Closing the Gap on Clean Fuels
Bringing Research to Market
by Diane Gow McDilda

John Wolan, Associate Professor of Chemical and Biomedical Engineering at the University of South Florida and UF alumni, is working closely with a team of USF professors, graduate students and a statewide solid waste research center created by the Florida Legislature to produce alternative and sustainable fuels. The feedstock doesn't include vegetation grown for the sole purpose of fuel production, but it does include "yard waste"— something that most homeowners produce and put out on their curb for pickup. John is using something that would otherwise go to, well, waste.

John Wolan and his students are working to produce fuel from yard waste.

"We've made both diesel and jet fuel from pine chips. It's almost like alchemy, like doing magic and turning straw into gold. We start out by converting the pine chips into a synthetic gas thru a gasification process. The biomass derived syn-gas contains a mixture of Carbon Monoxide and Hydrogen Gas. We then use a patent pending catalyst that we have developed here at USF to turn the syn-gas into diesel or JP-8 aviation fuel. It is almost like magic. We think we can turn yard and municipal waste into fuels that can be used by everything from a fighter jet to a long haul trucker. We are very excited," says Wolan.

Conventional crude oil refining produces a spectrum of fuels and other petroleum products including gasoline, kerosene, diesel fuel, and naptha, which is used to make a variety of chemicals. Refining the fuel is done through fractional distillation, a process that is heavily water and energy intensive and produces a significant amount of waste, including sulfur emissions. In contrast, Wolan's process was designed specifically to produce ultra-low sulfur diesel and aviation fuel, eliminating the need for refining. The process is clean, sustainable, low impact and tunable toward customer fuel needs as gasoline or other liquid hydrocarbon fuels can be produced.

Engineering graduate student Syed Ali Gardezi works in the Wolan lab.

"The diesel produced has a cetane number about 30 points

higher than conventional diesel. The cetane number is a measurement of the combustion quality of diesel fuel during compression ignition —it's a very high quality and high performance diesel."

In March 2010, Wolan and his student team were invited to the Global Venture Challenge, sponsored by the US Department of Energy. Other guests included international research organizations, agencies, and venture capitalists. Competing research groups were judged not just by their research, but how processes could be scaled-up and mass marketed. The team, comprised of engineering student Syed Ali Gardezi and MBA student Jaideep Rajput were finalists in the event, placing fourth overall and second in the US.

"It was a great experience," says Wolan. "We got to meet other research groups as well as many venture capitalists." Beyond networking, the challenge was extremely educational.

"I'm a professor of chemical engineering, being at the challenge was like earning an additional finance & investment Ph.D. in three days," says Wolan.

Conversations between Wolan and capital investors he met at the challenge continue. It's a tenuous time for investors, particularly in the area of sustainable fuel. Some investors have been duped by researchers deceptively claiming they are capable of producing a high quality fuel, when their samples were actually purchased at a gas station. Because of this, investors are cautious and asking for more verification. Wolan has gone as far as carbon dating his fuel, showing that it was made recently, using biomass products and not fossils-based.

Even though Wolan is excited about the team's progress and accolades, he knows it will take some time for the business-side to pan out. Mean while, he's continuing to reach out to the business community. He's been in conversations with an equine center in Ocala that produces close to 300 tons of barn waste per day which is currently landfilled. Waste to most, the manure and straw is also a potential fuel source. By developing a process that allows for diversity in feedstock material, adaptations to various environments, including less than hospitable locations becomes attractive.

With a goal of 50 percent alternative fuel production by 2015, the military is investigating more in sustainable sources for their aviation and diesel fuel. Currently, fuel produced via Fischer-Tropsch synthesis such as Wolan's is the only current military-approved alternative for use in jet engines. In addition, the process equipment can be skid-mounted and operated turnkey. Because of this, the systems could potentially be air lifted and dropped to isolated locations such as military bases or to impoverish nations such as Haiti to generate fuel and manage waste material.

"We really think we're doing what is right in the right place at the right time," says Wolan. "When the military imports fuel to locations such as Middle East bases, there's a high cost for security due to the value of the fuel. We really can't see a downside to our process." The turning point will come, Wolan believes, when they can accurately estimate the cost of fuel produced by their biorefinery process.

"Investors want to know, will it cost $2 a gallon or $20 a gallon and what is my rate of return?" Wolan says. "These are not easy questions to accurately answer yet, but once that's known, the market will open up." Wolan and his crew are working on determining production costs, so it's likely that business support will soon follow.

Funding has been provided by several sources including the Florida Energy Systems Consortium (FESC). The FESC Principal Investigator at USF is the very distinguished Dr. Yogi Goswami. The FESC was established and funded by the Florida Legislature in 2008 and is comprised of faculty from many different disciplines at 11 public universities here in Florida.

Funding is also being provided by The Bill Hinkley Center for Solid and Hazardous Waste Management. The Bill Hinkley Center is a state-wide research center created by the Florida Legislature in 1988. (Bill Hinkley is a remarkable man who worked for the Florida Department of Environmental Protection for almost 30 years who was the architect of the way we recycle and manage waste here in Florida. Mr. Hinkley was deceased in 2005.) The Hinkley Center provides funding for waste management research to professors at 7 public and 2 private universities here in Florida. A tiny bit of the cost of buying a tire or a car battery here in Florida goes to fund this very important research of turning waste into a valuable resource. The Hinkley Center is hosted by the University of Florida College of Engineering and is the only center of its kind in the United States.