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THE BIODIESEL PROJECT How CHEWONKI IS USING RECYCLED COOKING OIL TO HEAT ITS BUILDINGS AND RUN ITS VEHICLES

Three days a week, Peter Arnold's workday begins well before he gets to his office at Chewonki. Peter is the man with the baby blue truck that has a small hydraulic barrel hoist mounted in the bed—"the vehicle that looks like an oversized and off-color praying mantis" he says—and it is his job to pick up the oil. Leaving his home in Damariscotta, Peter stops first at Reunion Station Restaurant on Route 1 and hoists aboard a 55-gallon metal drum of used cooking oil. Although a full drum can weigh almost 500 pounds, Peter handles the job easily by himself, thanks to the hoist. His next stop is the Sheepscot River Inn, but here the barrel is only half full, and Peter makes a mental note to stop again tomorrow.

He then heads for Red's Eats and Nick's Pizza in Wiscasset. Both small eateries set aside several 5-gallon plastic jugs of used fryolator oil for Chewonki, and Peter simply plops the jugs into his truck bed. The last stop is the Sea Basket Restaurant, a few miles farther down Route 1. "This is by far our largest supplier," Peter explains, and here he uses the hoist again to pick up another 55-gallon drum of used vegetable oil.



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PETER ARNOLD (LEFT) AND SCOTT BELANGER, MANAGER OF THE SEA BASKET RESTAURANT.



RIGHT: FACILITIES ENGINEER NATE ARNOLD (LEFT) AND PETER ARNOLD.

His five stops completed, Peter turns off Route 1 and onto Chewonki Neck, headed for the old pole barn now known as the Biodiesel Center. This is where Chewonki is transforming used cooking oil into fuel. Peter parks the praying mantis and unloads the day's haul. It is a chilly but lovely and clear blue September morning, and the air smells wonderful. And air quality is ultimately what all this oil is about.

The Biodiesel Project is part of the ongoing challenge at Chewonki to consume as few resources as possible, to become energy self-sufficient, and to reduce the foundation's contribution to global warming. Recognizing that global warming, caused by an increase in greenhouse gasses in the atmosphere, is the result of burning fossil fuels, Chewonki initiated the Biodiesel Project to demonstrate that fuel for transportation and heating can be produced from a renewable source, in this case waste vegetable oil, rather than from fossil petroleum. "Any time we eliminate burning a gallon of fossil fuel," says Peter Arnold, Chewonki's Renewable Energies Pathway Coordinator and the overall coordinator for the Biodiesel Project, "we're ahead. For every gallon of fossil fuel we burn, we release 20 pounds of CO₂ into the atmosphere. But with biodiesel we can cut that figure by about 78 percent." The Biodiesel Project aims to produce 20,000 gallons of fuel per year, which is anticipated will be enough to heat at

least four buildings, to power a 15-passenger diesel van, a Volvo station wagon, a tractor, and several staff vehicles, and to run a microturbine capable of producing 50 percent of Chewonki's electricity as well as heat for the Wallace Center and Natural History Center. The project will also serve as a demonstration and educational tool.

Peter is assisted by two other Chewonki staff members: Chris Riley, the Wilderness Equipment and Logistics Manager who serves as the production coordinator, and Nathan Arnold, Facilities Engineer, who is responsible for the project's design and systems engineering. The team's work began in earnest last October when Chewonki received a \$10,000 grant from the Maine Technology Institute to demonstrate the viability of making significant quantities of biodiesel from local sources of waste vegetable oil. The grant provided funds to assemble and test equipment, develop a business plan, and design a small production facility. Work has proceeded simultaneously on all three phases of the project, and word is currently awaited on an additional grant application, for funding to build a permanent production facility. In the meantime, the small-scale biodiesel production that began a year ago continues in the unheated pole barn, at least until the weather gets too cold.

Chewonki refers to its biodiesel as C³—Chewonki Climate Conscious fuel—and the recipe,



PRODUCTION COORDINATOR CHRIS RILEY OPENS THE LID OF A COOLED DOWN REACTION VESSEL. THE HEAVIER GLYCERIN SETTLES ON THE BOTTOM OF THE VESSEL, AND THE LIGHTER BIODIESEL LIES ON TOP.

What Is Biodiesel?

It may not be a household word yet, but given the rate at which biodiesel is gaining recognition and popularity as an alternative energy source, it will be soon. Biodiesel is a biodegradable, nontoxic, and clean-burning fuel that can be made from any fat or vegetable oil, including recycled cooking oil. Because it contains no petroleum or other fossil fuels, it emits virtually no sulfurs, aromatics, particulates, or carcinogenic compounds and is thus a safer and healthier alternative than petroleum diesel. And because biodiesel can be produced domestically from a renewable resource—primarily soybeans, which are grown in the U.S. by almost 400,000 farmers in 29 states—it also reduces dependence on foreign oil, increases agricultural revenue, and creates jobs.

Biodiesel can be used in all conventional diesel engines, delivers similar performance and engine durability as petroleum diesel, and requires virtually no changes in fuel handling and delivery systems. It can be used in its pure form or blended in any ratio with petroleum diesel. The latter is particularly advantageous since it means biodiesel can be stored and dispensed wherever petroleum diesel is. Used even in a 20% blend with 80% petroleum diesel (currently the most common commercial blend, known as “B20”), it is a significantly cleaner fuel than petroleum diesel, reducing emissions of unburned hydrocarbons by 14%, carbon monoxide by 9%, and particulate matter by 8%. Burning 100% biodiesel, known as “B100” or “neat” biodiesel, reduces these emissions by 68, 44, and 40% respectively. Nitrogen oxide emissions may increase slightly with biodiesel, but sulfur emissions, which are major components of acid rain, are essentially eliminated. With the improved air quality it offers, biodiesel is estimated to provide a 90% reduction in cancer risks compared with petroleum diesel.

Biodiesel is also safer to store, handle, and use. With a flash point of 300° F (versus 125° F for petroleum diesel), it is considered non-flammable and is not required to carry a Hazardous Material label. Yet another advantage, at least when it is made from recycled oil, is the savings it offers landfills. In Hawaii, for example, where Pacific Biodiesel, Inc. is producing biodiesel entirely from recycled cooking oil, the restaurants that supply the company formerly sent more than 40 tons of used oil to the Maui landfill every month.

And last but not least, of course, there’s the aroma. As everyone at Chewonki knows, biodiesel definitely changes the smell of your vehicle’s exhaust. French fries for lunch? Popcorn again? Nah, it’s just the tractor driving by.

You can learn more about biodiesel from the National Biodiesel Board; it maintains the largest library of biodiesel information in the U.S. Visit the NBB website at www.biodiesel.org; e-mail info@nbb.org; or call toll-free 1-800-841-5849.

CHEWONKI CURRENTLY
PRODUCE 300 TO 500 GALLONS
OF C³ A WEEK AND HAS BEEN
USING IT IN VEHICLES
AND FURNACES FOR MORE
THAN A YEAR.

according to one reporter, "is about as simple as Aunt Em's recipe for pound cake." That may be an exaggeration, but not by much. Once the used oil is unloaded from the praying mantis, it is pumped into 275-gallon storage tanks which gravity feed into a reaction vessel—a fancy name for another 55-gallon metal drum. For every 40 gallons of oil in the reaction vessel, reads the recipe, add 10 gallons of methanol and the appropriate amount of powdered lye as a catalyst. Heat to 120° F, stir for 1 hour, and let settle for 8 hours. Note: methanol is poisonous and lye is caustic, so it is important to wear protective clothing and safety glasses.

As the reaction vessel cools down, Aunt Em's recipe separates into two products. The heavier glycerin settles to the bottom. The lighter and more abundant biodiesel, comprising about 80 percent of the yield, lies on top and can be used directly in diesel engines and oil furnaces. The biodiesel team drains off the glycerin and transfers the biodiesel to 275-gallon plastic vessels. From there they can truck the fuel wherever it is needed, whether to furnaces or to the diesel pump at the garage. The glycerin, an organic compound which breaks down quickly, is composted, but the team may eventually decide to refine and sell it for pharmaceutical or soap use, as many commercial biodiesel producers do.

Chewonki currently produces 300 to 500 gallons of C³ a week and has been using it in vehicles and furnaces for more than a year. The only glitch, which is one all biodiesel users face, is that in vehicles the fuel can gel in cold weather and not flow properly. The biodiesel team has gotten around this for the past year by blending C³ with petroleum diesel, but they will experiment with other options this coming winter. Chewonki's 1982 diesel Volvo is getting refitted with a heated fuel tank, for example, and commercially available filter heaters may be installed in other vehicles.

Peter Arnold is delighted with how far the Biodiesel Project has come in its first year. "We've proved to ourselves that we can make 500 gallons a week," he says, "and although not all of the data are in yet, I think we'll also prove we can produce it for no more than what we pay for commercial fuel." Those costs, per gallon, are currently about \$1.29 for heating oil and \$1.50 for petroleum diesel gas. As they go up—which they surely will—Chewonki's ability to avoid increases in fuel costs will make the economic index of the project's success look even better. The environmental index of success is also impressive. "By burning 20,000 gallons of biodiesel instead of fossil fuels," says Peter, "Chewonki will contribute about 312,000 pounds less CO₂ to the atmosphere per year. That is quite significant." Indeed, with the foundation's combined use of electricity, transportation fuels, and heating oil estimated to have liberated more than 1 million pounds of CO₂ into the atmosphere last year, that 312,000

pounds will represent a more than 30-percent reduction in Chewonki's CO₂ liability.

Peter is also gratified by the contribution the project is making to the local community. "We're taking a waste product that the restaurants have had to pay to ship to Massachusetts—a process that not only is costly but puts more CO₂ into the atmosphere—and are recycling it within our own community at a lower cost. At the same time, we're modeling one of the ways in which we can all address the question 'What can we do about global warming?' We're demonstrating that the hardware needed to produce biodiesel is not complicated or expensive, nor is the process to make it. We're also demonstrating," he adds with a laugh, "that the darn stuff works!"

Chewonki can hardly claim to have invented the idea of using vegetable oil as fuel. The German engineer Rudolf Diesel did that back in 1895 when he developed the first diesel engine and ran it on peanut oil. Today biodiesel is produced most widely in Europe, where it has been used for more than 20 years, but it is quickly gaining momentum elsewhere. In the U.S. biodiesel is now used by at least 80 major transportation fleets, including transit authorities, school districts, government and municipal agencies, and national parks. In Maine, however, use of the alternative fuel is still in its infancy. Commercial biodiesel is available at only one outlet in the state, the Solar Market in Arundel, at a price of \$2.45 a gallon. Peter Arnold believes Chewonki's Biodiesel Project can be a model for many organizations and towns in Maine, especially in rural areas. "If we can demonstrate here that it's possible to produce and use biodiesel for no more than the cost of doing 'business as usual,' that would be a very strong role model," he says.

President Don Hudson is also delighted at how much interest the project has sparked. "It's amazing how many people all over Maine, in both the private and the public sectors, are interested in this," he says. "The state is very interested in pushing biodiesel. The air quality people are thrilled about it." Don sees the Biodiesel Project as a "what if" project. "What if the world really did start making and using biodiesel on a large scale?" he asks. "If we can do it well here, it will be a model for others. There's a very satisfying feeling in doing something this neat on a small scale. There's an even better feeling when it's connected to something so much larger."

With temperatures dropping regularly now and the first snowfall no longer far off, there are few worries at Chewonki about the coming winter. Thanks to the Biodiesel Project, the furnaces are full of C³—and that 1982 Volvo is ready for the snowy roads. ■

ELIZABETH PIERSON