

# The Kentucky Rural Energy Consortium's (KREC)

## 25 x '25 Vision for Kentucky



*Submitted to:*

The U.S. Department of Agriculture and 25x'25 Alliance Grand Challenge Competition

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# USDA and 25x'25 Alliance Grand Challenge

## A Vision for Charting Kentucky's Renewable Energy Future

The prosperity of Kentucky and the nation depends on having a reliable supply of clean, sustainable energy now and far into the future. Yet world events, climate change, uncertain supplies and an ever-growing global demand for fossil fuels have converged to place our collective energy future in jeopardy. It is now obvious that we can no longer count on a limitless supply of inexpensive fossil fuel to meet our future energy needs.

The 25x'25 goal is certainly achievable, but will require a high level of cooperation and collaborative effort among many diverse stakeholders in addition to Kentucky's Land Grant universities – state leaders, policy makers, advocacy groups, the agricultural community, commercial energy developers, financial institutions and the public will need to work together to overcome the challenges of financial barriers, regulatory restrictions and a lack of public understanding about emerging energy technologies.

*Kentucky is prepared to meet this challenge.*

Kentucky's institutions of higher learning are working with the Kentucky Rural Energy Consortium (KREC) towards the 25x'25 goals. The Kentucky Rural Energy Supply Program was established in 2005 by a federal direct appropriation to benefit the citizens of the Commonwealth by creating a unified statewide consortium to promote renewable energy and energy efficiency (REEE) in Kentucky. The Kentucky Rural Energy Consortium (KREC) was formed at the outset of the program and seeks to advance comprehensive research on biomass and bioenergy of importance to Kentucky agriculture, rural communities, and related industries. KREC is a partnership of the University of Louisville's Kentucky Pollution Prevention Center and J.B. Speed School of Engineering; University of Kentucky's College of Agriculture, College of Engineering, Cooperative Extension Service and Center for Applied Energy Research; other Kentucky Universities; the Governor's Office of Energy Policy and other key state agencies; and agricultural commodities groups and industry partners.

### Building Partnerships

The Consortium is strongly supported by leaders in agribusiness, government and universities and is a supporting partner of the National 25x'25 Initiative. KREC has over 60 active partners and 200 members who have pledged their support of the goals and mission of the organization. KREC members include Kentucky land grant colleges and state university researchers focused on developing innovative renewable energy technologies. Through quarterly KREC meetings, a diverse group of researchers, industry leaders, agriculture representatives and policy makers have had an unprecedented opportunity to collaborate on renewable and sustainable energy solutions.

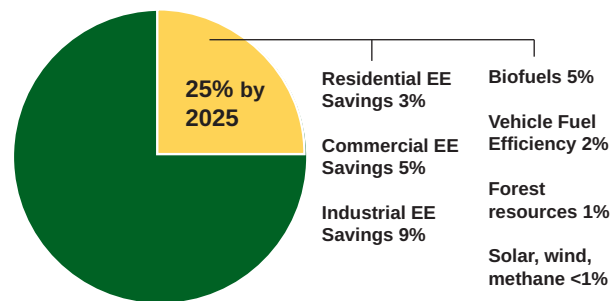
### Section I

#### ***KREC and Kentucky's Universities Vision of Agriculture's Contribution to the Energy Economy***

KREC believes that Kentucky's agricultural community will play a major role in the state's, and the nation's, energy future. The Commonwealth already enjoys many comparative advantages in energy production, including a strong natural resource base, a highly qualified community of educators and researchers, and the commitment of its state government to achieving energy independence. Kentucky's Land Grant Universities (the University of Kentucky and Kentucky State University) and the University of Louisville are strategically planning to build on these advantages, while encouraging innovation and ingenuity, moving the state forward to a secure energy future.

The Kentucky Rural Energy Consortium recently produced a Kentucky 25x'25 Roadmap document entitled "Charting Kentucky's Renewable Energy Future." The Roadmap was created as a guide for stakeholders to find common ground for cooperation and to provide information vital to future planning and decision-making. The Roadmap offers a range of options,

**2025 Distribution of Energy Usage & Savings in KY (Total = 2.804 Quad, Source)**



\*University of Kentucky College of Agriculture – *Kentucky Resources to Meet the Energy Needs of the 25x'25 Initiative.*

many of which require the leadership of Kentucky's Land Grant Universities, the University of Louisville and other public universities.

The following 25x'25 Grand Challenge proposal will examine Kentucky's extensive natural resource base and its historical agricultural tradition to identify renewable energy and energy efficiency opportunities in which Kentucky's Land Grant Universities and the University of Louisville can take the lead. This document will also make recommendations for moving the Commonwealth forward toward the national 25x'25 goals.

Promoting renewable energy technologies and energy efficiency opportunities can provide important benefits to the State as well as local communities. The key benefits are:

- Environmental Benefits – Most renewable-energy technologies are clean sources of energy that can have a much lower environmental impact than conventional-energy technologies.
- Sustainability Benefits – Renewable energy by definition is replenishable. Renewable energy will be available for our children's children. Other sources of energy are finite and will someday be depleted or become too expensive to use.
- Economic Benefits – Most renewable energy investments, unlike investments on costly imports, are usually made within the state – frequently in the same region or town as the users of energy. The result is that energy dollars stay home to create jobs and fuel local economies, rather than going overseas. Kentucky farmers may find additional benefits to renewable energy in the form of production of crops for processing into biomass fuels and land leases for the production of wind energy.
- Security Benefits – Our national dependence on foreign oil supplies leaves us vulnerable to supply disruptions and price fluctuations and complicates our foreign relations.

## **Section II**

### ***KREC's Role in Achieving the 25x'25 Goals for Renewable Energy and Rural Development***

The goals of the 25x'25 National Initiative are consistent with KREC's efforts to support, coordinate, promote and advance research, development, demonstration and deployment of renewable energy and energy efficiency technologies, practices and outreach activities.

In early 2007, the Kentucky Rural Energy Consortium (KREC) convened a diverse group of stakeholders and launched a state-wide renewable energy and energy efficiency initiative. The vision of the Consortium was to promote and recommend an ambitious goal for the Commonwealth –

*“By the year 2025, Kentucky will use renewable energy and energy efficiency as means to get at least 25 percent of its total energy from improved technologies and renewable resources such as solar, wind, biomass and biofuels.”*

To help achieve this goal, The Kentucky Rural Energy Consortium advances comprehensive research on renewable energy and energy efficiency and highlights the importance of these research efforts to Kentucky's agriculture, rural communities and related industries. The research goal for KREC includes dramatically reducing our nation's dependency on foreign oil and creating an economically viable and sustainable renewable energy industry in the Commonwealth.

#### **KREC's mission:**

- Conduct, sponsor and coordinate research to develop biomass and bioproducts of importance to Kentucky;
- Serve as a model for state efforts to decrease dependence on imported fuels and to increase reliance on energy production from biomass resources;
- Seek out opportunities and funding to provide research activities for biomass and bioproducts;
- Serve as a clearinghouse and networking group to exchange knowledge, programs, and ongoing activities of the Consortium and related state and federal programs.
- Build partnerships throughout the Commonwealth that support stated goals and federal biomass initiatives.
- Provide a forum for discussing the national 25x'25 initiative in Kentucky and develop a Kentucky 25x'25 Roadmap report.

The majority of the Commonwealth's renewable energy can be derived from its farm and forest resources, creating significant economic opportunities in rural communities and stimulating the state's agricultural industries. Energy efficiency efforts can also produce significant savings and contribute to the overall 25x'25 goal while providing a wide array

of economic and environmental benefits to Kentucky's residential, commercial and industrial sectors and to the state as a whole. Deployment of comprehensive energy efficiency technologies and programs is critical to achieving substantial energy use reductions by 2025. If energy efficiency measures are implemented broadly and aggressively over the next 18 years, efficiency efforts alone could account for a substantial percentage of the total 25x'25 goal.

### **Developing Kentucky's Natural Resource Base**

To meet the goal of 25% of Kentucky's energy from energy efficiency and renewable sources, the state's natural resource base must be robust enough to develop and sustain bioenergy production at an economically viable level. The state has an abundance of natural resources that could sustain bioenergy production and create new economic opportunities for its rural communities. Based upon these natural resource advantages, the development and expansion of new bioindustries hold great promise for Kentucky's future economy and energy security.

In order to evaluate the extent of Kentucky's natural resource base, the 25x'25 team utilized a very useful geographic information system (GIS) resource for identifying cropland, forests, and pasture/hay fields across the state. The Division of Geographic Information has an up-to-date dataset of the landcover (circa 2001) which was funded by NASA. The landcover dataset illustrates the diversity and extent of Kentucky's natural resource base.

Because of Kentucky's existing agricultural production and expertise, the state's agricultural community is well positioned to grow biomass and potential new energy crops. As reflected in the landcover data, there is a large percentage of acreage in the scrub/shrub grass/herbaceous and pasture/hay classes in the state that is currently not under cultivation but may be suitable for energy crops that will not compete with food production. In addition to Kentucky's rich natural resources, there is a long and successful agricultural tradition in the state. Many people choose to remain on the land and farm as a way of life. With the recent tobacco quota buy-out, some small farm owners are struggling to continue farming and looking for alternatives to tobacco. This transition period offers a real opportunity to develop Kentucky as an agricultural leader in biomass for energy production.

### **KREC Supported Research**

KREC's executive staff and Advisory Board have recently concluded administration of a \$2 million operational grant. With this funding, KREC organized and conducted a competitive grants program aimed at fundamental and applied research of importance to Kentucky. Proposals were requested from Land Grant and state universities for projects dealing with renewable energy and production of bioenergy or biochemicals from biomass feedstocks.

Seven projects were funded for \$1.15M and the state provided \$295,000 for cost share. The funded KREC research involved a peer-review by external, "federally competitive" peers. Specific areas of research included harvesting and storage of lignocellulosic feedstocks, biocatalysts and bioconversion of lignocellulosic feedstocks into liquid transportation fuels and bioproducts, thermal conversion of biomass into energy and co-products, conversion of solar energy through new technology applications and development of industrially important biochemicals for production in biorefineries. Funding supported the research efforts of 22 researchers and 22 graduate students at the University of Kentucky and the University of Louisville.

### **Kentucky State University's Role**

Kentucky State University (KSU) is a public, comprehensive 1890 land-grant university. The KSU Land Grant Program is committed to resolving educational, economic, and social challenges faced by the people of Kentucky through research, service, and teaching in the food and agricultural sciences. It places particular emphasis on serving small farmers and those with limited resources.

KSU's emphasis on sustainable systems for small farms is particularly important in Kentucky, where more than 75% of the farms are smaller than 180 acres, and 80% have an annual income under \$20,000. This emphasis also has important implications for energy efficiency. Smaller farms tend to support greater biodiversity than large farms, dedicate more land to soil-building practices that sequester carbon, and use land and energy more efficiently than larger farms.

## Research

- Organic agricultural focus for energy conservation
- Solar heated greenhouses for local production of winter crops
- Practical alternatives to pesticides
- Alternative energy sources
- Assessment of low-input alternative feedstock crops
- Assessment of fruit waste as bioethanol feedstock on farm bioethanol production
- Assessment of farm-scale effects on resource use efficiency
- Utilization of agricultural wastes for energy production

## Extension

- Third Thursday sustainable agriculture workshops
- Development of workshops/factsheets:
  - conservation of soil organic matter
  - organic agriculture
  - micro-hydro
  - conservation tillage
  - solar energy use on farm
  - biofuels

## Teaching

- Development of new Master's of Environmental Studies program
- Required course on energy and the environment
- Electives on sustainable agriculture systems, agricultural ecology
- Required field studies/practicum
- Continued collaboration with University of Kentucky to ensure success of sustainable agriculture major

## The University of Kentucky Agricultural Extension

KREC developed a Legislative Prospectus publication and a 25x'25 Roadmap report as part of its communication and outreach efforts. In an effort to generate public interest and support, KREC also sponsored three town hall meetings across Kentucky to explore ideas for developing a renewable energy plan for the Commonwealth. The meetings were open to the public and attended by representatives from farming, forestry, government agencies, industry and environmental organizations.

Press releases and regular news updates about KREC activities and renewable energy efforts are distributed as part of the consortium's extension and outreach efforts. Brochures, displays and educational materials were created and distributed state-wide. All KREC quarterly meetings are open to KREC members, the news media and the public.

The KREC Advisory Board believes that the establishment of a statewide public awareness and education program is necessary to insure that the general public, our agriculture community and other stakeholders understand the value of renewable energy and energy efficiency technologies. A branding and marketing campaign will be developed and the University Cooperative Extension Service will be used to develop and disseminate curriculum and other educational materials on renewable energy opportunities and energy efficiency savings. This method will provide the most effective way to disseminate needed information and technical support.

The extension service has a major responsibility for protecting the sustainability of rural communities — not only by providing a growing net farm income, but also as a conduit for change. Extension service resources can provide leadership in identifying problems, developing solutions and taking actions which will help achieve better economic opportunities, improve environmental stewardship and enhance the quality of life for all. Healthy and prosperous rural communities are a key factor in sustaining the future of Kentucky agriculture and innovations in agriculture are important to the future of rural communities.

Currently, UK Cooperative Extension Services reach millions of Kentucky residents each year with educational programs in agriculture and natural resources, family and consumer sciences, 4-H and youth development, and community and economic development. The University of Kentucky Extension serves as the local "front door" to the campus of the University of Kentucky through local agents working in each of the Commonwealth's 120 county Cooperative Extension offices. This partnership continues to include county governments working to solve local problems, a national network of land-grant universities, and the US Department of Agriculture. Extension agents coordinate and provide educational programs for the public through meetings and workshops, field days, personal consultations and web or satellite broadcasts. They also provide publications, newsletters, computer programs, videotapes and other educational materials.

Finally, the Kentucky 25x'25 initiative is driven by the leadership of KREC, in conjunction with Kentucky's Land Grant Universities and the University of Louisville, and creates an ongoing dialogue among Kentucky's key partners within the agriculture and forestry sectors, and other energy stakeholders. This ensures that KREC and the Land Grant Universities are in a strong position to communicate to the public that Kentucky's farms and forests are a key component of a new state and national energy economy.

### **KREC Legislative Efforts**

Kentucky's state leadership must be prepared to respond to the challenges of a rapidly changing energy economy. Kentucky's Land Grant Universities and the University of Louisville are well positioned to take the lead in addressing these challenges and making recommendations to state policy makers.

Recently passed legislation entitled "Kentucky's Energy Independence Act," and House Bill 2 (BR-106) established several mechanisms to promote renewable energy projects and energy efficiency technologies within the state. These legislative measures serve as solid foundations upon which to build an effective state-wide energy policy. Private industry in Kentucky is moving forward with significant investments in biodiesel and ethanol production facilities and research efforts are underway at Kentucky's Land Grant Universities and the University of Louisville to develop new bio-processing techniques and examine energy efficiency and renewable energy technologies and practices.

### **KREC Legislative Recommendations**

Below is a summary of near-term recommendations developed by KREC to help begin the process and to guide Kentucky toward achieving the 25x'25 goal of economic development and energy security.

#### **1. Establish a Center of Excellence**

It is vital to Kentucky's energy future that a center of excellence for renewable energy and energy efficiency be established, supported and held accountable for results. House Bill 2, recently passed by the Kentucky General Assembly, established the Center for Renewable Energy Research and Environmental Stewardship (CRERES) and attached it to the Governor's Office of Energy Policy (GOEP). KREC's Advisory Board is encouraged by this legislation and supports the center's mission and goals. The establishment of CRERES should advance the efforts of research, development, demonstration and commercialization of renewable energy, biomass co-products and energy efficiency technologies and practices that benefit Kentucky. The center should be funded with state funds at an adequate and consistent level to ensure a vital, effective center that produces results.

We encourage our state leadership to build upon the success of the KREC model as they develop this important Kentucky center of excellence. Governance of the center should include a balance between representatives from Kentucky's public universities, the legislative and executive branches, renewable energy and energy efficiency advocates, Kentucky's agriculture community and renewable energy business and industry stakeholders.

#### **2. Increase the Level of Highly Qualified Renewable Energy and Energy Efficiency Expertise**

It is vital to Kentucky's energy future that incentives be created for increasing the number of highly qualified renewable energy and energy efficiency faculty and researchers at state universities. Discoveries made through research translate directly into business opportunities. A renewable energy and energy efficiency research fund will help Kentucky businesses, consumers and workers by:

- Creating technology-based jobs and expanding Kentucky's knowledge economy;
- Helping Kentucky companies improve their effectiveness in competitive markets;
- Developing cost effective ways to get products to consumers;
- Keeping abreast of new technologies and;
- Providing expertise in emerging fields.

#### **3. Establish Renewable Energy and Energy Efficiency Outreach Programs**

It is vital to Kentucky's energy future that a statewide public awareness and education program be established utilizing the Cooperative Extension Service to develop and disseminate curriculum and other educational materials on renewable energy opportunities and energy efficiency savings. Partnering agencies and programs in this effort would include, but not be limited to; 4H, Future Farmers of America (FFA), Kentucky Department of Agriculture, Agriculture in the Classroom, the National Energy Education Development (NEED) project and KEEPS, the Kentucky Energy Efficiency Program for Schools. KEEPS is a program that helps Kentucky school districts reduce energy consumption and operat-

ing expenses. The KEEPS Energy Management and Training System is based on the ENERGY STAR® program. The KEEPS program is funded by the Governor's Office of Energy Policy and administered by the Kentucky Pollution Prevention Center. Participants in the KEEPS program include nine school districts, one Land Grant University, one state university and one private college.

#### **4. Encourage Energy Efficient Homes and Buildings**

It is vital to Kentucky's energy future that all new buildings built for the Executive Branch, Judicial Branch and public universities are required to be designed and constructed to meet or exceed ENERGY STAR® certification requirements. Through state incentives, encourage home builders to build homes that meet or exceed ENERGY STAR® certification requirements. Provide state incentives for homeowners to improve the energy efficiency of their own homes, improving overall efficiency of the state's existing housing stock.

#### **5. Expand Net Metering to Renewable Energy Resources**

It is vital to Kentucky's energy future that net metering opportunities are expanded to other renewable energy resources like wind, hydropower and smaller, distributed biomass facilities. State incentives should be provided for residential and commercial renewable energy applications.

#### **6. Support Expanded Use of Biofuels**

It is vital to Kentucky's energy future that a renewable fuel standard (RFS) be required using ethanol and biodiesel for state agencies and public universities that operate state-owned vehicle fleets and hold state agencies accountable for achieving targets.

Kentucky can realize numerous benefits by advancing the 25x'25 goals of establishing a comprehensive center of excellence for renewable energy and energy efficiency, expanding biofuels and biomass production, promoting research, education and outreach and developing new energy efficiency opportunities.

### **Section III**

#### ***Progress Towards Meeting the 25x'25 Goals***

##### **1. Accepted Legislative Recommendations**

KREC recommendations, as now established in House Bill 2, called for the Center for Renewable Energy Research and Environmental Stewardship to be created which will allow Kentucky's Land Grant Universities and the University of Louisville to:

- Provide leadership, research, support, and policy development in renewable energy;
- Advance the goal of renewable energy;
- Promote technologies, practices, and programs that increase efficiency in energy utilization in homes, businesses, and public buildings;
- Emphasize energy policies that would result in cost-conscious, responsible development of Kentucky's energy resources and a commitment to environmental quality;
- Promote partnerships among the state's postsecondary education institutions, private industry, and non-profit organizations to actively pursue federal research and development resources that are dedicated to renewable energy;
- Establish research priorities relating to renewable energy, and develop procedures and processes for awarding research grants to eligible recipients; and
- Carry out other activities to further the efficient and environmentally responsible use of renewable energy.

The KREC Advisory Board believes that it is crucial to have representation from Kentucky's rural community on the board of directors, and that important consideration be given to expanding the representation to include the Governor's Office of Agricultural Policy and/or recognized leaders from the state's agricultural community.

The KREC Advisory Board has recommended that the Center conduct and facilitate research and educate the public, students and practitioners in problems and issues related to efficient energy use and renewable energy production. This goal should be accomplished by a coordinated group of researchers, educators and field professionals using the existing Land Grant Mission and resource base as a model. Additionally, through public-private partnerships, the Center should develop broad-based support across the Commonwealth to strengthen collaborative and outreach initiatives and develop pilot projects utilizing new technologies.

The Center should also be charged with supporting research, development and demonstration for further deployment of technologies and outreach activities utilizing the capabilities of the University of Kentucky's College of Agriculture's Experiment Station and Cooperative Extension Service. The Center should work to build public-private partnerships that support Kentucky's rural communities through the wise use of energy.

Eventually, building on the KREC model, the Center will utilize resources of the Land Grant System to complement the stated principles of energy security for Kentucky. The Center will be uniquely suited to support on-going efforts to promote Kentucky's agriculture industry through biofuels, bioenergy and bio-based products. It will help our industries become more competitive through energy efficiency. The result of this crucial effort will be to keep industries here in the Commonwealth and attract new industry.

## **2. Energy Efficiency Efforts**

KREC believes that energy efficiency improvements must be the first choice in all energy decisions. Energy efficiency was a major section of the University of Kentucky College of Agriculture's report – *Kentucky Resources to Meet the Energy Needs of the 25x'25 Initiative*. The UK report states that Kentucky households could reduce site energy consumption by 30.9 trillion btu (tbtu) in 2025. Residential energy consumption in 2025 would be 172.6 tBtu if the housing stock operated at 2007 levels of efficiency and there were no improvements in energy efficiency. Energy improvements strategies have the potential to reduce the 2025 energy consumption level to 141.7 tBtu.

As part of its ongoing energy efficiency efforts, the Kentucky Pollution Prevention Center at the University of Louisville administers the KEEPS program. Kentucky's K-12 public school's energy expenses for fiscal year 2005-2006 totaled \$156 million. If all of these schools reduced energy costs by just 5%, the annual savings would total about \$7.7 million. KEEPS helps Kentucky school districts reduce energy consumption and operating expenses through an energy management and training program. The training system is based on the ENERGY STAR® program. KEEPS is funded by the Governor's Office of Energy Policy and administered by the Kentucky Pollution Prevention Center. Participants in the KEEPS program include nine school districts, one Land Grant University, one state university and one private college.

## **3. University of Kentucky and University of Louisville REEE Activities**

KREC supported seven research projects conducted by faculty from U of L and UK that focus on developing resource-responsible technologies and practices specific to the energy sector. The project lead is listed first for each project.

### ***Development of an Ethanol Pilot Scale Facility to Evaluate the Effect of Collection, Storage and Pretreatment of Corn Stover (UK/U of L)***

Dr. Michael Montross, Dr. Czarena Crofcheck, Dr. Scott Shearer, Dr. Sue Nokes, Dr. Eric Berson

The overall goal of this research is to reduce the cost of corn stover as a feedstock to a biorefinery by reducing collection, handling and storage costs and increasing the efficiency of pretreatment, enzymatic hydrolysis and fermentation into value-added fuels and chemicals. The project will allow for the evaluation of corn stover, a residue available on Kentucky farms, to be converted to a higher value product in rural communities.

### ***Development of an Integrated Solar Heat Pipe System for Improving Building Energy Efficiency (U of L)***

Dr. M. Keith Sharp, Dr. Ellen Brehob

This project encompasses the development of a solar heat pipe system particularly suited to climates, such as Kentucky, with moderately cold and moderately sunny winters. The system transfers energy into the building on sunny days and avoids losses during the night and cloudy days by using heat pipes, which have the ability to transfer heat in one direction only with virtually no losses in the reverse direction. Compared to traditional passive solar heating systems, the solar heat pipe system provides a greater improvement in efficiency in Kentucky's cloudy climate than it does in sunny climates.

### ***Differentiating Microbial Pathway and Membrane Adaptations for Enhanced Performance in Extreme Environments (UK)***

Dr. Sue Nokes, Dr. Barbara Knutson, Dr. Herbert Strobel, Dr. Bert Lynn

Few bacteria can convert biomass to ethanol directly, but *C. thermocellum* has this ability. However, to be commercially viable, this microorganism must tolerate more ethanol in the fermentation broth. This project will explore natural adaptations this organism has made to ethanol in order to use this information to further improve the organism.



### ***Novel Catalytic Approaches for Bio-Oil Upgrading (UK)***

Dr. Czarena Crofcheck, Dr. Mark Crocker

Crude bio-oil, which can be obtained from the thermal processing of biomass, is a potential renewable replacement for crude petroleum oil. However, it is not stable for long periods of time, which makes it difficult to store and transport. The objective of this project is to examine two novel processes to increase the stability of bio-oil so that it can be shipped to refineries for conversion to fuels and chemicals.

### ***Photocatalysts for Solar Energy and Hydrogen Production (U of L)***

Dr. Gerold Willing, Dr. Mahendra Sunkara, Dr. Thomas Starr

This project, which provides seed funding for a new research initiative, looks at a new, low-cost solar cell with dramatically improved efficiency. The solar cell technology that is proposed here, if successful, could be used for generating electricity or for producing hydrogen from water. It would also be scaleable for household use and commercial application.

### ***Production of Biomass Briquettes as an Alternative Fuel Source (UK)***

Dr. Michael Montross, Dr. Darrell Taulbee, Dr. Rodney Andrews, Dr. Scott Shearer

The goal of the project is to produce a durable briquetted biomass fuel from agricultural and wood wastes that is an attractive alternative energy source for coal-fired boilers for industrial process heat and steam generation, and could potentially be utilized in residential applications. Corn stover, fescue and wood waste will be investigated as feedstocks for the briquettes.

### ***Weather Responsive Ventilation for Residential Energy Efficiency and Indoor Air Quality (UK)***

Dr. Donald Colliver, James Bush, MS EIT

Between one-third and one-half of the cost of heating and cooling a well-insulated house is due to air leaks. Indoor air quality concerns become important when buildings are built tighter to reduce these leaks in order to reduce the heating and cooling bills. This project will determine the optimal amount of air to bring into the house in order to maintain adequate indoor air quality while minimizing the energy used for ventilation. It will then develop and test a prototype fan control system, which will adjust the amount of ventilation in the house. The control will be based on outside temperature and wind velocity.

## **Future Opportunities**

Kentucky's Land Grant Universities and the University of Louisville will work to promote public private partnerships that seek to site and locate commercial renewable energy technologies for power and fuel production utilizing MSW, waste wood, and biomass. For example, an effort is progressing to site a commercial scale 5MW gasification facility utilizing plasma arc technology. Plasma gasification is the gasification of matter in an oxygen-starved environment to decompose waste material into its basic molecular structure. Plasma gasification does not combust the waste as incinerators do. It converts the organic waste into a fuel gas that still contains all the chemical and heat energy from the waste. It converts the inorganic waste into an inert vitrified glass. It is the transformation of carbon-based material in an oxygen-starved environment using an external high heat source (plasma) to produce a fuel gas (also called a syngas) that can be used in other R&D applications. The net result is that all the biomass is converted to marketable energy and residual products.

The processing facility will test the feasibility and effectiveness of converting biomass sources and various grades of coal to syngas and usable byproducts. Kentucky State University's Research Farm and Agriculture Extension Service will assist and partner on these issues and opportunities. The development of research to assist farmers with crop bio-energy and bio-fuels crop production is a necessary component of achieving Kentucky's 25 x '25 plan. KSU has in the past been very successful with developing mobile technologies to implement processing at the farm level. Also, KSU has a strong history of agricultural experimentation at their 200+ acre research farm. KSU will maintain these traditions of excellence and also work to develop new core competencies in the areas of systems sustainability, feed-stock research, small farm opportunities, and overall public awareness.

Additionally, KREC will investigate near-term (5-7 years) high pay-off biomass energy opportunities that can help move Kentucky beyond the current food or fuel debate.

## **Conclusion**

Kentucky has heard the 25x'25 and USDA Grand Challenge call to action loud and clear. The University of Kentucky, the University of Louisville and Kentucky State University are actively working toward solutions to this challenge. While it is clear that America faces an uncertain energy economy in the years ahead, it is less certain how those problems will be solved. Without question, agriculture and forestry will offer many solutions to tomorrow's energy problems, but the answers will not present themselves. Any significant advance will surely require a combination of legislation, research, energy efficiency practices and technical trials to be successful. To that end, KREC is building public/private partnerships to realize the potential from farm and forest lands, to fund promising research and to advise decision makers on sound renewable energy and energy efficiency policies.

Responding effectively to the world's new energy realities will be one of the most urgent and important challenges of our time. To meet this challenge, we must identify and pursue aggressive, yet achievable, solutions to meet our energy needs. Now, more than ever, there are abundant new opportunities in safe, clean energy alternatives that can meet consumer demands, enhance sustainability and promote conservation. New innovative ideas are emerging every day while both private and public investments in alternative energy research and development and energy efficiency technologies are growing at a rapid pace. Kentucky universities, in collaboration with the Kentucky Rural Energy Consortium, are providing the vision and leadership that the Commonwealth needs to secure its energy future.

Becoming a finalist for the 25x'25 and USDA Grand Challenge will allow KREC to be seen as a unique national model of cooperation which has the potential to be replicated in other states. Together, we can meet the challenge.

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## **Applicable Websites**

- <http://louisville.edu/kppc/krec>

This is KPPC's host page for the Kentucky Rural Energy Consortium. The page houses information about KREC's vision, mission, background and projects. The KPPC web page also includes information about Kentucky's 25x'25 initiative.

- <http://www.energy.ky.gov/dre3/25by25.htm>

This site, hosted by the Kentucky Governor's Office of Energy Policy, provides brief information about KREC and the National 25x'25 Action Plan and links to both organizations' web pages.

## **Contact Information**

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