

Tennessee Biofuels Production – An Integrated Approach
RCAS Meeting
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In 2007, the State of Tennessee, under Governor Phil Bredesen's leadership, made an unprecedented commitment to invest in building a bioenergy industry in Tennessee. The state committed \$70.5 million in 2007 to fund the University of Tennessee Biofuels Initiative, a comprehensive farm-field-filling station approach.

The state's initial \$70 M investment has already returned more than \$225 M in new federal and private investments in bioenergy in Tennessee.

Establishing a biofuels industry in Tennessee is a four step process:

1. Creating an energy crop supply chain (switchgrass production);
2. Securing research and development capabilities (ORNL, Bioenergy Science Center, and Center for Renewable Carbon)
3. Demonstrating pre-commercial production capabilities (DDCE, Genera biorefinery)
4. Building the infrastructure for a self-sustaining commercial biofuels industry (Genera and Tennessee)

Genera Energy is the for-profit company formed to implement the business operations of the Biofuels Initiative, wholly owned by the UT Research Foundation.

Through research and partnerships with UT AgResearch and UT Extension, switchgrass has been identified as an ideal initial energy crop in this region to support a large-scale, commercial biofuels industry. As part of the UT Biofuels Initiative, UT biofuels specialists work with local farmers to develop switchgrass production and provide one-on-one technical assistance through UT Extension and wide-ranging research related to all aspects of the feedstock supply chain. Currently, about 5,200 acres have been planted under the UT Biofuels Initiative's incentive program. The UTBI has the largest plantings of switchgrass on private farms in the United States.

One of the biggest challenges in developing a biomass based industry is the chicken-or-egg-first problem: how do you get farmers to produce switchgrass before there is a biorefinery ready to sign long-term contracts for it, and how do you get investors to build a very expensive biorefinery that relies on biomass before you have the crop in the ground? The UTBI addresses this stalemate by doing both switchgrass production and biorefinery development simultaneously. In East Tennessee, the University of Tennessee and Genera Energy have contracted with local farmers to produce nearly 6,000 acres of switchgrass. Now in our third

year of production, farmers in our Switchgrass Farmers' Incentive Program are seeing average yields of about 8 tons per acre. Under the program, farmers receive \$450 acre per year for three years.

Within the University of Tennessee, much of the research in the bioenergy area is conducted under the umbrella of the Center for Renewable Carbon (CRC) in the UT Institute of Agriculture. CRC is a relatively new organization that coordinates the research and demonstration of renewable carbon systems, drawing from a wide range of fields and disciplines within the university. The CRC's goal is to create and improve conversion technologies; support technology demonstrations; educate and train the new workforce; and transfer science and technology to a broad client base.

The major areas of research focus include:

- New crop development
- Feedstock supply systems and management
- Sustainable feedstock production
- Biorefinery systems
- Co-products and materials

UT and Genera have partnered with DuPont Danisco Cellulosic Ethanol (DDCE) in the construction and operation of a demonstration-scale biorefinery in Vonore. DDCE brings world-class biorefinery technology that has helped Tennessee become a national leader in biorefining. The Genera/DDCE demonstration-scale cellulosic ethanol biorefinery began construction in late 2008 and officially began production in December 2009. The facility celebrated its grand opening in January 2010. Located in the Niles Ferry Industrial Park in Vonore, the 74,000 square foot facility is capable of producing 250,000 gallons of cellulosic ethanol per year. The biggest benefit of the Vonore biorefinery is the ability to demonstrate that the technology is ready in every way – science, economics, engineering, efficiency – to support commercial scale investments and to continue to improve the process and the economics over time.

It is important to recognize that the entire biomass feedstock supply chain is highly interdependent. With this in mind, the research and commercialization programs of the University of Tennessee and Genera Energy are heavily focused on the pieces of this integrated biomass supply chain, including

- biomass production and harvesting (farmers);
- handling, storing, and transporting of switchgrass ;
- pre-processing and densification;
- Value-added pre-treatment of biomass; and
- industrial processing.

One way we're establishing an integrated biomass supply chain is through the development of a Biomass Innovation Park. Genera broke ground in late July on a 22-acre site adjacent to the biorefinery. The Biomass Innovation Park is where all of the harvesting, handling, storage, pre-processing, production and conversion of biomass (switchgrass) will occur. The Biomass Innovation Park will be able to handle additional feedstocks besides switchgrass.

The Biomass Innovation Park can be a template for developing and optimizing a series of biomass aggregation and pre-processing centers (depots) that serve farmers in a local region and collectively supply a large-scale biorefinery. The Biomass Depot supply model can be a good fit with a New Generation Processing Cooperative, such as the Tennessee Biomass Supply Cooperative recently formed by Genera Energy.