will sponsor a bioenergy event in Arkansas to raise awareness for biofuels and renewable power. Additionally, this region sponsored several biodiesel demonstrations, including buses used during the Olympics and with the Bi-State Transit Authority.

Northwest Regional Program

For 10 years, the Northwestern Regional Program has sponsored research on biodiesel produced from rapeseed. Most of this work was prepared under the guidance of Charles Pederson through the University of Idaho.

This research includes biodiesel emissions, performance, toxicity, biodegradability, environmental risk assessment, durability, and formulation testing. “We are in the final stages of testing biodiesel in pickup trucks,” said Jeff James, manager of the Western Regional Energy Biomass Program. The research should be complete in April 1997.

During the upcoming year, the Northwestern program will focus on more durability testing to include a 200,000-mile evaluation of heavy-duty engines as part of a 2-year evaluation. Additionally, the program will help improve air quality and demonstrate the use of biodiesel in snowmobiles and trucks at Yellowstone National Park.

“All our testing is leading up to making biodiesel a commercial fuel,” said James.

If you would like to be involved with your Regional Biomass Energy Program, please call one of our program managers:

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Biodiesel Gets Approval for Fleet Emissions Compliance Strategy

Biodiesel used in 20% blends (B20) was recently certified by the U.S. Environmental Protection Agency (EPA) for use in certain older engines to meet requirements of its retrofit/rebuild program. In a notice published on October 22, EPA approved an application from Twin Rivers Technologies (TRT), a biodiesel producer based in Quincy, Massachusetts.

"The Agency [EPA] believes that this certified TRT equipment, which includes a catalyst component, will provide program benefits and additional options for operators. Further, certification is consistent with Agency support for fuels that may be renewable," EPA stated in its notice. The Clean Air Act Amendments of

1990 require urban bus fleets to reduce particulate matter emissions on buses 25% below what they were certified for when new. To comply, fleet managers must retrofit or rebuild those engines with EPA-certified technology. By using B20, TRT is the first and only approved technology that uses a fuel-based compliance solution. "Some mechanical compliance can get very expensive, particularly with an older bus," said Leroy Watson, director of regulatory management for the National Biodiesel Board. "The aim is to use fuel technology to give urban bus operators more choice."

The certification applies to petroleum-fueled Detroit Diesel Corporation (DDC) two stroke/cycle engines originally installed in

urban buses of model years 1979 through 1993, excluding 1990 model year DDC 6L71TA engines. It specifies B20 in combination with a particular exhaust system oxidation catalyst previously certified under the urban bus program by the Engelhard Corporation. Some engines will also require adjustments to fuel injection timing. Although biodiesel can be produced from a variety of sources, the EPA program requires it be made from virgin vegetable oil and blended with low-sulfur diesel fuel.

Three transit operators, the Bi-State Development Agency, Southwest Ohio Regional Transit Authority, and Mass Transit Administration of Maryland, supported the B20 compliance option based on their own biodiesel demonstration experiences. They commented on biodiesel's excellent operational record and its ability to maintain power and mileage without extra infrastructure costs.

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development of a commercial plant with 120 employees on the production line or in oil distribution and collection.

"Chicago wins by attracting a developer who can clean up the land and return it to the city's tax roll," said Deborah Boldt, the City's director of Emerging Technologies. This in turn may attract other developers. By focusing on areas that already have transit systems, utility infrastructure, and a ready labor force, the City hopes to keep production and work within its boundaries.

Columbus Foods expects to find a strong local market; the combined consumption of diesel fuel for Chicago Transit Authority (CTA) buses and City of Chicago fleet vehicles is 50 million gallons per year. According to a recent

study by the Energy Resources Center of the University of Illinois at Chicago, about 45% of the greater Chicago area's fleet managers might consider using biodiesel despite its higher cost.

The CTA and American Sightseeing Bus Company have already agreed to test biodiesel in 20% blends for at least 100,000 miles in each bus. In August they provided biodiesel buses to transport delegates and media representatives during the Democratic National Convention.

"We've operated several buses on biodiesel over the last year," said Christopher Ferrone, vice president of American Sightseeing. "It's important for us to make the city a little cleaner and more attractive for our customers." The fuel has also shown

the potential to reduce particulate emissions associated with human respiratory ailments.

The leadership and creativity of those involved was recently recognized by the U.S. Department of Energy (DOE) with an Energy Pioneer Award. The project was also selected under DOE's 1995 Sustainable Technology Energy Partnerships Pilot Program and received funding from DOE, the National Biodiesel Board, and the Fats and Protein Research Foundation.

The national recognition is nice, but Gagliardo gets most of his inspiration from his 6-year-old twins. "Biodiesel is good for clean air, clean water, and it can help reduce the deficit. This is something we can give back to the children and have fun with."

Biofuels News Bites

BioEnergy '96 Marks Industry Progress

Farm-scale ethanol plants and biomass resources identification were just two of 200 projects highlighted at the recent joint BioEnergy '96 and Liquid Fuels and Industrial Products from Renewable Resources Conference, at the Opryland Hotel in Nashville, Tennessee.

For copies of the BioEnergy '96 Proceedings, contact the Southeast Regional Biomass Energy Program (SERBEP), P.O. Box 1010 CEB 3A, Muscle Shoals, AL 35662-1010. Proceedings are \$35, and checks should be made payable to TVA. Credit card orders may be faxed to SERBEP at 205-386-2963 with pertinent credit card information.

☛ *Copies of the Liquid Fuels Conference Proceedings are \$46 for nonmembers and can be ordered by calling 616-428-6324.*

Nebraska Puts Home-Grown Fuel in the Tank

During the next year, the Nebraska Department of Roads will test 10% blends of biodiesel in 120 trucks in the state's heavy-duty vehicle fleet. The vehicles will be located at six sites: Auburn, David City, Lincoln Salt Valley, Fremont, Elkhorn, and Beatrice. Project leaders hope to displace up to 12,000 gallons of diesel per year. One goal of the project is to raise awareness of the biodiesel and to help the state's soybean farmers develop new markets for their crops.

"Our state has a demonstrated commitment to promoting the use of clean-burning, high-performing and home-grown



Nebraska's Governor Ben Nelson announces a program that will test biodiesel blends in 120 trucks in the state's heavy-duty vehicle fleet.

energy sources," said Governor Ben Nelson. "Biodiesel joins ethanol as another value-added Ag product fueling our state fleet and our state economy."

Through a cooperative agreement, the Department of Roads, the Nebraska Energy Office, and the Nebraska Soybean Board will each fund one-third of the \$50,000 project. The energy office's contribution comes from DOE's Western Regional Biomass Energy Program.

Ethanol Refueling Handbook

Fuel distributors and retailers interested in selling fuel ethanol may want to obtain a copy of the Guidebook for Handling, Storage, and Dispensing Fuel Ethanol. The brochure, recently released by the U.S. Department of Energy's (DOE) Argonne National Laboratory, provides information on fuel specifications, fuel handling, equipment recommendations, safety practices, and testing procedures. The information was prepared with assistance and

input from the National Corn Growers Association, the Governor's Ethanol Coalition, DOE, General Motors Corporation, and Ford Motor Company.

☛ *For a copy, go to <http://afdc3.nrel.gov/refuel/reports/fuelrpts.html> or call the National Alternative Fuels Hotline at 800-423-1363.*

Los Angeles Converts Buses to Ethanol

The Los Angeles Metropolitan Transit Agency (LAMTA) recently converted its alcohol bus fleet (which has almost 330 vehicles) from neat methanol to 95% ethanol. When LAMTA ordered the first 30 buses equipped with Detroit Diesel 6V-92TA methanol engines in 1989, methanol was the only fuel choice allowed by the State of California for new transit buses. Since then, the engines have been California certified for ethanol.

Federal Ethanol Blending Tax Credit Extended

The ethanol blending tax refund provision that expired October 1, 1995, was extended as part of the 1996 tax/minimum wage bill signed by President Clinton in September. The legislation is retroactive, which means blenders can file amendments for their 1995 taxes and receive credit for ethanol used after April 1, 1996.

Illinois Extends Ethanol Tax Credit

This summer Illinois Governor Jim Edgar (R) signed a bill to extend the state's sales tax break for ethanol-blended gasoline that otherwise would have ended July 1, 1996.

19th Symposium on Biotechnology for Fuels and Chemicals May 4-8, 1997 ■ Colorado Springs, Colorado

The 19th Symposium on Biotechnology for Fuels and Chemicals continues the symposium series in which participants gather in an informal, congenial atmosphere to present research results and exchange ideas. This year's topics include:

- Session 1. Feedstock Supply and Processing
- Session 2. Applied Biological Research
- Session 3. Bioprocessing Research
- Session 4. Industrial Needs, Commercialization, and Process Economics
- Session 5. Specialty Chemicals, with Emphasis on Environmentally Benign Products and Processes
- Session 6. Biotechnology in the Paper and Pulp Industry

For registration information visit our web site at:

<http://www.nrel.gov/biotech/>

Or contact Mark Finkelstein, Conference Chairman, at:

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Biofuels UPDATE

BIOFUELS PROGRAM

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