

# The WKU Biodiesel Project

WKU's Mechanical Engineering program and the Agriculture Department have completed the initial facilities installation and produced a 250 gallon test batch of biodiesel on the WKU Agriculture Farm in May 2012. The facility will begin supplying a significant fraction of the diesel fuel needs of the WKU Agriculture Farm in fall 2012 with biodiesel produced from used cooking oil collected from the various WKU cafeterias. Jack Rudolph, chair of the Agriculture Department, approached Mechanical Engineering faculty member Kevin Schmaltz with the biodiesel idea in spring 2007. ME students have researched the feasibility of the concept, and in three separate senior project teams (ME412 ME Senior Project courses) a dozen ME seniors have designed the process, selected equipment, installed the equipment and piping, and developed operating procedures to safely produce biodiesel. WKU's Ogden College funded the \$80,000 project, which is expected to save the College thousands of dollars annually on fuel costs, as well as provide opportunities for student engagement and alternative fuel research. The WKU biodiesel facility will supply a significant portion of the Agriculture Department's average 6,500-gallon-per-year fuel needs, at an estimated cost of about \$2.00 per gallon. Agriculture vehicles using blend of mostly biodiesel can reduce carbon dioxide emissions by up to 75% compared to using traditional diesel fuel.

The biodiesel facility beside the Taylor Center at the Agricultural Farm allows for the collection and storage of 500 gallons of used vegetable oil (Figure 1) from the various Aramark cafeterias on campus. Used vegetable oil is heated and mixed with a catalyst and methanol (Figure 2, vessel to left) in a reactor vessel (Figure 3), transforming the used cooking oil and methanol into biodiesel and glycerin. The biodiesel is also purified (Figure 2, vessels to right) and stored for Agriculture farm equipment use (Figure 4). WKU's Restaurant & Catering contractor, Aramark, will supply the used vegetable oil free of charge. Investigations are also being considered into other feed sources, and efficiency improvements to the facility. Safety and environmental protection issues have also been addressed, including specially designed storage facilities for some of the processing chemicals and spill containment around key processing areas.

The biodiesel project is expected to be an economical collaboration of sustainability and technology, allowing for cooperation among students and faculty from the Engineering and Agriculture Departments. The WKU Biodiesel system has been designed to be scalable, with a possible expansion to increase annual production to over 20,000 gallons. With these capacities, it would be possible for other users, such as the WKU campus shuttle bus fleet to run on WKU-produced biodiesel.

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Figure 1: Waste Vegetable Oil Storage Tank



Figure 2: Catalyst Preparation and Biodiesel Washing Equipment



Figure 3: Main Reactor Vessel and Glycerin Processing Equipment



Figure 4: Final Biodiesel Storage Tank



Figure 5: Methanol and Chemical Storage Building