

# Fuel from vegetable oil: Biodiesel

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It smells familiar -- fried chicken, french fries, maybe burned popcorn. That's how the Keene State College staff describe the new diesel fuel that's awakening their senses and running some campus equipment.

The fuel, called biodiesel, is made from vegetable oils or animal fats. Gone are the black puffs of smoke when the engines are started; gone is the strong diesel smell. Also missing are most of the pollutants emitted by conventional petroleum diesel.

"It's more pleasant and it smells less harmful," said Kelley L. Tacy, assistant gardener at the college.

During the summer, she spends about six hours a week mowing the campus yards. Her mower now burns 100 percent vegetable oil instead of regular diesel. "It wasn't horrible before, but I definitely can tell the difference between the two smells."

Biodiesel's environmental benefits are twofold, college officials say: Biodiesel emits fewer pollutants, overall, and it's made from crop oils or recycled cooking grease, reducing a dependence on imported oil. According to the U.S. Environmental Protection Agency, the vegetable oil-based fuel emits fewer carbon monoxide, hydrocarbons, sulfate and small, soot-like particles than petroleum-based diesel.

"Toxic compounds grab onto that soot. The particles are very fine; you breathe them in and the toxics get carried way down into your lungs," said Rebecca E. Ohler, an air quality engineer with the N.H.

Department of Environmental Services.

In New Hampshire, about half of the air pollution is generated by mobile sources -- cars, trucks, buses, snowmobiles and lawn and garden equipment. Nonroad sources, such as Keene State's mowers, are just a small percentage, but they do contribute to pollution, Ohler said.

"We're not going to see a jump in our ozone level, but localized health impacts can be quite high" from nonroad engine exhaust, she said. Cleaning up that exhaust creates healthier air.

Biodiesel isn't environmentally perfect. It emits up to 9 percent more smog-causing nitrogen oxide than regular diesel; its methane emissions are the same as petrodiesel.

"Biodiesel is a step forward; however, we are cautious," said Catherine M. Corkery, a lobbyist with the N.H. Sierra Club. Her organization calls biodiesel a good

transition fuel. "We all share the same goal -- to get away from fossil fuels. Biodiesel is a first step," Corkery said.

### **A natural choice**

Biodiesel is more expensive, costing about 30 cents more per gallon than regular diesel. Keene State pays about \$1 for regular diesel; about \$1.30 for biodiesel. The college is getting help with the extra expense this year from the Governor's Office of Energy and Community Services.

Keene State is the first college or university in New Hampshire to use the alternative fuel. While it's fun to talk about the smell, it wasn't the fried chicken aroma that attracted the college. It was the environmental benefits, and funding help, that swayed officials.

"We are trying to find better ways to do things that are less polluting and more sustainable -- that was the big push behind this," said Bud Winsor, assistant director of the physical plant and grounds at Keene State. He supervises the college's vehicle fleet.

Members of the Keene State President's Council for a Sustainable Future looked for alternative fuels or vehicles to reduce pollution.

"We like the electric cars, but they're expensive," said Mary E. Jensen, recycling coordinator and member of the council.

Biodiesel was a natural choice for an alternative fuel.

Most engines don't have to be modified to burn the biodiesel -- a big plus in Keene State's eyes. "It was the easiest and cheapest thing we could do. It didn't require any money or investment on our part," Jensen said.

Biodiesel comes in two forms: B100 is 100 percent vegetable oil; B20 is petroleum diesel blended with 20 percent vegetable oil.

Keene State will use B100 through October. "With one change in the delivery of our diesel fuel, we've gone to no dependency at all on foreign oil," Winsor said. But when the temperatures drop, the college will switch to B20, because the 100 percent vegetable oil freezes more quickly and becomes like a gel at higher temperatures, clogging the engines.

After one month, the six vehicles -- mowers, tractors and a trash truck -- using the biodiesel are running smoothly, Keene State officials say.

"It has less impurities in it. It helps clean out the intake system and fuel systems in the vehicles," said Michael H. Fuller, lead mechanic. "When you burn a fuel, you have sulfur and carbon buildups in the engine -- this doesn't have that."

Keene State College gets its biodiesel from World Energy Alternatives in Chelsea, Mass. The company is the country's largest provider of biodiesel.

Surplus soybean oil is typically used to make World Energy's biodiesel. "The long and short of it is soybeans now are produced for their meal protein. There's a strong demand for the protein but not for the oil," said Gene J. Gebolys, World Energy Alternatives president.

Most of World Energy's fuel is made from virgin, unused oil, but not all of it. Some oil may have been used to make cosmetics or to fry foods. "It's all cleaned up -- you're not going to have potato chip bits in your fuel," Gebolys said.

The college market for biodiesel is just beginning to develop, Gebolys said. The University of Michigan was the first university to use biodiesel two years ago. Now

Keene State College joins the list that includes the University of Massachusetts at Amherst, University of California at Davis and Ohio State University.

Keene State officials said a college campus is a natural place for the vegetable oil fuel. The diesel engines operate close to dorms and classrooms with students, faculty and staff, so reducing pollutants reduces health hazards. "I've had complaints in the past from students and professors. Hopefully, this will alleviate some things," Winsor said.

The pure B100 biodiesel emits fewer pollutants than the B20 blend; both are cleaner than regular diesel on most counts.

Particulate emissions are cut 15 percent with the B20 blend or 70 percent with the B100. Total hydrocarbon emissions are reduced by 10 percent with B20 or 40 percent with the B100.

Carbon monoxide emissions are cut by 10 percent with B20 or 50 percent with the B100. Sulfate emissions are cut by 20 percent with B20; they're totally omitted with B100.

Ohler at the state environmental agency said people with delicate respiratory systems may notice a change with the biodiesel.

"The immediate benefits are the people who are right in that area where that equipment is being used. Anybody exercising, breathing deeply or jogging by that equipment will get a lot less hit when going by biodiesel," Ohler said.

### **Back to 1895**

Biodiesel fuel is a return to the diesel engine's roots, according to the EPA. Back in 1895, French-born Rudolf Diesel developed his namesake engine so it could run on a variety of fuels, including vegetable oil. When Diesel showed off the engine at the 1900 World Exhibition in Paris, he used peanut oil as fuel.

In 100 years, the engine has been modified to run on petroleum diesel, because it was the least expensive fuel, the EPA says.

Now, attitudes are changing. Fossil fuels are finite and polluting, and make the United States dependent on other countries that are oil-rich. That's sending some companies and organizations back to Diesel and his original intent.

If the diesel engines continue to run smoothly at Keene State, Winsor will move biodiesel out of the pilot stage and onto the permanent budget next year.

"It's almost too good to be true. I've got my fingers crossed, but I don't foresee any problems," Winsor said. "We're definitely in it for the long haul."