

2014 Annual Summary

Department for Energy Development and
Independence

Kentucky Energy and Environment Cabinet



Foreword

When Governor Steve Beshear entered office he put forth a bold challenge to position Kentucky as a national leader in energy technology and production to help lead the nation toward greater energy self-reliance. The strategy for achieving that challenge was defined in the Governor's action plan, *Intelligent Energy Choices for Kentucky's Future*. The plan was designed to be a "living" document to improve the quality and security of life for all Kentuckians by creating efficient, sustainable energy solutions and strategies; by protecting the environment; and by creating a base for strong economic growth over the long term.

Since that initial challenge and plan the Energy and Environment Cabinet (EEC) and the Department for Energy Development and Independence (DEDI) have worked diligently to initiate discussions and develop energy opportunities that better the Commonwealth. That work has accelerated developments in fossil energy, renewable energy and energy efficiency for all Kentuckians.

This year the department worked with other Cabinet agencies to assess energy policy ramifications caused by federal environmental regulation. Additionally, the department helped identify energy and economic impacts that will have significant influence on Kentucky's energy reliability, affordability and security. National markets and regulatory forces are dramatically shifting Kentucky's energy landscape and we need to be positioned to shape that change rather than just merely react to external forces. To bring focus to these events the Cabinet commissioned a documentary, "Shifting Lines – Kentucky's Changing Energy Landscape," to better prepare Kentucky's leadership for a new energy future - a future where Kentucky remains economically competitive while protecting its environment.

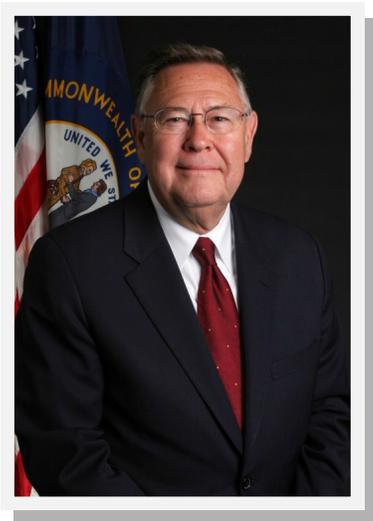
Our efforts remain focused to improve the quality of life for all citizens by simultaneously creating efficient, sustainable energy solutions and strategies; by protecting the environment; and by creating a base for strong economic growth.

This annual summary provides a brief overview of DEDI's programs and projects that are helping shape Kentucky's energy future.

More information about DEDI's activities can be found at <http://energy.ky.gov>.

Dr. Len Peters

Secretary, Kentucky Energy and Environment Cabinet



Kentucky's energy landscape is rapidly changing. Abundant supplies of low-priced natural gas continue to place downward pressure on coal consumption and production. Alternative forms of energy are becoming more cost competitive allowing for the construction of natural gas and solar electric generation facilities in Kentucky. At the same time, new federal environmental regulations are dictating energy policy for the nation. These actions are influencing our energy landscape and impacting Kentucky's economy and prosperity.

Changes to our energy landscape have the potential of disrupting our low-cost power and adversely affecting our economy. New federal environmental regulations may threaten our traditional least-cost power dispatch that could result in unintended consequences, influencing price stability and power reliability. This year these impacts were assessed by the department and concerns were incorporated into the Cabinet's response to EPA's Proposed Clean Power Plan. We are optimistic that EPA will address our concerns when the final Clean Power Plan rule is released in the summer of 2015.

President Kennedy once said, "Change is the law of life. And those who look only to the past or the present are certain to miss the future." Heeding this call the Cabinet, in conjunction with the University of Kentucky's Center for Visualization, produced a documentary, "Shifting Lines – Kentucky's Changing Energy Landscape," that brings attention to our energy and economic challenges with respect to the decisions that lie ahead. I believe you will find the documentary interesting and hope you re-view it.

To complement our energy policy work, the department also actively managed 38 grants representing more than \$33 million. These grants support programs and projects in Kentucky for energy efficiency and renewable energy, as well as energy research and coal education. Through these efforts Kentucky continues to be recognized as a national leader in energy efficiency and fossil energy research. This annual summary highlights the department's many energy activities that are helping improve Kentucky's schools, businesses, industries and communities.

As the federal government adopts regulations that affect energy and environmental policy, we must work together to chart a course that is best for Kentucky's economy and environment while ensuring that our energy future remains strong, reliable and affordable.

Thank you for your confidence and opportunity to serve as your cabinet secretary.

A handwritten signature in black ink, appearing to read "L. Peters".

Leonard Peters
Secretary
Kentucky Energy and Environment Cabinet

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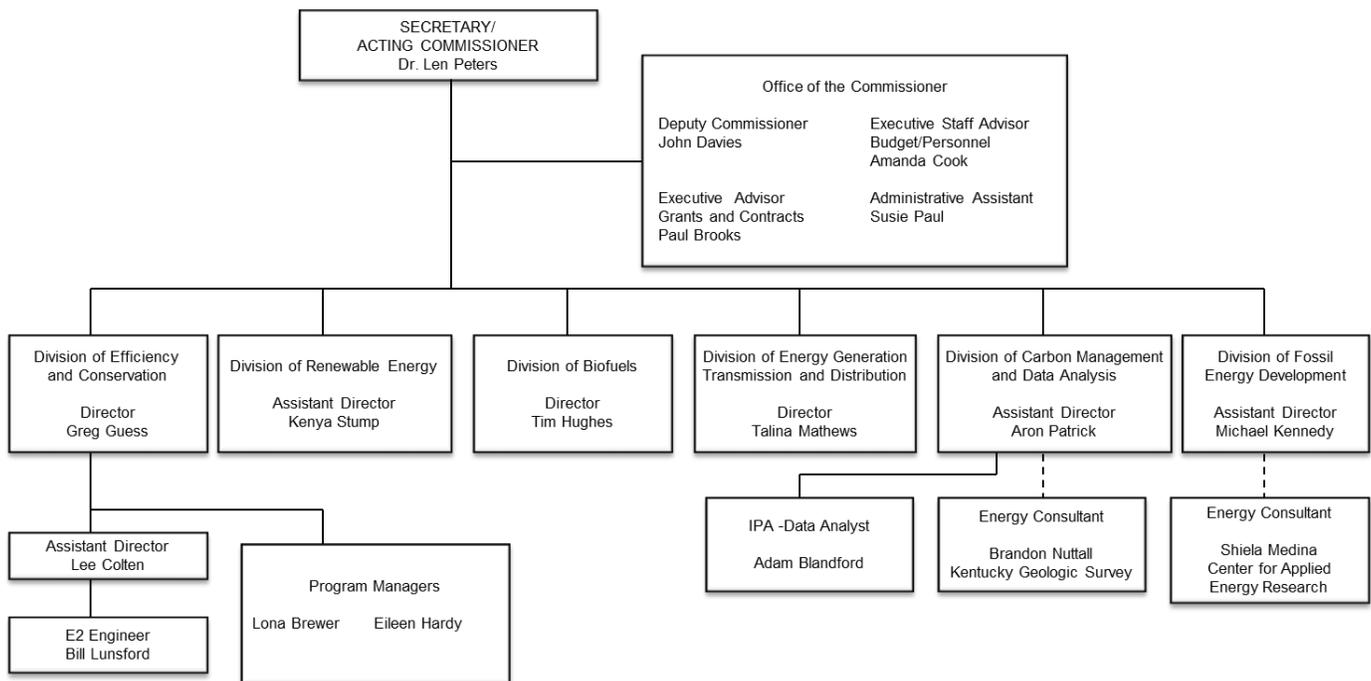
DEDI Organization

The Kentucky General Assembly enacted legislation (KRS 152.712) that established DEDI within the Energy and Environment Cabinet in 2008. The department was created with six divisions that support implementation of Governor Steve Beshear’s energy plan and policies. The department ends the year with 15 employees. Additionally, the department collaborates with both the University of Kentucky’s Center for Applied Energy Research and the Kentucky Geological Survey, which provide technical expertise and advice.

DEDI’s mission is to improve the quality and security of life for all Kentuckians by creating efficient, sustainable energy solutions and strategies and promoting clean, reliable, affordable energy sources that help Kentucky improve energy security, reduce emissions, and provide economic prosperity. Additionally, the department supports and encourages energy-related research and development that will benefit Kentuckians.

A short summary highlighting the accomplishments and grants managed by each division follows.

DEPARTMENT FOR ENERGY DEVELOPMENT AND INDEPENDENCE



Revised 12/31/14
Contact Information:
<http://energy.ky.gov/Pages/AboutUs.aspx>

Division for Efficiency and Conservation



The Division of Efficiency and Conservation provides leadership to maximize the benefits of energy efficiency and conservation through awareness, research and technology by embracing new and existing partnerships. It is charged with implementing the Governor's goal of offsetting at least 18 percent of Kentucky's projected 2025 energy demand through energy efficiency. Though no easy task, the broad spectrum of initiatives and energy programs currently underway will lead the way toward meeting Kentucky's energy goals.

The division focuses on market transformation to accomplish this mission. By strengthening its existing partnerships and embracing new opportunities, energy efficiency programs are changing how Kentucky produces, uses and conserves energy. 2014 was a year for looking ahead, as the department seeks to put many of its programs on a more sustainable path. Division staff worked with 20 partner agencies and organizations to identify sustainable energy efficiency programs. Today there are more than 20 programs in place in various sectors of Kentucky's economic landscape, including agriculture, research, education, local government, residential, commercial and industrial sectors.

The programs outlined on the following pages represent innovative leadership and also reflect the dedication and creativity of the division's partners and staff to pursue energy solutions. What's notable is that many of these partnerships started as standalone grant-funded projects; however, many of these partners have truly embraced the principles of energy management as an environmental or cost-management mission of their organization.

For example, energy efficiency programs have benefited the housing and education sectors by creating or retaining jobs and by reducing greenhouse gas emissions and energy consumption. Two programs in particular are the School Energy Managers Project (SEMP), administered by the Kentucky School Boards Association (KSBA), and the Kentucky Home Performance Program administered by the Kentucky Housing Corporation (KHC).

Division for Efficiency and Conservation - Continued



KSBA is continually on the lookout for funding opportunities and intervened in utility rate cases as a means of supporting school districts in their energy management quest. KHC has made energy management a core aspect of nearly every financial product or program that they create, to ensure energy costs support the housing affordability mission of their agency.

Division staff are also managing four projects that resulted from successful application for competitive grants from the U.S. Department of Energy (DOE). The Energy Efficiency Awareness and Action program is engaging citizens to reduce energy consumption utilizing the ‘grass-roots’ efforts of Kentucky’s Cooperative Extension Service. The Cooperative Extension Service is so pleased with the success of this program they have provided funding for a half-time position.

The Department for Local Government/Energy Savings Performance Contracting (DLG/ESPC) project provides education and technical assistance to local governments on programs that reduce energy consumption, greenhouse gas emissions and utility costs.

The Midwest Energy Efficiency Alliance is working with DEDI to conduct a three-year energy codes compliance and improvement study. Finally, the Foundation for Kentucky Industry is partnering with the Kentucky Pollution Prevention Center and the department to deliver outreach and technical assistance for the implementation of combined heat and power technology.

Staff also provided oversight to 13 projects and programs funded by an EEC environmental mitigation settlement fund, which resulted in \$11.2 million through 2015. This funding has helped strengthen existing programs as well as supported new energy efficiency and renewable energy projects in the Commonwealth.

Although new energy policies are on the horizon, the division is poised with innovative, cost-effective energy programs to meet the energy needs of tomorrow. A review of 2014 program activities follows.

Division for Efficiency and Conservation - Continued

Kentucky School Energy Managers Project (SEMP)

During 2014, the Kentucky School Boards Association (KSBA) continued to provide training, technical support and administrative oversight of SEMP with funds provided by a two and one-half year \$750,000 grant awarded by the EEC. Grant funds support a small staff at KSBA and partial salaries for energy managers hired by school boards through 2015.

The successful accomplishments of SEMP attracted the attention of utility service providers and identified new funding opportunities to support energy management in Kentucky's schools. Through utility company demand-side management programs at Louisville Gas and Electric/Kentucky Utilities and American Electric Power – Kentucky Power Company they developed a similar school energy management program. School districts located within the utility provider's service territories are eligible to participate in the program. The funding will pay for partial salaries for 25 Kentucky school energy manager positions through fiscal year ending 2015.

Since the program was launched in 2010, SEMP has raised awareness to the benefits of energy efficiency, reduced energy usage and saved districts millions of dollars. According to the KSBA Energy Management Report for Fiscal Year 2013/14, more than \$47 million in cumulative avoided costs have been redirected back into school budgets. Overall, Kentucky's school districts are using less energy than they did three years ago, even though the conditioned space increased more than five million square feet. The complete energy report is available on the KSBA website, <http://www.ksba.org/>.

Fayette County Public Schools (FCPS) Integrated Live Energy Management

EEC awarded FCPS \$335,000 in 2013 to support completion of the integrated live energy metering project. The project comprises real-time energy monitoring equipment, live data analysis software, and a district-wide, public energy and sustainability education portal. The completed project, expected to be fully implemented in 2015, is estimated to reduce building energy consumption by 20 percent, to save more than \$1.1 million a year in energy costs and reduce CO₂ emissions by more than 11,000 metric tons per year. FCPS is one of the state's leaders in the adoption of real-time tracking of energy consumption.



Zero Net Energy Schools

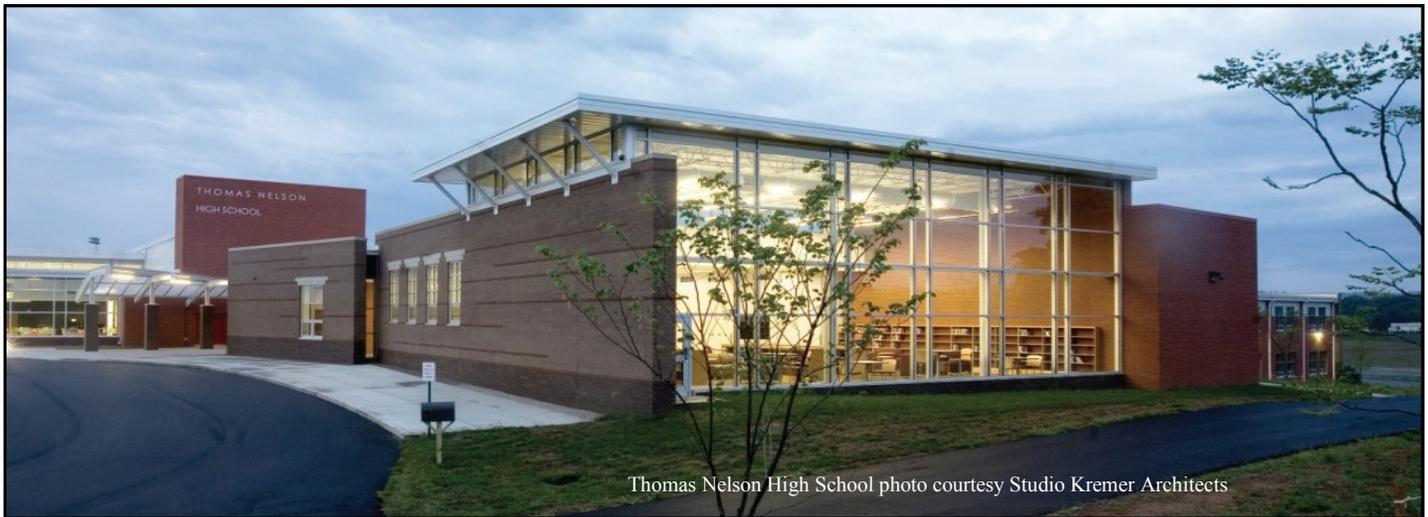
Through partnerships developed through the High Performance Schools Workshop series, Kentucky has become a recognized national leader in zero net energy (ZNE) schools. Currently Kentucky has two ZNE schools and 10 ZNE-ready schools in operation. A ZNE Ready school only lacks a renewable energy source to achieve ZNE. Kentucky's ZNE schools include [Richardsville Elementary](#) and [Locust Trace AgriScience Farm](#). These schools have been showcased across the country as innovative, highly energy efficient buildings that are helping push the design threshold for school facilities and commercial buildings of the future.

High Performance Sustainable Schools Workshop

“Good Design Equals Energy Efficiency and Economy” was the theme of the 2014 High Performance Schools Workshop conducted by Kentucky NEED in partnership with DEDI. Kentucky NEED is the state affiliate of the National Energy Education Development (NEED) Project, a national non-profit organization. Kentucky NEED focuses on the scientific concepts of energy and provides objective, grade-appropriate information about conventional and emerging energy sources, including their use and impact on the environment, economy, and society.

On March 12 and 13, 2014, 100 school superintendents, board members, facilities managers, architects and engineers gathered in Bardstown, Kentucky to learn how an integrated planning approach to building design and operation, and holistic management of energy allow a district to better manage utility costs with limited fiscal resources. The keynote speaker was Nicky Rapier, vice

Division for Efficiency and Conservation - Continued

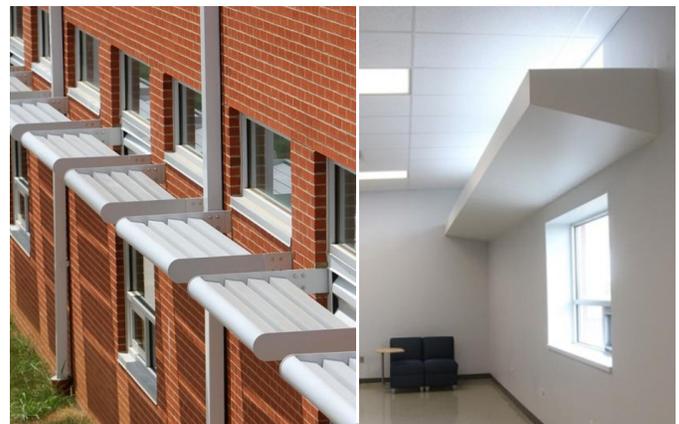


president of community and economic development and Salt River Electric Cooperative and Nelson County School board member. Rapier shared the process and strategies utilized by the Nelson County school district to create economical and highly efficient facilities. The district's design team presentations described how collaboration and pragmatic decision making achieved and exceeded high performance goals and resulted in reduced construction costs. The workshop also allowed participants to tour nearby Foster Heights Elementary School, a renovated and expanded school originally built in 1958, and the newly constructed Thomas Nelson High School. The site tours were led by students describing facility features, and provided attendees with a first-hand look at high performance facilities.

DEDI awarded a \$38,000 grant to NEED to fund the High Performance Schools Workshop and to provide a one-day teacher training event. Last fall, 21 K-12 teachers gathered in western Kentucky to receive valuable energy education and ideas to use in the classroom. Detailed information about NEED teacher and student energy education is available at <http://www.need.org/kentucky>.

Kentucky Home Performance

The Kentucky Housing Corporation (KHC) received a \$3 million grant from EEC to support the ongoing Kentucky Home Performance Program and expand the program's financial services to homeowners through 2015. The grant continues to fund program operations to jump-start the program with additional energy efficient loans and retrofits. The program is designed to



The Nelson County School District design team implemented an aggressive daylighting strategy in order to welcome as much natural light into the building as possible. This strategy lessened the need for electrical lighting and mitigated the temperature increase they cause. Aluminum light shelves outside these windows and dry wall shelves inside are configured to reflect light up into the ceiling plane.

provide reliable information to homeowners concerning how efficient their existing home performs, what can be done to improve the home, and how long the investment in each measure (e.g., insulation, sealing infiltration leaks, replacing HVAC or other measures) will take to "pay back" the original investment. The program focuses on owner-occupied, single-family energy efficiency retrofit loans ranging from \$1,000 - \$25,000 per home.

Using \$500,000 of remaining American Recovery and Reinvestment Act (ARRA) and the \$3 million of funds

Division for Efficiency and Conservation - Continued

from EEC, KHC has partnered to establish a low-interest revolving loan fund known as Warehousing for Energy Efficiency Loans (WHEEL). Along with Pennsylvania,



Kentucky is the nation's first state to provide low cost, large scale capital for state and local government and utility-sponsored residential energy efficiency loan programs. As this program expands, it should

produce enough revenue to sustain program operation over time. To date, KY Home Performance has provided 58 loans through the WHEEL, resulting in \$570,377 in energy efficient home improvements.

In addition to the loan program for site-built homes, KHC is partnering with NextStep, a nonprofit organization dedicated to providing efficient and affordable housing in the form of manufactured homes. KHC is providing loans, along with incentives from EEC to reduce the cost differential of ENERGY STAR manufactured homes compared to tradition HUD-code manufactured units. The goal is that by putting units on the ground, this initiative will stimulate the market interest in these utility-affordable units.

HowSmart KY On-Bill Financing-Energy Efficiency Retrofit

HowSmart KY is a partnership between DEDI and the Mountain Association for Community Economic Development (MACED), funded by a \$300,000, two-and a half-year grant from EEC through 2015. This program provides "on-bill" financing for energy-efficiency improvements for homeowners served by participating rural electric cooperative corporations (RECCs) in eastern Kentucky. Four RECCs have transitioned from pilot programs to permanent tariff programs in HowSmart KY: Fleming-Mason, Grayson, Big Sandy, and Jackson RECCs. Licking Valley and Farmers RECCs are in the process of seeking PSC approval.

The HowSmart KY Program offers homeowners the opportunity to receive energy efficiency audits and provides loans to implement energy efficiency upgrades to their homes. The program provides a line of credit that allows participating electric co-ops to pay for energy efficiency improvements on select residences. In exchange for the costs of efficiency upgrades, the loan re-

payment is added to the utility bill of the participating residence as a fixed monthly charge, paying for the energy efficiency investment during the term of amortization.



Efficiency measures are selected and the loan is structured such that the reduced energy bill and loan repayment to-

gether are lower than the bill was before the improvements, giving the customer a net positive cash flow from the first month. Individual customers will bear little to no up-front cost for the price of the energy efficiency improvements, with the long-term goals of helping co-op customers realize a net reduction in their monthly utility bills and helping utilities shave peak energy demand. Having the loan repayment as part of the electric bill reduces the default rate, thus attracting loan capital and reducing the interest rate. A loan loss reserve has been established to ensure against defaults on the loans. This arrangement also benefits the homeowner – if the house is sold, the loan balance stays with the meter and the new owner gets the benefits of the efficiency improvements.

MACED is matching the grant award with \$320,000 from its resources. Residential energy efficiency improvements play an important role in helping electric utilities in Kentucky reduce energy consumption, energy supply requirements, and individual consumer costs. To date, HowSmart has provided 48 loans, resulting in \$211,254 in energy efficient home improvements.

"On-farm" Energy Efficiency & Production

The Governor's Office of Agricultural Policy (GOAP) continued to operate a program to support energy efficiency projects on Kentucky farms. GOAP received \$750,000 from EEC to support the three year program. Leveraging matching funds made available through Kentucky Agricultural Development Funds, this program provides incentives for Kentucky's farm families to increase energy efficiency and in previous years, renewable energy production in the Commonwealth. The pro-

Division for Efficiency and Conservation - Continued



gram has continued to increase producer awareness of the opportunities to improve energy efficiency and production of useable energy within their farming operations. Recipients of the grants state that in some cases, the efficiency upgrades have made the difference in their being able to remain financially solvent and competitive with larger industrial farm operations. Many of the producers, upon seeing how significant their overall energy savings are relative to the small investment, are looking for additional efficiency or renewable opportunities to make more improvements to increase their energy savings.



Energy and Environment Cabinet Secretary Len Peters joined DEDI staff and officials from LORD to celebrate the successful completion of the energy project. A media event was held June 17th at LORD Corporation's Bowling Green, Ky. facility.

Industrial Plant Energy Efficiency Upgrade

The Lord Corporation's Bowling Green plant, producer of bonded rubber parts for the vehicle and equipment industries, has invested over \$1 million to install and operate energy efficient equipment and a new energy management control system. To assist in this initiative EEC provided a grant of \$504,000. Lord Corporation has replaced an inefficient chiller with a new chiller and associated controls, a steam generation system with a high-efficiency boiler, and installed a rubber preheater metering and scheduling system. The project was accomplished through a complete turnkey installation and commissioning process and will have a simple payback of 5.5 years. Lord Corporation is expected to realize an annual utility savings of more than \$170,000 and a 1,433 metric ton reduction of CO₂.

Energy Efficient Modular Buildings

Southern Tier Housing Corporation (STHC) was awarded a grant of \$504,000 for a three-year period by EEC to support energy modeling and design research to develop more cost-effective and energy-efficient factory built structures, Houseboats to Energy Efficient Residences (HBEER). The project will use other funds for the construction of four new energy-efficient, factory-built structures equipped with photovoltaic generation systems. The program is a continuation of the partnership between DEDI and the Kentucky Highlands Investment Corporation, with which STHC is affiliated, that was originally initiated with Recovery Act funding in 2009. In addition to providing energy-efficient affordable housing to low-income buyers, the program is designed to develop a market for factory-built modular homes and provide jobs for workers in the region who formerly worked in the dozen or so houseboat factories in the area that were adversely impacted by the 2008 recession.

Green Bank

The [Green Bank of Kentucky](#) was created by an administrative order of the Finance and Administration Cabinet (FAC) in 2009 and was initially funded by a DEDI grant of \$14.4 million in Recovery Act funds. The Green Bank is administered by FAC through a partnership with DEDI. The mission of the Green Bank of Kentucky is to promote energy efficiency in state buildings through competition for low-interest loans to reduce operating costs and energy use, protect the environment, save tax-

Division for Efficiency and Conservation - Continued

payer dollars, promote economic development, and create new green-collar jobs by means of education, engineering analyses and building improvements. The Green Bank is a revolving loan fund primarily used for energy savings performance contracts (ESPC) on state-owned facilities. With the initial balance of funds loaned out, Green Bank repayments are being rolled over to finance new energy-efficient improvements in other state buildings. The Green Bank is able to loan money at very low interest rates, thus allowing more energy conservation measures to be implemented on a project. If additional funding can be made available to the Green Bank, its pool of money for energy efficiency improvements could be expanded to provide loans to local governments and school systems. At the close of 2014 approximately \$1 million has been recycled through the bank to support ESPC projects and more than \$3 million is available for projects under development.

Local Government Initiatives

DEDI continues to work with the Department for Local Government (DLG) in an effort to encourage local government officials to explore energy efficiency and renewable energy opportunities. DLG and DEDI are partnering to educate and provide incentives for local governments to embrace energy efficiency and renewable energy opportunities through a three-pronged approach.

In the spring of 2013 DLG was awarded \$1.2 million by EEC to support continuation of a competitively-funded grant program for local governments. This program provides resources for cities and counties to increase their community's energy efficiency by developing projects that reduce energy consumption, greenhouse gas emissions and utility costs.

Remaining funds from the former Energy Efficiency and Conservation Block Grant Program Recovery Act program were used to establish a low-interest revolving loan fund. This loan fund is available to local communities where energy savings opportunities exist on a smaller level, such as replacement of an old boiler with a newer, more efficient one. These loans are typically interest free and are paid back over time, allowing the communities to take on efficiency projects they may not have otherwise been able to fund.

The third component of the local government initiative is designed to educate local governments on energy savings

performance contracts (ESPCs). This program provides funding for technical experts to assist local governments with procuring, managing and evaluating ESPCs that can significantly reduce energy consumption.

Funded through a competitive grant award through U.S. DOE, this program provided resources to implement a three-year pilot project to assist local governments with the ESPC process. In a partnership between DLG and DEDI, the Local Government Energy Retrofit Program (LGERP) promotes a comprehensive system-wide ap-



Former Lt. Governor Jerry Abramson speaking at one of DLG's workshops to promote Energy Savings Performance Contracts as a means for local governments to undertake and finance energy efficiency improvements. Additional information is available: <https://kydlgweb.ky.gov/>

proach to energy efficiency and conservation of buildings, street lighting, or water infrastructure improvements through the use of ESPCs.

ESPCs provide a financing mechanism that pays the cost of energy improvements from the utility savings. An added benefit to local government is that the energy services company (ESCO) that provides the turnkey service guarantees that the customer will achieve the targeted savings level or the ESCO will pay the difference.

ESPCs have been utilized in Kentucky extensively by the state government, the state's public universities, and some of the larger municipal jurisdictions. Over the last 10 to 12 years, these public entities are estimated to have completed approximately \$800 million in projects.

Division for Efficiency and Conservation - Continued

However, only rarely have local governments used ESPCs. This is particularly true for the smaller cities and counties.

The LGERP project is partnering with existing organizations—including the Kentucky League of Cities (KLC), the Kentucky Association of Counties (KACo), and area development districts (KCADD) and the Center for Applied Energy Research (CAER) at the University of Kentucky—to leverage existing bond pools to fund efficiency projects, provide communications and training networks to local governments on ESPCs, and provide legal and technical support to local governments in the entire ESPC process.

During 2014, this project was instrumental in providing outreach and education on ESPCs throughout the state. Many local communities are in the process of investigating the use of ESPCs and approximately seven local governments have taken steps toward entering into ESPCs in 2014.

Energy Efficiency Awareness and Action (EEAA)

Built on the long-standing partnership between DEDI and the University of Kentucky's Cooperative Extension



Teens toured the University of Kentucky solar house as part of a two-day workshop entitled, Sustainable You. The EEAA program sponsored the educational event during the 2014 Kentucky 4-H Teen Conference held in Lexington.

Service (CES), the EEAA program continued to operate under the two-year \$200,704 federal grant through June 30. As a result of the program's success in curriculum development and education, the UK CES extended financial support to EEAA. DEDI awarded a \$17,500 grant to provide partial funding for the Extension Associate's position for the 2014/2015 fiscal year. The EEAA program's in-service trainings provided CES agents in Kentucky's 120 counties step-by-step instructions to measure energy efficiency, review utility bills, and to benchmark a building's or home's energy performance. Agents are trained to use an energy-consumption analysis tool and the ENERGY STAR Portfolio Manager program. The EEAA program has also introduced a significant number of 4-H youth to scientific energy concepts through interactive educational activities and equipped them with the right tools to assist their families improve their household energy environment. Further training opportunities are scheduled through 2015 for 4-H Program training assistants.

True to Cooperative Extension's 'grass-roots' approach of disseminating information, the EEAA program successfully developed and implemented energy education programs across the state. One example of the program's sustainability as a credible resource to Extension Agents is the adoption of the residential program by the Family Consumer Science (FCS) component. During 2014, the residential program was published in the FCS agent training catalog and selected as a leader lesson for the Kentucky Extension Homemakers Association (KEHA) clubs during 2014. KEHA leaders are trained to be peer teachers to share the skills and information in their clubs and community settings. Membership in KEHA clubs is estimated at 15,000 individuals. To further expand commercial energy education, UK CES has partnered with the Kentucky Pollution Prevention Center (KPPC) to implement a new commercial building assessment program funded through a one-year State Energy Program grant from DEDI.

Commercial Office Assessment

The University of Louisville and the Kentucky Pollution Prevention Center (KPPC) was awarded \$24,500 to perform energy audits at selected cooperative extension offices in Kentucky. Seven facilities were chosen for energy assessments geographically and for potential by using

Division for Efficiency and Conservation - Continued

EPA's Portfolio Manager software. Tangible energy efficiency improvements are expected, as well as the benefits of education/outreach to the extension system and to the communities served. The initial energy assessment of the Warren County extension office has been used as a case study to develop a webinar for sister facilities to learn the energy assessment process and to gauge potential for comparable site improvements. Additional training and educational materials will be provided as needed.

University of Kentucky Cooperative Extension Service Partnership

DEDI continued its decade-long partnership with the University of Kentucky's Cooperative Extension Service (CES). Through a \$100,000 grant provided by DEDI, CES provided ENERGY STAR information statewide through its network of county extension agents. The grant supported a CES agent who acted as a "circuit rider," taking an exhibit featuring various residential energy-efficiency technologies to over 40 venues across the state annually – including energy fairs, RECC membership meetings, trade shows and other events.

The Kentucky State Fair is the highlight of the CES annual exhibit schedule. The exhibit, shared with the UK College of Agriculture, included 1,500 sq. ft. of hands-on materials and played center stage in the South Wing

— Main Street pavilion. It is estimated that more than 400,000 fair attendees viewed the exhibit. Extension agents on site at the fair exhibit provide private consultations with homeowners and contractors, and is highly anticipated by many "regulars." After years of interaction with the Extension resources, many homeowners



Domtar, located in Hawesville near the Ohio River in Daviess County, has had a CHP project at its paper pulp mill since 2001. It produces 75 percent of the electricity it uses by recovering byproducts from its production process.

have developed an allegiance to this nonprofit, non-marketing, unbiased clearinghouse of information and quality coaching.

Combined Heat and Power - CHP

DEDI received two grants to help promote the utilization of CHP in the state. A four-year grant of \$95,000 from the [Southeast CHP Technical Assistance Partnership](#) and another \$100,000 two-year cooperative agreement award from the U.S. DOE are helping to identify policies and programs that can help develop the CHP market. DEDI partnered with the Foundation for Kentucky Industry and the [Kentucky Pollution Prevention Center](#) to include stakeholders in the process of providing input in the development of a plan to expand the utilization of CHP in Kentucky, to educate industry on the benefits of the technology, and to provide the technical assistance needed for manufacturers and large commercial building owners to assess the application of CHP in their facilities.

The stakeholder process began in March, CHP presenta-



The UK CES exhibit shared with the UK College of Agriculture was center stage in the South Wing Main Street pavilion during the 2014 Kentucky State Fair.

Division for Efficiency and Conservation - Continued

tions were given at various conferences, and two workshops were conducted in November in Bowling Green and Richmond. DEDI hosts a website containing meeting notes and other stakeholder reference materials. Upcoming activities include a webinar, a CHP site visit, and more targeted outreach activities to pursue technical screening for potential CHP candidates.

Local Partnerships

DEDI works with numerous local partners to identify opportunities for collaboration and to seek initiatives. One example is DEDI's partnership with the [Louisville Energy Alliance \(LEA\)](#). LEA hosts an annual energy

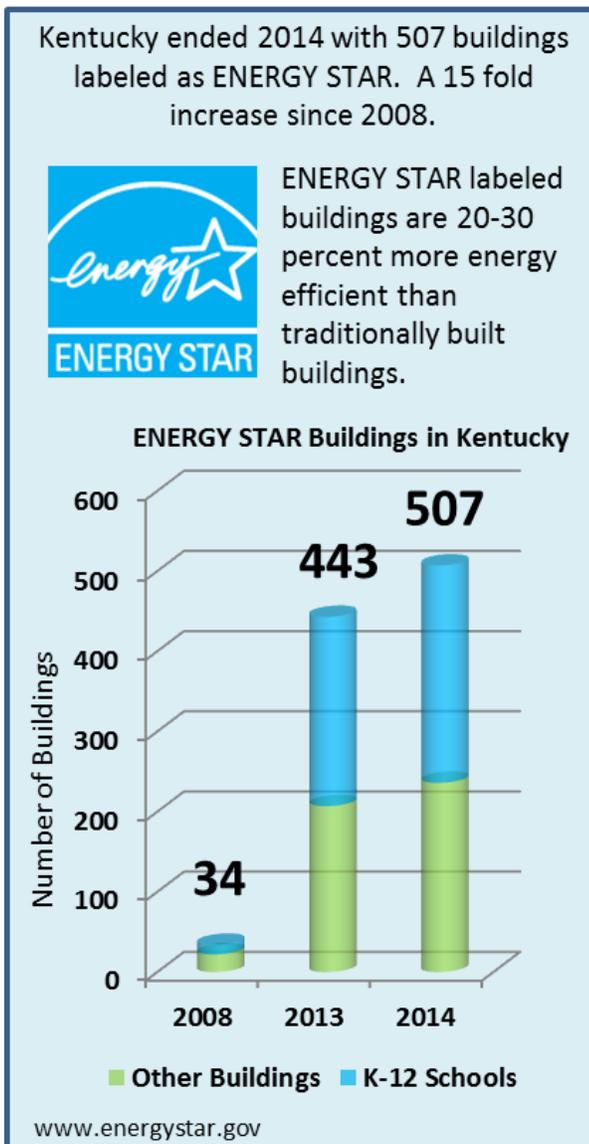
efficiency competition among commercial building owners and operators called the ENERGY STAR Kilowatt Crackdown. DEDI has participated in board meetings and provided funding for modest strategic activities, such as web site development, that help the organization be successful. DEDI has also facilitated a number of stakeholder meetings to help explore various concepts to make efficiency more economical. [ePAD \(Energy Property Assessment Districts\)](#) – or [Property Assessed Clean Energy \(PACE\)](#) as it is known nationally – is a means of helping local governments provide financing to commercial property owners interested in investing in energy efficiency retrofits. Additionally, under the exiting Kentucky Reinvestment Act, is a tax credit for jobs retention; the concept of adding a second tier to retain jobs with a tax credit specifically for energy efficiency and heat recovery activities has been explored. These dialogues have resulted in stakeholders drafting legislation for the 2015 Kentucky General Assembly.

U.S. Green Buildings Council (USGBC) Kentucky Chapter

DEDI continues to work with USGBC to promote better, more environmentally sustainable buildings. Chapter members are volunteering time and expertise on a year-long project at Wilmore Elementary School (Jessamine County) to conduct a LEED EB (Existing Buildings) pilot. They have also been meeting with influential leaders in Lexington to encourage the use of LEED in the proposed renovation of Rupp Arena.

Energy Codes

A key partner of DEDI is the [Department for Housing Buildings and Construction](#) (DHBC). As the principal agency charged with enforcement of the state's energy codes, its role in managing future building energy demands is huge. Everyone acknowledges that the job of code compliance is a resource-intensive job, and that DHBC is resource limited. DEDI has partnered with the [Midwest Energy Efficiency Alliance](#) to secure a \$900,000 grant from the U.S. Department of Energy to conduct a three-year energy codes improvement project; this initiative will result in a pre- and post-compliance survey providing valuable information the rate of compliance of the residential building stock under the current code and areas most in need of compliance assistance. The survey will result in information that can allow tailoring of code compliance improvement activities, such



Division for Efficiency and Conservation - Continued

as targeted training, web site, hotline, and circuit riders. A codes collaborative will provide a forum to facilitate discussion among DHBC, electric utilities, home builders association, and other stakeholders to guide the initiative. As is required by federal law every three years, EEC participated with DHBC in a series of meetings with a range of stakeholders to consider upgrading of the energy codes. As a result of these meetings the state has upgraded the commercial energy code to the 2010 ASHRAE 90.1 (IECC 2012 equivalent); the residential code will remain at the IECC 2009 at this time.

Energy Assurance

DEDI has performed a yearly update of the energy assurance plan (EAP). Energy assurance signifies the capability of planning for the prevention, mitigation, or recovery from energy emergencies. An energy emergency may be simply viewed as an event where energy demand exceeds energy supply. Electricity, coal, natural gas, petroleum products, and biofuel supplies are all considered. The EAP supports operational aspects of the emergency support function 12 (ESF-12) of the state emergency operations plan (EOP). Kentucky Emergency Management (KYEM) has responsibility for managing the state EOP. In some emergencies, such as natural disasters, more than one support function may be activated at once. DEDI also convenes the Energy Resource Management Board, an interagency task force, to facilitate coordination of energy emergency activities

Outdoor Lighting Energy Efficiency Project

Hickman – Fulton Counties Rural Electric Cooperative Corporation (RECC) replaced 1,715 of its inefficient outdoor lighting fixtures with energy efficient LED fixtures throughout its service territory in Hickman, Fulton, Carlisle and Graves counties. The total cost of the project was estimated to be \$652,000. EEC awarded a matching grant for \$316,000 toward the project. The replacement LED lights are projected to have a 20 year life and 50 percent lower maintenance costs. Hickman-Fulton Counties RECC calculated that the new LED lights would generate 40 - 60 percent energy cost reductions, which equates to annual savings of more than 194 kW, 852,117 kWh and reduced the company's power bill by \$49,298. The energy savings equates to approximately 919 pounds of nitrogen oxide, 2,904 pounds of sulfur dioxide and 1.2 tons of carbon dioxide. Hickman-Fulton Counties RECC completed the project under budget and in record time.

In the final report submitted in April 2014, Hickman-Fulton RECC was pleased with the outcome of the project and serve as an example to other Co-ops on what can be done to be more energy efficient for themselves and the communities they serve.

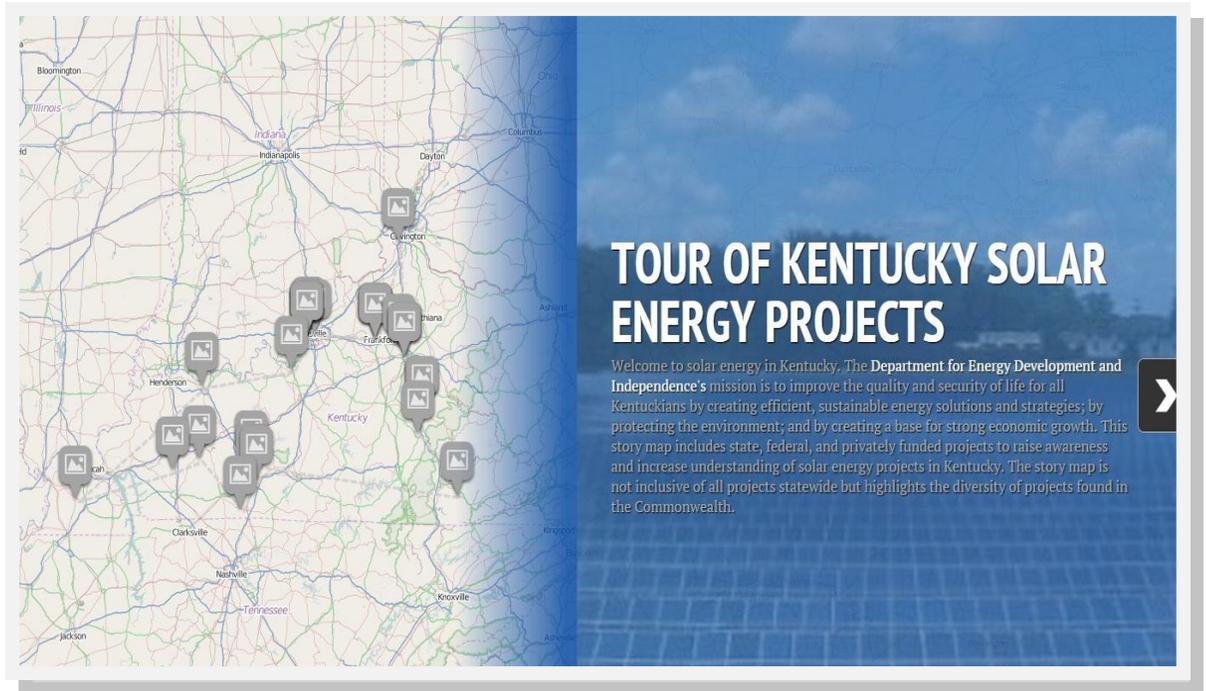
State Heating Oil and Propane Program



The 2013-2014 heating season marked Kentucky's nineteenth year to participate in the U.S. Energy Information Administration (EIA) State Heating Oil and Propane Program (SHOPP). Fifty-five companies in Kentucky participated in 2013-14 season survey.

Twenty-six were heating oil dealers and twenty-nine were propane dealers. Survey participants were contacted by telephone or email each reporting period from Oct. 1, 2013, through March 17, 2014. The survey is conducted every week, as requested by the Energy Information Administration (EIA) The pricing data collected are transmitted to EIA for public dissemination. Results are regularly published in the Kentucky Department of Energy Development and Independence's weekly publication "Kentucky Energy Watch" available at <http://www.energy.ky.gov/>.

Division of Renewable Energy



The Division of Renewable Energy worked with Kentucky stakeholders this year to deliver the Governor's goal of tripling Kentucky's renewable energy generation by providing the equivalent of 1,000 megawatts of clean energy while continuing to produce safe, abundant, and affordable, food, feed and fiber. In meeting this objective, staff primarily focused on policy development and analysis, education and outreach, and technical assistance to those pursuing renewable energy. Through the first three quarters of 2014, Kentucky's net electricity generation from renewables totaled approximately 2.6 million megawatt hours (Figure 1). This represents ~3.7 percent of all net electricity generation in Kentucky for that same time period. While dominated by hydroelectric, Kentucky's other renewables include biomass combined heat and power projects along with six landfill gas to energy projects.

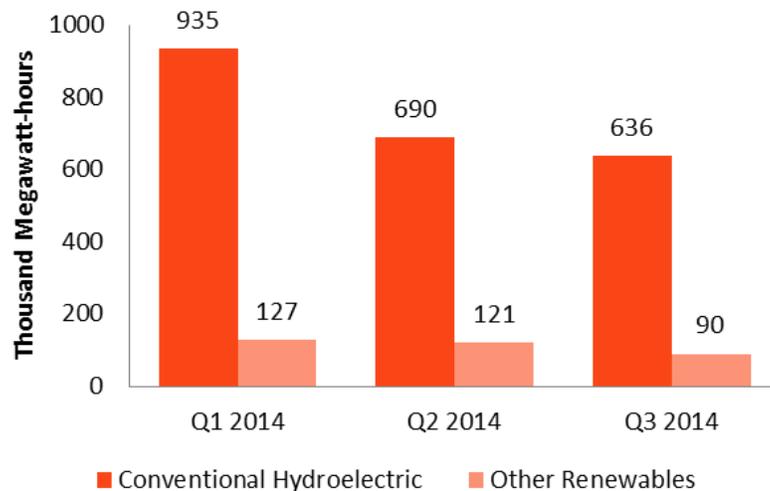


Figure 1: EIA's KY Net Electricity Generation from Renewables

Division of Renewable Energy - Continued

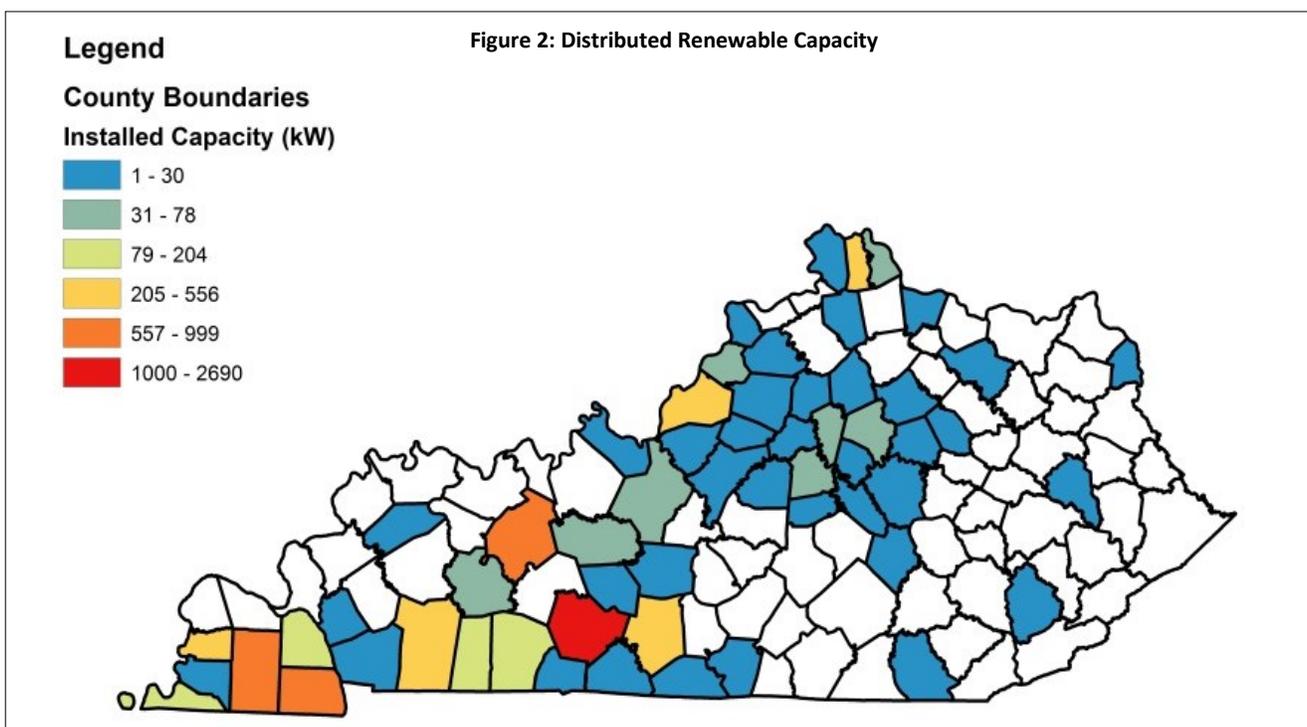
Landfill gas to energy projects began a resurgence in 2014 with both the city of Glasgow and Toyota Motor Manufacturing of Georgetown announcing projects along with Jackson Energy Cooperative announcing their power purchase from the Blue Ridge Landfill near Irvine. These projects add to the six existing East Kentucky Power Cooperative projects. In total, Kentucky has 16 landfills categorized as having the potential for energy projects. Those 16 represent ~ 40 megawatts of electricity potential for the state.

In addition, Kentucky continues to see growth in the area of distributed generation with the majority of this growth occurring in the Tennessee Valley Authority's (TVA) service territory through their Green Power Providers (GPP) program. The GPP program pays an incentive to TVA customers who generate renewable electricity. Many homeowners, schools, farmers, and commercial business owners in Kentucky are taking advantage of this program.

Projects eligible for the incentive payments include wind, solar, biomass and hydro systems rated at 50 kilowatts and below. In total, Kentucky has over 10 megawatts of distributed renewable generation (Figure 2), with the majority of that being distributed solar projects.

One sector that has continued to grow renewable energy is Kentucky's agricultural operations. Kentucky's farmers continue to supplement their incomes with renewable energy by combining federal and state tax credits with grants and utility incentive payments. The Governor's Office of Agricultural Policy's On Farm Energy Program has been a strong supporter for renewable energy. This program, funded partially through a grant from DEDI and from funding approved through the Kentucky Agricultural Development Fund Board, was first initiated with American Recovery and Reinvestment Act funds. Although no longer funding applications for solar projects, several projects approved in previous years, came on-line during 2014. This year, biomass and solar hot water heaters qualified as eligible technologies. During the first two funding rounds, the Governor's Office of Agricultural Policy (GOAP) approved over \$400,000 in funding for energy related projects on farms in Kentucky.

A central goal of the division is education and outreach. Division staff provided education and outreach services through presentations, webinars and workshops and assisted project developers and communities by providing information about permitting, siting conditions, zoning, tax credits and potential partners as well as understand-



Division of Renewable Energy - Continued

ing the regulatory and economic situation in Kentucky for large-scale renewable energy generation. One of the largest outreach projects occurred in October with the release of the Kentucky Solar Energy Story Map. The project is a virtual tour of solar energy projects in Kentucky and accessible to the public via the division's website.

The division continued to provide primary staff support for the Kentucky Center for Renewable Energy Research and Environmental Stewardship (CRERES). The CRERES was established by HB 2 during the 2008 legislative session. The CRERES board of directors is comprised of 13 members and is currently chaired by the Secretary of the Energy and Environment Cabinet. For 2014, the board heard and discussed issues relating to the President's Climate Action Plan and the Clean Air Act Section 111(d) and 111(b) rulemakings for greenhouse gases relating to electric generating units.

In addition, DEDI staff presented on projects relating to combined heat and power initiatives, landfill gas to energy, local government and residential energy efficiency. Dr. Mahendra Sunkara discussed research efforts from the University of Louisville Conn Center as well as emphasizing that theme for advancing renewable energy and energy efficiency stem from advances in new materials and processes.



Installation of 5 kilowatt solar photovoltaic and hot water systems at the Dishman-McGinnis Elementary School in Bowling Green Kentucky will help the school use 50 percent less electricity than the average school built in the area.

Bowling Green Schools Solar Project

One project that was completed in 2014 was the installation of 5 kilowatt solar photovoltaic and hot water system at the Dishman-McGinnis Elementary School in Bowling Green. The EEC awarded a \$33,700 grant for the 63,000 square foot facility that will use 50 percent less electricity than the average school built in the area. The energy produced by these systems will avoid the purchase of about 32,500 kilowatt hours of electricity, and combined they will meet five percent of the school's energy needs. In addition, the project will be used as a teaching tool to help students understand the role of renewable energy in meeting energy needs and reducing the environmental impact of energy consumption.

Kentucky Utilities

Some Kentucky utilities continue to take steps to add renewable energy to their supply mixes. Louisville Gas and Electric/Kentucky Utilities (LG&E/KU) company continued forward with their plans for a 10 MW solar array at an existing facility. In November of 2014, a hearing on the project was conducted at the Kentucky Public Service Commission (PSC). Additionally, the division continues to monitor the legal proceedings surrounding the EcoPower Generation project in Perry County and the PSC approved PPA with Kentucky Power. In May, Duke Energy announced withdrawal of planned wind turbine project in northeastern Kentucky. The proposed project would have built between 26 and 100 wind turbines in Mason and Fleming counties near the community of May's Lick but resulted in community divisiveness surrounding the wind turbine project. House Bill 291 passed during the 2014 General Assembly and established criteria for siting merchant electric generating facilities such as wind turbines and established requirements for public meetings to inform and answer questions about proposed facility construction projects.

Pennyriple Rural Electric Cooperative Corporation

EEC continues to provide oversight of the grant to Pennyriple Rural Electric Cooperative Corporation (PRECC) for construction of the largest solar array in Kentucky. The 5 MW solar array will be built at Fort Campbell on unusable landfill space. Design work was completed in 2014 and PRECC received approval in December of

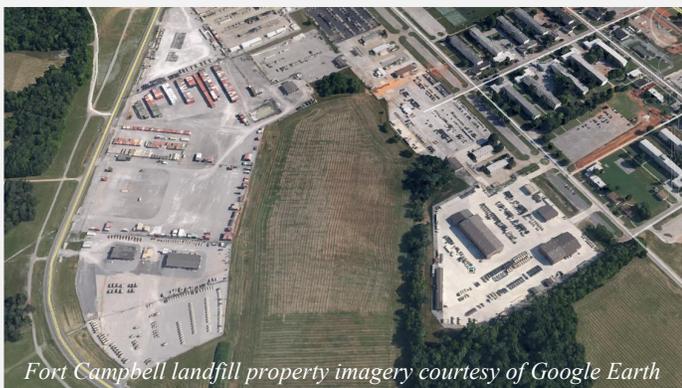
Division of Renewable Energy - Continued

2014 for phase 1 installation. Ft. Campbell is currently awaiting approval from the Army's Realty Governance Board. In addition, this year, the U.S. Department of Energy granted \$800,000 in support of the project. The project is unique to Kentucky in that it highlights the partnership between EEC, Ft. Campbell, PRECC, the U.S. Army, and the U.S. Department of Energy. The total project represents an investment of more than \$19.5 million. EEC awarded Pennyriple RECC a \$3.1 million grant to fund 1.3 megawatts (MW) of the 5 MW array.

Pennyriple RECC will be financing approximately 500 kilowatts of the array and Ft. Campbell will be entering into a power purchase agreement for the remainder. The solar array is expected to produce approximately 6,651 megawatt-hours a year, enough electricity to power about 460 average homes. This will avoid about 4,700 tons of carbon dioxide emissions a year which is equivalent to removing 1,160 cars from the road. The project is slated to be completed in 2015.

Landfill to solar power

By the end of 2015, Fort Campbell will be home to the largest solar array in Kentucky, coming in at 5 megawatts (MW). What makes this project unique, aside from the partnership between state, federal and private organizations, is that the project will be located on a 30-acre parcel of previously unusable landfill space. This will not only be the largest solar project in Kentucky, but it will be the first solar project built on a landfill, creating a learning opportunity for other developers looking at landfills and other brownfield properties as potential sites for renewable energy projects.



Landfill gas recovery system

The Glasgow Landfill Gas Recovery System, a \$1.5 million gas to energy project, was announced during a press conference in April. The project was funded by a \$100,000 grant awarded to the city of Glasgow from the EEC and the Department for Local Government through the Energy Efficiency and Conservation for Local Governments Grant. Additional funds were provided from the Glasgow Regional Landfill. With assistance from the Farmers RECC the city also received a \$1 million no-interest loan from the U.S. Department of Agriculture's Rural Economic Development Loan and Grant Program for the construction of the methane recovery system.



Gov. Steve Beshear presented a check to former Glasgow Mayor Rhonda Trautman during a press conference announcing the Glasgow Landfill Gas Recovery System project.

Photo courtesy of Alex Stiltz, Bowling Green Daily Press

Division of Biofuels



The mission of the Division of Biofuels is to provide leadership to grow Kentucky's bio-fuels and biomass industries through research, development and commercialization while continuing to produce safe, abundant and affordable food, feed, and fiber. Division staff worked toward achieving the Governor's goal that by 2025, Kentucky will derive 12 percent of its motor fuels demand from biofuels. Based upon U.S. Energy Information Administration data, Kentucky's ethanol consumption relative to motor gasoline use has increased from 8.49 percent in 2008 to 10.28 percent in 2013. Data are not available to identify the percent of biodiesel consumed in Kentucky, but there is currently around 60 million gallons of production capacity in the state. Biodiesel production throughout the U.S. surged in 2013 to 1.8 billion gallons, which was up from 1.1 billion in 2012. Monthly production during 2014 trailed the record levels from 2013. Biodiesel consumed represented about 2 percent of our domestic diesel usage. Diesel fuel sold in Kentucky may contain up to 5 percent biodiesel without being labeled. A few stations in Kentucky offer biodiesel blends of up to 20 percent.

Federal policy uncertainty continued to dominate the bioenergy sector's future in 2014. The U.S. Environmental Protection Agency's (EPA) guidance on biogenic CO₂ wasn't released until November 2014. While the report recognized the attributes of specified biomass scenarios, the agency outlined a number of factors to be considered in determining the emission assessment. The document is available at - [http://epa.gov/climatechange/downloads/Framework-for-Assessing-Biogenic-CO₂-Emissions.pdf](http://epa.gov/climatechange/downloads/Framework-for-Assessing-Biogenic-CO2-Emissions.pdf). Even though the EPA proposed reducing the 2014 Renewable Volume Obligation (RVO) substantially for corn ethanol under the Renewable Fuel Standard in November 2013, they continued postponing the final requirements and failed to deliver them in 2014. The RVO uncertainty drew the ire of both the petroleum and renewable fuel sectors. Another large U.S. corn crop in 2014 helped further reduce commodity prices and this translated into ethanol prices significantly below the price of gasoline for much of the year. The retreat of oil prices in late 2014 eroded most of this price differential, but the year was a

Division of Biofuels - Continued

positive one for most ethanol producers. While no stations are currently offering E15 in Kentucky, motorists with flex fuel vehicles can fill up with E85 at one of more than 50 locations offering the fuel. To increase the number of E85 stations, the Kentucky Corn Promotion Council offered petroleum retailers \$5,000 grants throughout 2014 to install the E85 pumps.

The Kentucky Soybean Promotion Board (KSPB) continued their efforts of training diesel technicians for the second year in cooperation with the Kentucky Community and Technical College System (KCTCS). The teachers were provided access to the biodiesel curriculum that was developed in Iowa and accredited by the National Automotive Technician Education Foundation. The KSPB also provided certificates and awards to students enrolled in the KCTCS diesel programs who successfully completed the training at their respective schools. The Owensboro campus took alternative fuel technology training to a new level as they were awarded a \$745,602 grant from the National Science Foundation for *Preparing Technicians for Advanced Transportation Fuels*. The effort involves training and outreach in ethanol, biodiesel, electric, hybrid, propane, natural gas (CNG/LNG), and fuel cell systems.

Division staff remain actively engaged in networking with community leadership, research teams, economic development personnel, and commercial firms to foster additional investment in the state. Staff were invited to speak on Kentucky's bioenergy efforts at the Bioenergy Fuels & Products Conference & Expo in Atlanta and the Ohio Aviation Biofuel's working group meeting in Columbus. Additionally, staff presented a poster on Kentucky's resource potential for bioenergy projects at the Extension, Energy, and Environment Summit held at Iowa State University. DEDI is involved with presenter planning with the Kentucky Association of Manufacturer's Energy Conference and other events.

DEDI staff joined EPA AgSTAR's partner program in order to gain better access to their technical resources available for livestock based biogas projects. A poultry farm in southern Kentucky is in the final phases of com-

missioning an anaerobic digester for the conversion of poultry litter and other organic waste streams into electricity. Staff have consulted with other potential waste to energy projects ranging from individual livestock producers, to food processors, and community digester systems.

The Division of Biofuels helped facilitate a successful application on behalf of various stakeholders within the US Forest Service's Statewide Wood Energy Team (SWET) Cooperative Agreement solicitation. The KY SWET will have access to \$250,000 in federal funds over a four year term. The partners also include the Governor's Office of Agricultural Policy, Kentucky Division of Forestry, Western Kentucky University Institute for

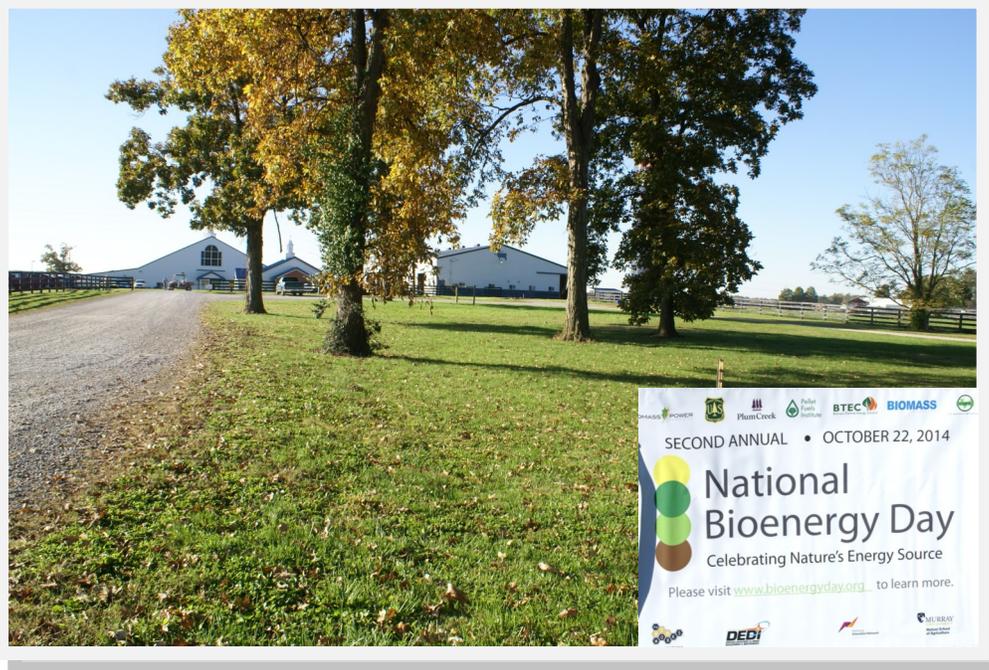
Combustion Science and Environmental Technology, the University of Kentucky Center for Applied Energy Research and Department of Forestry, Murray State University West Kentucky AgBioworks, Midwest Clean Energy Enterprise, LLC, Mountain Association for Community Economic Development, and the Kentucky Poultry Federation.

The SWET will be the catalyst to coordinate the efforts of a number of existing agency personnel, rural development leaders, agricultural organizations, forestry expertise, and other stakeholders for the purpose of improving the utilization of woody biomass resources for energy uses. In order to enhance the stewardship of our natural resources, strengthen existing forest industry sectors, identify efficiencies, and stimulate new demand for undervalued woody materials, the emphasis will be on **LOGS**:

- All segments of the industry can benefit from improved **Logistics** in woodland management, during timber harvest, throughout resource transportation, and at each market channel.
- Efforts will be made to evaluate existing biomass energy **Opportunities** and develop strategies to increase awareness, improve financial returns, and expand the feedstocks available for these legacy customers.



Division of Biofuels - Continued



- Through **Growth** in expanded bioenergy markets for diseased, insect infected, and storm damaged trees, we can reduce the hazardous fuels in our public and private woodlands while creating economic opportunities for our rural communities.
- Finally, all of these initiatives will be predicated by a strong emphasis on **Sustainability** that considers energy resource, economic, and environmental criteria.

Significant progress was made in 2014 by a number of commercial advanced biofuel firms in the United States and around the world. DuPont, Abengoa, and Poet-DSM commissioned or neared completion of construction on commercial cellulosic ethanol plants in late 2014. Division staff have remained in contact with a number of these firms to determine project prerequisites and identify potential sites in the state. Future bioenergy investment opportunities for Kentucky will depend primarily on the financial viability of the commercial projects currently operating and under construction. If the existing technologies are profitable and/or the investment community senses the success can be replicated and enhanced with future advancements, our state has vast resources and attributes for a role in this industry. Specific grants managed by the Division of Biofuels include the following.



Murray State University and EEC leadership help commission Bio-Energy Demonstration Center

West Kentucky Bio-Energy Demonstration Center at Murray State University

Murray State University (MSU) completed the West Kentucky Bio-Energy Demonstration Center at the MSU Equine Farm to explore biomass options to produce clean energy. The Center installed a BB500 stationary and a BB300 mobile Bio Burner unit manufactured in Kentucky, a screening system to remove excess hay, and a building enclosure for both units. One of the two units at the equine center will be used for off-site demonstration purposes. The units were commissioned

Division of Biofuels - Continued

and featured during Kentucky's celebration of National Bioenergy Day in October. Over 150 attendees participated in the event and the venue served as the inaugural meeting for KY's SWET.

This project will demonstrate how cost-effective bioenergy applications can supplant traditional heating systems. MSU will also conduct emission testing of the bioenergy units for air quality compliance. The units will provide radiant heat to the equine center and will offset fossil fuel energy with renewable energy at a rate of 40,000 kWh to 50,000 kWh per year. The primary biomass for the units will consist of muck or bedding material from horse stalls. Each unit will have the capacity of producing 500,000 btu per hour of renewable energy. Total project costs were more than \$618,000 with the \$309,000 match from EEC. MSU was also able to leverage EEC's support to secure an USDA National Institute of Food and Agriculture grant to further the efforts of the West Kentucky AgBioworks initiative.

Energy from Hatchery Waste at Perdue Farms, Inc.

Perdue Farms, Inc., developed an integrated waste recovery process at their poultry facility in Cromwell that utilizes discarded materials from their hatchery. Newly installed equipment will recover the organic waste from spent eggs that did not hatch, eggs that could not be used, and other high organic wastes. The protein and water mixture is being delivered to an an-

aerobic pond that has been producing biogas for conversion to electricity and heat at their processing facility. Cleaned and finely ground egg shells are being stockpiled and land applied as a soil amendment. The project should generate 620,000 kwh of power and avoid burning 2,506 decatherms of natural gas annually. Additional environmental benefits of the project are resulting in the diversion of an estimated 1,500 tons of organic waste from the Ohio County landfill annually. Total project costs were more than \$290,000 with the EEC committing \$145,000 in matching funds. Perdue is working closely with researchers at the USDA Food Animal Environmental Systems Research Unit in Bowling Green to improve the efficiency of their waste to energy efforts and enhance the deployment of these technologies for other applications.

Biomass Heating Evaluation for Poultry Farms

The University of Kentucky Biosystems and Agricultural Engineering Department will evaluate the economics and operational aspects of bioenergy heating systems for poultry operations in the state. Information from this project and oversight shall be shared with this office, and various outlets to help poultry and other livestock farms evaluate the performance and economics of biomass heating systems. DEDI is providing up to \$20,000 in funding from the SWET award to help cover the costs of this project.

Division of Fossil Energy Development



The division's mission is to provide leadership to maximize the benefits of Kentucky's energy resources in a clean and sustainable manner while creating a base for strong economic growth and fostering national energy independence and security. The division has oversight to implement fossil energy initiatives in Kentucky that includes, but is not limited to, coal-to-gas, coal-to-liquids, compressed natural gas and liquefied natural gas. Additionally, division staff helped to educate Kentucky stakeholders about developing natural gas as a transportation fuel. Division staff played an important role in the Cabinet's efforts to understand and comment on EPA's proposed Clean Power Plan, which proposes to regulate carbon dioxide emissions from existing power plants.

Fossil energy research and public education on coal initiatives managed by the department are highlighted in the following pages.

Energy Research Projects

University of Kentucky Carbon Management Research Group (CMRG)

CMRG is a consortium of government, private, and university partners dedicated to developing an amine-based post combustion CO₂ capture process. The annual budget authorized \$1 million per year of state Energy Research Program funds to be matched by private utility investment. The \$2 million per year is granted to the University of Kentucky Center for Applied Energy Research (CAER) for the process research and development effort. Researchers at CAER took a comprehensive approach to developing an amine-based process along with understanding process dynamics and characterization to enable scale-up to a utility-size system.

Division of Fossil Energy Development - Continued

As a result of the researchers' efforts, CAER received a \$16 million grant from the Department of Energy in 2013 to build and operate a demonstration unit to be installed in an operating utility plant. The project involves the design, fabrication, installation, testing, and analysis of a slipstream facility located at LG&E-KU's E.W. Brown Generating Station to demonstrate an innovative carbon capture system that utilizes heat integration with the main power plant. Construction at Brown Generating Station is underway and startup is expected in 2015. Success of this project will advance the commercialization and economy of CO₂ capture as a means for reducing greenhouse gas emissions from coal-burning power plants. This project will help make existing coal-burning plants viable and new ones feasible in the future.

Western Kentucky University Heat & Air Pollutant Recovery Project

Western Kentucky University WKU was awarded \$142,900 for the research and development of a coal utilization process, integrating optimization of thermal efficiencies and air pollutant recovery over existing coal-fired utilities' processes. This process captures wasted latent heat, plus some of the exhaust's sensible heat, in a way that allows it to be sent back to the boiler, thus dramatically reducing the fuel-based operating cost and environmental impact of the power plant. This research combines efforts to utilize coal in a more environmentally conscious manner and to more efficiently use Kentucky's natural resources. Both are essential for coal resources to remain competitive in power generation under increasingly stringent environmental regulations.

University of Kentucky Thermogalvanic Cells

In response to an EEC grant solicitation, UK CAER proposed to focus on a system for capturing waste heat in coal fired power plants, converting that heat into electricity and re-injecting the electricity into the system as supplemental power. The project cost is \$116,695, of which \$94,000 is provided by DEDI and the research project will conclude by mid-2015.

University of Kentucky Chemical Looping

Limits or controls on CO₂ emissions, such as those proposed in the EPA's Clean Power Plan are putting coal at a disadvantage in a carbon-constrained world because coal is the most carbon-intensive fuel for power generation. Unfortunately, most of the current technologies for carbon reduction from coal-fueled power generation have extensive energy penalties. The goal of this project is to develop a new coal combustion with low energy-penalty CO₂ capture technology as a next generation technology for large scale coal-based power generation. It will be based on the chemical-looping combustion concept and provides a pathway to maintain and strengthen coal's competitive advantage for Kentucky's energy sector and coal industry.



Chemical-looping combustion (CLC) technology is regarded as an advanced generation technology of CO₂ capture from fossil fuel power plants and it has been well demonstrated for gaseous fuel. Different from traditional fuel combustion, CLC is accomplished with a two-step reaction in two inter-connected reactors; oxygen carrier (OC) reduction by fuels in the fuel reactor (FR) and regeneration by air in the air reactor (AR). In this process, solid metal oxide materials are circulated between the two reactors to transport oxygen from air to the fuel, thus providing a high concentration CO₂ flue gas from the FR that can be easily sequestered underground. The energy penalty is extremely low due to in-situ CO₂ capture and it represents a potential breakthrough in CO₂ capture cost.

The project cost for this phase is \$198,278, of which DEDI provided \$177,000.

University of Kentucky Algae Project

UK CAER was awarded \$253,000 to continue a current project designed to demonstrate an Algae-Based System for CO₂ Mitigation from Coal-Fired Power Plants. The project is focused on the design, construction, and demonstration of an algae-based CO₂ mitigation process suitable for use at Kentucky power plants. The overall

Division of Fossil Energy Development - Continued



goal of this project is to design a process capable of utilizing the flue gas through operation of a continuous microalgae culture, harvesting a sustainable quantity of the algae, and converting harvested algae into a value-added product (e.g., fuel for co-firing, bio-oil for conversion to biodiesel, bio-gas, or a nutritional additive for animal feed). Efforts to date have resulted in the development of a low-cost, closed-loop photo-bioreactor. The system was scaled-up to slip-stream size and installed at the Duke Energy East Bend station for actual field testing. The CAER-developed algae photobioreactor is a unique technology for capturing CO₂ from coal-burning utility flue gas and harvesting a useful bio-fuel from the algae. Successful commercialization of the process could be very beneficial to existing and potential new coal-burning power plants.

Eastern Kentucky University Low-cost Biomass to Biofuels

In 2014 Eastern Kentucky University completed a \$123,662 research project sponsored by DEDI on a novel approach to acquire sugars from biomass in order to provide a feedstock for biofuels that rely on microbial fermentation such as ethanol and algae. Biomass feedstocks evaluated under the initiative included switchgrass and post-harvest wood residue which were both sourced locally. Personnel from the University of Kentucky cooperated on the engineering and techno-economic analysis phases of the project. Observations indicate that the sugar yields were higher from the switchgrass than the woody biomass. Commercial projects utilizing similar enzymes for the conversion of cellulose to ethanol from biomass sources such as crop residue began operations in Iowa in 2014.

Western Kentucky University: Optimization of Conversion Kinetics of Kentucky Coals in an Integrated Process for Flexible Syngas Production

Western Kentucky University (WKU) was awarded \$200,000 for a DEDI sponsored project that ended in mid-2014. This funding was for the research and development of a novel coal utilization process, integrating the partial gasification of coal in the chemical looping and combustion of the rest char residue (in brief as PGCLC). This process adapts widely to different following-up coal processes, such as coal-to-liquid (CTL) and coal-to-gas (CTG) and retrofitting for the current aged coal combustion utilities. This new process could be an initial step of CTL and CTG for syngas supply, and also an initial step of the aged coal-power utilities for their capacity retrofitting and efficiency improvement of power generation.

Advanced Particle Separation Technology, LLC: Advanced Development and Assessment of Innovative HM Cyclone Separation Technology for High Efficiency Coal Cleaning

Advanced Particle Separation Technology, LLC (APST), was awarded \$254,268 for a project scheduled to end in mid-2014 to research the development and assessment of innovative cyclone separation technology for high efficiency coal cleaning. This project was cancelled in January 2014.

Division of Fossil Energy Development - Continued

University of Kentucky: Remediation of Coal Slurry Impoundment Liquids Using a Multi-Stage Constructed Treatment Wetland System

The University of Kentucky College of Agriculture was awarded \$61,355 for a project that finished mid-2014. This project was to develop a novel and cost effective approach that can be used by the coal industry to reduce the burdens associated with controlling the movement and quality of liquids from surface impoundments and storage ponds, using constructed treatment wetlands. Achievement of this goal would improve the long-term economic and environmental sustainability of coal production in the Commonwealth. A pilot-scale, multi-celled treatment wetland system was constructed at the University Research farm. Liquid obtained from a working slurry pond was circulated in the constructed wetland system to determine parameters for design and operation of a full-scale system.

University of Kentucky: Modern Rock Dust

The University of Kentucky Department for Mining Engineering (UK DME) was awarded \$364,011 for a DEDI sponsored project concluding in mid-2014 to evaluate current technology for rock dust dispersion in underground coal mines. Several new technologies are emerging onto the market and need to be evaluated for inerting performance in coal dust applications. Project objectives include evaluating the flame-front extinguishing performance of the new technologies developed by the project team and independent companies against typical dry-dust and wet-dust applications, and comparing cost of each newer rock dusting process with typical dry or wet dust applications.

University of Kentucky: Anode Coke from Coal

The University of Kentucky Center for Applied Energy Research (CAER) was awarded \$163,565 for a proof of concept study to examine the feasibility of producing anode grade coke by the solvent extraction of coal, but without a costly solids separation step. This project, ending in mid-2014, was for researchers to select suitable high volatile A coals from the east Kentucky coalfield (e.g. Knox and Whitley counties) and determine whether the process could be adapted to provide an economically viable alternative for producing anode-grade coke. Western Kentucky primary aluminum producers located in

Henderson and Hancock counties had expressed interest in the project and offered their backing.

University of Kentucky: Underground Coal Laboratory

UK DME was awarded \$350,000 in 2012 to study the feasibility of and initiate a preliminary design for an underground coal laboratory. The project ended in 2014 with the final report identifying facility design, and potential site selection.

University of Kentucky CO₂ Capture Regeneration

UK CAER was awarded \$203,344 for research on efficiency improvement in CO₂ capture solvent regeneration using a load leveling electricity to thermal energy absorption strategy. The project provided an energy absorption and release technology that can be directly applied to coal, post-combustion CO₂ capture at power plants. The proposed technology improves power plant efficiency by load leveling, reducing cost and energy demand for the CO₂ capture process. The project concluded in 2014 and its results will be used to help reduce the cost and maintain the delivery of electricity in the Commonwealth.

Public Education on Coal Related Issues (KRS 132.020(5))

University Energy Clubs

UK CAER was awarded \$30,000 to continue the sponsorship of the University Energy Clubs. CAER will continue the existing Energy Club programs in addition to incorporating workforce development initiatives and inter-club project(s) involving all of the existing and future Energy Clubs. The club structure encourages membership within all major areas of study, resulting in the education of students pursuing a wide variety of career paths. In a collaborative effort between the CAER facilitator and the club members and advisors, energy-related opportunities will be organized and in some cases hosted by clubs. Such activities will include lectures, site tours, round table events, and attendance at energy-related conferences. Energy Clubs are a strong extracurricular activity that inform future decision-makers about the issues and opportunities of Kentucky's energy resources and applications. They encourage and stimulate interest in Kentucky energy careers.

Division of Fossil Energy Development - Continued

Kentucky Coal Museum and Portal 31

In 2014 EEC awarded \$60,000 to the Southeast Kentucky Community and Technical College (SKCTC) for management of the museum's and portal's activities. The Kentucky Coal Museum and Portal 31 provide education on coal and coal mining activities to the public by allowing access to one of the most comprehensive collections of mining information and memorabilia in the nation, including touring an underground mine.

SKCTC uses story boarding and interpretive signage to enhance the educational experience for visitors of the [Kentucky Coal Museum and Portal 31 Exhibition Mine](#). The grant also funds a percentage of salaries and benefits



for the museum curator and assistant curator. The goal of the project is to improve the visitor experience by enriching discussion, broadening understanding, clarifying perceptions and sharpening observation of details. With

a focus on coal mining and the community culture of coal mining families, this project significantly increases the museum and portal's ability to educate visitors about this important energy resource, its history, industry and people, in Kentucky and the nation. SKCTC is currently improving the museum experience by developing scripts for the exhibit areas which can be used to provide audio tours both at the museum and online.

Bluegrass Greensource Coal Education

Bluegrass Greensource was awarded \$40,000 to continue coal education initiatives throughout central Kentucky. Bluegrass Greensource (formerly Bluegrass PRIDE) is an environmental nonprofit that provides resources and education to empower residents of its service area (Anderson, Bourbon, Boyle, Clark, Estill, Fayette, Franklin, Garrard, Harrison, Jessamine, Lincoln, Madison, Mercer, Montgomery, Nicholas, Powell, Scott and Woodford Counties) to foster positive environmental change in their communities. Activities include an energy tour for teachers, experiential education in classrooms, energy tours for K-12 students, and energy-



In October, Bluegrass Greensource held three regional Green Career Fairs in central Kentucky. These events connected students with the basic green jobs information with businesses and colleges that offer green career opportunities, education, and/or training. The career fairs also featured interactive activities for students to engage with business and college volunteers.

The three Green Career Fairs were held at Danville High School, Locust Trace Agriscience Farm, and Kentucky State University. The Locust Trace Green Career Fair featured student tours of the net-zero energy and waste facilities. KSU Green Career Fair featured break-out sessions on developing small businesses, green consulting, and a student-led session on caring for the environment. Over 1,200 students from 17 schools across central Kentucky attended these Green Career Fairs.

related careers tour for postsecondary students. Providing deeper and broader education about all aspects of energy in Kentucky prepares students for positive energy engagement in the future. Students visited the UK Center for Applied Energy Research to learn about coal research and development in Kentucky, as well as toured coal power plants to understand how coal is used in the Commonwealth.

Coal Education Development and Resources (CEDAR, Inc.) East Kentucky Coal Education Project

[CEDAR, Inc.](#) was awarded \$65,000 by EEC to continue its coal education programs for K-12 school children in 15 east Kentucky coal counties. Among several program initiatives of CEDAR, Inc., three illustrate the scope of

Division of Fossil Energy Development - Continued

the organization's activities. Through the CEDAR Coal Study Unit (CSU) Program, teachers have the opportunity to use their skills in creating, developing, and implementing a Study Unit (lesson plan) on an array of topics involving coal. The CEDAR Coal Fair Program provides students the opportunity to investigate certain aspects of coal and apply their findings to showcase their talent and knowledge by creating a coal project and entering it in one of seven subject categories. Through a partnership with the [Challenger Learning Center](#) (CLC) in Hazard, CEDAR offers a fourth grade program known as Mars Invasion 2030 – From Coal Camp to Space Camp. This program provides students the opportunity to discover the similarities between space science and coal mining, as well as those of the job skills required to be either an astronaut or coal miner.

National Energy Education Development Project (NEED) Energy Tours & Curriculum Project

[NEED Project](#) was awarded \$70,000 to develop a coal curriculum, provide energy education workshops and an energy tour. The coal curriculum was developed this summer and presented to educators during the fall energy workshops. The energy education workshops focus on class room projects to make learning about energy easy and fun. Educators are provided with energy education packets. The energy tour rotates around the state each year. The tour for spring of 2015 will be in Eastern Kentucky. The tour will provide educators with an opportunity to see energy operations first hand and speak to energy professionals.

CEDAR West, Inc.: West Kentucky Coal Education Programs

EEC awarded [CEDAR West, Inc.](#) \$50,000 to offer coal education programs in six west Kentucky coal counties. CEDAR West, Inc. is in its 19th year of implementing coal education programs that stress the importance of coal to the citizens of Kentucky. The program provides an avenue of learning about the history of coal, the economic contributions that coal provides in meeting Kentucky's energy demands, and the energy demands of our nation. CEDAR West provides teachers in the region a "Coal Education Packet" containing sample coal education materials. From this packet they develop an idea for a coal study unit to be implemented in the classroom. CEDAR West also conducts the annual public coal fair.

The coal fair involves the judging of K-12 student entries in the following academic categories: science, math, language arts, music, art, and technology.

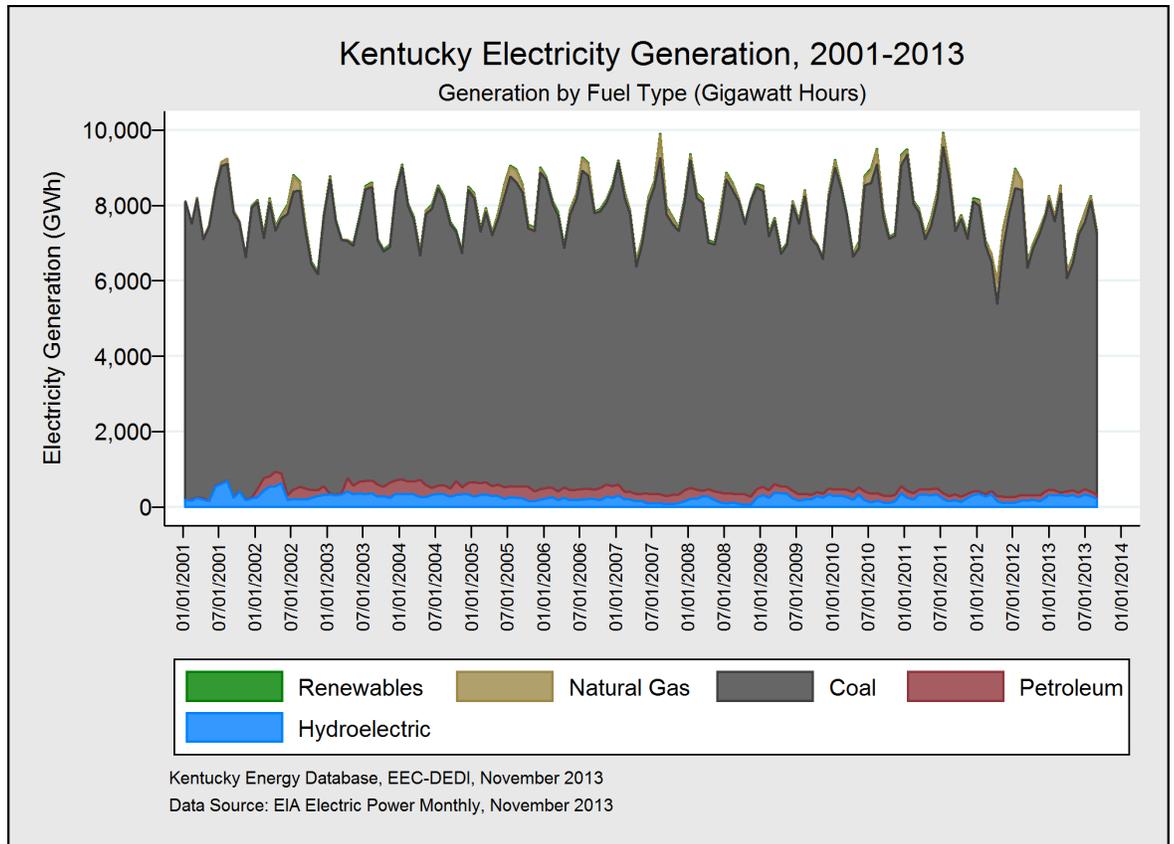
University of Kentucky Energy Video

The University of Kentucky Center for Visualization & Virtual Environments was awarded \$152,717 to create two professional videos. The first was released in mid-November "[Shifting Lines](#)" focuses on Kentucky's manufacturing economy and the importance of electricity. The second video will be a more in-depth look at the subject and will be released in early 2015.

The documentary looks at how national market and regulatory forces are dramatically shifting Kentucky's energy landscape—and more importantly, how we in Kentucky can navigate these changes to remain economically competitive and protect our environment.



Division of Carbon Management & Data Analysis



The Division of Carbon Management and Data Analysis evaluates technical solutions for carbon dioxide mitigation, including modeling future carbon dioxide emissions and reduction strategies such as utilization of coal-based carbon capture and storage. In addition, division staff are responsible for storing, analyzing, and publishing data on Kentucky energy production and consumption to promote efficient energy markets, sound policymaking, and better public understanding of energy and its interaction with the environment and economy in the Commonwealth. Databases and data-related publications also support the Commonwealth Energy Assurance Plan that identifies potential threats to the energy security of the Commonwealth, and facilitates the restoration of energy supplies in the event of an emergency. The division's comprehensive databases are made possible through partnerships with the Kentucky Department of Natural Resources, Kentucky Department for Environmental Protection, Kentucky Geologic Survey, Kentucky Coal Association, United States Department of Energy, United States Department of Commerce, and Mine Safety Health Administration.

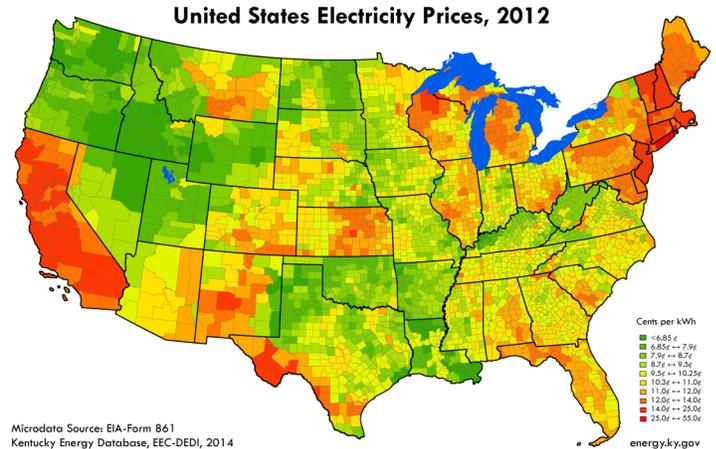
In 2014, division staff graphically summarized data on energy production and consumption in four data publications that are intended to serve as an impartial point of reference for the general public, researchers, and policy makers.

Division of Carbon Management & Data Analysis - Continued

The [Kentucky Energy Profile](#), includes hundreds of charts and maps describing where Kentucky's energy comes from and how it is used. Additions to this year's profile include summaries for each of Kentucky's individual electric utilities and all of Kentucky's power plants offering the internal dynamics of each including changes to electricity prices and pollutant emissions by utility. Power plant profiles illustrate the pollutant emissions of each plant, the capacity factor—or utilization—of the plant, and where each plant purchases coal.

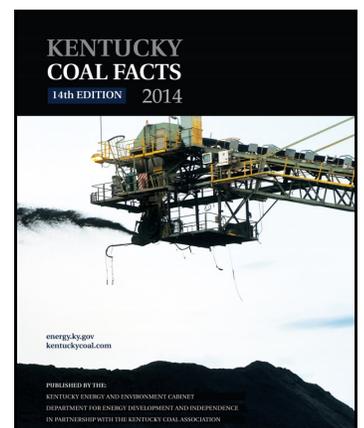
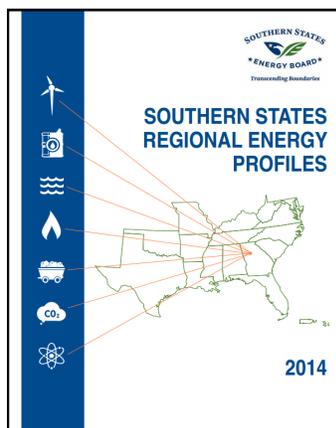
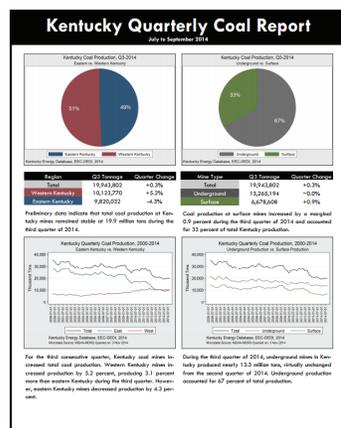
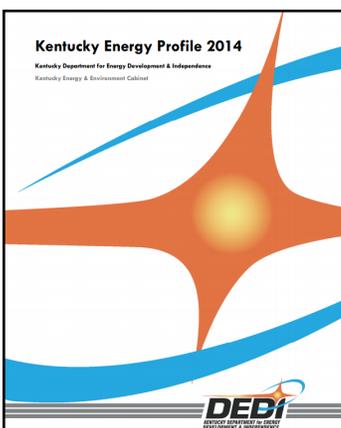
Through contracts with the Southern States Energy Board (SSEB) and the National Association for State Energy Officials (NASEO) over the past three years, DEDI has also provided customized energy data publications for 20 other state governments. In the [Southern States Energy Profiles](#), staff highlighted the importance of energy to the region, which encompasses 16 states and two territories, and presented otherwise unavailable statistics of energy to those states. The publication includes data regarding electricity consumption by fuel type and sector, production by fuel type, and the electricity prices in each state.

Because Kentucky is both a leading producer and consumer of coal, much of DEDI's data analytics are largely focused on coal. DEDI tracks coal production, employment, prices, chemical composition, as well as all shipments of coal to and from Kentucky. These metrics are also presented at the county level to assist local communities in understanding the impact of coal on their residents.



Microdata Source: EIA-Form 861
Kentucky Energy Database, EEC-DEDI, 2014

These data on Kentucky coal are summarized in the annual publication of the [Kentucky Coal Facts](#). However, in light of the rapid changes underway in Kentucky coal markets in 2014, DEDI began publishing the [Kentucky Quarterly Coal Report](#) to provide leadership and the general public with current coal production and employment statistics.



Division of Generation, Transmission & Distribution



The primary responsibilities of the division are to analyze and develop policies that will facilitate the generation, transmission, and distribution of secure, adequate, affordable, and clean energy within the Commonwealth. Division staff also work to understand the economic tradeoffs for baseload electricity generation alternatives and to identify policies that will ensure adequate transmission and distribution of energy resources. Staff work closely with the Public Service Commission (PSC) to clearly understand implications of PSC actions on the energy strategy initiatives of DEDI. Additionally, staff have the responsibility for initiating research and promoting discussion on all generating technologies and energy strategies.

Staff continue to monitor changes in environmental regulations affecting the mining and transportation of coal, natural gas, and other petroleum liquids as well as electricity production and overall energy prices. Pending changes will continue to have significant impacts on how energy is produced and priced in Kentucky. Equally important will be the effects of environmental regulations on Kentucky's energy intensive industrial base and overall economy. Of particular concern is the U.S. EPA Proposed Rule regulating CO₂ and other greenhouse gas emissions from new and existing fossil fueled electric power plants. These regulations and the speed with which they are implemented may have profound effects upon Kentucky's economy. Division staff continue to use recently enhanced electricity price forecasting software developed by DEDI to evaluate the potential changes in electricity prices and the long term effects of those price changes for Kentucky.

Division staff represented the Governor's office on the Eastern Interconnection States Planning Council (EISPC). The EISPC is a collaboration between state utility commissions and governors' offices of the states east of the Rocky Mountains, organized to direct the analysis of electricity system plans for the Eastern Electricity Interconnection. The result of this collaboration will be the identification of additional interstate transmission corridors. In addition to the transmission planning taken on by EISPC, there are also many studies and whitepapers being produced by the group which can inform states such as Kentucky when addressing change, whether market or rulemaking driven.

Division of Generation, Transmission & Distribution - Continued

Grants managed by division staff include Carbon Management Research Group, Thermogalvanic Cells for Improved Efficiency in Power Plants and Coal Fueled Pressurized Chemical Looping. These projects are explained in more detail under Energy Research Grants on pages 21 and 22.

Kentucky-Argonne Battery Manufacturing Research and Development Center

In 2014, a contract was awarded to TRK, Inc. for continuing support and advancement of the [Kentucky Argonne Battery Manufacturing Research and Development Center](#) (Center). TRK was tasked to advance a plan to support the Center and develop industry and government partnerships. The Center is a multi-institutional, interdisciplinary, non-profit collaboration established to support the development of advanced battery manufacturing technologies of the next decade and beyond. The Center's mission is to provide a full-service research and development capability for industry, universities and government to enable competitive domestic manufacturing for advanced batteries. Current partnerships include University of Kentucky, University of Louisville and U.S. DOE Argonne National Laboratory.

Governor's Conference on Energy & Environment 2014

Kentucky Energy and Environment Cabinet Secretary Len Peters presented Energy Leadership Awards to Harry Carver and the Department for Local Government (DLG) and to John Boyd and the Energy Services Coalition (ESC) during the 38th Governor's Conference on Energy and the Environment. The awards recognized leaders from public and private sectors who have made outstanding contributions in Kentucky's energy field by promoting and utilizing energy efficiency and alternative energy resources as a way to achieve sustainability goals. DLG, under the Office of the Governor, provides financial help in the form of grant and loan assistance and is a pathway for local officials to exchange information in matters relating to local governments. ESC is a nonprofit network of energy experts that promotes energy savings performance contracting as a mechanism to achieve environmental and economic benefits. John Boyd, co-chair of the Kentucky ESC chapter, has a long history serving as an advocate for the industry.



Pictured left to right: John Davies, Deputy Commissioner, Department for Energy Development and Independence, Energy Leadership Award Recipient Harry Carver, Department for Local Government, and Energy and Environment Cabinet Secretary Len Peters.



Pictured left to right: John Davies, Deputy Commissioner, Department for Energy Development and Independence, Energy Leadership Award Recipient John Boyd, Energy Services Coalition, and Energy and Environment Cabinet Secretary Len Peters

Appendix A

Summary of Grant Awards

Grant Award	Recipient	Start	End	Grant Award 2	Matching Amount	Total Project	Page
Ag-Bioworks Bioenergy Demonstration Center	Murray State University	4/15/2013	12/31/2015	\$ 309,000.00	\$ 309,000.00	\$ 618,000.00	19
Anode Coke from Coal	University of Kentucky	5/1/2013	6/30/2014	\$ 163,565.00	\$ 22,148.00	\$ 185,713.00	24
Biogas to Fuel Renewable Energy from Hatchery Waste	Perdue, Inc.	4/15/2013	12/31/2015	\$ 145,000.00	\$ 145,000.00	\$ 290,000.00	20
Biomass Heating Evaluation	University of Kentucky	12/1/2014	6/30/2016	\$ 20,000.00		\$ 20,000.00	20
Bowling Green Solar Project	Bowling Green Public School	4/1/2013	12/31/2015	\$ 33,721.00	\$ 33,721.00	\$ 67,442.00	15
Carbon Management Research Group	University of Kentucky	7/1/2014	6/30/2013	\$ 3,298,780.00	\$ 200,058.00	\$ 4,650,000.00	21
Chemical Looping	University of Kentucky	7/1/2013	6/30/2014	\$ 178,832.00	\$ -	\$ 178,832.00	22
CO ₂ Capture Regeneration	University of Kentucky	5/1/2013	6/30/2014	\$ 203,344.00	\$ 33,416.00	\$ 236,760.00	24
Coal Ed Programs	Bluegrass Green-source	7/1/2014	6/30/2015	\$ 40,000.00	\$ 20,583.00	\$ 60,583.00	25
Coal Ed Programs	CEDAR, Inc.	7/1/2014	6/30/2015	\$ 50,000.00	\$ 30,100.00	\$ 80,100.00	26
Coal Ed Programs	CEDAR West	8/1/2014	6/30/2015	\$ 50,000.00	\$ 30,100.00	\$ 80,100.00	26
Coal Museum & Portal 31	Southeast Ky. Community & Technical College	7/1/2014	6/30/2015	\$ 60,000.00	\$ 206,922.00	\$ 266,922.00	25
Coal Slurry Remediation	University of Kentucky	5/1/2013	6/30/2014	\$ 61,355.00	\$ 34,158.00	\$ 95,513.00	24
Combined Heat & Power	University of Louisville	4/14/2014	1/31/2016	\$ 85,000.00	\$ 8,896.00	\$ 93,896.00	10
Commercial Office Assessment	University of Kentucky	7/1/2014	6/30/2015	\$ 24,500.00	\$ 2,344.00	\$ 26,844.00	9
Conversion Kinetics Syngas Production	Western Kentucky University	7/1/2013	6/30/2014	\$ 200,000.00	\$ -	\$ 200,000.00	23
Cooperative Extension Energy Associate	University of Kentucky	7/1/2014	6/30/2015	\$ 100,000.00	\$ -	\$ 100,000.00	10
Cyclone Coal Cleaning	APST, LLC	3/15/2013	6/30/2014	\$ 254,268.00	\$ 284,163.00	\$ 538,431.00	23
Energy Efficiency & Conservation for Local Governments	Kentucky Department for Local Government	4/1/2013	12/31/2015	\$ 1,203,279.00	\$ 224,269.00	\$ 1,427,548.00	8
Energy Efficiency Awareness and Action Program	University of Kentucky	7/1/2104	6/30/2015	\$ 17,500.00	\$ 3,505.00	\$ 21,005.00	9

Appendix A

Summary of Grant Awards - Continued

Grant Award	Recipient	Start	End	Grant Award 2	Matching Amount	Total Project	Page
Energy Efficiency Modular Buildings	Southern Tier	5/1/2013	6/30/2016	\$ 504,000.00	\$ 524,000.00	\$ 1,028,000.00	7
Energy Managers	Kentucky School Boards Association	7/1/2013	6/30/2014	\$ 50,000.00	\$ -	\$ 50,000.00	4
Energy Tours & Curriculum	NEED	7/1/2014	6/30/2015	\$ 70,000.00	\$ 626,670.00	\$ 696,670.00	26
Energy Video	University of Kentucky	7/1/2014	6/30/2015	\$ 152,717.00		\$ 152,717.00	26
Green Bank -- Revolving Loan Fund - ARRA	Kentucky Finance and Administration Cabinet		On going	\$ 14,000,000.00		\$ 14,000,000.00	7
Heat & Air Pollutant Recovery	Western Kentucky University	8/1/2014	6/30/2015	\$ 143,000.00	\$ 58,125.00	\$ 201,125.00	22
High Performance Schools Workshop	Kentucky National Energy Education Development Project (NEED)	7/1/2014	6/30/2015	\$ 38,000.00		\$ 38,000.00	4
HowSmartKY - On-bill Financing – Energy Efficiency Retrofit	Mountain Association for Community Economic Development (MACED)	4/22/2013	12/31/2015	\$ 300,000.00	\$ 320,000.00	\$ 620,000.00	6
Industrial Combined Heat & Power	Foundation for Kentucky Industry	9/1/2014	9/30/2015	\$ 25,860.00	\$ 5,172.00	\$ 31,032.00	10
Integrated Live Energy Management	Fayette County Public Schools	4/8/2013	12/31/2015	\$ 335,000.00	\$ 601,497.00	\$ 936,497.00	4
Kentucky Home Performance with Energy Star	Kentucky Housing Corporation	4/15/2013	12/31/2015	\$ 3,000,000.00	\$ 7,085,000.00	\$ 10,085,000.00	5
Kentucky Home Performance with Energy Star	Kentucky Housing Corporation			\$ 500,000.00		\$ 500,000.00	5
KY Argonne Research Center	TRK	7/1/2014	6/30/2015	\$ 77,000.00		\$ 77,000.00	30
Local Government – Revolving Loan Fund-ARRA	Kentucky Department for Local Government	1/1/2013		\$ 760,000.00		\$ 760,000.00	8

Appendix A

Summary of Grant Awards - Continued

Grant Award	Recipient	Start	End	Grant Award 2	Matching Amount	Total Project	Page
Local Government Energy Retrofit Program	Kentucky Department for Local Government	1/1/2013	9/30/2015	\$ 607,700.00		\$ 607,700.00	8
Low-cost biomass to biofuels	Eastern Kentucky University	3/18/2013	6/30/2014	\$ 123,662.00	\$ 40,515.00	\$ 164,177.00	23
Mechanical Systems Upgrades	LORD Co.	4/15/2013	12/31/2015	\$ 504,000.00	\$ 504,900.00	\$ 1,008,900.00	7
Modern Rock Dust	University of Kentucky	5/1/2013	6/30/2014	\$ 364,011.00		\$ 479,011.00	24
On-farm Energy Efficiency & Production	Governor's Office of Ag Policy	3/15/2013	12/31/2015	\$ 750,000.00	\$ 750,000.00	\$ 1,500,000.00	6
Outdoor Lighting Energy Efficiency Project	Hickman-Fulton RECC	4/15/2013	12/31/2015	\$ 316,000.00	\$ 335,892.00	\$ 651,892.00	12
Photobioreactor Microalgae System	University of Kentucky	8/1/2014	6/30/2015	\$ 253,000.00	\$ 59,710.00	\$ 312,710.00	22
Pressurized Chemical Looping Combustion	University of Kentucky	8/1/2014	6/30/2015	\$ 177,000.00	\$ 21,278.00	\$ 198,278.00	22
School Energy Managers Project	Kentucky School Boards Association	4/1/2013	12/31/2015	\$ 700,000.00	\$ 722,259.00	\$ 1,422,259.00	4
Solar PV Project - 5 MW	Pennyrile RECC	5/1/2013	12/31/2015	\$ 3,100,000.00	\$ 1,263,196.00	\$ 4,363,196.00	15
Thermogalvanic Cells	University of Kentucky	8/1/2014	6/30/2014	\$ 94,000.00	\$ 19,695.00	\$ 113,695.00	22
Underground Coal Laboratory	University of Kentucky	7/1/2012	6/30/2014	\$ 350,000.00		\$ 350,000.00	24
University Energy Clubs	University of Kentucky	7/1/2014	6/30/2015	\$ 30,000.00	\$ 5,438.00	\$ 35,438.00	24



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