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# Richardson converts used vegetable oil into energy

By David Bedard  
Fort Richardson PAO

Since Rudolph Diesel demonstrated his namesake engine at the 1900 World Exhibition in Paris, running on peanut oil, the possibility of using vegetable oils as an alternative fuel has entertained the thoughts of engineers and conservationists alike.

This month, a partnership between Fort Richardson Directorate of Public Works Environmental Department, the U.S. Army Corps of Engineers Construction Engineering Research Laboratory and Leonardo Technologies Inc. successfully installed a 11-kilowatt generator resourced solely from used vegetable oil to provide heat for the Fort Richardson Hazardous Waste Center.

Jeff Raun, Colorado State University Center for Environmental Management of Military Lands contractor working for DPW Environmental, said he teamed with Scott Lux, USACE-CERL, and LTI employee Joel Lindstrom to bring the project to realization.

“I was lucky enough to get matched up with Scott and Joel who have been pursuing this technology in slightly different tangents,” Raun said. “It was such a good fit that I felt the installation shouldn’t pass up the opportunity to pursue what could be a well-demonstrated technology that we can expand to wider Army use.”

In that regard, Raun said the project serves



Joel Lindstrom, Leonardo Technologies, Inc., holds a purified sample of vegetable oil. The viscosity of the oil gives it a much higher freezing point than diesel, requiring special consideration in winter conditions. (Photo by David Bedard/Fort Richardson PAO)

as a proof of concept for Fort Richardson which will require innovative measures.

“We’re merging a few stages of the scientific

process into one, doing a demonstration and validation while still looking at the feasibility of the technology and the economic feasibility as well,” Raun explained. “We will compare the cost of this operation – which we won’t have established until we get all of the small bumps ironed out, determine the labor and mechanical requirements – and then compare those program costs versus alternative options, and the baseline operation of sending the used cooking oil off the installation.”

Raun said the process begins in the installation’s dining facility kitchens which feed hundreds of Soldiers every day.

“With minimal impact to their operations, the dining facilities – after clearing out their grease traps – would take the oil to 55-gallon drums located outside the building,” Raun said. “We’ve asked them to slightly modify procedure by adding a separate drum to keep the vegetable oil from the fryers separate from that which comes from the clean-outs to reduce water content.”

Raun said Environmental Compliance Consultants transports the drums from the dining facilities to the Hazardous Waste Center.

“Previously, the used cooking oil would – after coming here – be shipped through (Defense Reutilization and Marketing Service) and the installation was paying 25 cents a pound plus the cost of the steel drum to dispose of the used vegetable oil off post,” Raun said. “We’ve

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inserted this process to intercept the oil before it goes off post and before we pay for its disposal by capturing it here as a fuel.”

Lindstrom said vegetable oil is derived from plant lipids, biological energy storage molecules sufficient for combustion in diesel engines which normally run on fossil fuels.

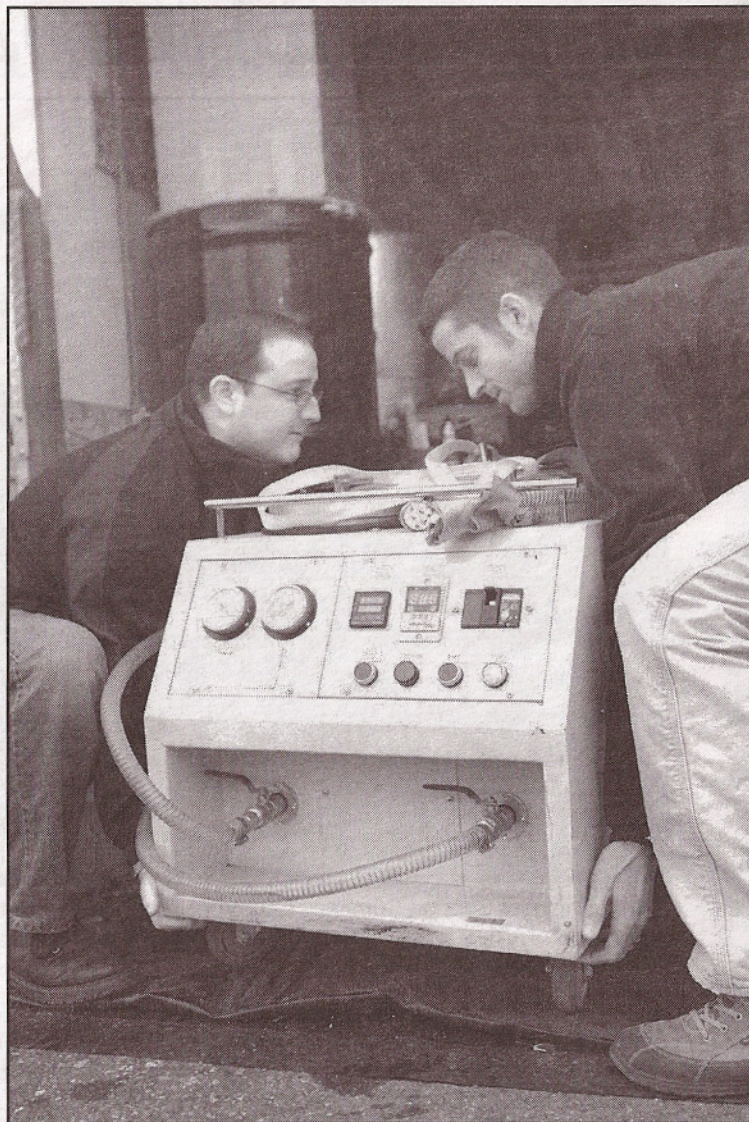
“Diesel fuel is refined from petroleum which is arguably produced from algal materials in the oceans a long time ago,” Lindstrom said. “So the two are different chemically. The properties such as viscosity and surface tension are notably different which is why we modify the engines to accommodate for those properties.

“In terms of energy content per volume, vegetable oil contains on the order of five to seven percent less energy content, so in some engines they may want to modify certain things to account for that, allowing for more fuel flow,” Lindstrom continued. “For this engine, there’s no difference, so it’s really remarkable how similar they are in terms of energy content but they come from entirely different sources.”

The generator set is contained in an otherwise unassuming trailer, home to a system which processes the vegetable oil into a purified biofuel, ushering the previously untapped resource into a three-cylinder indirect injection generator which produces electricity for space heaters providing heat to Fort Richardson’s Hazardous Waste Center.

Lindstrom said a 55-gallon drum containing the used vegetable oil is brought into the trailer where heat is both ducted from the engine into a shroud surrounding the barrel as well as produced by an electric band encapsulating the bottom of the barrel to redundantly prime the oil for filtering.

“We have a couple of filters that pre-filter the oil and then we have a centrifuge that takes the small particles out,” Lindstrom said. “In the back of the trailer, there is a 275-gallon tote that stores the clean oil which is fed to the engine generator which runs continuously day and night. The generator set provides power



Scott Lux, U.S. Army Corps of Engineers Construction Engineering Research Laboratory, and Jeff Raun, Fort Richardson Directorate of Public Works Environmental Department, lift a filtration system into the trailer containing a vegetable oil-powered 11-kilowatt generator. (Photo by David Bedard/Fort Richardson PAO)

which runs into the side of the building to space heaters that run on thermostat, drawing power as needed.”

Lindstrom estimates the generator set will burn two 55-gallon drums every week with ap-

proximately 85 to 90 percent of the used vegetable oil available for combustion after the animal fats and water are filtered out.

“We’re not doing anything here that hasn’t been done already,” Lindstrom conceded. “But what we need to do – which I think we have done – is assemble off-the-shelf components and know how that makes sense for this concept and proves to be economical.”

Raun said the project may have implications beyond the installation.

“Fort Richardson is not unique in that we use cooking oil,” Raun clarified. “Army installations across the country use vegetable oil in their dining facilities.

“My counterparts at other installations who have fought the same battle of what to do with their cooking oil – it’s a sizable problem from the solid waste standpoint,” Raun said. “Marrying that solid waste problem with the potential to diversify energy resources on an installation, it’s a good fit, a win-win for both program areas.

“In terms of overall energy consumption on the installation, it’s a very small piece of the puzzle,” he continued. “But it does add that alternative energy component to an energy portfolio and that is something the Army is very cognizant of – providing sustainability for installations as far as energy resources.”

For his part, Lux said he believes alternative energy sources are important to the security of Army installations.

“Energy security is a huge issue,”

Lux said. “If something happens to the grid, then the mission can be hindered because of a lack of power. So if we can have distributed energy generation resources such as this, then this is something that we are most certainly interested in.”