

*Working cooperatively  
to develop  
a sustainable future*

### **BIOMASS PRODUCTION and HANDLING**

All bioenergy processes require environmentally friendly, cost effective feedstocks for conversion into fuels, chemicals, and biopower. Feedstocks include dedicated energy crops and organic residues. Researchers at UK are developing improved methods of biomass collection and characterization of biomass for chemical composition and structure related to processing. Plant breeding and genetics research is being conducted to improve the yield of crops, increase their susceptibility to conversion processes, and maximize overall energy production per acre of land.

### **SUGAR Platform**

More efficient biochemical processes are needed to convert biomass into simple sugars before fermenta-

tion into ethanol and other valuable biochemicals. Major roadblocks associated with these biochemical processes

are the cost of enzymes used to convert cellulose and hemicellulose and the pretreatment methods

required to allow the enzymes to work effectively. Ongoing research at UK focuses on the development of enzyme systems to improve the yield of fermentable sugars from biomass and the development of novel organisms to convert biomass directly into ethanol without the addition of other enzymes. In addition, the distillation of ethanol requires a tremendous amount of energy and alternatives to distillation are being developed.

### **THERMOCHEMICAL Platform**

Thermochemical processes rely on heat and pressure to convert biomass into synthesis gas that can be converted into liquid fuels and chemicals. UK has extensive experi-

ence using catalysis for converting synthesis gas into liquid fuels and chemicals via the Fischer-Tropsch (FT) process.

Additional strategies for converting biomass into fuels involve liquefaction where biomass is converted into a high-density bio-oil that is refined much like crude oil. Stabilizing the bio-oil for transportation and storage is an ongoing area of research.

### **BIOPOWER**

Biomass can be converted to electricity by cofiring with coal. Research is focused on densifying biomass

(into briquettes) that will result in a product that can be directly fed into a boiler with coal. In addition, densifying substantially reduces the cost of transportation. More cost effective transportation techniques would aid the economic viability of the biochemical and thermochemical conversion processes.

### **TRADITIONAL Renewable ENERGY**

UK also supports the traditional renewable energy industry that relies on vegetable oils and animal fats to produce biodiesel and grain to produce starch-based ethanol. Alternative oilseed cropping rotations (canola and sunflowers) for biodiesel production, development of new catalysts for biodiesel production, and evaluation of corn hybrids for ethanol yield are some of the many topics currently being investigated.





### **OUTREACH *and* EDUCATION**

The UK College of Agriculture manages extension agents located in every county of Kentucky. These agents are available to assist farmers, landowners and homeowners on biofuels and energy efficiency, education. Numerous field days, the state fair, and other events are held each year to expose a large portion of the state's population to energy related information. The University also provides students with coursework that is based on cutting edge research conducted at UK.

### **GOVERNMENT *and* INDUSTRIAL PARTNERS**

Over the last decade, researchers at UK have been funded by agencies such as the National Science Foundation, US Department of Energy, US Department of Agriculture, state agencies Governors Office of Energy Policy and KY Agricultural Development Board and by corporations such as Alltech, Inc., Commonwealth Agri-Industries, CNH Global, East Kentucky Power Cooperative, EON, John Deere, Martek, and Owensboro Grain and is a member of the Kentucky Rural Energy Consortium.



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### **RENEWABLE ENERGY INITIATIVE**

The initiative involves over 50 scientists from 12 departments within the University of Kentucky. The initiative is also involved in multi-institutional collaborative work, with other institutions such as Dartmouth, Iowa State University, North Carolina State University, University of Louisville, Idaho National Laboratory, and Oak Ridge National Laboratory, just to name a few. The University of Kentucky is currently conducting research on all aspects required to develop biofuels.

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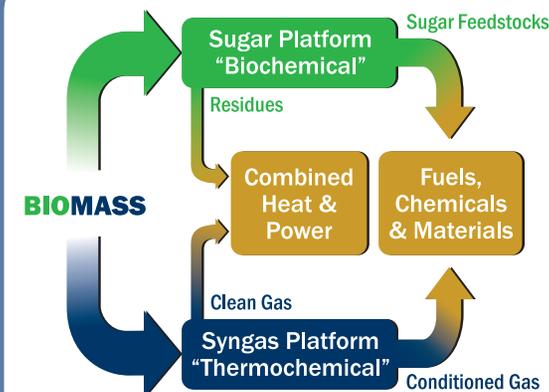
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[www.research.uky.edu/renewable\\_energy.htm](http://www.research.uky.edu/renewable_energy.htm)

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# RENEWABLE ENERGY INITIATIVE

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**BIOREFINERY CONCEPT**