WEB ONLY: Innovation in feedstock transport , testing

By Chris Hanson | November 04, 2013

One version of Vermeer's 605 corn stover special lays bales out across the row. The goal of field testing is to identify the technology that speeds up and improves the efficiency of biomass collection.
PHOTO: ANTARES GROUP

In August, Ernest Moniz, secretary for the U.S. DOE, announced more than $22 million in new investments to develop a more efficient feedstock supply chain for advanced biofuels, in addition to more affordable algae-derived fuels.

Of that investment, nearly $6 million is destined for Ohio-based FDC Enterprises (FDCE) team of industry experts and companies that work within the biofuel industry to streamline the feedstock supply chain over the next three years by developing new field equipment, upgrading biorefinery conveyer processes and advancing preprocessing technologies, such as a near-infrared (NIR) spectrometer to quickly evaluate biomass feedstocks.

This award is a continuation of a similar DOE logistics award from 2009 that is now complete. "That project was $5.7 million and we concentrated on the large square bale platform designing industrial type equipment with an industrial vision for the feestock supply chain, and that's where we identified quality control issues for the Department of Energy," said Bill Belden, senior agriculture specialist for Antares Group and project coordinator for the FDCE team. He adds issues about ash collection, moisture and other criteria that could affect cellulosic ethanol production were those identified, and the project was rated one of the top developments in the Bioenergy Technologies Office program by independent peer review experts.

The FDCE team originates from the Chariton Valley Biomass Project, which lasted from 1996 to 2006, and features team members from five sectors of biofuel production. Vermeer, Kelderman Manufacturing and MacDon Industries Limited make up the original equipment manufacturers group. Poet-DSM, Clariant, ADM and Pellet Technologies USA represent the refinery partners. The field operations and production arm represents FDC Enterprises, Antares Group Inc., Feedstox, Virginia Tech University and the Oak Ridge National Laboratories. The analytical and sustainable partners include biomass conversion consultant Bonnie Hames, Praxik, the Council for Sustainable Biomass Production, Idaho National Labs and Dave Lightle. Lastly, other broad audience collaborators include the Iowa Farm Bureau, the Iowa Corn Growers and Doug Karlen from the USDA's Agricultural Research Service.

Through the comprehensive list of industry experts and professionals, FDCE aims to meet the funding opportunity announcement's objectives. "What we were asked to do is to demonstrate a feedstock supply system, starting from the stump at the field level, to collect, harvest, store, transport and process biomass from the field to the reactor throat and meet a cost target of $50 [per] bone-dry ton," Belden explained. "That does not include the value of the biomass or what we would pay farmers or land owners." He added the biorefiners will provide their feedstock speculations, such as ash content, moisture levels and other proprietary protected criteria to determine if the feedstock will be utilized in Poet's cellulosic mix, Clariant's operation, ADM's feed production or Pellet Technologies' project.

Another objective involves the development of a rapid feedstock analysis. Belden explains current methods involve using a drill to collect samples to send a lab for analysis, which could take roughly two months to receive a result. "Our goal is to use near-infrared spectrometry to have a rapid analysis, so within minutes we can tell the baler operator 'you're collecting too much dirt,'" he said, adding the spectrometry device, which is being developed by Bonnie Hames, would be able to determine if the ground material contains the characteristics a biorefinery desires. The NIR spectrometry has been a dream of Hames for several years, said Belden.

Most analytical equipment is difficult to implement during onsite testing, explained Hames, the analytical partner of the project, whereas NIR methods and technology do not require special testing environments and is rugged enough to be incorporated on a facility's work floor, in the field, inside a backpack or mounted onto a tractor or harvester. "Our first work was in pulp and paper applications, characterizing wood chips and pulp," she said. For her team's effort, they were awarded a Research and Development 100 award in 2000, which helped motivate them to apply the technology towards the ethanol department at the National Renewable Energy Laboratory.

One of the main steps in developing the technology involves calibrating the machines to correctly interpret complex material. "As we start up to calibrate, we start out with a set of samples that have been well characterized," Hames said. "We're characterizing them using those traditional methods that were developed at NREL that we know work for these types of process and applications. So we train it against the best data that we have and we can pull those patterns and information from the spectra that we're getting from the near-infrared spectrometer."

After the initial calibration, using NREL's validated methods, the National Bioenergy Center and the Idaho National Laboratory will add more relevant samples that were collected in real-harvest scenarios. "We're going

to incorporate more seasons and more soil types," she said. "Those signatures are there in the samples. We all know that the location, the environment where the plant is growing affects the plant, you have a signature of the soil in that harvest season, sort of the basis of the fragrant and wine industry, but it has those effects and we see those in the NIR."

By taking the NIR from the lab to the field, Hames believes the technology will benefit producers and harvesters by giving them more information to calculate ethanol yields and save on enzyme costs. Furthermore, provide additional information about what other materials are being sent through the process. "All that information coming in with the feedstock is new," Hames said. "It is something that really hasn't been done rigorously in a commercial scale."

As a whole, Belden believes the FDCE team will work together to deliver dreams to move the biofuel industry forward. "We all want to have a key role influencing the shape of the industry from a grower or farmer perspective," Belden said.

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