

FUEL FOR ECONOMIC DEVELOPMENT

ETHANOL PRODUCTION PLANS GAIN POWER IN NORTH CAROLINA

Three facilities are on the drawing board in the eastern part of the state, creating a potential cash crop alternative for tobacco farmers and cleaner fuel to help meet air pollution standards.

Rhonda Sherman

WHAT do alternative transportation fuel, farming, biomass reuse, and high-speed fiber optics all have in common? The answer is a multifaceted project that could have an enormous impact on eastern North Carolina's economy. On March 7, North Carolina Governor Jim Hunt joined the state commerce secretary, commissioner of agriculture, and officials from a private company called DFI Group in announcing the development of three ethanol production facilities in eastern North Carolina. With an expected investment of \$1.4 billion and the creation of 1,200 new jobs, this was the largest investment announcement in North Carolina's history.

"The ethanol project had been on the back burner for several years," says T.C. Adams, director of the state Energy Division. "It came to the front burner in October, 1999, after convincing the State Motor Fleet people a couple of years ago to buy ethanol-powered vehicles and to obtain the ethanol. More than 1,200 vehicles later, they showed that it could work and it kick started this project."

Governor Hunt is a strong supporter of ethanol fuels to help ease the state's growing air pollution problems, develop a sustainable fuel source that reduces dependence on foreign oil, and provide alternative crops for the state's beleaguered tobacco farmers. In 1999, Hunt became the only governor on the East Coast to join the national Governor's Ethanol Coalition, which is devoted to the promotion and increased use of ethanol.

North Carolina already has established several local and state incentives to encourage the use of alternative fuels. (For example, the city of Greensboro is starting operation of an anaerobic digester designed to process 30,000 tons/year of yard trimmings into high quality compost, with biogas sold to a nearby industry as boiler fuel.) Since 1987, the state has provided a corporate or personal income tax credit for construction of certain new ethanol fuel plants in North Carolina. In 1996, its Division of Air Quali-

ty began administering a grant program that funds incremental costs of alternative fuel vehicles and publicly accessible refueling stations. The General Assembly adopted legislation in 1999 that set a state goal to reduce emissions of nitrogen oxides from all sources by at least 25 percent by June 1, 2009. To help achieve this goal, Senate Bill 953 (the Ambient Air Quality Improvement Act of 1999) mandates that new transit and school bus purchases as of January 1, 2004 include at least 50 percent alternative fuel or low emissions vehicles.

"Ethanol is a viable alternative, especially in terms of air quality, because it can replace MTBE as an oxygenate in reformulated gasolines that are sold as cleaner burning fuels," explains Carol Werner, executive director of the Environmental and Energy Study Institute in Washington, D.C., and a long-time proponent of alternative energy. MTBE has been targeted as a pollutant of water supplies, and California, New York and other states are phasing out its use (see sidebar). "In addition, use of fuels like ethanol can help states comply with Clean Air Act requirements," notes Werner. "Ethanol is also a big winner in reducing greenhouse gas emissions, the cause of global warming."

INVESTING IN ETHANOL PRODUCTION

The ethanol production project involves several components, including creation of a 250-mile natural gas pipeline spreading across the eastern half of the state, new markets for some of the state's agricultural products, three cogeneration power plants, and the possibility of fiber optic networking to facilitate eastern North Carolina's access to the Internet.

DFI Group, a land development company, plans to break ground on the ethanol production facilities in early 2001, and be fully operational by September, 2003. The natural gas pipeline construction is targeted to begin in 2002 and be completed in 2003.

Each of the three plants will produce 60 million gallons/year of ethanol (national

Each plant will use 60 million bushels of sweet potatoes and 22 million bushels of corn to produce ethanol.

ethanol production in 1999 was approximately 1.8 billion gallons). The plants will not only make the state one of the nation's larger ethanol producers, they will be the only major production facilities east of Tennessee and Kentucky.

Fuel ethanol is a high octane, water-free alcohol produced from the fermentation of sugar or converted starch. Steam is used to break down and ferment the feedstock. Each ethanol plant will be run by steam generated at an adjacent cogeneration power plant. The power plants will be fueled by natural gas supplied by a pipeline that will span eastern North Carolina from South Carolina to Virginia.

"What's involved is more than just mak-

ing ethanol," says John Nelms, recycling specialist with the state Department of Commerce. "A large component is having natural gas run to each power plant to generate steam to produce the ethanol. Currently, parts of eastern North Carolina are either not served or grossly underserved with natural gas. What makes it complicated is that 200 megawatts of electricity need to be generated to produce enough steam to make ethanol. But the process of making ethanol only uses roughly 10 megawatts of electricity, so about 190 megawatts need to be marketed to nearby industries or utilities. Discussions are underway with utility companies and large users of natural gas to negotiate how much they would buy and at what price."

ETHANOL MARKETS GET BOOST

AT present, nearly 95 percent of the ethanol sold in the U.S. is produced from corn. But at a recent National Conference on Ethanol Policy sponsored by the Renewable Fuels Association (RFA), industry analysts predicted that a third will come from other biomass sources such as sweet potatoes in North Carolina, wood residuals in states like Arkansas and Oregon, and MSW in New York and Pennsylvania. Ethanol is produced by a fermentation/distillation process that converts sugars to alcohol, which then can be used as a clean-burning fuel. Ethanol blended with diesel fuel, called oxygenated diesel, represents an exciting opportunity to reduce exhaust emissions for diesel powered vehicles.

"The U.S. ethanol industry is capable of expanding to meet the demand for oxygenates that would result from a total withdrawal of Methyl Tertiary Butyl Ether (MTBE) from the domestic marketplace," reported John Urbanchuk, an energy consultant, to a recent meeting of the Governor's Ethanol Coalition. His comments were made in response to rising national concern about the presence of MTBE (a gasoline additive) in groundwater and its risk to public health. "The replacement of MTBE with ethanol will increase the demand for ethanol to nearly 3.2 billion gallons by 2004 from an estimated 1.3 billion gallons this year," predicts Urbanchuk. "Increased capacity will come from improvements in production efficiency leading to increased utilization in existing plants; expansion of existing operating facilities; new construction in place, and proposed facilities currently in vari-

ous stages of development."

California in particular looks to benefit from ethanol production in major ways. Ethanol can halt new groundwater pollution that would be caused by MTBE and help solve the difficult issue of disposal of rice straw. Farmers now plow the straw into the ground or burn it after harvest, creating terrible air pollution problems in areas near Sacramento. California rice farmers are looking to ethanol plants as a low cost, environmentally friendly solution to their problems.

Governor Tom Vilsack of Iowa, chairman of the Governor's Ethanol Coalition, believes that an adequate ethanol supply will be available to meet California needs. The coalition, composed of 22 governors, mostly from the corn belt states (although the governors of Arizona, Colorado, North Carolina and Hawaii are also members), has been lobbying for a renewable fuel standard if the current oxygenate standard is removed in reaction to the MTBE problem. This would ensure demand for ethanol and boost the price of corn. According to the RFA's estimates, full substitution of MTBE by ethanol would "increase net farm income \$1 billion annually, create 13,000 new jobs and enhance the nation's balance of trade \$12 billion by 2010." Eric Vaughn, RFA president, concluded that "domestically produced renewable ethanol will provide tremendous economic stimulus to rural America while protecting air quality, preserving water resources and maintaining stable consumer gasoline prices and supply."

— Robert Feinbaum

A HIGHER ENERGY SWEET POTATO

Each plant will use 60 million bushels of sweet potatoes and 22 million bushels of corn to produce ethanol. North Carolina State University (NCSU) scientists have developed industrial-type, white sweet potatoes specifically designed for ethanol production that bear little similarity to edible sweet potatoes. As such, the ethanol feedstock has been dubbed Industrial Energy Potatoes (IEP). While regular sweet potatoes contain 18 to 19 percent dry matter (the rest is water), current experimental lines are in the 26 to 30 percent range. Research is continuing at NCSU to further increase the dry matter content. "Over the long-term, we'll use a combination of conventional and modern breeding techniques, including new biotechnical tools, to develop new varieties of sweet potatoes that are optimized for ethanol production and other value-added traits," says Craig Yencho in NCSU's Horticultural Science Department. "Although we will use biotechnology to facilitate development of the new sweet potato varieties, none will be genetically transformed. Our team will access exotic germ plasms and make crosses that create a new ratio of starches in the potatoes and increase protein content for the coproducts."

Although North Carolina is the country's leading producer of sweet potatoes, these new markets are expected to increase sweet potato production five-fold. The sweet potatoes could be integrated into normal crop rotations for farmers, and provide an alternative product for tobacco farmers facing shrinking markets. Tobacco farmers would be able to use the same equipment with minor modifications for sweet potato crops. Not only is this a remarkable market opportunity, but it saves money for the ethanol project because the developers originally assumed they would need to import close to 100 percent of the feedstock as corn from the Midwest.

Plans are underway to set up a farmers' cooperative that includes ten refrigerated collection and distribution centers where sweet potatoes would come in for processing before going to the ethanol plants. "Coop members could share equipment such as greenhouses and potato harvesters," says

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DEVELOPING BETTER ENZYMES

KEY to the longer term economic viability of ethanol production is reducing the cost of converting the starch and sugars in plant materials to a fuel source, as well as being able to use as much of the plant as possible. What this entails, explains Carol Werner, executive director of the Environmental and Energy Study Institute in Washington, D.C., is reducing the cost of the enzymes that do the conversion. Recently, she notes, the U.S. Department of Energy signed a contract with a leading biotechnology firm to work on getting the costs of enzymes down.

One area being closely examined is development of enzymes that break down the

cellulose and hemicellulose parts of the plant. "Traditionally, the focus has been on enzymes to convert starches in plants," says Werner. "Being able to use more parts of the plant to produce biomass or cellulosic ethanol will significantly alter the economics of ethanol production."

Eventually, she adds, ethanol facilities should be able to use the lignin in the plant to fire the whole process — instead of using natural gas or another fossil fuel. "Using lignin makes the whole process carbon dioxide neutral, which is significant in terms of air quality and climate change. Ethanol plants will become closed loop facilities — essentially biorefineries."

Dewitt Hardy with the North Carolina Department of Agriculture. "This will enable small farmers to participate in addition to large farming operations."

Under this plan, at least 80 percent of the feedstock for the three ethanol plants could be grown in North Carolina. Corn is not a major crop in the state, so current plans call for most of it to be imported. However, the North Carolina Corn Growers Association is very interested in this project and anticipates that corn production will significantly increase as a result.

IMPROVING ECONOMICS WITH COPRODUCTS

Critical to the economic viability of ethanol production — at least at this time — is that the process yields valuable coproducts with their own market niches. Each plant has the potential to produce 14 by-product streams. These include beverage-grade carbon dioxide for use by soft drink bottlers; mash from the potatoes (i.e., dried distiller grains containing digestible protein) for animal feed; high-quality starches that pharmaceutical companies can use to make aspirin and other drugs; starch for use in biodegradable plastics; and sale of excess energy.

By-products reuse also results in a more environmentally friendly facility. "Due to the plans for coproduct marketing and water reuse, waste and water discharge will not be environmental issues associated with the ethanol plants," says Nelms. "However, air pollution is a concern due to the size of the plants, so permitting is already underway since it will take six months to a year to obtain an air permit." It will also take nine months to obtain easements for permitting the pipeline.

Aside from his goal to construct ethanol plants, DFI President Bill Horton wants to increase and enhance the natural gas infrastructure in eastern North Carolina. Local governments in the region are limited in the types of industries they can attract due to the limited supply of natural gas. Expan-

sion of existing industries is constrained by expensive fuel. In addition, air quality in the region is poor from the use of coal and other higher-polluting fuels.

A South Carolina natural gas company, SCANA, will be constructing the pipeline. SCANA has a subsidiary in high-speed fiber optics, so it is exploring the feasibility of running those cables in trenches along with the pipeline. It will be a \$300 million dollar investment by SCANA to run the fiber optics cables.

DFI is optimistic about the progress being made in developing the ethanol facilities. "With the state making such a big commitment to alternative fuel vehicles in the State Motor Fleet and the governor joining the Governor's Ethanol Coalition, it laid the groundwork for embracing the proposed project," says Ed Stalls, vicepresident of DFI Group. "Our company unveiled our proposal to top state officials in mid-December, 1999 and it's been nonstop forward ever since."

Given the high price of fuel, increasing air pollution, overall global climate change concerns and the need to improve farm-based economies, many will be watching the development of an ethanol production infrastructure in North Carolina. "We are now at a different stage where there's a confluence of factors coming together to help realize an opportunity that offers significant economic, environmental and energy benefits," says Werner. "To a state that has gone through enormous hard times, this offers an opportunity to promote economic development in an environmentally sustainable manner. The project is drawing together a variety of investments that will benefit the economy of North Carolina. It is an illustration of how synergies have been created, dealing with multiple problems, creating multiple benefits and products — truly a win-win-win situation for North Carolina." ■

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