On north Broadway Avenue, an unassuming, windowless building holds what may be part of this country’s future energy independence. It is the facilities management building of Loyola University and it houses, among a fleet of university trucks and tractors, a biodiesel production lab, part of the university’s Center for Urban Environment Research and Policy. While it may not have the charm of Fermi and Szilard working beneath the University of Chicago football stadium, Loyola’s biodiesel program fits the zeitgeist much as the Manhattan Project did.

Four years ago, an Environmental Protection Agency (EPA) grant helped the university launch their Solutions to Environmental Problems (STEP) course. The concept of this class was to take a tangible environmental problem facing the university and address it with student power. "One of the greatest untapped resources at any university is the student body," said Zach Waickman, Loyola’s Biodiesel Lab Manager. "They may not have the specialized knowledge of our professors, but there are so many of them."

The lab takes in waste vegetable oil from campus cafeterias, Devon Avenue’s ecologically-minded restaurant UnCommon Ground and other sources. During pretreatment, the oil is heated and filtered to separate out any water or food deposits, to which the lab staff have applied the appropriately revolt ing name "chunkles."

Waickman held up his hand to represent a triglyceride and demonstrate the next step in the process. His fist, the glycerin molecule, binds his fingers, the desired hydrocarbon chains. His team next adds the catalyst, a mix of methanol and lye, and aerates the concoction. "What those
chemicals are doing is lopping off my fingers," said Waickman.

Like curds and whey, the molecules rearrange themselves into biodiesel on top and the denser glycerin below. Once separated, the remaining biodiesel is nearly finished at this point; a water rinse removes any excess catalyst and other impurities.

All of the fuel that the lab creates is sold to Free Enterprise Systems, which operates shuttle buses between the Rogers Park and Water Tower campuses. The buses run on a blend containing between 5% and 7% biodiesel. Because they are producing fuel for a third party to be used on public roadways, Loyola became the first and only university licensed to sell biodiesel.

Semester to semester, one goal of the lab is to improve overall production efficiency. The current setup is the fourth generation reactor, installed last summer. As the students and interns track the minutia of biodiesel manufacture, they will suggest tweaks that would improve production even further.

Some efficiencies have come just from scaling up. In its first year, the lab lived in a small, unventilated room in the now demolished Damon Hall. A relatively larger space meant pre-treating the waste oil in one day instead of two. Larger batches of oil also retain heat for longer, obviating extra energy output to reheat the oil.

But the greatest efficiency came in the form of water usage. To make 100 gallons of fuel, the first batch required 80 gallons of water to clean it up. Through efficiencies in the reaction and some procedural changes during washing, water use is now down to 8% by volume. Waickman expects the lab to produce 1,000 gallons of biodiesel this semester. "The fact that we got those water efficiencies in place before we made this major expansion of production was huge."

The glycerin, that saponified slurry of oil drained away from the biodiesel, is no mere byproduct. It itself is a very
serviceable compound used in everything from agriculture to medicine. Its most obvious use, especially with the potassium hydroxide already present from the catalyst, is soap. But the methanol makes this glycerin a hazardous waste.

A Methanol recovery unit—essentially an alcohol still made from a modified hot water heater—not only cleans the glycerin for a later use, it recovers all of the expensive and toxic methanol to be reused in another reaction. One ingenious efficiency is built into the unit’s condenser, usually an electric apparatus that draws a tremendous amount of power to wick heat away. The team instead built a cooling barrel filled with water; all they need to do is add ice. As the lab is located in the facilities management building, they simply exploited the unused freezer in the refrigerator that the maintenance crew members use for their lunches. "It was energy already being used at the university that we tapped into," Waickman said.

All of the cleaned glycerin currently goes into BioSoap, which the university sells in its bookstores and on-campus convenience stores. Waickman hopes eventually to produce enough glycerin to supply all of Loyola’s hand soap needs. However, the biodiesel lab currently produces about ninety gallons of BioSoap a year; they’d have to make that much per week to match the university’s demand.

The lab is also exploring other uses for the glycerin. It could be turned into antifreeze—ethylene glycol or propylene glycol—for use in the campus air conditioning chillers. It is also a good compost additive, speeding up the breakdown of kitchen waste.

Regardless of the ultimate function, Waickman explained, the glycerin, like the biodiesel shuttling students between campuses, will be used by the university. "Who are we working for here? What’s the goal? We work for Loyola University, and the goal is education. It’s not high production volume."

And that education is not limited to Loyola students. The EPA funding that launched the biodiesel program was contingent on the university creating an outreach program to bring biodiesel into high schools. Loyola developed a series of labs to help high school teachers introduce renewable energy topics into existing curricula, designed to teach common chemical, physical and environmental principles through the lens of biodiesel production and testing.

The outreach program has now been in dozens of area high schools, and as far away as Pennsylvania. Mobile biodiesel processors can be wheeled into the classroom with all the necessary equipment to demonstrate biofuel production. A classic high school experiment is the calorimetry lab where students light a peanut on fire to see how much energy it contains. "We do the same lab, but we do
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