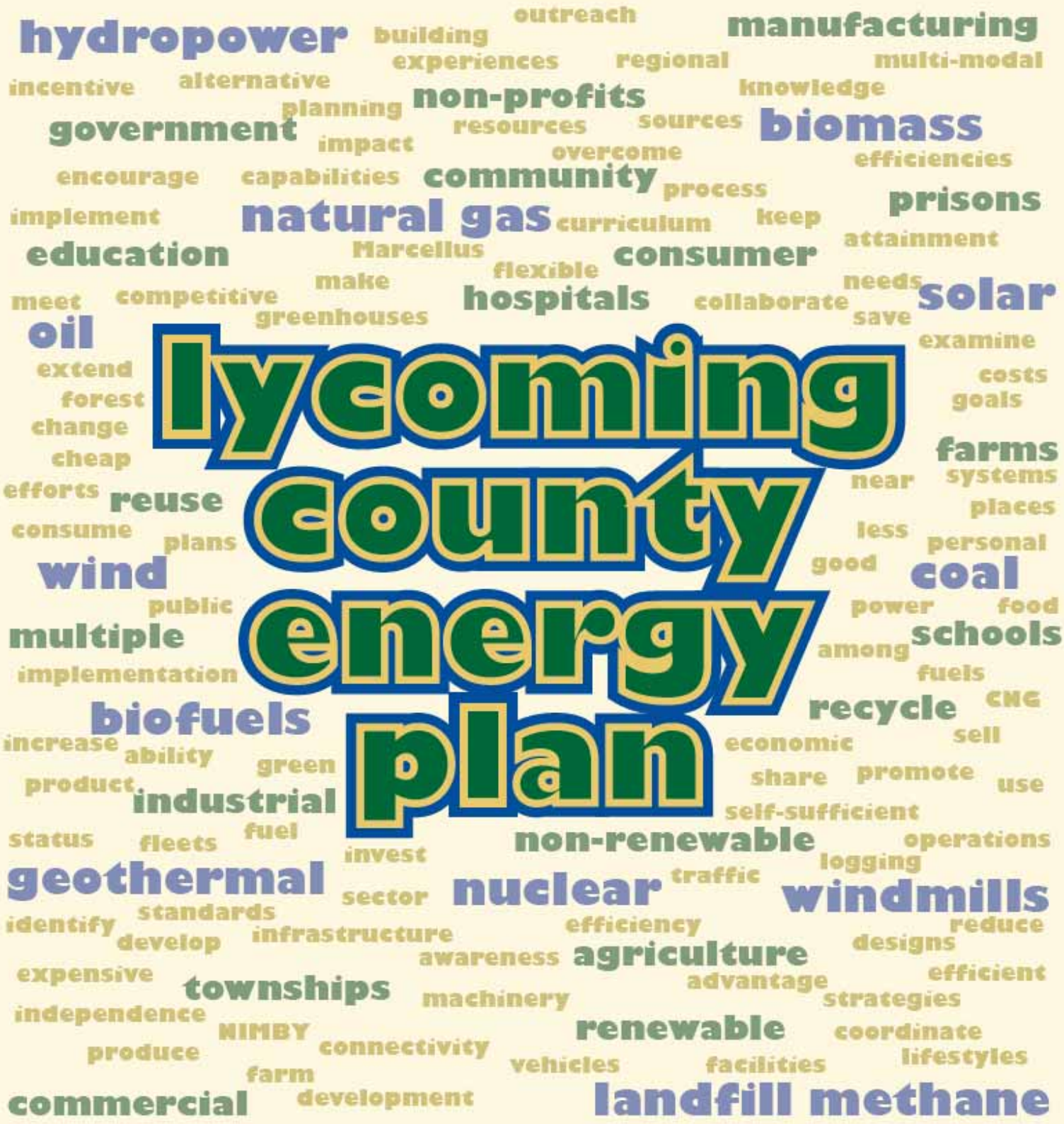

LYCOMING COUNTY ENERGY PLAN

Department of Planning & Community Development
48 West Third Street, Williamsport PA 17701

Adopted by County Resolution 2011-44 on December 22, 2011

LYCOMING COUNTY ENERGY PLAN

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EXECUTIVE SUMMARY

The Energy Plan is a standalone document that serves to weave together existing Comprehensive Plan components and the impact of energy on each, and sets forth new strategic actions to integrate energy into Lycoming County's daily activities. The Energy Plan sets forth targeted, measurable recommendations that will help Lycoming County work with the shale gas industry, but just as important the Energy Plan will help to diversify the County's energy portfolio by seeking ways to utilize renewable energy that uses Lycoming County's existing natural resources effectively, efficiently, and economically. Further, the Energy Plan was conceived and strategies developed to take into consideration diverse energy-related needs of several sectors: residential, commercial, industrial, public/nonprofit, agriculture, and transportation. A summary of the energy strategies and strategic actions to be implemented as part of the Energy Plan are included in Chapter 1 and detailed in Chapter 7.

Many factors prompted Lycoming County to embark upon preparation of an energy plan: renewed national interest in using energy efficiently and reducing energy consumption, rising fuel costs, as well as the authority to prepare an energy plan per Pennsylvania's Municipalities Planning Code (MPC). But perhaps the factor that has most spurred the need to prepare an energy plan is the impact of shale gas development on Lycoming County and the surrounding regions.

When Lycoming County updated and adopted its current Comprehensive Plan in 2006, shale gas development was occurring in other parts of the country but was not heard of in Pennsylvania. Within the five years since the County's Comprehensive Plan was updated, Lycoming County has become northern Pennsylvania's commerce and logistics hub for shale gas development. In addition to being a hub for commerce and logistics, shale gas exploration and production is also occurring in Lycoming County, with the county having the second-highest number of wells drilled between January 2011 and November 2011. Since the County's land use patterns are being significantly altered due to natural resource extraction, the purpose for preparing an energy plan becomes quite clear.

The Energy Plan not only addresses natural gas exploration and production, but it also identifies ways to improve energy efficiency for the County's residents and businesses and reduce energy costs, and sets forth strategies to use other types of renewable energy sources in an effort to make Lycoming County more energy self-sufficient.

Although energy planning is enabled in Pennsylvania as part of a county's comprehensive plan, just a handful of Pennsylvania's 67 counties have completed or are in the process of completing an energy plan. Lycoming County's Energy Plan is consistent with the progressive, forward-thinking planning that has come to exemplify the County.

The Lycoming County Energy Advisory Council will work collaboratively with the Lycoming County Department of Planning and Community Development (PCD) to implement the Energy Plan. Progress toward implementing the Energy Strategies and Strategic Actions will be monitored and reported to the community frequently, with the Energy Plan component updated to be consistent with Lycoming County's Comprehensive Plan.

CHAPTER 1 INTRODUCTION

ENERGY VISION

A vision statement describes an organization's future. It sets forth what is possible, what is the potential, and how circumstances would be different than they are today. The following Energy Plan vision was developed with input from the Energy Plan Advisory Committee assembled for the energy plan and input obtained from a wide representation of public and private stakeholders.

This vision statement is consistent with an Energy Awareness Month Proclamation made by the Lycoming County Commissioners in May 2011. Energy is important to Lycoming County's economic prosperity and its quality of life.

Lycoming County's Energy Vision

Drawing upon competitive economic advantages, regional industrial capabilities, energy efficiencies, and natural resources, Lycoming County's energy vision is to use local energy resources to meet local energy needs, making Lycoming County more energy self-sufficient, while at the same time improving energy efficiency and reducing energy demand.

ENERGY PLAN PURPOSE

The production and consumption of energy impacts everyday activities in Lycoming County. To make certain that energy production and consumption is consistent with existing and future land use patterns, to promote energy conservation and the effective utilization of renewable energy sources, Section 301.1 of Pennsylvania's MPC (Act of 1968, P.L.805) allows comprehensive plans to include an energy conservation plan element. The purpose is "to promote energy conservation and the effective utilization of renewable energy sources." The purpose of the Energy Plan element is to examine the effect of each of the other plan elements on current and future energy use, note the particular actions contained in each plan element related to energy, and recommend other actions to reduce energy consumption and to promote the use of renewable energy sources.[1]

1 Pennsylvania Municipalities Planning Code, Act of 1968, P.L.805, No.247, as reenacted and amended, p. 14.

PROCLAMATION

WHEREAS, reliable, ample and affordable energy is critical to Lycoming County's economic prosperity and high quality of life; and

WHEREAS, the production and consumption of energy affects our everyday activities and natural resources; and

WHEREAS, Lycoming County already has implemented many programs encouraging energy efficiency within our government and among its citizens, businesses, and industries; and

WHEREAS, energy efficiency and renewable energy development can offer employment and economic opportunities while contributing to a sustainable Lycoming County; and

WHEREAS, all citizens of Lycoming County can continue to contribute to the bounty and efficiency of Lycoming County by becoming educated about energy conservation and enhancing energy efficiency efforts in their homes, work and recreation areas;

NOW THEREFORE, The Board of Commissioners of the County of Lycoming, proclaim the Month of May, 2011 as

ENERGY AWARENESS MONTH

in the County of Lycoming and encourage citizens to recognize the advantages of becoming more aware of energy usage.

IN WITNESS WHEREOF, we have set our hand and seal 12th day of May, 2011.

COUNTY OF LYCOMING

Rebecca A. Burke
Rebecca A. Burke, Chairperson

Ernest P. Larson
Ernest P. Larson, Vice Chairman

Jeff C. Wheeland, Secretary

Lycoming County's most recent Comprehensive Plan was adopted on August 10, 2006, and contains four planning elements: Community and Economic Development Plan, Land Use and Resource Management Plan, Transportation Plan, and Community Infrastructure Plan. An Energy Plan element identifies interrelationships between the existing comprehensive plan, County policies, and functional plans to energy, such as the County Water Supply Plan and the County Hazard Mitigation Plan, ensuring consistency with each. The Energy Plan has been adopted as a standalone document and will be referenced in the next Lycoming County Comprehensive Plan update.

Preparing an Energy Plan presents an opportunity for the County to promote energy efficiency, energy demand reduction, renewable energy deployment, and sustainability. Renewable energy is derived from resources that are naturally regenerative or are practically inexhaustible (such as biomass), heat (geothermal, solar), moving water (hydropower), and wind energy. It differs from alternative energy in that alternative energy can either be a renewable or nonrenewable energy source but it is used in a way that differs from traditional energy technology. As an example, shale gas is considered an alternative energy source but not a renewable energy source. Sustainability meets the needs of the present without compromising the needs of future generations by promoting a concept of a triple bottom line – people, planet, and profit.

SCOPE OF WORK

The Energy Plan scope of work was developed with eight main tasks. The results of each task are included throughout this document. Tasks 2 and 3 are summarized in Chapter 2 of the plan. Chapter 3 summarizes Task 4. Chapter 4 summarizes Task 7. Tasks 1, 5, 9, and 10 are summarized in Chapter 5 of the plan. Chapter 6 includes the results from Task 6. Finally, Chapter 7 presents the Energy Strategies and Strategic Actions referenced in Task 8, and Chapter 8 includes a monitoring and evaluation plan also included as part of Task 8.

In developing the scope of work, it was important to consider ways to assist each energy sector (identified for this plan) in Lycoming County. Those energy sectors include Residential, Commercial, Industrial, Public/Non-Profit, Agriculture, and Transportation. Throughout the plan, information pertaining to each sector is discussed.

TASK 1 – ESTABLISH AN ENERGY PLAN ADVISORY COMMITTEE

To make certain that the Energy Plan was not limited by the views and expertise of the Lycoming County PCD and the planning consultants, an Energy Plan Advisory Committee was established. The Energy Plan Advisory Committee was tasked to meet at key milestones in the planning process, to review information gathered and documentation prepared, and provide input on Energy Plan strategies and strategic actions.

TASK 2 – BENCHMARK LYCOMING COUNTY ENERGY-RELATED PLANNING, POLICIES, AND RECENT ACTIVITIES

This task included a review of Lycoming County's Comprehensive Plan and other planning documents to demonstrate how each interrelates with the Energy Plan both currently and in the future. Identifying the links between energy development needs and existing County resources provided the information necessary to benchmark planning, policies, and recent activities.

TASK 3 – REVIEW REGIONAL, STATE, AND NATIONAL ENERGY POLICY, INITIATIVES, AND FUNDING

Existing energy policy, energy initiatives, and energy funding were reviewed to determine how these policies, initiatives, and strategies relate to and can be deployed in Lycoming County. Information was gathered from private, public, and non-profit organizations at the local, regional, state, and federal levels.

TASK 4 – INVENTORY AND ANALYZE LYCOMING COUNTY'S EXISTING ENERGY MARKET

Lycoming County's energy market was inventoried to provide the data required to benchmark Lycoming County's current energy market trends. Combined with the information obtained from reviewing existing plans, policies, and activities, the energy market inventory was used in developing energy plan strategies.

TASK 5 – COMMUNITY OUTREACH

Working with the Energy Plan Advisory Committee, an Energy Plan Workshop was conducted to provide information about existing energy conditions, seek input on developing an energy vision for Lycoming County, and develop input on what actions could be undertaken as part of the energy plan. In addition, several interviews were conducted with key stakeholders after research was conducted as part of Tasks 1 through 4.

TASK 6 – ASSESS ENERGY CONSERVATION AND REDUCTION MEASURES

Based on information gathered in Tasks 2 through 5, energy conservation and reduction measures were identified that could be implemented by both public and private-sector entities in Lycoming County.

TASK 7 – ASSESS FUTURE NONRENEWABLE AND RENEWABLE DEPLOYMENT

Information gathered in Tasks 2 through 6 provided information required to make an assessment of how Lycoming County should approach nonrenewable and renewable energy source deployment in the future. Using a strategy focused on diversifying resources that have the potential to be deployed in Lycoming County will help position the County for energy needs in the future.

TASK 8 – DEVELOP ENERGY PLAN STRATEGIES AND STRATEGIC ACTIONS

Energy strategies and corresponding strategic actions were developed to implement the energy plan. Each strategy included the identification of partners, funding sources, and methods/tools/references.

TASK 9 –PUBLIC MEETING

The Lycoming County PCD and the Energy Plan Advisory Committee convened a public meeting to present and review the draft energy plan to obtain the public's comments and suggestions.

TASK 10 – DELIVER FINAL ENERGY PLAN

Based on comments from the public meeting, the energy plan was finalized and presented to the Lycoming County Commissioners for their review and approval.

SUMMARY OF KEY FINDING

Completing the Scope of Work outlined above yielded a significant amount of data and observations. To summarize the data and observations, Key Findings were developed and are listed below. The Key Findings led to the development of the Energy Strategies and Strategic Actions summarized at the end of this chapter and detailed in Chapter 7.

LYCOMING COUNTY'S COMPREHENSIVE PLAN AND ORDINANCES ARE INTERRELATED TO THE ENERGY PLAN.

- Lycoming County's Comprehensive Plan elements are interrelated to the Energy Plan in many areas.
  - The concept of a virtual Internet Community Resource Center as identified in the Comprehensive Plan is similar to the Energy Portal identified as an Energy Plan Strategy.
  - The Comprehensive Plan recommended the review and update of ordinances at the county and local government levels to make certain the documents meet the Comprehensive Plan's goals and objectives. This recommendation should be expanded through the Energy Plan to facilitate the development of renewable energy projects such as geothermal and wind and energy efficiency actions such as incorporating LEED building standards.
  - Promoting opportunities for sustainable agriculture and sustainable forestry was identified in the Comprehensive Plan. There are potential opportunities to benefit Lycoming County's Agriculture industry through the energy plan such as encouraging the growth of crops for use as biomass feedstock.
  - Supporting the presence of Agriculture was identified in the Comprehensive Plan. Lycoming County's agriculture community should be supported through the Energy Plan by encouraging energy efficiency, deploying renewable energy strategies, and identifying potential funding sources to offset energy-related project costs.
  - The Comprehensive Plan recommended coordinating economic development, transportation, and infrastructure planning with land use planning. This recommendation is particularly applicable to the Energy Plan as extraction of natural gas resources is impacting and will continue to impact economic development, transportation, and infrastructure throughout Lycoming County.
  - Encouraging innovative employment and alternative energy production was identified as a recommendation. This recommendation is relevant to the Energy Plan as new employment and energy production opportunities are available through the shale gas industry.
- Lycoming County has been attentive to ensure that energy-related land use issues are addressed through the County zoning ordinance.
  - Both wind energy and natural gas and oil and extraction have recently been addressed through the County zoning ordinance.
  - Lycoming County may want to incorporated provisions for solar and geothermal energy in the County zoning ordinance.
  - A few Pennsylvania municipalities have adopted comprehensive Alternative Energy Ordinances to address an increasing number of energy projects.

SHALE GAS EXPLORATION AND PRODUCTION HAS AND WILL CONTINUE TO IMPACT LYCOMING COUNTY.

- Shale gas exploration and production has had a profound impact on Lycoming County and will continue to have an impact on Lycoming County for years to come.
- The number of Marcellus Shale natural gas wells permitted in Lycoming County in 2006 was 3. This number increased to 85 in 2009 and 254 in 2010.
- Between January and November 2011, only two counties exceeded Lycoming County in the number of well permits issued – Bradford and Tioga. Lycoming County was surpassed only by Bradford County in the number of Marcellus Shale wells drilled during the same time frame.
- Many positive impacts have been associated with shale gas exploration and production.
  - Opportunities for establishing innovative high-tech employment and alternative energy production have increased. For example, a new natural gas-fired power plant has been proposed in Clinton Township, Lycoming County. Opportunities to expand natural gas lines in Lycoming County will likely increase the use of natural gas in homes and businesses and will impact land use as new gathering lines are constructed.
  - Lycoming Valley Railroad (LVRR) is experiencing a positive resurgence brought about by shale gas activities. A total of 80 rail carloads related to Marcellus Shale natural gas travelled on the LVRR in 2008. This number increased to over 6,000 in 2010. Increase in rail transportation and redevelopment of properties surrounding the railroad will continue to increase.
  - Lycoming County, particularly the Williamsport area, is a commerce hub (headquarters, lodging, and services) for the shale gas industry in eastern Pennsylvania. Over the past 3 years more than 120 companies have located or expanded in Lycoming County due to shale gas exploration and production.
  - Collectively, these companies have invested over $300 million in Lycoming County and created more than 5,000 jobs.
- There is a shortage of affordable housing for Lycoming County residents who have been displaced due to the rapid rise in housing costs and rental rates caused by shale gas development.
- Additional shale gas impacts that should be addressed include:
  - Increased need for emergency response personnel, preparedness, equipment, and training
  - Impacts on roads, bridges, and other types of infrastructure due to increased truck traffic
  - Increased need to protect surface and subsurface water supplies
  - Increased need for upgrades and expansion to water and wastewater facilities
  - Increased demand on County and local services for records management and mapping
  - Increased need for social services: domestic relations, drug/alcohol treatment, and job training
  - Increased demand on the County court system
- The Governor's Marcellus Shale Advisory Commission report issued on July 22, 2011 contained 96 recommendations. Many of the recommendations are applicable to Lycoming County.
- DEP addressed one of the Marcellus Shale Advisory Commission recommendations in December 2011 by issuing technical guidance on Natural Gas Vehicle (NGV) conversion systems. The guidance clarifies that natural gas conversions are authorized under the Pennsylvania Clean Vehicles Program. In 2006 Pennsylvania adopted low-emission vehicle standards based on the California Air Resources Board (CARB) regulations. DEP issued the technical guidance as the Pennsylvania Clean Vehicles Program did not address alternative fuel conversion systems.
- There are tremendous opportunities to expand the development of Pennsylvania's compressed natural gas (CNG) infrastructure beginning with converting to fleet vehicles.
- River Valley Transit (RVT) was awarded in 2011 a $3.5 million Federal Transit Administration (FTA) Clean Fuels Grant and a $400,000 DEP Alternative Fuels Incentive Grant (AFIG). RVT's project includes construction of a CNG Pumping Station for public and private fleet vehicles and the purchase of CNG transit buses. The CNG Focus Group, collaboration between Larson Design Group and key stakeholders, spearheaded this effort.

FEDERAL AND STATE ENERGY POLICY AND LEGISLATION ARE IN A STATE OF FLUX.

- There is no comprehensive federal or state energy policy in place at present, although the Governor's Energy Executive has indicated a state energy plan will be prepared.
- Federal Senate and House versions of the New Alternative Transportation to Give America Solutions (NAT GAS) Act support the development of natural gas for transportation and are pending as of November 15, 2011.
- Proposals and several pieces of legislation have been introduced in Pennsylvania to address shale gas exploration and production.
  - In October 2011, Governor Corbett proposed to implement several recommendations of the Marcellus Shale Advisory Commission report including new well drilling standards which provide further protections for public health and safety and an impact fee adopted by counties for the benefit of municipalities experiencing drilling impacts. Fees would also be used by state agencies that respond to issues associated with shale gas drilling.
  - Pennsylvania House and Senate bills introduced in November 2011 (HB 1950 and SB 1100) provide for shale gas impact fees and establish limitations on local government regulation over shale gas activities.
  - Marcellus Works, a package of 6 bills to facilitate the implementation of natural gas vehicle infrastructure throughout Pennsylvania, was introduced in the Pennsylvania House of Representatives in April 2011.
- While American Recovery and Reinvestment Act (ARRA) energy related projects, of which Lycoming County projects received approximately $4.7 million in funding are near completion future programs and funding opportunities are dependent on the passage of federal budgets.
- The Win-the-Future Initiative, proposed in February 2011, which promotes increasing energy efficiency in buildings throughout the country, clean energy initiatives, and funding sources is on hold pending federal budget discussions.

MANY SUCCESSFUL ENERGY EFFICIENCY PROJECTS HAVE BEEN COMPLETED IN LYCOMING COUNTY

- Over $2.9 million in funding has been awarded to Lycoming County businesses, non-profits, and schools over the past 5 years through DEP energy efficiency programs including: Pennsylvania Energy Development Authority (PEDA) funding (both annual program funding and ARRA funding), Small Business Advantage Grant, and Small Business Energy Efficiency Grant (part of Pennsylvania's Alternative Energy Investment Fund). In addition, 71 loans have been made to Lycoming County homeowners through the Keystone Home Energy Loan Program (HELP).
- STEP, Inc. has provided more than $7.6 million in weatherization assistance to Lycoming and Clinton County moderate to low income homeowners since 2005.
- STEP, Inc. was awarded over $4.3 million to provide weatherization services for 620 homes in Lycoming and Clinton Counties by the end of March 2012 through ARRA. As part of the services on-site energy audits are conducted for each home and prioritized improvements are recommended with an average amount of $6,500 spent per home.
- STEP, Inc. also received $50,000 from the Williamsport-Lycoming Community Foundation (WLCF) to provide weatherization assistance service to households that exceeded low to moderate income levels.
- YWCA Northcentral Pennsylvania has implemented energy efficiency upgrades at its historic building which reduce energy consumption by 261,488 kilowatts annually and save $231,000 in energy costs annually. The building rehabilitation included installing solar panels which has resulted in an annual energy reduction cost savings of 60 percent.
- Ashkar Elementary School in the East Lycoming School District received an ENERGY STAR label, one of only 143 ENERGY STAR labeled schools in Pennsylvania. ENERGY STAR labeled schools cost 40 cents per square foot less to operate compared to non-labeled schools.
- LEED (Leadership in Energy and Environmental Design) is the standard for measuring energy efficiency across the country. A total of 332 Pennsylvania LEED-certified buildings are listed on the U.S. Green

Building Council's online LEED inventory with Roosevelt Middle School in the Williamsport Area School District listed as having achieved LEED Gold certification.

- A few additional buildings are expected to achieve LEED certification. Williamsport Regional Medical Center is seeking LEED certification for its 242,000 square foot renovation. LEED certification is pending for the PA Department of Conservation and Natural Resources (DCNR), Bureau of Forestry Resource Management Center (Forest District Office) in Waterville.
- Pennsylvania College of Technology continues to be a leader in training Pennsylvania's energy workforce with over 8,000 individuals graduating from the Weatherization Training Center. Penn College's Factory Built Housing Center (FBHC) is working with Pennsylvania's modular home industry to focus on LEED-certified modular homes.
- PPL Electric Utilities and FirstEnergy (formerly Penelec) and Allegheny Power (formerly West Penn Power) are the Electric Distribution Companies (EDCs) that serve Lycoming County. According to Act 129 Statewide Evaluator Quarterly Reports, each of the EDCs is in compliance with Act 129 requirements.
- According to PPL the value of the company's Act 129 incentives in Lycoming County is $907,307.

LYCOMING COUNTY LOCAL GOVERNMENTS ARE STARTING TO ADDRESS ENERGY EFFICIENCY AND RENEWABLE ENERGY DEPLOYMENT.

- Lycoming County has conducted a utility bill analysis of county buildings. The Lycoming County Courthouse is benchmarked in ENERGY STAR Portfolio Manager. Portfolio Manager assists the county in tracking and monitoring energy performance.
- Four local municipalities have worked with SEDA-COG Energy Resource Center (ERC) to conduct utility bill analysis: Loyalsock Township, Montgomery Borough, Hughesville Borough, and Montoursville Borough. The utility bill analysis helps local governments benchmark their energy costs. As a next step, local governments often conduct an energy audit which recommends prioritized improvements to enhance energy efficiency.
- Loyalsock Township completed an energy efficiency retrofit as follow up to the utility bill analysis conducted by SEDA-COG ERC. The township installed a 15 kilowatt rooftop solar energy project. The total project cost was $115,000 with $40,000 funded through an Appalachian Regional Commission (ARC) grant. Energy efficiency improvements combined with the solar installation have cut electricity costs at the municipal building to zero.
- Muncy Borough is in the process of designing a streetscape project. As part of the project the Borough is exploring incorporating plug-ins for electric cars or 'Smart Curbs'.

SEVERAL SUCCESSFUL RENEWABLE ENERGY PROJECTS HAVE BEEN COMPLETED IN LYCOMING COUNTY.

- Both the East Lycoming School District and the Montoursville Area School District have completed successful renewable energy projects which serve as models for school districts across Pennsylvania.
  - o East Lycoming School District has implemented 4 renewable energy projects at buildings throughout the Hughesville Campus.
    - Biomass. Hybrid willow, a short rotation woody crop planted on 60 acres, is converted from wood to heat in a biomass energy plant and used for heat and hot water for Hughesville High School and the Lycoming County Career and Technology Center.
    - Solar PV. A 600 kilowatt solar photovoltaic (PV) field has been installed which supplies 50 percent of the high school's annual electrical power (or 411,000 kilowatts).
    - Geothermal. A closed loop geothermal system has been installed to heat and cool Ferrell and Renn Elementary Schools. The geothermal system saves the school district $17,000 per year in heating and air conditioning costs.
    - Wind. A 115' horizontal axis wind turbine rated at 2.5 kilowatts annually has been installed. East Lycoming School District has accessed several funding and technical assistance resources to implement the projects and the benefits include: increased energy efficiency, reduced heating

and electrical energy costs resulting in taxpayer savings, providing hands-on energy education for district students, and revenue generation: $96,000 per year for 8 years to district in SRECs, $49,000 of district owned energy production annually, PPL Renewable Energy Power Purchase Agreement of $8,700.

- Renovations at the C.E. McCall Middle School in the Montoursville Area School District include the construction and installation of a 20 kilowatt solar PV roof photovoltaic array roof panel system. The school district received a $35,000 grant through the Commonwealth Financing Authority (CFA) Solar Energy Program to install the system. The project will generate approximately 22,000 kilowatt hours of electricity annually, which will offset district utility costs.

- Biomass is a renewable energy source that is being deployed in Lycoming County with many opportunities to expand.
  - Several biomass waste-to-energy projects have been implemented in Lycoming County.
    - The Lycoming County Landfill is one of the largest projects. Since 1993, LCRMS has operated a one-megawatt cogeneration plant that includes two engines producing 1,000 kilowatts per hour, and through a partnership with PPL Renewable Energy, the energy is sold to the electrical grid. The cogeneration plant produces enough electricity to power approximately 1,400 homes per year and provides excess thermal energy to heat on-site County buildings.
    - Koppers, Inc. recycles waste railroad ties into electrical and thermal energy.
    - While it is in the research and development stages, the conversion of septage-to-energy is an opportunity that could be explored in Lycoming County.
    - Sewage-to-energy projects could potentially be incorporated into wastewater treatment plants that will be required to make upgrades mandated due to Chesapeake Bay requirements.
    - Manure digesters are an additional opportunity to convert biomass waste into energy. AgSTAR tracks anaerobic digester projects from across the country. A total of 157 digesters are operating with 22 located in Pennsylvania. None of the Pennsylvania-tracked projects are located in Lycoming County; however, ongoing biodigester discussions have been occurring as part of an informal group of regional digester owner/operators.
  - Woody biomass is a renewable energy source that is being used in Lycoming County and could potentially be expanded.
    - The USDA Bureau of Forestry is updating the Timber Product Output Survey for Pennsylvania. The survey, scheduled for completion in 2012, estimates and tracks timber removal and the impact on forests and regional economies, making it easier to understand the energy supply potential from woody biomass and the products being generated from Lycoming County's feedstock.
    - According to the USDA 2007 Census of Agriculture, 55 percent of Lycoming County's agricultural land is classified as cropland, providing the potential opportunity to grow woody biomass feedstock.
    - East Lycoming School District's Hughesville Campus is an example. Hybrid willow, a short-rotation woody crop that reaches harvest three years after planting, has been planted on 60 acres of the Hughesville Campus. The crop is converted from wood to heat in a biomass energy plant and used for heat and hot water for Hughesville High School and the Lycoming County Career and Technology Center.
    - According to DCNR's Biomass Energy Specialist, Jersey Shore School District, Williamsport Area School District and Susquehanna Health Divine Providence Campus are interested in implementing biomass energy projects. It is important to note that a few biomass projects once thought viable are no longer viable as natural gas is quite competitive.
    - In addition to residential usage, county wood energy users include schools, manufacturers, and forest products sectors (such as sawmills, mulch producers, and loggers). Forest products companies that transport wood chips to bioenergy facilities such as Viking Energy of Northumberland in Northumberland County for electricity, and Energex, one of the largest wood pellet manufacturers in the country located in Mifflin County.

- According to Clean Power Markets, the program administrator retained by the Pennsylvania Public Utility

Commission to implement the Alternative Energy Portfolio Standards (AEPS), a total of 38 qualified alterative energy facilities are located in Lycoming County.

- A small number of wind energy projects have been completed in Lycoming County. One utility-scale project is under construction. Duke Energy Renewables will complete the Laurel Hill Windpower Project in September 2012. The 69 megawatt wind farm is projected to generate enough electricity to power more than 20,000 homes.
- Only one hydropower project was identified in Lycoming County.
  - According to data obtained from the U.S. Federal Energy Regulatory Commission (FERC), an Order issuing a preliminary permit was granted to Renew Hydro, LLC on July 11, 2011. The preliminary permit will be in effect for 36 months and the proposed project would be located on the West Branch of the Susquehanna River near South Williamsport.
  - Since both low-impact and large-scale hydropower are included as Tier 1 energy sources according to Pennsylvania's AEPS, there may be opportunities to increase hydropower deployment in Lycoming County.
- Communities with a dense concentration of businesses and residents such as Jersey Shore, Hughesville, Muncy, Montgomery, and Montoursville may support the critical mass needed to explore a community-wide renewable energy project. A community-wide energy project is ongoing in New Berlin Borough, Union County (through SEDA-COG ERG) and has been considered in Smethport Borough, McKean County.
- The use of renewable energy sources is increasing around the country.
  - The use of renewable energy sources is slowly increasing in the United States, from 7 percent in 2006 up to 8 percent in 2009.
  - At the national level, biomass accounts for 50 percent of total renewable energy sources, hydropower accounts for 35 percent, wind at 9 percent, and geothermal at 5 percent.
  - Estimated renewable energy consumption in Lycoming County is 3 percent.

LYCOMING COUNTY'S ENERGY CONSUMPTION BY SECTOR DIFFERS FROM NATIONAL ENERGY CONSUMPTION.

- It is estimated that Industrial uses consume the most energy in Lycoming County (47 percent) followed by Residential (33 percent).
- At the national level, Industrial uses consume 30 percent of the country's energy while Transportation consumes 29 percent.
- Lycoming County's estimated transportation energy consumption (1 percent) is low compared to the country. It is assumed that this is due to the county's rural location; however, it is anticipated that transportation energy consumption numbers will increase due to increased transportation demands associated with shale gas exploration and production.

NUMEROUS TECHNICAL SERVICES PROVIDERS AND FUNDING SOURCES SERVE LYCOMING COUNTY.

- A total of 19 known technical service providers and federal, state, and regional agencies provide energy related services to Lycoming County.
- Technical services and funding availability change rapidly due to political and agency uncertainty.
- Close monitoring of services and funding is necessary to make certain that Lycoming County takes advantage of both technical services and funding as the Energy Plan is implemented.

SUMMARY OF ENERGY PLAN STRATEGIES AND STRATEGIC ACTIONS

STRATEGY 1: ADVANCE LOCAL, STATE, AND FEDERAL ENERGY POLICY
1.1 Adopt and Periodically Update the County Energy Policy
1.2 Create the Lycoming County Energy Advisory Council
1.3 Brief and Regularly Update the Governor's Energy Executive
1.4 Brief and Regularly Update Pennsylvania State Legislative Representatives
1.5 Brief and Regularly Update Pennsylvania Federal Congressional Representatives
1.6 Brief and Regularly Update Federal Agencies
STRATEGY 2: PROMOTE ENERGY EDUCATION, PARTNERSHIPS, AND COMMUNICATION
2.1 Develop and Maintain Partnerships with Technical Assistance Providers
2.2 Market Existing Energy Education Programs
2.3 Foster Secondary and Higher Education Student Interest in Energy Issues
2.4 Establish a Lycoming County Energy Information Portal
2.5 Highlight the Benefits of Energy Efficiency and Demand Reduction at Events
STRATEGY 3: PROMOTE ENERGY EFFICIENCY AND DEMAND REDUCTION
3.1 Encourage Electric Choice in All Sectors
3.2 Encourage Leadership in Energy and Environmental Design (LEED) Construction in All Sectors
3.3 Promote Energy Efficiency and Demand Reduction in County and Local Governments
3.4 Market Existing Energy Efficiency and Demand Reduction Programs for Residents
3.5 Market Energy Efficiency and Demand Reduction Programs for Businesses
3.6 Market Energy Efficiency and Demand Reduction Programs for Agricultural Businesses
3.7 Promote "Reduce, Reuse, and Recycle"
STRATEGY 4: PROMOTE RENEWABLE ENERGY DEPLOYMENT THAT ENCOURAGES SUPPLY CHAIN DEVELOPMENT AND ENERGY INDEPENDENCE
4.1 Expand Biomass Energy Deployment
4.2 Encourage Cogeneration Projects
4.3 Encourage the Deployment of Solar Energy Projects
4.4 Promote the Installation of Geothermal Systems
4.5 Support the Use of Hydropower
4.6 Advance the Deployment of Biomass Waste Projects
4.7 Consider the Development of a Communitywide Energy Independence Project
4.8 Monitor Developments in Renewable Energy
STRATEGY 5: ENCOURAGE THE ECONOMIC BENEFITS AND MONITOR THE IMPACTS OF MARCELLUS SHALE NATURAL GAS PRODUCTION
5.1 Support the Facilitation of Economic Development Focused on Natural Gas Production and Use within New and Existing Industries
5.2 Evaluate the Potential Location of Intrastate Natural Gas Pipelines in Lycoming County
5.3 Promote Natural Gas-Fired Power Plants

5.4 Plan and Prepare for Natural Gas-Powered Vehicles by Promoting Compressed Natural Gas (CNG) Infrastructure Countywide
5.5 Educate the Public and Businesses about the Advantages of Using Natural Gas to Fuel Vehicles
5.6 Prepare Lycoming County Businesses and Workforce to Service CNG Fueling Operations
5.7 Monitor the Economic, Environmental, and Social Impacts of Shale Gas Exploration and Production
STRATEGY 6: HELP PREPARE LOCAL GOVERNMENTS TO ADDRESS ENERGY –RELATED LAND USE CONSIDERATIONS
6.1 Update Land Use Regulations as Required
6.2 Provide Outreach to Lycoming County Local Governments
STRATEGY 7: FACILITATE THE AWARD OF ENERGY INCENTIVES TO LYCOMING COUNTY PROJECTS
7.1 Monitor and Secure Energy-Related Incentives That May Be Applicable for Each Energy Strategy
7.2 Provide County-Level Support for Energy Projects
7.3 Develop and Implement *Lycoming Energy Now*

CHAPTER 2 BACKGROUND RESEARCH

This chapter summarizes background research conducted for the preparation of Lycoming County's Energy Plan. It includes a synopsis of information pulled from existing plans, studies, and online resources at the county, regional, state, and federal levels. It also includes information obtained from discussions with public and private sector professionals from each level.

REVIEW OF EXISTING PLANS AND STUDIES

Lycoming County's Comprehensive Plan, multi-municipal plans, and functional plans were reviewed for the purpose of identifying if and how each document addresses energy. Within each of the reviews of existing plans and studies any plan modifications necessary to eliminate obstacles to renewable and alternative energy use in the County, to promote energy efficiency and demand reduction efforts, or to track energy-related trends will be suggested.

Review of the plans and studies resulted in a large amount of information; therefore, Key Findings from each document are summarized at the beginning of each document review to aid in review.

LYCOMING COUNTY COMPREHENSIVE PLAN

KEY FINDINGS

Lycoming County's Comprehensive Plan is interrelated to the Energy Plan in many areas.

- Many of the Key Goals identified in the Community and Economic Development Plan are applicable to energy planning, specifically renewable energy deployment and resource extraction.
  - To diversify housing choices while enhancing and preserving local community settings.
  - To increase and diversify educational and training opportunities for the County workforce.
  - To conserve ridgetops and steep slopes for environmental, aesthetic, and economic value.
  - To manage land and associated natural resources with clear regard for economic, environmental, aesthetic, and overall quality of life values.
- The concept of a virtual Internet Community Resource Center as identified in the Comprehensive Plan is similar to the Energy Portal identified as an Energy Plan Strategy.
- The Comprehensive Plan recommended the review and update of ordinances at the county and local government levels to make sure documents meet the Comprehensive Plan's goals and objectives. This recommendation should be expanded through the Energy Plan to facilitate the development of renewable energy projects such as geothermal and wind and energy efficiency actions such as incorporating LEED building standards.
- Evaluating local incentives to determine opportunities to leverage federal, state, and private funding sources was identified as a strategic action in the Comprehensive Plan. This strategic action could be expanded to include incentives for energy efficiency and renewable energy deployment.
- Implementing actions or programs to promote the development of housing was identified as a strategy. Affordable housing for Lycoming County residents displaced due to the rapid rise in housing costs and rental rates resulting from shale gas development is an issue should be addressed as an energy strategy.
- Promoting opportunities for sustainable agriculture and sustainable forestry was identified in the Comprehensive Plan. Potential opportunities for Lycoming County's agriculture industry such as encouraging the growth of crops for use as biomass feedstock should be supported through the Energy Plan.
- Supporting the presence of Agriculture was identified in the Comprehensive Plan. Lycoming County's agriculture community should be supported through the Energy Plan by encouraging energy efficiency, deploying renewable energy strategies, and identifying potential funding sources to offset energy-related project costs.

- The Comprehensive Plan recommends coordinating economic development, transportation, and infrastructure planning with land use planning. This recommendation is particularly applicable to the Energy Plan as extraction of natural gas resources is impacting and will continue to impact economic development, transportation, and infrastructure throughout Lycoming County.
- Encouraging innovative employment and alternative energy production was identified as a recommendation. This recommendation is relevant to the Energy Plan as new employment and energy production opportunities are available through the shale gas industry.
- The Transportation Plan suggests maintaining and expanding the County's rail infrastructure. Lycoming Valley Railroad (LVRR) provides a critical hub for transporting supplies associated with the shale gas industry. The Comprehensive Plan strategy to maintain and expand the County's rail infrastructure is interrelated to the Energy Plan.
- The Transportation Plan suggests maintaining public transit as a viable transportation alternative. This suggestion is applicable to the Energy Plan as conversion of fleet vehicles to Compressed Natural Gas (CNG) will improve the viability of public transportation, as fuel costs would be significantly reduced over time.
- Maintaining the viability of volunteer fire companies was identified as a strategy in the Community Infrastructure Plan. This suggestion is applicable to the Energy Plan particularly if an impact fee is enacted to offset the cost of mitigating impacts associated with shale gas exploration and production. An impact fee could likely be used towards funding volunteer fire company needs.

Lycoming County's Comprehensive Plan was adopted in 2006 and includes four plan elements:

- Community and Economic Development Plan
- Land Use and Resource Management Plan
- Transportation Plan
- Community Infrastructure Plan

The Comprehensive Plan was prepared concurrently with six multi-municipal plans, which include the same four elements.

Section 301 (4.1) of the MPC requires that a comprehensive plan discuss the interrelationships between plan elements. This is required to ensure plan elements work cross-functionally without conflicts in goals or policies.

While the four plan elements do not reference energy to any great extent, energy is connected to each. The impact energy has had in Lycoming County since 2006 due to natural gas extraction is tremendous. Community and economic development is impacted by the extraction of natural resources within the County, as is land use and the environment. Transportation is impacted by energy extraction not only by physical infrastructure such as roads and rail but the opportunity to use alternative fuel sources to power vehicles, such as natural gas or biodiesel. Communities are impacted by energy in significant ways, including more opportunities to develop a sustainable community energy strategy, and changes in community resource needs due to population fluctuations. There is also an increase in the need for trained emergency service personnel to address energy extraction incidents as well as to handle emergency issues for renewable energy emergencies such as electrical issues associated with solar panels on rooftops. Several interrelationships and opportunities exist to enhance the value of each Comprehensive Plan component through the Energy Plan. These interrelationships are noted as follows.

COMMUNITY AND ECONOMIC DEVELOPMENT PLAN

Many of the key goals identified in the Community and Economic Development Plan are integral to energy efficiency and renewable energy strategies. Since the shale gas development is related to community and economic development it was included for consideration in the plan review and analysis. The interrelationships between energy and the Comprehensive Plan are as follows:

- To maintain and enhance our quality of life
- To diversify our housing choices while enhancing and preserving our local community settings
- To increase and diversify educational and training opportunities for the County workforce
- To strengthen and diversify our economy
- To conserve ridge tops and steep slopes for their environmental, aesthetic, and economic value to the County, and to manage development in these areas
- To manage new development and redevelopment along highway corridors in ways that complement and enhance local communities
- To manage land and associated natural resources with clear regard for economic, environmental, aesthetic, and overall quality of life values
- To maintain and enhance the image of Lycoming County as a scenic place where communities take pride in maintaining the image of their properties
- To protect and demonstrate appreciation of natural resources as a community
- To expand outdoor recreation opportunities where appropriate, while respecting and protecting the character of undeveloped areas and small villages as well as respecting private property owners' rights and interests
- To more fully develop a functional and effective multimodal transportation network
- To increase public transit availability and use as one component of a more fully developed multimodal transportation network
- To designate select roadway corridors for the protection of specific, unique resources, features, and/or qualities
- To develop and maintain effective infrastructure systems for long-term community use and to expand systems in targeted areas

With these goals in mind, it is critical the Energy Plan become an element of Lycoming County's Comprehensive Plan. The Energy Plan will provide the foundation for implementation efforts to achieve the goals established by the community.

The Community and Economic Development Plan includes demographic, housing, and economic development trends. Demographic trends such as population change, resident mobility, origin of new residents, housing affordability, median home values, wages by industry, and employment change will be relevant as indicators of the impacts of natural gas development in Lycoming County.

Several of the strategies and strategic actions noted in the Community and Economic Development Plan are relevant to the implementation of the Energy Plan. Comments included under each strategy were considered when the Energy Plan's strategies and strategic actions (see Chapter 7) were developed. The following strategies and strategic actions are taken from the Community and Economic Development Plan to illustrate its connection to the Energy Plan.

- STRATEGY #1– REVIEW ALL APPLICABLE ORDINANCES TO MAKE SURE THEY ARE CONDUCIVE TO MEETING THE SPECIFIC GOALS AND OBJECTIVES IDENTIFIED IN THE COMPREHENSIVE PLAN.

    - Strategic Action 1a. This strategy calls for making regulations conducive to reuse and rehabilitation of existing structures and promoting training of zoning, subdivision, and code enforcement officials. A similar strategic action for the Energy Plan has been developed. Requiring the review of applicable ordinances to ensure that development restrictions are eased for energy efficiency improvements, LEED standards, and renewable energy facilities such as geothermal and solar would help facilitate energy projects.
    - Strategic Action 1i. This strategy suggests the County work with the Williamsport/Lycoming Chamber of Commerce and meet with businesses to identify potential expansion or permitting issues, and Strategic Action 1l. suggests developing a fast-track review/development procedure for businesses locating in growth areas. Through these action items, the County has been working with the Williamsport/Lycoming Chamber to develop a simple code audit guideline to help municipalities assess where ordinance provisions may be adversely impacting business development. In light of the increase in business development in Lycoming County due to shale gas development as well as future renewable energy projects, it might be helpful to revisit these action items to ensure that business development issues are identified and addressed.

- STRATEGY #3 – ESTABLISH A COUNTY PARTNERSHIP FORUM THAT WILL MEET ON A REGULAR BASIS TO CREATE STRATEGIC PARTNERSHIPS AND COORDINATE THE MUTUAL INITIATIVES AMONG THESE PARTNERSHIPS TO ACHIEVE ECONOMY OF SCALE AND PROGRAM EFFICIENCIES.

In the discussion of this strategy in the Comprehensive Plan, it was noted that stakeholder events were worthwhile as they brought together many organizations to work together and share ideas. Currently, Lycoming County does not have a County Partnership Forum as identified in Strategy #3. If established, the framework of the County Partnership Forum may work to facilitate relevant energy issues amongst various organizations. Participants at the Energy Plan Workshop expressed a need for a County Partnership Forum or something similar (See Chapter 5 – Public Outreach).

    - Strategic Action 3g. suggests the evaluation of local incentives for economic and community development to determine opportunities to leverage federal, state, and private funding sources. This strategic action could be expanded to include incentives for energy efficiency and renewable energy deployment.
    - Strategic Action 3n. suggests the establishment of a virtual Internet Community Resource Center that could serve as a clearinghouse for community information. A similar suggestion has been developed to disseminate energy-related information.

- STRATEGY #4 – ESTABLISH A CLOSER WORKING RELATIONSHIP WITH OUR EDUCATIONAL INSTITUTIONS TO MAKE THEM A MORE INTEGRAL PLAYER IN SHAPING OUR COMMUNITY.

This strategy includes several strategic actions including ways to become actively involved with educational institutions in the County. Adding a strategic action to focus on energy education in K – 12

schools and on the college level may be beneficial, particularly with respect to educating students about energy-related jobs.

- STRATEGY #5 – UNDERTAKE SPECIFIC ACTIONS OR PROGRAMS TO PROMOTE THE DEVELOPMENT OF HOUSING TO SUPPORT THE COMMUNITY GOALS AND OBJECTIVES IDENTIFIED IN THE COMPREHENSIVE PLAN.

Affordable housing for Lycoming County residents who have been displaced due to the rapid rise in housing costs and rental rates caused by shale gas development is an issue that has been addressed in an energy strategy.

- STRATEGY #6 – UNDERTAKE SPECIFIC ACTIONS OR PROGRAMS TO PROMOTE ECONOMIC DEVELOPMENT THAT SUPPORTS THE COMMUNITY GOALS AND OBJECTIVES IDENTIFIED IN THE COMPREHENSIVE PLAN.

The rapid increase in shale gas production and the associated supply chain necessary to support the industry provides an excellent opportunity to promote economic development throughout Lycoming County, plus it also provides local employment for Lycoming County citizens in many different fields.

  - Strategic action 6k. suggests that the County should promote the establishment of innovative, high-tech employment opportunities and alternative energy production. The adoption of the Energy Plan will strengthen and support this strategic action.

LAND USE AND RESOURCE MANAGEMENT PLAN

A few issues associated with the Land Use and Resource Management Plan element are applicable to the Energy Plan. For example, development of wind energy facilities for the purpose of harvesting wind as a natural resource is maximized by placement on ridge tops. Ridge top development has been identified as an issue, as scenic landscapes are irreplaceable. Other Land Use and Resource Management Plan issues applicable to the Energy Plan pertain to shale gas development including both open space and agricultural space preservation areas. These areas could potentially be impacted by well drilling activities and new land development associated with well service companies. For example, groundwater quality could potentially be at risk by the hydraulic fracturing required to extract shale gas. Also, scenic resources could be adversely impacted by well drilling activities, and cultural resources could be altered by an influx of new citizens into Lycoming County.

Several of the strategies and strategic actions noted in the Land Use and Resource Management Plan are relevant to the implementation of the Energy Plan.

- STRATEGY #1 – REVIEW AND REVISE ORDINANCES TO ENSURE THAT THEY ARE CONSISTENT WITH THE GOALS AND OBJECTIVES OF THE COMPREHENSIVE PLAN.

With the rapid increase in development pressure due to natural gas extraction, as well as increased deployment of renewable energy sources, it is critical that ordinances are consistent with the Comprehensive Plan. Lycoming County has responded to shale gas drilling land development concerns by amending the County zoning ordinance to regulate natural gas and oil extraction and related activities. The amendments address the following: location, siting standards, permitting procedures, controls for height, setback, noise, impervious cover percentage, and site restoration.

Additional energy-related areas that should be considered include solar and geothermal. Model ordinances for solar and geothermal have been developed by Pennsylvania's local government organizations, and several municipalities have adopted ordinances addressing solar and geothermal. In 2010, Ralpho Township in Lancaster County adopted one of Pennsylvania's few comprehensive Alternative Energy Ordinances that regulates the placement, construction, operation, and maintenance of the following energy systems: geothermal, outdoor hydronic heaters (wood-fired boilers), solar energy, wind energy, and manure digesters.

- STRATEGY #2 – DEVELOP AND SUPPORT ADDITIONAL PUBLIC AND/OR PRIVATE PROGRAMS TO ACHIEVE THE COMPREHENSIVE PLAN'S GOALS AND OBJECTIVES.

    - Strategic Action 2g. suggests working with partners to disseminate existing information or develop new public education materials on sustainable natural resource production, including both sustainable agriculture and sustainable forestry. This is applicable to the Energy Plan as there are opportunities for Lycoming County farmers to work collaboratively with business and industry to grow crops used for biomass.

Lycoming County has addressed wind energy facilities in the County zoning ordinance and should address solar and geothermal energy projects as well.

- STRATEGY #4 – SUPPORT THE CONTINUED PRESENCE OF AGRICULTURE.

Consistent with Strategy #4, the Energy Plan addresses the County's agriculture community and identifies opportunities to improve energy efficiency, deploy renewable energy strategies, and find potential public funding sources to do so.

- STRATEGY #5 – SUPPORT THE SUSTAINABILITY OF FOREST RESOURCES AND THE FOREST-RELATED ECONOMIC SECTOR.

Consistent with Strategy #5, the Energy Plan addresses biomass energy and the integral link with Lycoming County's timber industry.

- STRATEGY #8 – COORDINATE ECONOMIC DEVELOPMENT AND TRANSPORTATION AND INFRASTRUCTURE PLANNING WITH LAND USE PLANNING.

    - Strategic Action 8g. suggests coordinating infrastructure improvements and expansion within growth areas, and discouraging infrastructure investment in rural resource areas. Opportunities to use natural gas for vehicular fuel and extend natural gas for use in commercial and industrial applications will require coordination with land use planning at the County and local levels.

      There will likely be opportunities to expand natural gas lines throughout the County as providers such as UGI are making significant gas line expansions to bring Marcellus Shale natural gas to their customers. Pennsylvania-extracted natural gas will save gas companies sizable transportation costs.

TRANSPORTATION PLAN

Transportation issues that are particularly relevant to energy are focused on shale gas extraction, including access driveways, maintaining a quality road and rail transportation system, protecting scenic roadway corridors, and bridge rehabilitation and replacement. In addition, using natural gas to power vehicles should be considered in a future Transportation Plan update.

Several of the strategies and strategic actions noted in the Transportation Plan are relevant to the implementation of the Energy Plan.

- STRATEGY #1 – MAINTAIN AND EXPAND (WHERE APPROPRIATE) THE INFRASTRUCTURE FOR THE COUNTY'S RAIL NETWORK.

Lycoming Valley Railroad (LVRR) has been positively impacted by the extraction of shale gas in Lycoming County and the surrounding region. LVRR provides a critical hub for supplies that are necessary to drill natural gas wells. The extraction of shale gas requires immediate upgrades to the LVRR; therefore, the strategy to maintain and expand the infrastructure for the County's rail network is interrelated to the Energy Plan.

- STRATEGY #3 – MAINTAIN PUBLIC TRANSIT AS A VIABLE TRANSPORTATION ALTERNATIVE IN LYCOMING COUNTY.

The use of public transit, if developed efficiently with heavy ridership, reduces overall energy consumption and is therefore relevant to the Energy Plan. In addition, conversion of fleet vehicles to CNG will improve the viability of public transportation, as fuel costs would be significantly reduced over time.

- STRATEGY #5 MAINTAIN/IMPROVE ROADWAYS THROUGH REDESIGN INITIATIVES TO PROVIDE A SAFE AND EFFICIENT MODE OF TRAVEL FOR LOCAL RESIDENTS, VISITORS, AND THROUGH-TRAVELERS.

The extraction of shale gas is impacting Lycoming County's roads; therefore, the strategy to maintain and improve County roadways is interrelated to the Energy Plan.

- STRATEGY #6 – DEVELOP A COUNTY SCENIC BYWAYS PROGRAM TO ASSIST LOCAL GOVERNMENT IN ACHIEVING COMMUNITY OBJECTIVES.

The extraction of shale gas in Lycoming County is impacting scenic byways just as locating renewable energy projects such as wind energy facilities may do the same. The strategy to develop a County scenic byways program thus relates to the Energy Plan.

Several key transportation issues noted in the transportation technical background study, prepared as part of the Transportation Plan, are particularly relevant to the increased development experienced in the County. Functional capacity of many of the road networks is critical. It was noted the capacity of many of the local road systems is reaching its limit. Bridges throughout the County are in major need of either rehabilitation or replacement; the need to repair bridges is critical. Severe flooding in September

2011 resulted in several bridge collapses in the County, which significantly impairs emergency response. The sharp increase in rail and truck traffic due to shale gas development exacerbates the need to repair transportation infrastructure immediately.

COMMUNITY INFRASTRUCTURE PLAN

As the Community Infrastructure Plan is broad in nature, it is linked to the Energy Plan in many ways. Many of the important issues identified by Lycoming County residents during the preparation of the Community Infrastructure Plan have already been identified as concerns with respect to rapid increase in development due to shale gas exploration and extraction. These include water quality, stormwater management, campground sewage disposal, sewer expansion capacity, public infrastructure, subdivision without infrastructure, hospital and medical support, and natural areas.

Specific strategies and strategic actions noted in the Community Infrastructure Plan that are relevant to the implementation of the Energy Plan follow.

- STRATEGY #2 – IMPROVE COMMUNITY IMAGE AND APPEARANCE.

Should Pennsylvania adopt an impact fee on shale gas development, there might be opportunities to address some of the strategies suggested in the Community Infrastructure Plan. These include the following: 2c. Develop community streetscape and traffic calming plans; 2d. Review ordinances for screening and tree planting requirements; and 2g. Develop Community Gateways reflecting the unique character of the community and its heritage.

- STRATEGY #5 – PROMOTE FACILITIES AND SERVICES TO ATTRACT INDUSTRY.

    - Strategic Action 5a. suggests promoting high-quality, accessible healthcare facilities and services. Lycoming County's healthcare facilities are used more frequently as a result of new development associated with the energy industry. Supporting healthcare facility expansion will help to ease current and future increases in healthcare demand.

    - Strategic Action 5b. suggests promoting the excellent educational opportunities in the County. Pennsylvania College of Technology (Penn College) and Lycoming College were noted in the Community Infrastructure Element as key partners for community and economic development initiatives. This extends to energy initiatives as well, as Penn College has been involved with training for residential energy efficiency and natural gas-related careers. Lycoming College has been involved with the development of the Energy Plan, as students have helped develop the case studies included in Chapter 6.

- STRATEGY #6 – MAINTAIN VIABILITY OF VOLUNTEER FIRE COMPANIES.

The following strategic actions were identified in the Community Infrastructure Plan to maintain the viability of Lycoming County's volunteer fire companies: 6a. Identify shared facility and service opportunities; 6b. Promote volunteerism; 6c. Promote financial support through donations; and 6d. Develop a comprehensive evaluation of essential emergency service needs. Each of these strategic

actions would be addressed should Pennsylvania enact an impact fee to offset the cost of mitigating impacts associated with shale gas development and production. An impact fee was recommended as part of the Governor's Marcellus Shale Advisory Commission Report released in July 2011 and an impact fee proposal outline by Governor Corbett in October 2011.[2]

CONSISTENCY WITH MULTI-MUNICIPAL COMPREHENSIVE PLANS

The goals and objectives in each of Lycoming County's six multi-municipal plans are consistent with those adopted in the County's Comprehensive Plan. The strategies and strategic actions are predominately the same in each; therefore, the interrelationships identified between the Energy Plan and the County's Comprehensive Plan are primarily the same for the multi-municipal comprehensive plans as well. A few additional energy-related comments identified in the multi-municipal comprehensive plans are noted below.

MUNCY CREEK COMPREHENSIVE PLAN

KEY FINDINGS

The Muncy Creek Comprehensive Plan addresses land use concerns associated with renewable energy deployment and shale gas exploration and production.

- The plan notes that municipalities seek to have better control of scenic hillsides and ridgetops. This could be a conflict with both wind energy and shale gas development.
- The plan includes a suggestion to enact municipal and multi-municipal zoning to protect large and contiguous agricultural regions through the designation of rural resource protection areas and to identify specific areas for concentrated animal feeding operations (CAFOs). CAFOs provide an opportunity to expand biomass waste energy use.

Recommendations in the Muncy Creek multi-municipal plan address urban and rural issues, preservation, and development. The plan recommends land use planning that reduces vehicle trips and encourages pedestrian, bicycle, and transit alternatives, and notes that municipalities seek to have better control of scenic hillsides and ridge tops, which could be a conflict with both wind energy and shale gas development. Likewise, there is a concern for protecting the rural countryside with recommendations to enact municipal and multi-municipal zoning to protect large and contiguous agricultural regions through the designation of rural resource protection areas and to identify specific areas for concentrated animal feeding operations (CAFOs). CAFOs provide an opportunity to expand biomass energy use.

[2] Commonwealth of Pennsylvania, Office of the Governor, Governor's Marcellus Shale Advisory Commission Report, p. 114.

MONTOURSVILLE/MUNCY COMPREHENSIVE PLAN

KEY FINDINGS

The Montoursville/Muncy Comprehensive Plan identified several issues of importance within the Montoursville-Muncy Growth Corridor, one of which was uneven natural gas distribution.

- The plan also observes natural gas is readily available in the major urban areas but not in outlying areas of the County.
- Planning for future natural gas lines should consider growth areas within the County that are not currently served by natural gas.

Municipalities in the Montoursville/Muncy planning area have agreed to work on a regional basis to identify future highway and municipal infrastructure (water and sewer) needs for anticipated growth and development as part of the completion of the Susquehanna Throughway and other highway projects.

The plan identified several issues of importance within the Montoursville-Muncy Growth Corridor, one of which was uneven natural gas distribution for both residential and business consumers. The plan also observes while natural gas is readily available in the major urban areas, "the availability of natural gas is sporadic in the outlying areas of the County."[3] Planning for future natural gas lines should consider growth areas within Lycoming County that are not currently served by natural gas.

US 220/FUTURE I-99 COMPREHENSIVE PLAN

KEY FINDINGS

The US 220/Future I-99 multi-municipal plan recommends exploring shared facility and service opportunities such as public water and sewer, recreation, and public safety.

- From an energy planning perspective new opportunities to use biomass waste treatment could be identified as wastewater treatment facilities in the County require future upgrades.

The US 220/Future I-99 multi-municipal plan recommends exploring shared facility and service opportunities such as public water and sewer, recreation, and public safety. There could be opportunities to identify new public sewer treatment opportunities should facilities be upgraded.

US 15 SOUTH COMPREHENSIVE PLAN

KEY FINDINGS

The US 15 South Comprehensive Plan includes strategic actions to preserve and conserve farmland, permitting CAFOs in locations where the community and its environment would not be adversely impacted, and protecting natural resource areas.

- These strategic actions are consistent with the Energy Plan strategies to support the County's agriculture community through energy conservation and encouraging biomass waste renewable energy deployment.

[3] Lycoming County Planning Commission, The Comprehensive Plan for the Montoursville-Muncy Planning Area, p. 5-2.

The comprehensive plan for the US 15 South Planning Area identified a strategy to use land management to protect natural resources. The strategic action developed includes supporting and monitoring compliance with state requirements for safe mining practices and area restoration after extraction has ceased.

Other strategic actions include preserving and conserving farmland, permitting CAFOs in locations where the community and its environment would not be adversely impacted, and protecting natural resource areas.

CONSISTENCY WITH COUNTY ORDINANCES AND FUNCTIONAL PLANS

This section notes the interrelationship between the Energy Plan and several of the County's ordinances and functional plans. The ordinances and functional plans provide the framework from which to implement the goals of the Comprehensive Plan.

LYCOMING COUNTY ZONING ORDINANCE

KEY FINDINGS

Lycoming County has been attentive to ensure that energy-related land use issues are addressed through the County zoning ordinance.

- Both wind energy and natural gas and oil and extraction have recently been addressed through the County zoning ordinance.
- Lycoming County may want to incorporate provisions for solar and geothermal energy in the County zoning ordinance.
- A few Pennsylvania municipalities have adopted comprehensive Alternative Energy Ordinances to address an increasing number of energy projects.

Lycoming County's zoning ordinance was originally enacted in December 1991, with the most recent update in February 2011. Lycoming County has been diligent in addressing energy-related land use issues through the County zoning ordinance.

A Wind Energy Facility Use provision provides standards for the development, operation and decommissioning of a wind energy facility as an Institutional use. The regulations address location, height, and setback and also require a Community and Environmental Impact Analysis to address the site's hydrology, geology, and soils, and consider impacts on land use, transportation, emergency and safety services, and economic impacts. Small Wind Energy Systems are permitted as an accessory use to an individual home, multifamily residential use, office or business, and industrial and agricultural uses located on the same lot. The wind energy is not to be provided to others for sale off-site in the power grid.

The most recent amendment of the zoning ordinance provides standards to regulate natural gas and oil extraction and related activities including location, siting standards, permitting procedures, controls for height, setback, noise, impervious cover percentage, and site restoration. The zoning ordinance amendments pertaining to natural gas were developed in collaboration with natural gas companies.

Additional energy-related areas that should be considered include solar and geothermal. Model ordinances for solar and geothermal have been developed by Pennsylvania's local government organizations and several municipalities have adopted ordinances addressing solar and geothermal. Ralpho Township in Lancaster County has adopted a comprehensive Alternative Energy Ordinance to address the increasing number of energy projects in the municipality.

LYCOMING COUNTY WATER SUPPLY PLAN

KEY FINDINGS

The Lycoming County Water Supply Plan includes several recommendations for improving water storage and capacity.

- The recommendations are applicable to energy planning as water supply is critical for hydropower, shale gas exploration and production, and emergency services.
- The Lycoming County Water Supply Plan should be considered when each of these uses is proposed.

The Lycoming County Water Supply Plan was completed for the County in 2001. The plan was developed to:

- Evaluate existing community water system capabilities,
- Project future water needs,
- Identify service deficiencies,
- Evaluate alternative solution strategies, and
- Make recommendations to promote coordination and consistency with County and municipal planning efforts.

Several recommendations for improving water storage and capacity were identified in the plan. Water supply is critical for energy planning for hydropower as well as for shale gas exploration and production and emergency services. The Lycoming County Water Supply Plan should be considered when each of these uses is contemplated.

ALL-HAZARD REDUCTION/MITIGATION PLANS

KEY FINDINGS

The Lycoming County All-Hazard Mitigation Plan assesses hazard vulnerabilities within each of Lycoming County's municipalities.

- The All-Hazard Mitigation Plan is directly related to shale gas exploration and production from both a safety and water supply perspective and should be considered when natural gas extraction projects are proposed.

The Lycoming County All-Hazard Mitigation Plan assesses hazard vulnerabilities within each of Lycoming County's municipalities. Hazards considered in the plan include flooding, winter storms, tropical storms and hurricanes, tornadoes and windstorms, hazardous materials incidents, fixed nuclear incidents, droughts and water supply deficiencies, fires, and terrorism.

The All-Hazard Mitigation Plan is directly related to shale gas development from both a safety and water supply perspective and should be considered when natural gas extraction projects are proposed.

WATS LONG-RANGE TRANSPORTATION PLAN

KEY FINDINGS

The Williamsport Area Transportation Study (WATS) Metropolitan Planning Organization (MPO) is responsible for the review and approval of local plans and programs seeking federal and state funds for transportation improvements.

- The WATS Long-Range Transportation Plan becomes an integral tool to prioritize much-needed transportation infrastructure improvements as shale gas exploration and production increases in Lycoming County.

The Williamsport Area Transportation Study (WATS) Metropolitan Planning Organization (MPO) is responsible for the review and approval of local plans and programs seeking federal and state funds for transportation improvements. The WATS jurisdiction includes all of Lycoming County.

Due to shale gas development as well as flooding occurring in September 2011, the WATS Long-Range Transportation Plan becomes an integral tool to prioritize much-needed transportation infrastructure improvements.

PENNSYLVANIA FOREST MANAGEMENT PLANS

KEY FINDINGS

Several components of the State Forest Management Plan are relevant to energy planning in Lycoming County, particularly biomass energy.

- The District Management Plan for Lycoming County state forests places special emphasis on the value of the state forests to the local economy. It indicates the economy of the area will likely continue to depend on land resources. It goes on further to state that resource extraction and storage of natural gas provides a significant number of jobs.
- A reference to the natural gas and state forest lands refers specifically to the Tiadaghton State Forest and indicates no immediate plans to further develop the mineral resources of the forest, with the possible exception of leases for the exploration of oil and natural gas.
- The plan recognizes the scenic and recreational value of state forests. As such energy-related activities for biomass harvesting and shale gas exploration and production should take the recreational and open space value of Lycoming County's state forests into consideration.

The Bureau of Forestry prepared an update to the State Forest Resource Management Plan in 2003, adopted by the Pennsylvania Department of Conservation and Natural Resources in March 2004.
Several components of the State Forest Management Plan are relevant to energy planning in Lycoming County, particularly biomass energy.

Through a partnership with Penn State University, a new timber harvest planning system was developed that provides greater accuracy to the allocation of resources. Of the several goals listed in the plan, one is particularly relevant to energy planning. The silviculture/timbering goal is to demonstrate and promote silvicultural practices that sustain ecological and economic forest values. To achieve this goal, the County and the County conservation district would partner with the forest district to promote sustainable forestry that protects ecological and economic forest values.

Lycoming County Comprehensive Plan (2006), p. 7-12.

Three state forests are located in Lycoming County: Sproul State Forest, Tiadaghton State Forest, and Tioga State Forest. The District Management Plan gives special emphasis to the value of the state forests to the local economy stating, "the economy of the area in the vicinity of the forest has been and will most likely continue to be dependent on its land resources. Resource extraction and storage of natural gas provide a significant number of jobs."[4] Another reference to the natural gas and state forest lands refers specifically to the Tiadaghton State Forest: "There are no immediate plans to further develop the mineral resources on the Tiadaghton State Forest, with the possible exception of leases for the exploration of oil and natural gas."[5] The scenic value of the forests was clearly noted, in that the plan recognizes the state forest for both active and passive recreation. Energy-related activities for biomass harvesting and shale gas exploration and production should take the recreational and open space value of Lycoming County's state forests into consideration.

PINE CREEK WATERSHED RIVERS CONSERVATION PLAN

KEY FINDINGS

The Pine Creek Watershed Rivers Conservation Plan was adopted in October 2005 and references both natural gas extraction and renewable energy deployment.

- The plan notes several companies drilling deep, high-pressure gas wells in the Trenton-Black River formation which runs from New York to Kentucky and thought to include large supplies of natural gas in northcentral Pennsylvania under state forest lands.
- Brine contamination from drilling and impoundments associated with the formation was noted as a concern in the plan.
- The plan goes on further to state that the Pennsylvania Department of Conservation and Natural Resources (DCNR) has recognized the concerns and developed stringent lease requirements.
- The plan suggests that private landowners should seek advice from the Penn State Cooperative Extension Service before signing leases for exploration.
- Management options for potential impacts to the watershed included planning and zoning for intensive land uses such as CAFOs, oil and gas wells, and wind farms.

The Pine Creek Watershed Rivers Conservation Plan was adopted in October 2005 and includes municipalities in Clinton, Lycoming, Potter, and Tioga counties. The plan notes that several companies began successfully drilling deep, high-pressure gas wells in southern New York and in West Virginia from the Trenton-Black River formation. The Trenton-Black River formation runs from New York to Kentucky and was thought to be the location of large supplies of natural gas in north-central Pennsylvania under state forest lands. Brine contamination from drilling and impoundments associated with the formation, which is geologically older and deposited before the Marcellus Shale formation, was noted as a concern in the plan.

The plan goes on further to state that the Pennsylvania Department of Conservation and Natural Resources (DCNR) has recognized the concerns and developed stringent lease requirements. The plan suggests that private landowners should seek advice from the Penn State Cooperative Extension

[4] Lycoming County Comprehensive Plan (2006), p. 7-12.

[5] Ibid., p. 7-13.

Service and others before signing leases for exploration. Although the plan was written in 2005, activity in the Marcellus Shale was not yet occurring; therefore, it was not mentioned in the plan.

Management options for several potential impacts to the Pine Creek Watershed identified in the plan included planning and zoning by considering controls for potentially intensive land uses like CAFOs, resort development, oil/gas wells, wind farms, and cell towers.

ENERGY POLICY AND PROGRAMS

While a detailed energy policy is not in place at either the state or federal levels, many federal, state, and regional agencies and organizations are responsible for addressing energy-related issues. This section of the Energy Plan identifies those agencies and organizations that serve Lycoming County and details what services each delivers. A matrix summarizing the key organizations that provide energy-related services is located in Chapter 6 – Helpful Resources for Each Sector.

FEDERAL POLICY

Federal policy relating to energy has been evolving since the 1970s. The current administration's policies and programs are focused on reducing the nation's dependence on fossil fuels for both environmental and security reasons, transitioning to clean energy to reduce greenhouse gases and create jobs, and improve energy efficiency in transportation and buildings. The American Recovery and Reinvestment Act of 2009 (ARRA), the Partnership for Sustainable Communities, and the "Win the Future" Initiative (announced in February 2011) were the policy and program vehicles to implement the federal government's energy-related initiatives at the time this plan was written.

ARRA was enacted to promote investment, create jobs, reduce the impact of the recession, and lead to economic recovery. ARRA's domestic spending initiatives were focused on education, healthcare, infrastructure, and energy. It included numerous programs to improve energy efficiency, deploy renewable energy resources, and develop and apply new technologies in these areas. In Pennsylvania, energy programs funded by ARRA were administered by the Pennsylvania DEP and the Pennsylvania Department of Community and Economic Development (DCED). Additional ARRA funding was provided to Pennsylvania businesses through specific energy programs administered by the U.S. Department of Energy (DOE). Lycoming County schools, hospital, residents, and businesses received over $37 million in ARRA funding. Of this amount, $4.7 million was focused on energy efficiency and renewable energy deployment.

The Partnership for Sustainable Communities is a joint initiative of the U.S. Department of Housing and Urban Development (HUD), the U.S. Department of Transportation (DOT), and the U.S. Environmental Protection Agency (EPA) and was established in June 2009. The purpose of the partnership is to help communities across the nation improve access to affordable housing, increase transportation options, and lower transportation costs while protecting the environment. Working to coordinate federal housing, transportation, water, and other infrastructure investments to make neighborhoods more prosperous, the partnership will help people live closer to jobs, save households time and money, and reduce pollution. Six livability principles have been developed and incorporated into federal funding programs, policies, and future legislative proposals:

1. Provide more transportation choices. Develop safe, reliable, and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions, and promote public health.
2. Promote equitable, affordable housing. Expand location- and energy-efficient housing choices for people of all ages, incomes, races, and ethnicities to increase mobility and lower the combined cost of housing and transportation.
3. Enhance economic competitiveness. Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers, as well as expanded business access to markets.
4. Support existing communities. Target federal funding toward existing communities—through strategies like transit-oriented, mixed-use development and land recycling—to increase community revitalization and the efficiency of public works investments and safeguard rural landscapes.
5. Coordinate and leverage federal policies and investment. Align federal policies and funding to remove barriers to collaboration, leverage funding, and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.
6. Value communities and neighborhoods. Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.[6]

The livability principles provide federal policy guidance for energy sustainability and energy efficiency and are consistent with Pennsylvania's Keystone Principles for Growth, Investment and Resource Conservation adopted by Pennsylvania's Economic Development Cabinet in May 2005. The Keystone Principles will be further discussed under the state policy component of this section.

In his State of the Union address in February 2011, President Obama announced the "'Win the Future" initiative, focusing on the following principles: Out-Innovate, Out-Educate, and Out-Build. If funded through the passage of the federal budget, the initiative will target investments in clean energy technologies and doubling the amount of electricity derived for clean energy sources by 2035. The "Better Buildings" initiative is part of the overall strategy and includes new efforts to improve energy efficiency in commercial buildings across the country. Specifically, the "Better Buildings" initiative will be implemented to accomplish the following:

- Improve energy efficiency 20 percent by 2020 through cost-effective upgrades so commercial buildings will be 20 percent more energy efficient.
- Reduce business energy bills by approximately $40 billion annually by improving the energy efficiency of buildings, saving business owners money by reducing energy bills. This has been estimated as a $40 billion savings in current dollars.[7]

[6] Partnership for Sustainable Communities Web site, accessed September 26, 2011, http://www.sustainablecommunities.gov/aboutUs.html.

- Save energy by modifying incentives and working cooperatively with the private sector through the reform of existing tax and other incentives for commercial building retrofits and proposing a new competitive grant program.

As part of the "Better Buildings" initiative, Penn State University was designated as one of three Energy Regional Innovation Clusters (E-RICs) (or Energy Innovation Hubs) in the country. Penn State's Energy-Efficient Buildings System Design Hub will develop new technology to improve energy efficiency in buildings, helping to achieve the goal of reducing energy use in commercial buildings by 20 percent by 2020. Penn State will receive up to $122 million over the next five years to develop technologies to make buildings more energy efficient. The Energy Innovation Hub will be located at the Philadelphia Navy Yard Clean Energy campus, and will bring together leading researchers from academia, two U.S. National Laboratories, and the private sector in an ambitious effort to develop energy-efficient building designs that will save energy, cut pollution, and position the United States as a leader in this industry.

In addition to Penn State's Energy-Efficiency Buildings System Design Hub, two other E-RICs have been designated. California Institute of Technology's "Fuels from Sunlight" initiative will focus on finding new ways to improve solar energy efficiency, and the Oak Ridge National Laboratory's Modeling and Simulation for Nuclear Reactors will concentrate on re-establishing U.S. leadership in nuclear energy research and development.

New funding programs proposed pending the outcome of federal budget negotiations include the following:

- New tax incentives for building efficiency – Modifying the current tax deduction for commercial building upgrades to a credit as an incentive to encourage building owners and real estate investment trusts (REITs) to retrofit properties.
- Additional financing opportunities for commercial building retrofits – A pilot program through the DOE to guarantee loans for energy efficiency upgrades at hospitals, schools, and commercial buildings.
- "Race to Green" – This program will encourage state and municipal governments to increase energy efficiency and renewable energy projects by streamlining regulations, encouraging upgrades, and attracting private-sector investment.
- The Better Buildings Challenge – Businesses and educational institutions will be encouraged to promote energy efficiency, which will reduce operating costs and improve productivity. In return, those businesses and educational institutions will receive public recognition, technical assistance, and best-practices sharing through a network of peers.

[7] The White House, Office of Media Affairs, February 3, 2011 press release, "President Obama's Plan to Win the Future by Making American Businesses More Energy Efficient through the 'Better Buildings Initiative'."

- Training commercial building technology workers – Using existing authorities, a Building Construction Technology Extension Partnership will be launched and modeled on the Manufacturing Extension Partnership at the U.S. Department of Commerce, providing more workforce training in areas such as energy auditing and building operations.

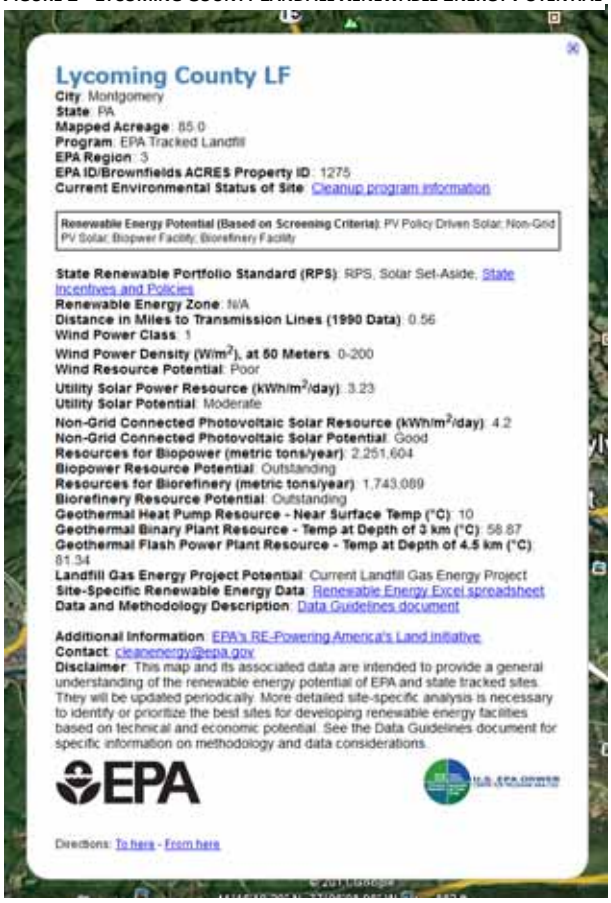
The federal government currently offers a number of programs including technical assistance and incentives to promote the adoption of energy-efficient technologies and practices as well as renewable energy resources. Federal energy funding and financing is broadly categorized by incentives for corporate deductions, exemptions, and credits; business and industry grant and loan programs; industry recruitment credits; and personal tax credits. The federal government also provides energy project funding for various technologies through the release of a Notice of Funding Availability (NOFA) through DOE, the U.S. Environmental Protection Agency (EPA), and DOT. A summary of federally funded programs is referenced throughout this section.

FEDERAL AGENCIES

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) AND U.S. DEPARTMENT OF ENERGY (DOE)

The DOE and EPA maintain primary responsibility for assessing existing and future energy sources through research, technical assistance, information sharing, development of standards, project facilitation, and funding support. The agencies offer programs that specifically address energy efficiency as well as renewable energy such as the National Renewable Energy Laboratory (NREL), the Office of Energy Efficiency and Renewable Energy (EERE), the Clean Energy Program, and the Landfill Methane Outreach Program (LMOP).

FIGURE 1 - LYCOMING COUNTY LANDFILL RENEWABLE ENERGY POTENTIAL



In an effort to encourage the redevelopment of contaminated lands with renewable energy sources, EPA Office of Solid Waste and Emergency Response (OSWER) and DOE's NREL have mapped opportunities for renewable energy generation on contaminated lands and mining sites in all 50 states using Google Earth. Mapping and associated data have been developed to identify the preliminary feasibility for the following types of mapped sites:

- Abandoned Mine Land
- Brownfields
- Resource Conservation and Recovery Act (RCRA)
- Federal Superfund
- Nonfederal Superfund
- Landfill

- Abandoned Coal Mine Areas (state tracked)
- Non-coal Orphaned Mineral Mines (state tracked)

While this mapping has been developed for targeted sites, it provides an overall assessment of renewable energy potential. As an example, Figure 1 shows the energy resource potential data for the Lycoming County Landfill.

ENERGY STAR is a joint program of the EPA and DOE, helping all sectors to save money and protect the environment through energy-efficient products and practices. For purposes of benchmarking energy consumption and energy efficiency, ENERY STAR has become a highly recognized name and a valuable tool. It is widely used by agencies, local governments, and businesses as a technical resource on energy efficiency and a tool to benchmark strides toward energy efficiency progress.

The EPA introduced ENERGY STAR in 1992 as a voluntary labeling program to identify and promote energy-efficient products to reduce greenhouse gas emissions, with computers and monitors the first labeled products. Through 1995, the EPA expanded the label to additional office equipment products and residential heating and cooling equipment. In 1996, the EPA partnered with DOE for certain product categories, and today the ENERGY STAR label appears on major appliances, office equipment, lighting, and home electronics. The EPA has also extended the label to cover new homes and commercial and industrial buildings.

Through partnerships with over 17,000 private and public-sector organizations, ENERGY STAR delivers technical information and tools that organizations and consumers need to choose energy-efficient solutions and best management practices. “ENERGY STAR has successfully delivered energy and cost savings across the country, saving businesses, organizations, and consumers about $17 billion in 2009 alone.”[8]

Particularly for the residential sector, ENERGY STAR certification through energy efficiency is one of the most recognizable energy programs in the country. ENERGY STAR-certified homes are at least 15 percent more energy efficient than homes built to the 2004 International Residential Code (IRC) and include additional energy-saving features that typically make them 20 to 30 percent more efficient than standard homes. In addition to making homes more energy efficient, through ENERGY STAR’s Portfolio Manager an organization can track and assess energy and water consumption across all buildings online. Portfolio Manager is an interactive energy management tool that can help establish energy investment priorities, identify under-performing buildings, verify efficiency improvements, and receive EPA recognition for superior energy performance. Through Portfolio Manager, ENERGY STAR provides

8 ENERGY STAR Web page, accessed January 28, 2011, http://www.energystar.gov/index.cfm?c=about.ab_history.

benchmarking and certification tools for Government, Healthcare, Higher Education, K-12 Schools, Hospitality/Entertainment, Industrial, Real Estate/Multifamily, Retail, Small Business, Congregations, Service and Products Providers, Utilities and Energy Efficiency Program Sponsors, and Water/Wastewater Utilities.

The National Association of Counties (NACo) helps counties benchmark buildings in Portfolio Manager by creating Portfolio Manager accounts, entering building information into Portfolio Manager, conducting training, and providing on-going technical assistance. Lycoming County has worked with NACo and the County Courthouse is benchmarked in Portfolio Manager.

ENERGY STAR-labeled schools cost 40 cents per square foot less to operate than non-labeled schools. There are currently 143 ENERGY STAR-labeled schools in Pennsylvania. Ashkar Elementary School in the East Lycoming School District has received an ENERGY STAR label.

Through the Energy Conservation in Existing Buildings Act of 1976, Title IV of the Energy Conservation and Production Act (referred to as "the Act"), DOE is authorized to establish a Weatherization Assistance Program to help low-income households, elderly citizens, or the disabled, to decrease energy consumption and energy costs. The focus of the program is to reduce national energy consumption and to reduce the impact of higher fuel costs on low-income families. Funds are provided to facilitate energy conservation measures such as building air sealing, hot water conservation measures, attic and foundation insulation, heating system modifications, and electric base load measures. DOE allocates the regular weatherization assistance by a formula that considers relative need for weatherization assistance among the states. ARRA funds were also made available in 2009 to provide additional weatherization assistance. This funding is administered in Pennsylvania through DCED and is discussed later in this chapter.

DOE recently launched the Energy Information Portal (http://techportal.eere.energy.gov/) to link energy technologies with market opportunities. The portal includes opportunities for businesses and educational institutions to identify new technologies, build businesses through licensing of technology developed by DOE laboratories and research institutions, and fulfill energy market business plans. The portal includes over 500 summaries of technology marketing opportunities, close to 12,000 technology patent abstracts, nearly 4,000 technology patent application abstracts, and research on emerging technologies.

Finally, DOE has funded the development of an online tool to track state and federal energy incentives found at http://dsireusa.org/. The Database of State Incentives for Renewables and Efficiency (DSIRE) is funded by DOE and maintained by the North Carolina Solar Center and the Interstate Renewable Energy Council.

U.S DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT

Through the Partnership for Sustainable Communities, HUD has provided technical assistance and funding to make certain that energy-efficient housing choices are available for all citizens, to reduce energy consumption and promote energy efficiency. Through its Office of Sustainable Housing and Communities, HUD awarded nearly $100 million in October 2010 through the Sustainable Communities Regional Planning Grant Program to support development and implementation of regional plans that integrate affordable housing with neighboring retail and business development. HUD, in conjunction with DOT, also awarded $20 million in October 2010 through the Sustainable Community Challenge Planning Grant Program, to be used by large and small communities to address local challenges to integrating transportation and housing.

A second round of both the Sustainable Communities Regional Planning Grant and Sustainable Community Challenge Planning Grant Program, totaling $95 million, was opened during the third quarter of 2011.

In addition, $2.5 million in Sustainable Communities Research Grant (SCRG) Program funding was awarded in September 2011 to support efforts in the research community to build on existing evidence-based studies in sustainability. SCRG funding is intended to fill information gaps and begin to develop and evaluate policy that communities can use to aid in decision making about investments such as affordable housing and preservation, transportation and infrastructure planning, healthy community design, and green and energy-efficient practices.

Finally, HUD's Office of Affordable Housing Preservation issued a NOFA in the third quarter of 2011 for the Multifamily Energy Innovation Fund. Awards of up to $25 million in grants will be used for energy efficiency upgrades at multifamily properties. The funding program has the following goals:

- Demonstrate solutions to the primary and longstanding challenges to implementing energy efficiency and renewable energy improvements in existing affordable multifamily properties.
- Leverage private capital and additional public funding to demonstrate "proof of concept" of specific models.
- Conduct applied research to document and disseminate mainstream, scalable approaches to retrofitting affordable multifamily properties.

According to HUD, the objective of the Energy Innovation Fund is to help establish a home energy retrofit market across the country by "accelerating private investment in cost-saving energy efficiency retrofits in the residential sector. Innovative and replicable strategies to improve the usefulness of existing HUD programs—as well as developing new financing tools—will lead to significant reductions in energy consumption, operating costs, and the carbon footprint of both affordable and market-rate housing."[9]

9 U.S. Department of Housing and Urban Development Web page, accessed September 26, 2011, http://portal.hud.gov/hudportal/HUD?src=/program_offices/sustainable_housing_communities/Multifamily_Energy_Innovation_Fund_NOFA.

U. S. DEPARTMENT OF AGRICULTURE

The U.S. Department of Agriculture (USDA) provides energy efficiency technical assistance and funding through three divisions: Rural Development, the Farm Service Agency (FSA), and Natural Resource Conservation Service (NRCS).

With resources for technical assistance and funding through the most recent Farm Bill (the Food, Conservation and Energy Act of 2008), there are resources available for Pennsylvania's agricultural industry to improve energy efficiency and advance renewable energy deployment. The 2008 Farm Bill sets policy for federal agriculture and related programs for the next five years and includes 15 titles, including one title dedicated to Energy.

The Energy Title expands and adds new initiatives to encourage production, use, and development of biobased and other renewable energy sources. The 2008 Farm Act also includes a number of tax provisions, including several related to biofuels. Among these are a temporary production tax credit for cellulosic biofuels, reduction in the tax credit for ethanol after the Renewable Fuel Standard for ethanol is reached, and an extension of the additional duty on ethanol imported for fuel use through 2010.

USDA Rural Development works with rural communities across the country, providing technical and financial support for public facilities and services such as water and sewer systems, housing, health clinics, emergency service facilities, and electric and phone service. Rural Development offers technical assistance and information to help agricultural producers and cooperatives get started and improve the energy efficiency and effectiveness of operations. The FSA provides technical assistance and funding sources to improve economic opportunity for the agricultural industry across the country. NRCS provides technical and financial assistance on a voluntary basis to farmers and landowners who want to address natural resource concerns on their land, such as soil erosion and water quality issues. NRCS has developed four energy tools designed to increase energy awareness in agriculture and to help farmers identify where they can reduce their energy costs. Energy Estimators have been developed for Animal Housing, Irrigation, Nitrogen, and Tillage.

1. Energy Estimator for Animal Housing. Estimates potential energy savings associated with animal housing operations, lighting retrofits, and ventilation and heating costs. It also evaluates major energy costs with lighting, air circulation, milk cooling, water heating, and milk harvesting costs for a typical dairy.
2. Energy Estimator for Irrigation. Estimates potential energy savings associated with pumping water for irrigation. NRCS technical specialists developed this model to integrate general technical information for farm-specific crops and energy prices.
3. Energy Estimator for Nitrogen. Calculates the potential cost-savings related to nitrogen use on farms. NRCS agronomists developed this model to integrate general technical information on nitrogen use with farm-specific information on fertilizer types, costs, timing, and placement.
4. Energy Estimator for Tillage. Estimates diesel fuel use and costs in the production of key crops in 74 Crop Management Zones (CMZs) across the country and compares potential energy savings between conventional tillage and alternative tillage systems. The crops covered are limited to the most prevalent crops in each of the CMZs. Agronomists have identified these crops and estimated the fuel use associated with common tillage systems. The Energy Estimator estimates the magnitude of diesel fuel savings under different levels of tillage.

Several USDA funding sources address energy efficiency and renewable energy deployment on U.S. farms. The energy-related programs that are agriculture related include the Rural Energy for America Program (REAP), the Farm Storage Facility Loan (FSFL) Program, the Biomass Crop Assistance Program, and the Environmental Quality Incentives Program (EQIP). In addition, USDA announced that $25 million was available through NRCS for the Conservation Innovation Grants (CIGs) program to address natural resource concerns nationwide, with a special emphasis on the Chesapeake Bay Watershed and the Mississippi River Basin.

To offset the costs of an energy audit for farmers, NRCS can provide reimbursable grant funds through the EQIP. After an energy audit is complete, there may be opportunities to leverage additional USDA funding sources to implement recommended energy audit improvements. While no Lycoming County farms have taken advantage of EQIP funding for energy audits, approximately 10 Lycoming County agricultural businesses have taken advantage of the REAP and FSFL programs.

An additional initiative developed through a partnership between USDA, EPA, and DOE is AgSTAR. AgSTAR is an outreach program designed to reduce methane emissions from livestock waste management operations by promoting the use of biogas recovery systems. AgSTAR provides information and technical assistance to promote biogas recovery, including information and tools designed to assist producers in the evaluation and implementation of these systems, including the following:

- Convening farm digester extension events and conferences
- Providing project development tools and industry listings
- Conducting performance analysis on digesters and conventional waste management systems
- Providing farm recognition for voluntary environmental initiatives
- Collaborating with federal and state renewable energy, agricultural, and environmental programs

AgSTAR also maintains an online database of Operating Anaerobic Digester Projects at http://www.epa.gov/agstar/projects/index.html. No Lycoming County projects were listed on the AgSTAR database as of the date the Energy Plan was finalized. However, a working group has been meeting on a regular basis to discuss biodigester projects in the region (see Chapter 4).

APPALACHIAN REGIONAL COMMISSION

Fifty-two of Pennsylvania's 67 counties are served by the Appalachian Regional Commission (ARC) through seven Local Development Districts (LDDs). LDDs provide services such as community and economic development, transportation, international trade, strategic planning, and most recently, energy assistance throughout Appalachia. SEDA-COG is the 11-county LDD that serves Lycoming County.

ARC created an energy blueprint for Appalachia in 2006 to provide a framework for promoting energy-related job opportunities through the stimulation of sustainable energy production, efficiency, and innovation efforts. One of the plan's objectives is to support the development of conventional energy resources, especially advanced clean coal, in Appalachia to produce alternative transportation fuels,

electricity, and heat.[10] Pennsylvania's Alternative Energy Portfolio Standards, discussed later in this chapter, are highlighted as a best practice for including several renewable energy sources.[11]

Pennsylvania's LDDs have developed a specific focus on energy efficiency through the Pennsylvania Energy Partnership. Through this initiative, local governments, schools, and non-profits are provided with education and technical assistance to reduce operating costs and energy consumption through utility bill analysis, energy assessment, workshops, and energy aggregation. SEDA-COG Energy Resource Center (ERC) provides many services to its 11-county region through this initiative, as discussed in this section under Technical Assistance.

Through the Renewable Energy and Energy Efficiency Grant competition, ARC has funded 39 projects totaling nearly $2 million in the areas of renewable energy production, energy-efficient facilities, green business financing programs, and workforce training and certification programs through energy grant competitions. Grantees include K-12 schools, vocational schools, community colleges, non-profits, and universities. Five awards have been made in Pennsylvania, with two awarded to SEDA-COG ERC, as discussed later in this chapter.

Most recently, ARC has implemented guidance to ensure that ARC-funded construction projects incorporate energy efficiency. Under the *Energy Efficiency Guidance for ARC Construction Projects*, grant proposals are required to "discuss the energy efficient features of the project; and/or describe efforts made to improve the energy efficiency of the project, including a discussion of features that were considered but were not included."[12] Specifics regarding technology, design, and materials are included in ARC's guidance.

10 Appalachian Regional Commission, *Energizing Appalachia: A Regional Blueprint for Economic and Energy Development* (October 2006), p. 19.

11 Ibid., p. 21.

12 Appalachian Regional Commission, *Energy Efficiency Guidance for ARC Construction Projects*, 2011.

PENNSYLVANIA STATE POLICY

In January of 2011, Tom Corbett became Pennsylvania's 46th governor. The governor's energy strategy proposed in the fall of 2010 included developing of a blend of energy resources. The policy proposal involves five interrelated strategies and includes the following:

- The growth of the state's energy infrastructure, including new electric generating plants, intrastate pipelines to increase the ease with which natural gas from the Marcellus Shale play is brought to market, modernization of the energy grid, and provisions for smart meters
- Encouraging renewable, alternative clean energy through the enforcement of the alternative energy portfolio program, competitive markets to stimulate the growth of alternative energy resources, support for coal-to-liquid (ctl), gas-to-liquid (gtl), nuclear, and biodiesel sectors
- Encouraging job training for the alternative energy sector and offering "regulatory stability" to support private investment
- Cultivating Pennsylvania's natural gas and coal resources that include the development of Marcellus Shale gas resources, growing coal mining using advancements in technology, and improved permitting review processes
- Preparing Pennsylvanians to benefit from the complete transition to deregulated energy consumption
- Restructuring the DEP to return to its core regulatory mission[13]

PENNSYLVANIA POLICY - MARCELLUS SHALE

One of the first actions taken by Governor Corbett to address an energy strategy was the designation of an Energy Executive to coordinate energy-related policy and initiatives throughout state agencies. Lycoming County welcomed the participation of the governor's Energy Executive at the Energy Plan Workshop held in May 2011.

Several of the policy proposal components proposed in the fall of 2010 have been implemented. DEP was restructured in September 2011, providing greater alignment between DEP's Central Office in Harrisburg and DEP's six regional offices throughout the Commonwealth. A separate Office of Oil and Gas was established to ensure that the oil and gas industry is administered uniformly as well as establishing training and outreach for agency staff, the regulated community, local governments, and the public.

To implement the energy strategy, Governor Corbett issued Executive Order 2011-01 on March 8, 2011, which created the Governor's Marcellus Shale Advisory Commission (Advisory Commission). The Advisory Commission was formed to "develop a comprehensive, strategic proposal for the responsible and environmentally sound development of Marcellus Shale."[14] Through the Executive Order, the Advisory Commission was charged with issuing a final report detailing its results. The final report, issued

13 "Tom Corbett's Plan to Grow our Energy Infrastructure," accessed December 21, 2010, http://www.tomcorbettforgovernor.com/issues/energy-infrastructure/.

14 Commonwealth of Pennsylvania, Governor's Office, Executive Order Number 2011-01, Creation of Governor's Marcellus Shale Advisory Commission, March 8, 2011.

on July 22, 2011, contained 96 recommendations–approximately 50 of which are policy oriented—that can be carried out by state agencies. The remaining recommendations would require legislative changes. Several of the recommendations are particularly relevant to Lycoming County. These recommendations are summarized as follows:

- Recommendation 9.1.3. To relieve the burden imposed upon roads and bridges from the transportation of sand, water, pipe, and other commodities associated with natural gas development, the Commonwealth should prioritize the utilization of its financial resources to evaluate and potentially expand its rail freight facilities and capabilities, and partner with rail authorities to seek federal rail assistance funding, such as the Transportation Investment Generating Economic Recovery (TIGER) program.

Lycoming County, along with the SEDA-COG Joint Rail Authority, participated in the preparation of a successful TIGER II application. The award totaled $10 million and included several Lycoming County rail improvement projects along the LVRR. Lycoming County will continue to seek financial resources to improve transportation infrastructure Countywide.

- Recommendation 9.2.32. DCNR should monitor and document effects, both positive and negative, of natural gas development on plants and forests, wildlife, habitat, water, soil, and recreational resources.

Lycoming County is in the process of documenting and monitoring the impacts of shale gas development on such resources.

- Recommendation 9.2.33. The Commonwealth and its agencies should work together to promote, encourage, and establish regular communications and information sharing among local communities, operators, environmental and conservation groups, and other stakeholders.

Lycoming County has already implemented a similar recommendation by creating the Community Gas Exploration Task Force in 2008.

- Recommendation 9.2.35. Identify legislative/regulatory changes needed to
    - Effect the sharing of pipeline capacity and reduce surface disturbance and associated environmental impacts;
    - Encourage the use of existing pipeline infrastructure and co-location with other rights-of-way;
    - Achieve coordination and consistency of infrastructure planning and siting decisions by state, county and local governments; and
    - Provide sufficient authority and resources for appropriate government agencies to ensure that ecological and natural resource data are used in the review and siting of proposed pipelines, in order to avoid or minimize impacts to these resources.

Lycoming County has and will continue to review its land use regulations to respond to each of these items.

- Recommendation 9.3.1. Oil and gas well pads and related facilities should be assigned a 9-1-1 address for emergency response purposes, and oil and gas operators should be required to provide GPS coordinates for access roads and well pad sites, and post this information, along with

appropriate emergency response contact information, in a conspicuous manner at the well pad site or related facilities, including but not limited to compressor stations, launching equipment sites, impoundments, and tank batteries.

Lycoming County established a 9-1-1 addressing system in 1996, therefore all oil and gas wells have addresses.

- Recommendation 9.3.9. Based upon the testimony presented, research conducted, and firsthand personal experiences, the Commission recommends the enactment of–or authorization to impose a fee for–the purpose of mitigating and offsetting the uncompensated portion of demonstrated impacts borne by the citizens and local governments of the Commonwealth attributable to unconventional natural gas development.

Lycoming County is supportive of a local impact fee to help address unintended negative impacts of shale gas drilling and support positive impacts such as business development and expansion. The County is in the process of developing the methodology to quantify the impacts of shale gas drilling. These impacts include but are not limited to those identified on page 114 of the Commission's report.

- Recommendation 9.4.5. Pennsylvania should develop "Green Corridors" for natural gas-fueled vehicles, including CNG and Liquefied Natural Gas (LNG) fueling stations, located at least every 50 miles and within two miles of designated highways.

River Valley Transit and partners, including PCD, submitted an AFIG application to DEP. The project was awarded $400,000 in October 2011 to help fund a CNG fueling station. This investment will help implement the "Green Corridors" recommendation. In addition, River Valley Transit received a $3.5 million Federal Transit Administration (FTA) Clean Fuels Grant for the construction of the CNG fueling station and purchase of transit buses which will also help implement the "Green Corridors" recommendation.

- Recommendation 9.4.7. Create financial incentives for the conversion of mass transit and school bus fleets to natural gas, as well as for the manufacture of engines and other component parts, utilizing funding sources such as the AFIG fund.

One of the Energy Plan strategic actions is the creation of an incentive program, *Lycoming Energy Now*, to assist business attraction and expansion in Lycoming County. This funding source could be used for businesses using natural gas in their processes or manufacturing parts to be used for the natural gas industry.

- Recommendation 9.4.13. The Commonwealth should incentivize the development of intrastate natural gas pipelines to ensure the in-state use of Marcellus Shale and to lower costs to consumers through the avoidance of interstate pipeline transmission costs.

Lycoming County may wish to evaluate the development of intrastate natural gas lines as part of the Energy Plan's recommendations.

- Recommendation 9.4.14. The Commonwealth should seek to attract and encourage the siting of facilities such as ethylene processing plants for the development of value-added gas by-products.

Through a supplemental report, Lycoming County could evaluate the appropriateness of siting facilities for the development of value-added gas by-products as one of the Energy Plan's recommendations.

- Recommendation 9.4.15. DCED should work closely with its regional economic development partners and gas producers to increase the number of existing manufacturing firms participating in the shale gas industry in Pennsylvania by helping suppliers adapt their products, meet industry standards, market their services and resources, and identify qualified suppliers.

This recommendation is being accomplished through the Williamsport-Lycoming Chamber of Business and Industry.

- Recommendation 9.4.16. The Commonwealth should work with the natural gas industry to identify future employment opportunities, and partner with academic institutions, including trade and technical schools, to develop and disseminate curriculum and training needed to educate and provide employment opportunities for Pennsylvania workers.

As part of the Energy Plan's recommendations, Lycoming County could develop an energy outreach strategy to ensure citizens are aware of energy-related educational opportunities.

- Recommendation 9.4.22. Pennsylvania should undertake a comprehensive effort to develop and disseminate educational material and curriculum for use in primary and secondary education institutions regarding the development, extraction, and uses of natural gas within the Commonwealth, drawing upon expertise from within industry, environmental, public health, academic, government, and other sectors.

As part of the Energy Plan's recommendations, Lycoming County could work with educational institutions to promote energy-related academic instruction for students in all grade levels.

In October 2011, Governor Corbett announced plans to implement several of the recommendations of the Marcellus Shale Advisory Commission, many of which will positively impact Lycoming County and its municipalities.[15] The implementation proposal is includes revised well drilling standards to provide increased protection to the public, health, and safety of Lycoming County residents and the environment and a local impact fee used to fund local and state expenses related to shale gas development.

Local level impact fees could potentially be used to fund:

- Construction, repair, and maintenance of roads, bridges, and other public infrastructure
- Water, stormwater, and sewer system construction and repair
- Emergency response preparedness, training, equipment, responder recruitment
- Preservation and reclamation of surface and subsurface water supplies
- Records management, geographic information systems, and information technology

[15] Commonwealth of Pennsylvania, Governor's Office, press release dated October 3, 2011.

- Projects that increase the availability of affordable housing to low-income residents
- Delivery of social services, including domestic relations, drug and alcohol treatment, job training, and counseling
- Offsetting increased judicial system costs, including training
- Assistance to county conservation districts for inspection, oversight enforcement of natural gas development
- County or municipal planning

Implementing the well drilling standards will provide increased protection to the public, health, and safety of Lycoming County residents and the environment, while impact fee funding will be extremely useful to address each of the items noted above.

Governor Corbett's proposal also addresses energy security and independence by advancing "Green Corridors" for natural gas vehicles, with refueling stations at least every 50 miles and within two miles of key highways, amending the Pennsylvania Clean Vehicles Program to include bi-fuel diesel and natural gas vehicles, and conversion of fleets to natural gas. The proposal also includes downstream benefits of using natural gas to generate electricity and encouraging the development of natural gas markets and natural gas by-products within industrial sectors.

DEP addressed the Pennsylvania Clean Vehicles Program in December 2011 by issuing technical guidance on Natural Gas Vehicle (NGV) conversion systems. The guidance clarifies that natural gas conversions are authorized under the Pennsylvania Clean Vehicles Program. In 2006 Pennsylvania adopted low-emission vehicle standards based on the California Air Resources Board (CARB) regulations. DEP issued the technical guidance as the program did not address alternative fuel conversion systems.

KEYSTONE PRINCIPLES

Governor Ed Rendell spearheaded several energy-related initiatives and legislation during his tenure as Governor. The Keystone Principles for Growth, Investment and Resource Conservation provide guiding principles and criteria to advance sustainable economic development and resource conservation. Adopted in 2005, the Keystone Principles were developed by the Interagency Land Use Team composed of officials representing key state agencies associated with community and economic development, environmental protection and conservation, and transportation. The principles establish general goals and objectives for economic development and resource conservation agreed upon among by the Interagency Land Use Team, while the criteria were designed to help measure the extent to which particular projects accomplish these goals. The Keystone Principles have been used by state agencies as guiding policy in developing initiatives and programs. The Keystone Principles are as follows:

1. Redevelop First. Support revitalization of Pennsylvania's many cities and towns. Give funding preference to reuse and redevelopment of "brownfield" and previously developed sites in urban, suburban, and rural communities for economic activity that creates jobs, housing, mixed use development, and recreational assets. Conserve Pennsylvania's exceptional heritage resources. Support rehabilitation of historic buildings and neighborhoods for compatible contemporary uses.

2. Provide Efficient Infrastructure. Fix it first: use and improve existing infrastructure. Make highway and public transportation investments that use context sensitive design to improve

existing developed areas and attract residents and visitors to these places. Provide transportation choice and intermodal connections for air travel, driving, public transit, bicycling and walking. Increase rail freight. Provide public water and sewer service for dense development in designated growth areas. Use on-lot and community systems in rural areas. Require private and public expansions of service to be consistent with approved comprehensive plans and consistent implementing ordinances.

3. Concentrate Development. Support infill and "greenfield" development that is compact, conserves land, and is integrated with existing or planned transportation, water and sewer services, and schools. Foster creation of well-designed developments and walkable, bikeable neighborhoods that offer healthy life style opportunities for Pennsylvania residents. Recognize the importance of projects that can document measurable impacts and are deemed "most-ready" to move to successful completion.

4. Increase Job Opportunities. Retain and attract a diverse, educated workforce through the quality of economic opportunity and quality of life offered in Pennsylvania's varied communities. Integrate educational and job training opportunities for workers of all ages with the workforce needs of businesses. Invest in businesses that offer good paying, high quality jobs, and that are located near existing or planned water & sewer infrastructure, housing, existing workforce, and transportation access (highway or transit).

5. Foster Sustainable Businesses. Strengthen natural resource based businesses that use sustainable practices in energy production and use, agriculture, forestry, fisheries, recreation and tourism. Increase our supply of renewable energy. Reduce consumption of water, energy and materials to reduce foreign energy dependence and address climate change. Lead by example: support conservation strategies, clean power and innovative industries. Construct and promote green buildings and infrastructure that use land, energy, water and materials efficiently. Support economic development that increases or replenishes knowledge-based employment, or builds on existing industry clusters.

6. Restore and Enhance the Environment. Maintain and expand our land, air and water protection and conservation programs. Conserve and restore environmentally sensitive lands and natural areas for ecological health, biodiversity and wildlife habitat. Promote development that respects and enhances the state's natural lands and resources.

7. Enhance Recreational and Heritage Opportunities. Maintain and improve recreational and heritage assets and infrastructure throughout the Commonwealth, including parks & forests, greenways & trails, heritage parks, historic sites & resources, fishing and boating areas and game lands offering recreational and cultural opportunities to Pennsylvanians and visitors.

8. Expand Housing Opportunities. Support the construction and rehabilitation of housing of all types to meet the needs of people of all incomes and abilities. Support local projects that are based on a comprehensive vision or plan, have significant potential impact (e.g., increased tax base, private investment), and demonstrate local capacity, technical ability and leadership to implement the project. Coordinate the provision of housing with the location of jobs, public transit, services, schools and other existing infrastructure. Foster the development of housing, home partnerships, and rental housing opportunities that are compatible with county and local plans and community character.

9. Plan Regionally; Implement Locally. Support multi-municipal, county and local government planning and implementation that has broad public input and support and is consistent with these principles. Provide education, training, technical assistance, and funding for such planning and for transportation, infrastructure, economic development, housing, mixed use and conservation projects that implement such plans.

10. Be Fair. Support equitable sharing of the benefits and burdens of development. Provide technical and strategic support for inclusive community planning to ensure social, economic, and environmental goals are met. Ensure that in applying the principles and criteria, fair consideration is given to rural projects that may have less existing infrastructure, workforce, and jobs than urban and suburban areas, but that offer sustainable development benefits to a defined rural community.[16]

ALTERNATIVE ENERGY PORTFOLIO STANDARDS ACT OF 2004

Pennsylvania's Energy Independence Strategy was developed to reduce the Commonwealth's diversified energy sources in an effort to protect the environment, reduce energy costs, protect consumers from price fluctuations, create jobs, and grow the Commonwealth's economy. The Energy Independence Strategy is supported by the Pennsylvania Energy Investment Act of July 2008, which provided $650 million in grants and loans to implement the outlined strategy. These included funding for energy efficiency, renewable energy, high-performance building, alternative fuels, public education and outreach as well as training. Specific Energy Independence Strategy funding programs are discussed later in this chapter.

Tier 1

- *Solar photovoltaic energy*
- *Solar thermal*
- *Wind power*
- *Low-impact hydropower*
- *Geothermal energy*
- *Biologically derived methane gas*
- *Fuel cells*
- *Biomass energy*
- *Coal mine methane*
- *Black liquor*
- *Large-scale hydropower*

The Pennsylvania Alternative Energy Portfolio Standards (AEPS) Act of 2004 and Act 129 of 2008 are also part of the Commonwealth's Energy Independence Strategy. The Alternative Energy Portfolio Standards Act (Act 213) requires that electricity sold to retail customers in Pennsylvania by electric distribution companies (EDCs) and electric generation suppliers include specified percentages of energy generated from alternative energy sources. The amounts of alternative energy required gradually increases over 15 years. Act 213 does not specify the type or quantity of alternative energy resources but it does establish Tier 1 and Tier 2 energy resources, as shown in the inserts on this page.

Tier 2

- *Waste coal*
- *Distributed generation systems*
- *Demand-side management*
- *Large-scale hydropower*
- *Generation of electricity from wood processing*
- *Integrated combined coal gasification technology*

[16]Pennsylvania Historical and Museum Commission, accessed September 26, 2011, http://www.phmc.state.pa.us/bhp/pkp.pdf.

EDCs and electric generation suppliers can comply with Act 213 by purchasing Alternative Energy Credits (AECs) from qualified alternative energy resource facilities. Each AEC is issued for each megawatt hour (mWh) (equal to 1000 kilowatt hours [kWh]) of generation from a qualified alternative energy system. According to information provided by Clean Power Markets, Pennsylvania's Alternative Energy Credit Program Administrator as contracted by Public Utility Commission (PUC), there are a total of 38 qualified alternative energy resource facilities in Lycoming County.[17]

Act 213 requires that 8 percent of all retail electricity sold by 2021 comes from Tier 1 and Tier 2 sources: less than the requirements established in a few other states. For example, Maryland has a renewable requirement of 20 percent by 2022; New Jersey – 22.5 percent by 2021, and Illinois – 25 percent by 2025.[18]

ACT 129 OF 2008

The passage of Act 129 of 2008 required Pennsylvania's 7 major EDCs to enact Energy Efficiency and Conservation strategies and reduce peak demand across Pennsylvania. Several Mid-Atlantic and Northeastern states have joined Pennsylvania in adopting similar strategies: Connecticut, Maryland, New Jersey, New York, North Carolina, Ohio, Vermont, and Virginia.

The major provisions of Act 129 include the following:

- 3 percent reductions in electricity consumption by 2013
- Peak load reduced by 4.5 percent by 2013
- Smart meters installed statewide within 15 years
- Voluntary, flexible electricity pricing schedules to consumers

A few state agencies provide technical and financial assistance to advance renewable energy deployment and energy efficiency strategies. Grant, low-interest loan, and loan guarantee programs are administered through DCED and DEP that can be used to finance energy efficiency improvements and renewable energy projects for citizens, government, and industry. Each agency's energy programs are noted in the following summaries and in the Financial Assistance section of this chapter.

[17] According to a phone conversation with Clean Power Markets, Inc. project manager, this information is self-reported; therefore, the actual number of qualified alternative energy resource facilities in Lycoming County may vary slightly. (March 4, 2011).

[18] Pennsylvania Department of Environmental Protection Web site, accessed March 3, 2011, http://www.portal.state.pa.us/portal/server.pt/community/strengthening_our_energy_independence/19175.

COMMONWEALTH OF PENNSYLVANIA AGENCIES

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION (DEP)

Pennsylvania DEP's recent reorganization (September 2011) moves the department's energy functions from the Office of Energy and Technology Deployment to the Office of Pollution Prevention and Energy Assistance within the newly created External Affairs Deputate. The focus of the office will be to foster and develop alternative energy, and work with DEP's regional staff on outreach to achieve increased pollution prevention, energy efficiency, and improved compliance. Pennsylvania's State Energy Office will be housed within this deputate. While the future of several recent energy funding programs and initiatives discussed in this section are uncertain, technical assistance that has been provided by DEP to businesses and communities will continue. DEP provides technical outreach, education, and public funding focused on energy efficiency and renewable energy strategies.

DEP's Northcentral Regional Office in Williamsport employs professionals who provide local government and energy-related support to Lycoming County. DEP also maintains working relationships with Pennsylvania's local government organizations to advance renewable energy efforts such as the Governor's Solar Working Group, which developed *Solar Energy Systems: A Guide for Pennsylvania Municipal Officials* in 2009. This document discusses the importance of solar energy for Pennsylvania's local governments and includes a model solar ordinance developed collaboratively with the Governor's Office, DEP, Pennsylvania State Association of Township Supervisors, Pennsylvania State Association of Boroughs, Pennsylvania League of Cities and Municipalities, County Commissioners Association of Pennsylvania, Pennsylvania Municipal Authorities Association, and the Pennsylvania School Boards Association.

DEP's Local Government Greenhouse Gas Pilot Grant Program provided funding for select municipalities to develop greenhouse gas inventories and action plans to reduce emissions. An inventory can tabulate total emissions from direct and indirect activities, while an action plan, or mitigation plan, offers specific recommendations tailored to the needs of the community to reduce its carbon emissions. The goal of the pilot program was to improve municipal energy efficiency and reduce energy costs in order to yield additional long-term savings. When the greenhouse gas inventories and mitigation plans of the pilot program have been completed, the results will be posted to DEP's Web site. No Lycoming County municipalities were included in the pilot program.

The Governor's Green Government Council (GGGC), established by executive order in 1998, is located within DEP and charged with helping state government incorporate environmental sustainability into policymaking and operations. The GGGC works with all levels of government to support green energy production consistent with the passage of the Alternative Energy Portfolio Standards Act and to promote green building design and development in public buildings, including schools. The GGGC has developed a list of online resources useful to develop a green building policy. This list is incorporated into a directory of online energy resources located in Appendix A.

Several Lycoming County energy projects for businesses, schools, non-profits, and local governments have been funded under DEP programs, including Pennsylvania Energy Development Authority (PEDA) funding (both annual program funding and ARRA funding), Small Business Advantage Grant, Small Business Energy Efficiency Grant (part of Pennsylvania's Alternative Energy Investment Fund), and Keystone Home Energy Loan Programs (HELP). Over $2.9 million has been awarded to Lycoming County grant recipients over the past 5 years, not including 71 loans made to Lycoming County homeowners through Keystone HELP.[19] PA Sunshine Solar Program helps to offset the costs of solar electric (solar photovoltaic), solar hot water (solar thermal) projects, and battery back-up systems for homeowners and small businesses. To date, Lycoming County residents and small businesses have not been awarded funding through PA Sunshine. A description of each funding source is included in Appendix B.

DEP's Environmental Education and Information Center has developed energy curriculum for K–12 educators and conducts an Introductory Alternative Energy Educator's Workshop. The workshop includes curriculum that introduces concepts of energy efficiency, demand reduction, and alternative energy strategies. The day-long program has been in place since 2006, includes approximately 30 educators or non-formal educators per session, and is conducted in approximately 3 to 4 locations across Pennsylvania annually. To offset costs associated with environmental and energy education, DEP administers an Environmental Education Grant Program. Funded through the Environmental Education Act of 1993, the focus of the grant program is to educate the public about local and regional environmental issues including sustainable energy sources and technologies such as solar, wind, hydropower, micro-hydropower, biomass, geothermal, alternative transportation fuels and energy efficiency and conservation.[20] The Environmental Education Grant Program typically opens in October, with applications due in December and projects starting July 1 of the following fiscal year. The maximum grant award is $7,500, with multiple-year projects potentially eligible for a second year of funding.

In addition to energy efficiency and renewable energy deployment, DEP provides regulatory oversight over natural resource extraction and sets environmental policies and regulatory protocols for the development of the Marcellus Shale. A detailed overview of the current regulatory structure associated with Marcellus Shale natural gas development is located in the Marcellus Shale Advisory Commission report issued in July 2011.[21]

[19] AFC First Financial Corporation, data received via e-mail, January 31, 2010.

[20] Five percent of the annual pollution fines and penalties collected by DEP are used to fund the Environmental Education Grant Program.

[21] Governor's Marcellus Shale Advisory Commission Report, July 22, 2011, p. 37 – 71.

PENNSYLVANIA DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT (DCED)

The DCED works directly with citizens, businesses, and local governments on community, economic, and government issues, including energy. Providing technical assistance as well as funding, DCED's energy-related services include energy efficiency and renewable energy deployment for residential, governmental, and business sectors.

DCED administers the Weatherization Assistance Program (WAP) and the Low Income Home Energy Assistance Program (LIHEAP). WAP is funded through DOE while LIHEAP is funded through the U.S. Department of Health and Human Services (HHS). Working in conjunction with a network of weatherization service providers, DCED administers the funding and delivery of much-needed home improvements for low-income citizens in Pennsylvania. In addition to regular program funds through DOE and HHS, DCED has also received weatherization funds from ARRA. Lycoming-Clinton Counties Commission for Community Action, Inc. (STEP), to be discussed later in this section, is DCED's network partner serving Lycoming and Clinton counties. The total amount of funding allocated through STEP to serve residents of Lycoming and Clinton Counties is more than $7.6 million since 2005. Specific services provided by STEP are included in the Technical Assistance section of this chapter.

DCED provided energy efficiency and renewable energy project funding for local governments, schools, businesses, and non-profits through funding allocated by the Energy Investment Act. Programs are funded by the Commonwealth Financing Authority (CFA) and administered by DCED, including the Alternative and Clean Energy Program, High Performance Building Program, Solar Energy Program, and Renewable Energy Program – Geothermal and Wind Projects. Over $1.1 million has been awarded to Lycoming County schools in the East Lycoming School District and Montoursville Area School District.

DCED also administers the Keystone Innovation Zone (KIZ) program in designated zones that have been established throughout Pennsylvania to encourage creativity, foster innovation, and provide entrepreneurial opportunities within geographic areas and industry concentrations. The Williamsport/Lycoming KIZ works with entrepreneurs and start-up businesses in Lycoming County that are interested in developing an invention, new product concepts or technology, or innovative ideas. The KIZ helps clients by evaluating ideas and accessing resources in the following industrial segments: diversified manufacturing, plastics, wood products, and information technology.

The Greenovation Competition of Central PA

The KIZ has consulted with over 260 entrepreneurs and companies, and allocated over $200,000 in funding to support innovation, development, and start-up efforts. The Williamsport/Lycoming KIZ is host to 15 KIZ-qualified companies and 2 KIZ program graduates. The KIZ has assisted more than 60 entrepreneurs in Lycoming County with developing new products and technologies.[22]

[22] Williamsport/Lycoming KIZ, accessed October 3, 2011, http://wlkiz.com/.

One of the initiatives sponsored by the KIZ is the Greenovation Competition of Central PA, an annual competition that encourages the Central Pennsylvania region's citizens and companies to pursue green product concepts to impact the environment and community.[23] The goal of the competition is to encourage the region's entrepreneurs and companies to pursue green product concepts, provide an opportunity to positively impact the environment by pursuing a green idea, and provide each contestant with awareness of and access to service providers who can assist in launching a solid business idea. Past criterion for considering products as a green idea included addressing both immediate and future environmental impacts, having positive environmental objectives, minimizing waste, and working toward resource sustainability.

The Williamsport/Lycoming KIZ has also formed the Inventor's Club, which is an informal association that receives support and encouragement from the Williamsport/Lycoming KIZ and SCORE (Counselors to America's Small Business). The Inventor's Club is focused on building capacity for developing new technology in Lycoming County. Membership is open to anyone who agrees with the organization's values. Voting members must attend at least 4 meetings annually.

In addition to technical assistance and funding, DCED also provides operational funding for several of the energy service providers listed in the Technical Assistance section of this chapter. It should be noted that as part of DCED's 2011-2012 budget, the operational funding of several of these programs has been combined to leverage limited state resources. Through the Partnerships for Regional Economic Performance (PREP) program, services provided by 4 core service providers -- Industrial Resource Centers (IRCs), Industrial Development Organizations, Local Development Districts, and Small Business Development Centers (SBDCs) -- will be integrated to the maximum extent practicable. As the services provided to Lycoming County by each of these organizations are not duplicative, it is likely that each organization will continue to provide its core services, albeit at a reduced rate. The energy-related services provided by regional service providers are described in the Technical Assistance section of this chapter.

PENNSYLVANIA DEPARTMENT OF EDUCATION

The Department of Education along with other state agency and authority partners, including the Department of General Services, Governor's Green Government Council, and the State Public School Building Authority, promote construction and renovation of Pennsylvania's public school buildings. Two funding programs specific to constructing energy-efficient school facilities are provided through the Department and its partners.

[23] Williamsport/Lycoming KIZ, accessed October 3, 2011,http://wlkiz.com/greenovation/greenovation08.

Through the Guaranteed Energy Savings Act (Act 77, preceded by Acts 29 and 57), school districts are permitted to enter into an agreement for energy services and energy-efficient equipment. The Act 77 program enables any governmental unit or state-aided institution to enter into an agreement with an energy service company for not longer than 10-years. This agreement has a written guarantee that the energy savings or operating cost savings will meet or exceed the project cost. Energy savings pay for specific improvements such as HVAC system replacements, indoor air quality improvements, energy recovery systems, energy efficiency improvements for swimming pools, building automation systems, and lighting. The Department of Education reimburses projects by taking into consideration total project cost, student building capacity and expenditures, and state aid ratios.

Under Act 46 of 2005, Pennsylvania public school districts may be eligible for an additional 10 percent in state reimbursement for new construction, additions, and renovations. To promote the construction of LEED schools at the Silver level or above for new construction, additions, and renovations, the State Public School Building Authority, the Governor's Green Government Council, and the Department of Education developed the High Performance Green School Planning Grants program. Administered jointly by the Governor's Green Government Council and the Department of Education, competitive grants are available to public pre-K-12 schools, area vocational schools, and career and technology centers to help cover costs directly associated with achieving a Silver LEED certification or higher. The program was designed to help defray costs that are not typically included in the design fee but are critical to the design of a high-performance building. Roosevelt Middle School in the Williamsport Area School District has achieved LEED Gold certification.

PENNSYLVANIA DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES

As a steward for Pennsylvania's parks, forest, and open space, DCNR has developed expertise in biomass energy, with a staff person designated to assist in developing this industry sector.

DCNR has experience in working across the state to promote the cultivation of feed stock specifically for biofuels. Warm season grasses and short-rotation woody crops such as hybrid willow are being grown specifically as farm-grown biofuel feedstock. In addition, wood chips and residue from area forests and mills, as well as brush from clearing roads for natural gas pipelines, can be used as biofuel feedstock.

DCNR also coordinates the Pennsylvania Schools for Fuels and Beyond initiative, a statewide energy-use strategy promoting the use of local wood and biomass resources to provide reliable energy for Pennsylvania schools and small businesses. While a primary focus is schools, the deployment of biomass projects for any type of business is supported through this initiative. The future of this initiative is uncertain due to funding availability.

PENNSYLVANIA PUBLIC UTILITY COMMISSION

As noted previously, PUC implements the major provisions of Act 129 of 2008 and the Alternative Energy Portfolio Standards Act of 2004 (Act 213).

ACT 129 OF 2008

Act 129 expands the PUC's oversight responsibilities and enforces new requirements on EDCs, with the overall goal of reducing energy consumption and demand. Act 129 requires each of the 7 major EDCs in

Pennsylvania to adopt a plan to reduce energy demand and consumption within its service territory by developing a portfolio of energy efficiency and demand response programs with customer participation on a voluntary basis. The legislation requires cost effectiveness among the residential, commercial, and industrial customer classes. Act 129 requires a 1 percent reduction by May 31, 2011, and a minimum of 3 percent by May 31, 2013. In addition, peak demand must be reduced by a minimum of 4.5 percent by May 31, 2013.

The Act requires at least 10 percent of the reduction in energy use must be obtained from federal, state, and local loads. If these reductions are not met, EDCs will be assessed fines that cannot be passed on to customers. Each of the EDCs has developed energy efficiency programs that involve the issuance of rebates to consumers (households, businesses, and government entities) for the purchase of qualifying efficient appliances, lighting, HVAC systems, and other improvements. Some also provide incentives for the purchase and installation of renewable energy systems and demand reductions. All of the programs are unique and are intended to provide consumers with an incentive to purchase new equipment or make efficiency improvements that will lead to the overall reduction in energy demand.

Incentives are available to all sectors including government, business, and residential. Incentives are offered through a rebate catalogue or customized for larger energy users. These programs also include incentives for demand reduction to reduce the energy the utility must generate and distribute. Incentives are typically available on a first-come, first-served basis.

To evaluate the effectiveness of the energy efficiency and conservation programs required under Act 129, the PUC established a Statewide Evaluator Contract. Statewide Evaluator reports are released to identify progress toward Act 129 savings targets, best practices, areas for improvement, and recommendations. A total of 76 energy efficiency or conservation programs have been implemented across Pennsylvania, with 43 additional programs with expected implementation in 2011.[24] PPL Electric Utilities and FirstEnergy (formerly Penelec and Allegheny Power [West Penn Power]) are the EDCs that serve Lycoming County.[25] A summary of the program results is included in Chapter 3 under the Utility-Delivered Energy section.

ACT 213 ALTERNATIVE ENERGY PORTFOLIO STANDARDS ACT OF 2004

Act 213 of 2004 requires EDCs that distribute electricity in Pennsylvania to procure a minimum amount of electricity that is generated by renewable sources. The EDCs are mandated by the PUC to purchase Alternative or Renewable Energy Credits (RECs) to satisfy this mandate. The Act is intended to incentivize the growth and expansion of renewable energy in Pennsylvania and achieve the goal of having 18 percent of the Commonwealth's energy provided by renewable sources by 2020. [26]

[24] GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 3. (November 2010 data).

[25] FirstEnergy merged with Allegheny Power (West Penn Power) in February 2011.

[26] The PUC's Pennsylvania Alterative Energy Portfolio Standard Program Web site is the statewide portal for monitoring the progress of Act 213 (http://paaeps.com/credit/index.do).

The Act requires EDCs to purchase this capacity in percentages that increase annually through 2021. It contains provisions for two separate groups of renewable energy. Tier I RECs include premium sources such as wind, geothermal, solar thermal hydropower, biomass, and methane. Tier II sources include waste coal, distributed generation, coal gasification, and demand side management. Solar photovoltaic (PV) sources are separately mandated.

A REC is generated for every 1,000 kWh of energy produced by one of the renewable energy sources identified by Pennsylvania's AEPS discussed previously. Credits can be qualified and sold to an EDC through a broker. RECs from various suppliers can be aggregated and sold as a cluster. RECs generated in Pennsylvania can be sold to EDCs in any state that borders Pennsylvania.

The value of these RECs is based on the supply of the resource and the annual requirement. The distinct mandate for solar PV makes theses RECs more valuable than any other source. The average price for a Pennsylvania solar REC (S-REC) was $300 in October 2010. The value of a REC from other sources ranged from $0.25 to $20.50. The average value of a Tier I REC in 2009 was $3.65. Tier II RECs averaged $0.36. The value of Pennsylvania RECs is expected to increase as the mandate increases. In 2011, EDCs are required to obtain a minimum of 3 percent of their power from Tier I sources, 6.2 percent from Tier II, and 0.02 percent from solar PV. By 2021, these percentages will increase to 8 percent, 10 percent, and 0.05 percent, respectively. RECs can be a valuable source in project financing. The funds generated by this source can significantly reduce a project's payback period.

The PUC has retained Clean Power Markets, Inc., as the Program Administrator to implement the AEPS. Administrative functions include, as amended (AEPS Act or Act):

- Verifying EDC and electric generation supplier (EGS) compliance with the minimum portfolio requirements and reporting of compliance to the PUC
- Calculating EDC and EGS Tier I requirements on a quarterly basis
- Reviewing applications for alternative energy system status
- Certifying that EDCs and EGSs use only valid alternative energy credits for compliance
- Verifying small solar customer-generator alternative energy system generation output data
- Approving, tracking, and verifying alternative energy credits created by energy efficiency and demand response measures
- Providing support services to customer-generators
- Tracking and reporting alternative energy credit prices to the PUC
- Calculating solar photovoltaic alternative compliance payment
- Calculating alternative compliance payment amounts for EDCs and EGSs
- Providing reports to the PUC and DEP documenting compliance with and costs associated with implementation of the AEPS Act

Based on data provided by Clean Power Markets, there are 38 qualified alternative energy facilities in Lycoming County.[27]

TECHNICAL ASSISTANCE

LOCAL GOVERNMENT ORGANIZATIONS

Pennsylvania's local government organizations, such as Township and Borough Associations, work on behalf of Pennsylvania's 2,562 municipalities in 67 counties as well as authorities and school districts, to advance energy-related legislation and technical assistance.

Each of the local government organizations participated as part of the Governor's Solar Working Group, mentioned previously in this chapter, to develop a model solar ordinance and guidebook for Pennsylvania's local governments, and each monitors and provides technical assistance to member local governments related to Marcellus Shale exploration and production.

The Pennsylvania State Association of Township Supervisors (PSATS) develops and maintains a series of energy-related model ordinances for the following topics: oil and gas exploration, wind energy facilities, windmills as an accessory use, heat pumps (including geothermal), and solar energy. PSATS also works with the Second Class townships that it represents to monitor energy-related legislation.

To address increasing energy and maintenance costs for municipal street lighting systems, the Pennsylvania League of Cities and Municipalities (PLCM) offers a Streetlight Services Program. The Streetlight Services Program includes a comprehensive streetlight analysis of cost savings, and provides recommendations of existing systems, the serving utility, applicable tariffs, and energy cost of each community. The results of this analysis will include recommendations on maintenance costs and energy savings. Lycoming County has already reduced energy use when it comes to streetlights by converting them to LED.

Through the County Commissioners Association of Pennsylvania, energy and telecommunication consulting services are administered by Cost Control Associates. This assistance provides review of utility bills for counties and other local government agencies to help reduce energy and telecommunications costs. Reviews in rate changes or services are also made to help reduce ongoing energy and telecommunication costs. The program is contingency fee based with no up-front costs to the county.

[27] Clean Power Markets, Inc., data received via e-mail, March 4, 2011.

REGIONAL TECHNICAL ASSISTANCE PROVIDERS

SEDA-COG ENERGY RESOURCE CENTER

Part of the ARC Local Development District network, SEDA-COG serves 11 Central Pennsylvania counties providing services to business and industry, communities, and non-profits. The SEDA-COG ERC is located within SEDA-COG and is focused on developing the region as a hub for efficient and renewable energy technology and expertise. Its primary goals are to retain the region's quality of life while enhancing its economy and to reduce the energy-related costs of residents, businesses, local governments, and schools. A sample of services provided by SEDA-COG ERC includes the following, with detailed information available on the ERC website at www.erc.sedacog.org:

- Conducting Utility Bill Analysis for Local Governments

SEDA-COG ERC provides free utility bill analyses to local governments and offers low-cost, on-site energy assessments to assist local governments to prioritize efficient and renewable energy opportunities. Utility bill analysis helps local governments benchmark their energy costs while the energy assessments establish short- and long-term energy use reduction strategies, including physical improvements.

Loyalsock Township, Montgomery Borough, Hughesville Borough, and Montoursville Borough have been provided with utility bill analysis through SEDA-COG ERC.

- Targeted Outreach through Educational Events

Through SEDA-COG ERC's Energizing Our Region educational series, a total of 42 past events have been conducted since January 2008 on diverse topics such as, but not limited to, Act 129, green building design and development, energy efficiency, solar and wind deployment, and green job opportunities.[28]

- Development of Regional Energy Efficiency Projects

SEDA-COG ERC and strategic partners such as PennDOT have developed a Light Emitting Diode (LED) Traffic Signal Project to bring LED energy-saving technology to local municipalities by reducing costs and assisting with installation. With funding provided in part by ARC, 65 municipalities were assisted through the purchase and installation of LED traffic signal modules at 225 signalized intersections. The traffic signal conversion resulted in operational energy savings of 80 percent. The large quantities of equipment purchased by forming a municipal consortium allowed SEDA-COG ERC to negotiate a price that was 25 percent below the equipment list price, representing an equipment savings of $47,648. The project has resulted in significant energy savings for participating municipalities, representing a

[28] As of October 2011, per the SEDA-COG ERC Web site, http://erc.sedacog.org/.

projected annual avoided aggregate cost savings of $48,746, and an aggregate annual energy reduction of 244,216 kWh.[29]

- Energy Independence Projects

SEDA-COG ERC has been working with New Berlin Borough in Union County on implementing a communitywide Energy Independence Project. The Borough, with a population of 838, has an overall goal of achieving energy independence. SEDA-COG ERC has been using the following steps to help the community achieve its goal:

1. Conduct a qualitative energy assessment as a benchmark to measure energy consumption in the community, municipal facilities, homes, schools, businesses, churches, and vehicles.
2. Develop an action plan to significantly reduce New Berlin's current energy consumption.
3. Implement the action plan and start saving energy and money. As part of the action plan information on energy-related rebates, financial incentives, and free energy-related services available through state, federal, and PPL Electric Utilities programs will be provided to the community in an effort to help the community identify opportunities to reduce energy consumption.

- Regional Inventory of Certified Energy Professionals

SEDA-COG ERC also maintains a list of Building Performance Institute (BPI)-certified contractors in the region. BPI-certified contractors are required to complete energy assessments and audits under Act 129 obligations as well as weatherization assistance provided through federally funded state initiatives such as DCED's Weatherization Assistance Program (WAP). SEDA-COG ERC maintains a directory of energy assessment and energy service providers on its Web site.[30]

STEP, INC.

Lycoming-Clinton Counties Commission for Community Action (STEP), Inc., is a private, non-profit community action agency serving low- to moderate-income households in Lycoming and Clinton Counties since 1966. STEP's five pathways to success include: (1) Early Learning, (2) Housing Options, (3) Workforce Development, (4) Community Collaboration, and (5) Independent Living.

STEP is one of a network of weatherization service providers across Pennsylvania that are sub-grantees to administer federal funding through DCED and the Pennsylvania Department of Public Welfare (DPW).

STEP provides weatherization services for low-income citizens under DCED's WAP. Eligible households are provided with technical assistance and prioritized home improvements to permanently reduce their energy bills, reducing heating costs by as much as 32 percent and saving approximately $350 per year.

[29] SEDA-COG ERC, LED Traffic Signal Conversion Project, accessed January 28, 2011, http://erc.sedacog.org/EnergyConservation/LocalGovernment/LEDTrafficSignalProject/tabid/81/Default.aspx.

[30] SEDA-COG ERC, Energy Assessment Providers Directory, accessed January 26, 2011, http://erc.sedacog.org/LinkClick.aspx?fileticket=rM2zoPuxflo=&tabid=303.

As part of the weatherization services, a certified energy auditor visits eligible homes to identify each home's most cost-effective energy saving measures and provide education on ways to reduce overall energy consumption.

STEP also works collaboratively with DCED and DPW managing Lycoming and Clinton County projects served under DOE's Crisis Program. The Crisis Program provides emergency funding to repair or replace failing heating systems, removing a safety hazard for low-income citizens.

Through ARRA, STEP was awarded over $4.3 million to provide these same weatherization services for 620 homes in Lycoming and Clinton Counties over the course of 3 years or by the end of March 2012. Eligible recipients are those persons or families whose income is at or below 200 percent of the federal poverty level. On-site energy audits are conducted on each home and prioritized improvements are recommended, with an average amount of $6,500 spent per home. Approximately 60 percent or 509 homes in Lycoming County received ARRA-funded weatherization services as of November 21, 2011.[31]

In addition to the weatherization services provided under WAP and ARRA, STEP, Inc., is also a BPI - certified contractor for PPL under the utility's Winter Relief Assistance Program (WRAP) and assists in meeting PPL's Act 129 obligations.

STEP also received $50,000 from the Williamsport-Lycoming Community Foundation (WLCF) in 2009 to provide additional WAP services in Lycoming County. This funding provided STEP with the ability to assist households who exceeded the WAP income limit of 200 percent and households up to 100 percent of the county median income level.

PENNSYLVANIA SMALL BUSINESS DEVELOPMENT CENTERS (SBDC)

Pennsylvania's SBDC network is an effective partner in providing many energy-related services to small businesses and received the ENERGY STAR Small Business Special Award for Excellence in Energy Efficiency in 2007.

The U.S. Small Business Administration (SBA) defines a small business as "one that is independently owned and operated, is organized for profit, and is not dominant in its field. Depending on the industry, size standard eligibility is based on the average number of employees for the preceding twelve months or on sales volume averaged over a three-year period."[32] Eligibility by industry sector follows below:

- Manufacturing: 500 to 1, 500 employees depending on the type of product manufactured.
- Services: Annual receipts may not exceed $2.5 million to $21.5 million, depending on the service provided.

[31] Kevin Mitcheltree, Director of Housing Services & Weatherization, November

[32] U.S. Small Business Administration Web site, accessed October 7, 2011, http:/ definition-small-business-concern.

CLEAN TECHNOLOGY RESOURCE CENTER

- Retail: Annual receipts may not exceed $5 million to $21 million, depending on the product provided.
- Construction: Annual receipts may not exceed $13.5 million to $17 million, depending on the type of construction.
- Agriculture: Annual receipts may not exceed $0.5 million to $9 million, depending on the agricultural product.

The Pennsylvania SBDC Environmental Management Assistance Program (EMAP) was launched in 1997 to provide small businesses with environmental technical assistance (including energy audits), regulatory compliance, environmental permitting, and most recently energy efficiency assistance. Services are delivered through the existing SBDC network at no cost to businesses. As the interest grows green building practices, reducing energy consumption, ensuring environmental compliance, and advancing environmental sustainability, EMAP is a valuable resource to help Pennsylvania's small businesses achieve these goals. In 2004, a partnership between Pennsylvania SBDC and Pennsylvania DEP expanded EMAP services, designating EMAP as the official provider of small business environmental assistance throughout Pennsylvania.

SBDC clients have implemented 189 different energy efficiency projects with funding assistance through the Pennsylvania DEP's Small Business Advantage Grant program. According to Pennsylvania's SBDC network, at current electricity rates, it is anticipated that by 2020 these small businesses will save over $10 million in energy costs on these projects alone.[33] Twenty-eight Small Business Advantage grants have been awarded to Lycoming County businesses between June 2006 and December 2010.[34]

The Pennsylvania SBDC also maintains the Pennsylvania Material Trader (www.materialtrader.org) and Pennsylvania Biomass Trader (www.materialtrader.org) as free, online services for the 'trading' of materials. Matching suppliers with producers the Materials Trader is a location to match waste or scrap resources with end users while the Biomass Trader encourages the use of biomass as a renewable energy source by matching agricultural growers with biomass producers. Additional information regarding the Biomass Trader is located in Chapter 4.

The Clean Technology Resource Center is a new initiative of Pennsylvania's SBDC, which helps businesses develop and commercialize technology products, goods, services, and processes that use renewable energy sources. Located at the Penn State SBDC, the Clean Technology Resource Center is accessible to all businesses in Pennsylvania to determine the viability of technologies, obtain financing, or introduce new technologies to market. Biomass is one industry sector that could benefit from the services of the Clean Technology Resource Center. According to the Penn State SBDC, "specific sectors in Pennsylvania stand to benefit substantially from increased support and development of clean technology. For instance, there is a great potential for manufacturers in the wood and manufactured housing sectors—two large industry sectors in Pennsylvania—to turn biomass-rich waste materials from

[33] Pennsylvania Small Business Development Center network, accessed October 2, 2011, http://www.askemap.org/history/.

[34] PA Department of Environmental Protection, received via e-mail, January 11, 2011.

an expense to a revenue generator. The agricultural sector will have additional uses for its residues, including manures and spent-mushroom soil, providing new opportunities to make the 55,000 farms in Pennsylvania more profitable."[35] Services available for Clean Technology providers and users include the following:

PROVIDERS

- Evaluating market opportunities
- Providing business development assistance
- Developing business plans
- Assessing commercialization potential
- Assisting with materials: designing, prototyping, testing, and sourcing
- Securing financing
- Subcontracting
- Educating and training

USERS

- Feasibility analyses
- Green construction
- Waste minimization
- Financing

In addition to one-on-one business consulting, the Clean Technology Resource Center has hosted a series of Webinars that have focused on wind, solar, and biomass technologies.

ST. FRANCIS UNIVERSITY RENEWABLE ENERGY CENTER (REC)

St. Francis University REC's mission is to educate businesses, schools, and communities in the development of cost-effective, environmentally sound energy alternatives, primarily wind energy. REC conducts wind feasibility analysis for communities interested in developing community wind resources and has developed wind energy mapping for each of Pennsylvania's counties.[36]

REC, in conjunction with St. Francis University's School of Business, also offers an online Renewable Energy Certificate program that gives working professionals the knowledge and real-world, practical perspectives on renewable energy and alternative energy technologies. The certificate program focuses on the business and policy aspects of the energy industry in addition to the technical aspects.

[35] Penn State SBDC, Clean Technology Resource Center, accessed October 2, 2011, http://www.pasbdc.org/cleantech.

[36] Wind mapping for each Pennsylvania county may be found at http://www.francis.edu/REC.htm.

INDUSTRIAL MODERNIZATION CENTER (IMC)

IMC is one of seven IRCs established in 1988 and located throughout Pennsylvania to help small- and medium-sized manufacturing enterprises (SMEs) respond to changing markets and new technology. IRCs assist manufacturers to improve their bottom line by helping to improve productivity and eliminate excess waste. IRCs work to support strategic initiatives that result in new and improved products, market differentiation, and workforce development strategies. IRCs are affiliated with the U.S. Department of Commerce, National Institutes of Standards and Technology (NIST) Manufacturing Extension Partnership (NIST-MEP), and are supported through DCED.

IMC typically serves clients with less than 100 employees and has helped over 500 companies improve their competitiveness, profitability, and productivity. IMC effectively refers manufacturers to resources as needed. IMC partners with other energy-related service providers and conducts workshops and Webinars for businesses, which is helpful as fiscal constraints over the past several years have limited IMC's capacity. Rising energy costs and requirements support investment in tools, methods, and practices for reducing energy costs and adoption of "greener" programs. IMC works to conduct Pollution Prevention and Energy Efficiency (P2/E2) Assessments to assess opportunities for recycling, and other new "green" practices.

PENNSYLVANIA TECHNICAL ASSISTANCE PROGRAM (PENNTAP)

PennTAP, an outreach program of Penn State, is a federal-state-university partnership that has been in operation since 1965. PennTAP helps Pennsylvania companies compete and grow in traditional and emerging fields. PennTAP recently added an energy efficiency initiative to services to help Pennsylvania businesses improve their competitiveness by providing analyses and information about energy consumption.

PennTAP provides fee-for-service company-specific energy assessments including inspection of facility HVAC systems, lighting, and building envelope along with utility bills to identify opportunities to improve energy efficiency and reduce energy costs. Level 1 assessments for renewable potential and combined heat and power projects are conducted for free. PennTAP historically offered free energy assessment services and worked primarily with small- to mid-sized manufacturers. Funding constraints are such that PennTAP can no longer offer services without a fee, with the exception of larger, complex manufacturing projects. For these larger manufacturing projects, PennTAP often works in conjunction with a team of energy efficiency consultants depending on a company's facility size and may offer clients a grant (50 percent match up to $7,500) for a comprehensive assessment. An investment grade energy auditor conducts the energy assessment with PennTAP providing subcontracting services to handle assessment activities such as compressed air or lighting. As an example, PennTAP routinely partners with the Energy Technology Applications Center (ETAC), located in Northampton Community College, to conduct comprehensive energy audits on complex facilities. ETAC's investment-grade energy audits evaluate complex manufacturing processes. The value of a typical investment grade audit is between $60,000 and $70,000. ETAC has worked in conjunction with PennTAP on two Lycoming County projects including a project for Lycoming Engines.

PennTAP conducts marketing and outreach to businesses and provides technical assistance as well as making clients aware of potential funding opportunities to improve energy efficiency such as energy rebates through Act 129. PennTAP receives and shares client referrals from other industry-based

service providers such as IMC, the regional Industrial Resource Center (IRC), SEDA-COG ERC, Penn State SBDC, and county economic development organizations.

PennTAP is also currently working with DOE's Superior Energy Performance Demonstration. This is a grant-funded project that is "piloting" an energy management system (draft ISO 50000) along with energy performance verification for certification. PennTAP is working with two Pennsylvania clients and while the companies are not from Lycoming County, PennTAP is hopeful that when the program moves beyond the pilot phase, services can be deployed to additional Pennsylvania companies.

Based on PennTAP's 2009 Impact Report, its statewide efforts provided 431 cases of technical assistance, helped to create or retain 477 jobs and generated over $46 million in economic impact. PennTAP provided approximately six cases of technical assistance in Lycoming County over the past five years.[37]

NON-PROFIT AND EDUCATIONAL TECHNICAL ASSISTANCE PROVIDERS

In addition to technical assistance provided through taxpayer funded federal, state, and local energy initiatives, private sector, non-profit organizations provide valuable energy resources particularly in the area of green building design and implementation.

U.S. GREEN BUILDING COUNCIL

The U.S. Green Building Council (USGBC) is a 501 (c) 3 non-profit organization focused on national sustainability through cost-efficient and energy-saving green buildings. USGBC includes a network of 78 local affiliates, approximately 16,000 member companies and organizations, and more than 170,000 LEED Professional Credential holders.[38] USGBC members are a diverse group of builders, environmentalists, corporations, non-profit organizations, elected officials, citizens, teachers, and students.

According to USGBC, "buildings in the United States are responsible for 39% of CO2 emissions, 40% of energy consumption, 13% water consumption and 15% of GDP per year, making green building a source of significant economic and environmental opportunity. Greater building efficiency can meet 85% of future U.S. demand for energy, and a national commitment to green building has the potential to generate 2.5 million American jobs."[39]

[37] PennTAP 2009 Impact Report, p. 3.

[38] U.S. Green Building Council Web site, Accessed October 5, 2011, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=124.

[39] U.S. Green Building Council website. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=124 Accessed: October 5, 2011.

LEED is an internationally recognized green building certification system developed by USGBC in 2000. LEED offers building owners and operators a framework to identify and implement measurable green building design, construction, operations, and maintenance solutions.

LEED GREEN BUILDING RATING SYSTEM

The LEED Green Building Rating System is the standard for rating the design, construction, and operation of green buildings. According to USGBC, a total of 35,000 projects are currently participating in the LEED system, totaling over 4.5 billion square feet of construction space in all 50 states and 91 countries. Individual LEED rating systems have been developed for the following:

- New Construction
- Existing Buildings Operations and Maintenance
- Commercial Interiors
- Core and Shell
- Schools
- Retail
- Healthcare
- Homes
- Neighborhood Development

LEED promotes a whole-building approach to sustainability by measuring building performance in the following categories as listed on the USGBC website:[40]

SUSTAINABLE SITES

The Sustainable Sites category discourages development on previously undeveloped land; seeks to minimize a building's impact on ecosystems and waterways; encourages regionally appropriate landscaping; rewards smart transportation choices; controls stormwater runoff; and promotes reduction of erosion, light pollution, heat island effect, and construction-related pollution.

WATER EFFICIENCY

The goal of the Water Efficiency category is to encourage smarter use of water, inside and out. Water reduction is typically achieved through more efficient appliances, fixtures, and fittings inside and water-conscious landscaping outside.

ENERGY AND ATMOSPHERE

The Energy and Atmosphere category encourages a wide variety of energy-wise strategies: commissioning; energy use monitoring; efficient design and construction; efficient appliances, systems and lighting; the use of renewable and clean sources of energy, generated on-site or off-site; and other innovative measures.

[40] U.S. Green Building Council Web site, Accessed October 5, 2011, http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1989.

MATERIALS AND RESOURCES

The Materials and Resources category encourages the selection of sustainably grown, harvested, produced, and transported products and materials. It promotes waste reduction as well as reuse and recycling, and it rewards the reduction of waste at a product's source.

INDOOR ENVIRONMENTAL QUALITY

The Indoor Environmental Quality category promotes strategies that improve indoor air as well as those that provide access to natural daylight and views and improve acoustics.

LOCATIONS AND LINKAGES

The Locations and Linkages category encourages building on previously developed or infill sites and away from environmentally sensitive areas. It credits reward homes that are built near already existing infrastructure, community resources, and transit – in locations that promote access to open space for walking, physical activity, and time outdoors.

AWARENESS AND EDUCATION

The Awareness and Education category encourages home builders and real estate professionals to provide homeowners, tenants, and building managers with the education and tools they need to understand what makes their home green and how to make the most of those features.

INNOVATION IN DESIGN

The Innovation in Design category provides bonus points for projects that use innovative technologies and strategies to improve a building's performance well beyond what is required by other LEED credits, or to account for green building considerations that are not specifically addressed elsewhere in LEED. This category also rewards projects for including a LEED Accredited Professional on the team to ensure a holistic, integrated approach to the design and construction process.

REGIONAL PRIORITY

USGBC's regional councils, chapters, and affiliates have identified the most important local environmental concerns, and six LEED credits addressing these local priorities have been selected for each region of the country. A project that earns a regional priority credit will earn one LEED bonus point in addition to any points awarded for that credit.

A total of 332 Pennsylvania LEED-certified buildings are listed on USGBC's online LEED inventory.[41] A few LEED buildings have been certified in Lycoming County. Roosevelt Middle School in the Williamsport Area School District has achieved LEED Gold certification. A few additional buildings are expected to achieve LEED certification. Williamsport Regional Medical Center is seeking LEED certification for its 242,000 square foot renovation. LEED certification is pending for the PA Department of Conservation and Natural Resources (DCNR), Bureau of Forestry Resource Management Center (Forest District Office) in Waterville. The Factory Built Housing Center (FBHC) operated out of Penn College is working with Pennsylvania's modular home industry to focus on LEED-certified modular homes.

[41] U.S. Green Building Council Web site, http://www.usgbc.org/LEED/Project/CertifiedProjectList.aspx.

PENNSYLVANIA COLLEGE OF TECHNOLOGY

Pennsylvania College of Technology (Penn College) provides several resources that are applicable to Lycoming County's Energy Plan efforts. The Weatherization Training Center (WTC) at Pennsylvania College of Technology is a Lycoming County-based organization. The WTC provides Pennsylvania's primary educational resource for weatherization-related technical education and training and has been in operation since 1985. Over 8,000 individuals have participated in WTC courses and training events, as well as private contractors interested in gaining education in weatherization and home energy efficiency.

The WTC has expanded operations in response to the growing demand for weatherization services funded under ARRA. Under the ARRA-funded Weatherization Recovery and Reinvestment Project, the center anticipates training up to 940 professionals over three years to weatherize at least 29,700 housing units.[42] Following protocols established by the Building Performance Institute (BPI), the WTC held its first BPI training and certification event during the week of January 12, 2011.

The WTC also houses the FBHC, funded by Ben Franklin Technology Partners, which works with the modular housing industry to improve energy efficiency standards in modular homes. The FBHC is currently exploring opportunities for EPA ENERGY STAR applications with the factory-built housing industry and is working on establishing a certification protocol specific to modular construction utilizing the EPA's guidelines. The modular housing industry faces challenges related to ENERGY STAR certification due to constructing components of a modular home in a manufacturing plant and completing the home construction at the home's location. Training and educational events addressing ENERGY STAR began in the spring of 2008. DCED, through Penn College, has been providing technical and financial support of the modular housing industry since 1998.

The FBHC is an industry partnership that has been in place for four years. For the past two years the FBHC has been providing training services funded through the Pennsylvania Department of Labor and Industry (L&I). Pennsylvania is home to the greatest number of modular homebuilders in the country, with 38 operating businesses. The modular home industry works directly with the building community, with Pennsylvania's modular homebuilders serving builders primarily in the northeast. There are also 12 manufactured home businesses that construct housing to meet federal HUD codes.

The FBHC is working with the modular home industry to make sure that Pennsylvania's modular homes are inspected during factory construction to meet ENERGY STAR standards. As EPA requires Home Energy Raters (HERS) as part of the ENERGY STAR home certification process and Residential Energy Services Network (RESNET), FBHC is working to train personnel at modular home manufacturers to become certified as a filed inspector to work with HERS raters. Over 78 percent of Pennsylvania's modular home product is sent out of state, with the majority going to the northeast. While the FBHC is focused on ENERGY STAR compliance for Pennsylvania's modular home industry, it is also working on developing technical resources and programs to focus on LEED certification. The largest impediment to

[42] Weatherization Training Center at Pennsylvania College of Technology, November 2009 newsletter, accessed January 17, 2011, http://www.pct.edu/wtc/docs/WTCnewsletter.pdf#zoom=75.

LEED certification is cost. Obtaining LEED certification typically adds $5,000 to $8,000 in soft costs. This does not include construction modifications.

Beyond workforce training, Penn College's Outreach for K – 12 program also provides continuing energy education for K–12 educators.

FINANCIAL ASSISTANCE

Federal funding for energy projects comes in the form of business and industry grant and loan programs; corporate deductions, exemptions, and credits; industry recruitment credits; and personal tax credits. Many states, Pennsylvania included, offer incentives to businesses or communities in the form of grants, loans, tax credits through corporate or property tax credits, and deductions. These financing mechanisms help to facilitate the implementation of renewable energy projects that are typically more costly to implement compared to traditional energy technologies.

While the future of federal, state, and local funding to finance energy projects is uncertain, there are several programs that may currently be beneficial to Lycoming County. Since the availability of public funding is in flux, the County should monitor program changes on a regular basis. Appendix B includes a snapshot of the most relevant programs (by Energy Plan sectors); many of these programs have been noted throughout this chapter, and Web site links to each. Several of the programs are one-time incentives provided through ARRA but are included to demonstrate the types of programs that have helped advance renewable energy choices in Lycoming County. Appendix C includes further information about the Lycoming County projects that have received state funding for energy efficiency and renewable energy purposes over the past five years. Although this list is not exhaustive, it provides an idea of the types of projects that have been implemented with public funding assistance. Research conducted for the Energy Plan indicated that an estimated $13.8 million has been awarded to Lycoming County citizens, schools, government, and businesses over the past five years primarily through DCED and DEP. In addition, the value of Act 129 incentives through PPL alone is over $907,000. The status of EDC Act 129 programs is discussed in Chapter 3 under Energy Consumption by Source.

Since the information in Appendix B is a snapshot in time, several Web sites are available that provide an inventory of energy-focused funding programs, the most well known of which is the DSIRE (http://dsireusa.org/). Appendix A includes a few additional websites containing public funding sources in addition to technical energy resource assistance.

CHAPTER 3 ENERGY CONSUMPTION ANALYSIS

This chapter provides a synopsis of energy sources and energy consumption in Lycoming County. It includes an overview of energy provided by utility companies and non-utility energy source providers, energy consumption estimates by sector and source, and analysis of renewable and non-renewable energy sources. The chapter answers the following questions:

- How is Lycoming County's energy delivered? Is it delivered through electric or natural gas utility companies? Is it non-utility energy delivered through independent oil, propane coal, or a wood product from a lumber yard or harvested on a homeowner's property?
- How much energy is consumed and what types of energy are consumed?

Why is it important for Lycoming County to answer these questions? One of the prime drivers for preparing the Energy Plan is to identify ways to reduce energy costs for each sector. As energy costs are increasing, reducing consumption or increasing energy efficiency would correspond to a decrease in energy costs. Therefore, estimating how much energy is consumed by each Energy Plan sector is useful to benchmark "as is" conditions now, prior to reevaluating energy usage in the future.

ENERGY PLAN SECTORS

The analysis of energy sources and uses was conducted by examining each energy sector identified as part of the Scope of Work prepared for the Energy Plan: Residential, Commercial, Industrial, Agriculture, Public/Non-Profit, and Transportation.

Why examine by sector? Each sector consumes energy differently; using different sources and fluctuating amounts. Residential uses consume energy from different sources and at varying amounts compared to Industrial and Transportation uses. While energy conservation and reduction strategies will likely produce favorable energy cost reduction outcomes in some sectors, the same strategies might not be applicable to other sectors. As an example, overall energy cost savings would likely result from energy efficiency or energy reduction strategies in the Residential and Public/Non-Profit sectors, but the Industrial and Transportation sectors will likely see an increase in consumption due to shale gas exploration and production. Over the next several years while shale gas activities such as well pad preparation, drilling, and production are occurring, there will be energy consumption increases in both sectors.

Analyzing what sources are used by sector and the amount of energy consumed by each helps to develop implementation strategies to meet the needs of each sector. The implementation strategies included in Chapter 7 were developed to improve energy efficiency and reduce energy consumption as well as identify opportunities for each sector to generate renewable energy, if feasible.

Collecting, analyzing, and reporting data by sector, required the identification of the number of (or count) of establishments (physical locations) in each of sector. Data by sector was needed not only to analyze how much energy is consumed in Lycoming County but also to provide context for how many residents, businesses, etc. could potentially be part of future outreach strategies for the Energy Plan's implementation. Transportation is the only Energy Plan sector that was not reported by establishment; it was determined by mode such as vehicular, rail, or air.

The number of establishments for the Residential, Commercial, Industrial, Public/Non-Profit, and Agriculture sectors was obtained from ESRI (Environmental Systems Research Institute, Inc.) for the year 2010. ESRI is an internationally known software development and services company providing Geographic Information System (GIS) software, geodatabase management applications, and demographic analysis systems. ESRI utilizes business data from a comprehensive list of businesses licensed from Infogroup. This listing contains information on over 12 million businesses in the United States, including name, location, franchise code, NAICS code, number of employees, and estimated sales volume. This base data was current as of January 2010. According to ESRI, Infogroup references several sources, including directory listings such as Yellow Pages and business white pages; annual reports; 10Ks and Securities and Exchange Commission (SEC) information; federal, state, and municipal government data; business magazines; newsletters and newspapers; and information from the U.S. Postal Service to maintain and add to its business database. To ensure accurate and complete information, Infogroup conducts annual telephone verifications with each business listed in the database.

The following table includes the number of establishments in each sector in Lycoming County. The ESRI data is presented by NAICS code; therefore, it was necessary to look at NAICS codes for establishments individually and assign the appropriate Energy Plan sector for each establishment.

TABLE 1 - LYCOMING COUNTY ESTABLISHMENTS BY SECTOR

Sector	# of Establishments
Residential	47,262
Commercial	3,059
Industrial	690
Agriculture	23
Public/Non-Profit	826

Source: ESRI 2010; Delta Development Group, Inc.

While the number of Agriculture establishments identified by analyzing ESRI data is low (23), there are many farming establishments in Lycoming County. The USDA 2007 Census of Agriculture reports 1,211 farms in Lycoming County. [43] The discrepancy between the ESRI derived number and the Census of Agriculture number is likely due to the categorization of establishments per ESRI. The 23 ESRI derived Agriculture establishments are most likely larger farming operations that are labeled differently than smaller, family farms categorized as Residential establishment per ESRI. Therefore, under ESRI the majority of the County's farms would be included in the number of Residential establishments.

[43] USDA, 2007 Census of Agriculture, Lycoming County, Pennsylvania, http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/County_Profiles/Pennsylvania/cp42081.pdf.

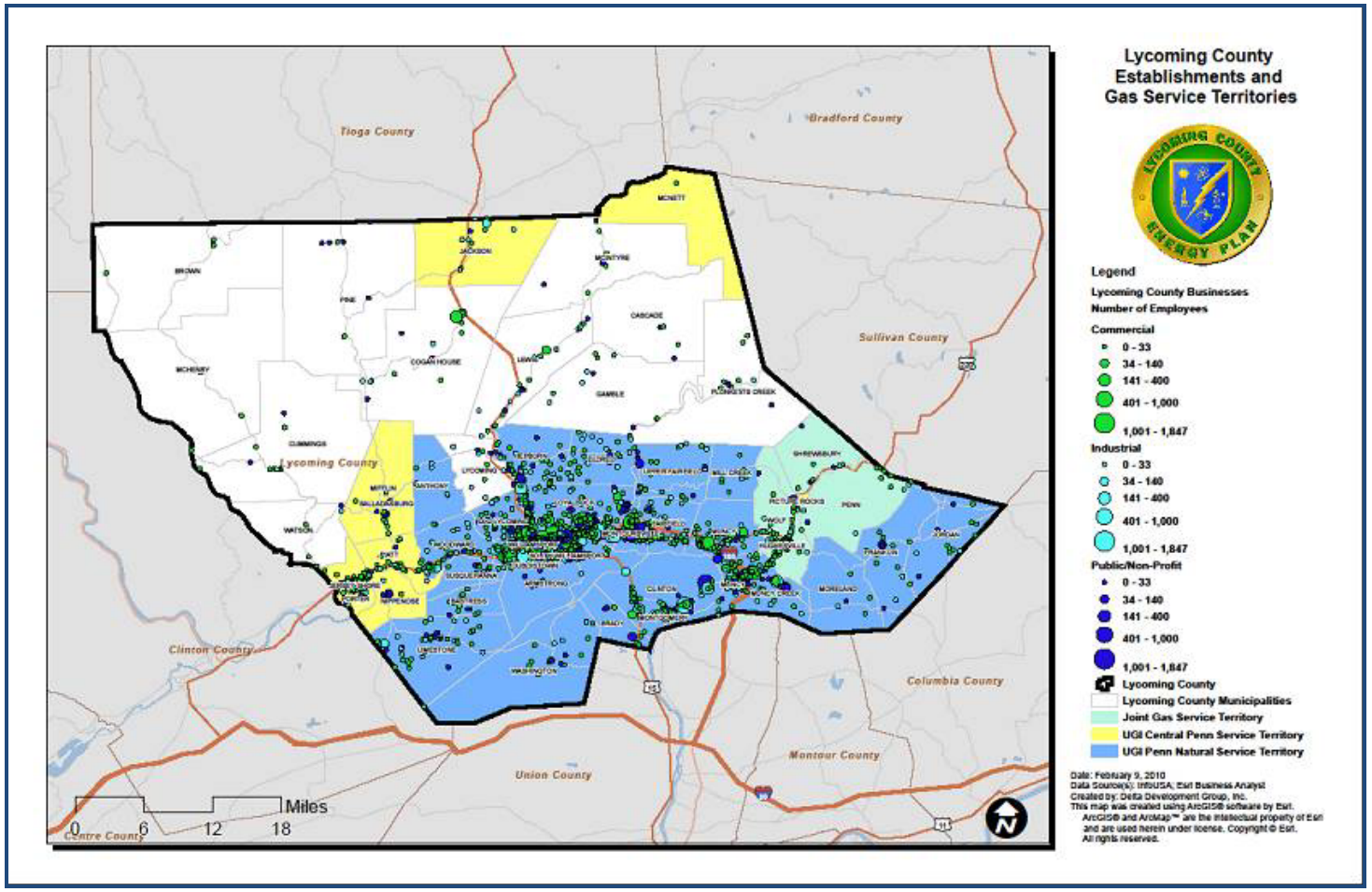
The methodology for the energy consumption calculations requires that data is applied consistently. Therefore, although there are 1,211 farms in Lycoming County according to the 2007 Census of Agriculture, for purposes of the energy consumption calculations the number of agriculture establishments in the County is 23. The amount of energy consumed by the 1,211 farms is included in the Residential consumption calculation. ESRI utilizes self-reported NAICs codes to categorize the types of businesses in their data set. It is assumed that the farms listed in the ESRI count are reported as larger income-generating farms and thus consume an amount of energy consistent with commercial operations. Small farms and family operated farms would likely consume energy which more closely represents a residential consumer.

SPATIAL ANALYSIS OF ENERGY SECTORS

Spatial analysis of energy sectors by establishment demonstrates distribution patterns for each sector throughout the County. This mapping was conducted to illustrate location and intensity trends by sector, with the exception of Agriculture and Transportation. The mapping also included utility gas service territories to highlight existing gas infrastructure and reveal gas service territory gaps for sectors showing an intensity of establishments in a non-utility area. The gaps could represent opportunities for natural gas line expansion.

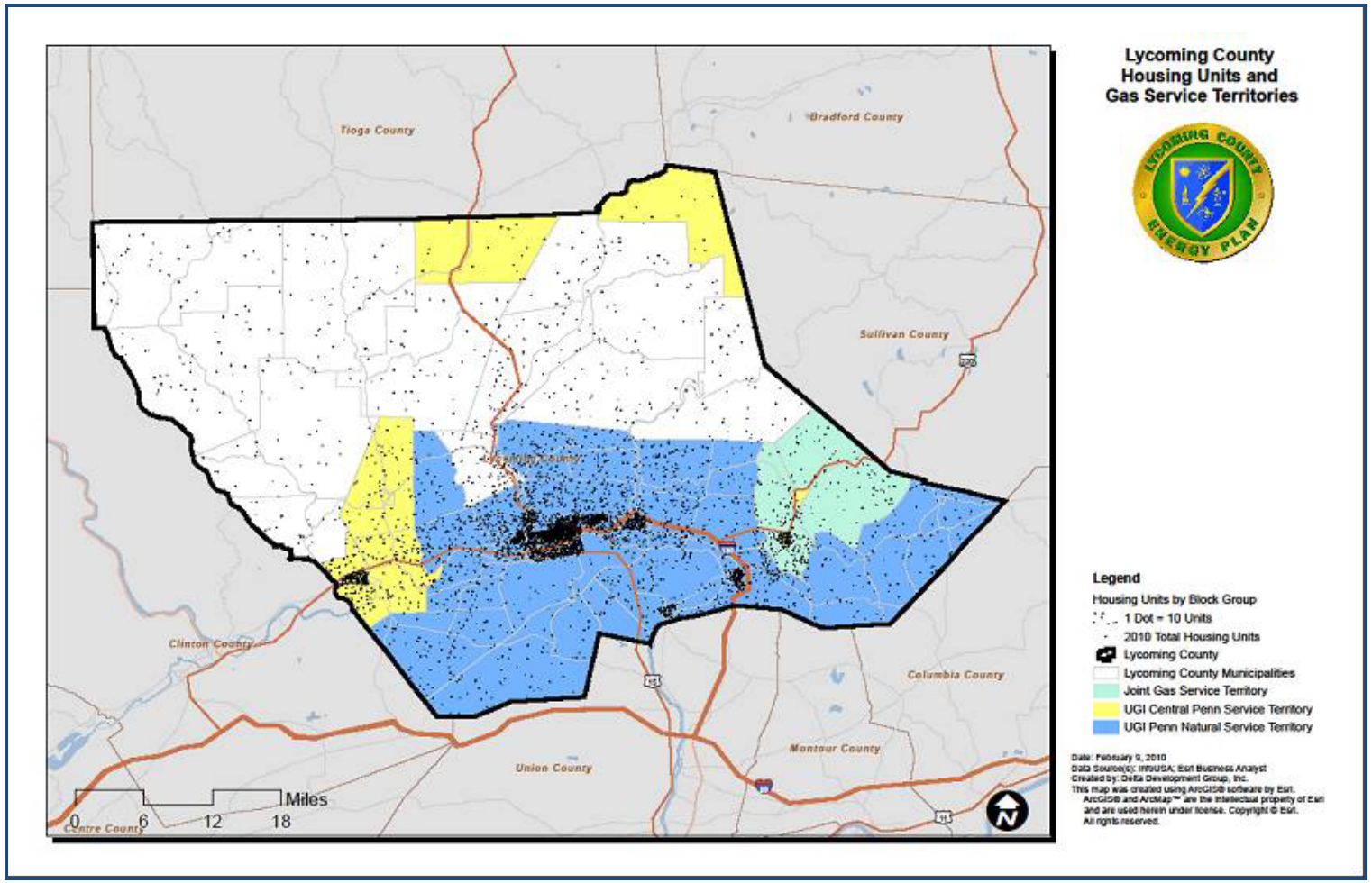
The following figures show the location of sector establishments by number of employees and natural gas service territories. Electricity was not mapped as it is available throughout the County. Figure 2 shows the location and number of employees for the Commercial, Industrial, and Public/Non-Profit sectors, while Figure 3 shows the location of residences. Agriculture is not mapped as the Census of Agriculture does not collect spatial data. Transportation is not mapped as it is determined by mode rather than location.

FIGURE 2 - ESTABLISHMENTS BY NUMBER OF EMPLOYEES AND GAS SERVICE TERRITORIES



Development is primarily concentrated along existing transportation corridors. Most Commercial, Industrial, and Public/Non-Profit development is located within existing natural gas service territories. Those Commercial and Public/Non-Profit establishments outside natural gas service territories are predominantly located in Lewis Township along the US 15 and SR 14 corridors, Cogan House Township, and Lycoming Township.

FIGURE 3 - HOUSING UNITS AND GAS SERVICE TERRITORIES



Housing units are located throughout the County with clusters in existing communities. The concentration in existing communities might provide an opportunity for a pilot small, communitywide energy project in the future. As an example, the New Berlin Borough project (2000 population: 838) mentioned previously was undertaken with an entire community focused on conserving energy and reducing costs in all sectors. Similarly, the Smethport Biomass project in Smethport Borough (2000 population: 1,684), McKean County, is focused on the feasibility of tapping into woody biomass as fuel for a heat and power (CHP) system. The system would supply district heat and electricity to local residents, businesses, and government buildings within the Borough's service area.

UTILITY-DELIVERED ENERGY

Utility delivered energy sources include electricity and natural gas provided through utilities regulated by the Pennsylvania Public Utility Commission as well as energy provided through rural electric cooperatives. The following utilities deliver electricity and natural gas to Lycoming County: Allegheny Power (West Penn Power), Penelec (FirstEnergy), PPL Electric Utilities, Sullivan County Rural Electric, Tri-County Rural Electric, and UGI Natural Gas Utilities.

These companies differ from non-utility energy source providers; the independent dealers of coal, oil, propane coal, and biomass such as firewood and pellets. A list of non-utility energy sources providers serving Lycoming County is included in Appendix D.

The PUC regulated utilities collect and report aggregate data by the following customer types: Residential, Commercial, and Industrial. Each regulated utility and the rural electric cooperatives were contacted for the following information: the number of customers by sector and the amount of energy consumed in each sector during the year 2010.

Kilowatt hours (kWhs) reported for electricity and therms reported for natural gas were converted to British Thermal Units (BTUs) for consistency in reporting the energy sources.[44] Data received from the utilities is not complete as customer counts and usage data were not available from the following companies: Penelec, Sullivan County Rural Electric, and Tri-County Rural Electric.

Non-utility energy source providers were also contacted for usage data as well; however, this information was not available. It is assumed that the information was not available because non-utility energy source providers are not required to report county level energy consumption information to state regulatory or monitoring authorities.

The primary reason for obtaining utility delivered and non-utility consumption data was to include the data as part of the energy consumption calculation for Lycoming County. The actual utility consumption information was not used in the calculation of county-wide energy consumption as corresponding nonutility data could not be collected at the County level. The methodology for estimating County energy consumption will be discussed later in this chapter.

The utility data obtained for this analysis is useful and will be collected every three years as a way to benchmark Energy Plan implementation progress. For example, if utility delivered energy consumption for a particular sector decreases over time, the decrease in energy consumption could serve as a metric

[44] 1 kWh equals 3,412 BTUs. 1 therm equals 100,000 BTUs.

for determining the effectiveness of Energy Plan implementation or signal that Act 129 programs are having their desired impact in reducing energy consumption.

The following table provides the number of customers reported by sector and energy consumption converted to BTUs for each utility company which supplied data.

TABLE 2 – LYCOMING COUNTY UTILITY CUSTOMER COUNTS AND ENERGY CONSUMPTION (2010)

Utility Customer Counts and Energy Consumption (2010)						
Utility	Residential		Commercial		Industrial	
	Customer Count	BTUs	Customer Count	BTUs	Customer Count	BTUs
Allegheny Power	5,563	8,925	638	3,145	62	725
PPL	46,755	1,690,859	7,050	1,629,442	328	1,174,530
UGI Utilities	14,418	1,140,441	2,013	1,520,358	38	799,817

Source: Utilities; Delta Development Group, Inc.

Note: PPL was reported an "Other" category. According to PPL, "Other" includes sales to other electric utilities and accounts owned by PPL. For purposes of this analysis, "Other" was allotted to the Industrial sector.

FACTORS IMPACTING UTILITY-DELIVERED ENERGY CONSUMPTION

Several factors impact or will impact in the future, the amount of energy that each utility delivers. One of the most significant impacts will be increased capacity because of shale gas exploration and production and the success of renewable energy deployment. Each of these factors will be discussed later in Chapter 4. Both Act 129 program implementation and demand aggregation influence the amount of utility-delivered energy both now and in the future.

ACT 129 ELECTRIC UTILITY PROGRAMS

The continued implementation of Act 129 electric utility programs by EDCs will have an impact on Lycoming County's utility-based energy consumption in the future. As noted in Chapter 2, as a result of PA Act 129, EDCs that provide service to populations of more than 100,000 in Pennsylvania must reduce energy consumption and demand. EDCs are required to reduce overall consumption of electricity by at least 1 percent by May 31, 2011, and by a minimum of 3 percent by May 31, 2013. In addition, peak demand must be reduced by a minimum of 4.5 percent by May 31, 2013.

To evaluate the effectiveness of the energy efficiency and conservation programs required under Act 129, the PUC established a Statewide Evaluator Contract. Statewide Evaluator reports are released quarterly with the Program Year 2 (2010-2011) 2nd Quarter report dated April 4, 2011, the most current report available. The quarterly reports identify progress towards Act 129 savings targets, best practices, areas for improvement, and recommendations. A total of 76 energy efficiency or conservation

programs have been implemented across Pennsylvania with 43 additional programs to be implemented in 2011. [45] PPL Electric Utilities, FirstEnergy (formerly Penelec), and Allegheny Power (formerly West Penn Power) are the EDCs that serve Lycoming County. A summary of program results for Program Year 2, 2nd Quarter is shown in the following table. The gross energy savings represent a change in energy consumption and/or demand resulting directly from program-related actions.

These results represent each EDCs entire service area including Lycoming County.

TABLE 3 - ACT 129 2ND QUARTER, PROGRAM YEAR 2 RESULTS

	Statewide	Allegheny Power	Penelec	PPL
Program Year-to-Date Reported Gross Energy Savings (mWh)	706,584	30,106	51,793	197,237
Program Year-to-Date Verified Energy Savings (mWh)	529,851	0	50,270	151,794
Program Inception to Date Reported Gross Energy Savings (mWh)	1,029,456	36,012	65,369	278,694
Program Inception to Date Verified Energy Savings (mWh)	850,932	2,952	63,135	235,597
% of 2011 Energy Savings Target Achieved	N/A	1.4%	45.4%	62.0%
% of 2013 Energy Savings Target Achieved	N/A	0.5%	15.1%	21.0%
Program Year-to-Date Reported Gross Demand Reduction (mW)	76.99	11.4	6.18	27.61
Program Year-to-Date Verified Demand Reduction (mW)	42.68	0	6.06	23.51

[45] GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 3. (November 2010 data).

Program Inception to Date Reported Gross Demand Reduction (mW)	99.22	12.4	7.62	33.7
Program Inception to Date Verified Demand Reduction (mW)	65.06	0.5	7.3	30.83
% of 2013 Demand Reduction Target	N/A	2.3%	7.1%	10.0%

Source: GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 6.

Appendix E includes a summary of each EDC's program results and lists programs implemented and reported savings, programs evaluated, and programs to be implemented or those with no savings for EDCs operating in Lycoming County.

DEMAND AGGREGATION

While more of a cost reduction measure than an energy efficiency measure, energy aggregation can be a useful tool. Energy demand aggregation is a process whereby energy is sold to municipalities that have joined together as a group to purchase electricity and natural gas collectively, resulting in reduced rates for municipal energy. As a first step to energy aggregation, the aggregator typically conducts a municipal utility bill analysis and analyzes rates. It then works to gather municipalities as part of a consortium of energy buyers that pool their buying power to get competitive energy rates.

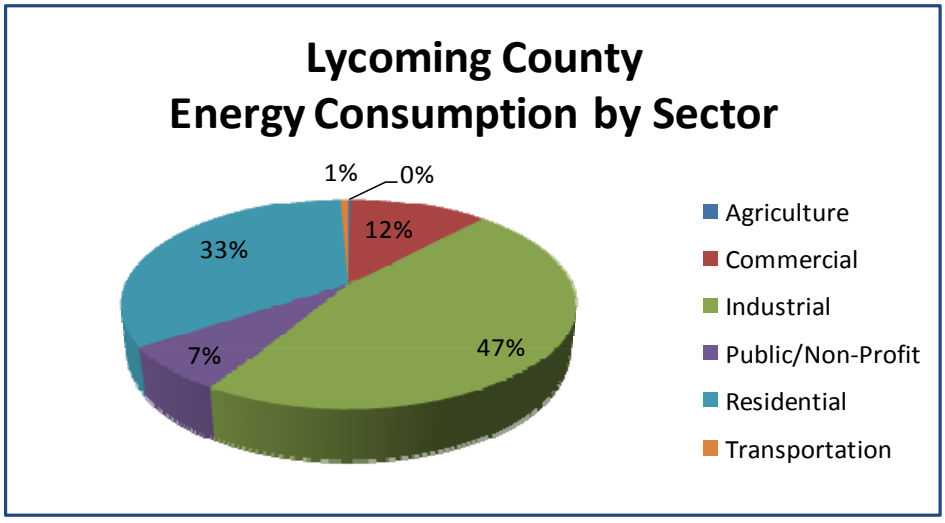
By purchasing large blocks of energy, aggregated groups may reduce a supplier's overhead in terms of marketing and administrative costs. This provides the aggregated groups with greater buying power, passing along savings to municipalities. An energy aggregator acts as an agent for a group of municipalities through negotiating offers and making purchasing decisions. The contract that results from this process is between the individual consumer and the supplier at the price negotiated by the aggregator.

Demand aggregation should be viewed as a sound alternative to reduce municipal energy costs and promoted to Lycoming County municipalities. Premier Power Solutions has been working with the Lycoming County Solid Waste Authority (LCSWA) to evaluate energy supplier costs. While not truly demand aggregation, Premier Power Solutions is able to objectively present the pros and cons of using each supplier allowing LCSWA to evaluate bottom line energy costs and make an informed energy provider decision.

LYCOMING COUNTY ENERGY CONSUMPTION ESTIMATES

Lycoming County's energy consumption was estimated for both sector and source. The following figures present the results of these estimates for both sector and type of energy source in 2010 based on the methodology described in this section.

FIGURE 4 - LYCOMING COUNTY ENERGY CONSUMPTION BY SECTOR

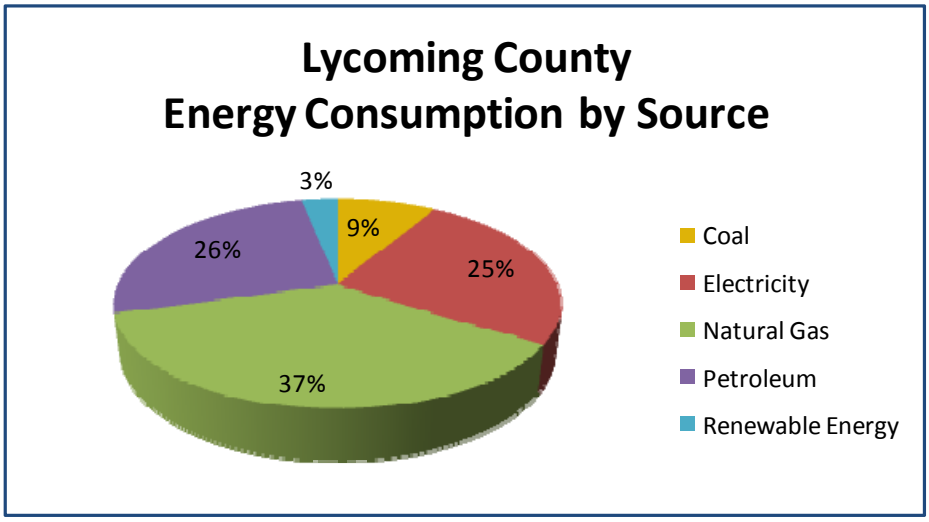


Source: Delta Development Group, Inc.

The majority of energy consumed in Lycoming County is in the Industrial sector followed by the Residential sector. While the Transportation sector is low compared to U.S. transportation energy consumption, which was calculated at 27 percent in 2009, this percentage is expected to increase with the increased truck and rail traffic associated with shale gas development.[46] Similar to the Transportation sector, Agriculture energy consumption is low. As discussed earlier in the Energy Plan Sectors section of this chapter, the ESRI data which is the basis for the calculation reflects larger farming operations, while the smaller farms are reported in the Residential sector. This is discussed further in the following methodology.

[46]U.S. Energy Information Administration, Annual Energy Review 2009. http://www.eia.gov/emeu/aer/pdf/pages/sec2_4.pdf

FIGURE 5 - LYCOMING COUNTY ENERGY CONSUMPTION BY SOURCE



Source: Delta Development Group, Inc.

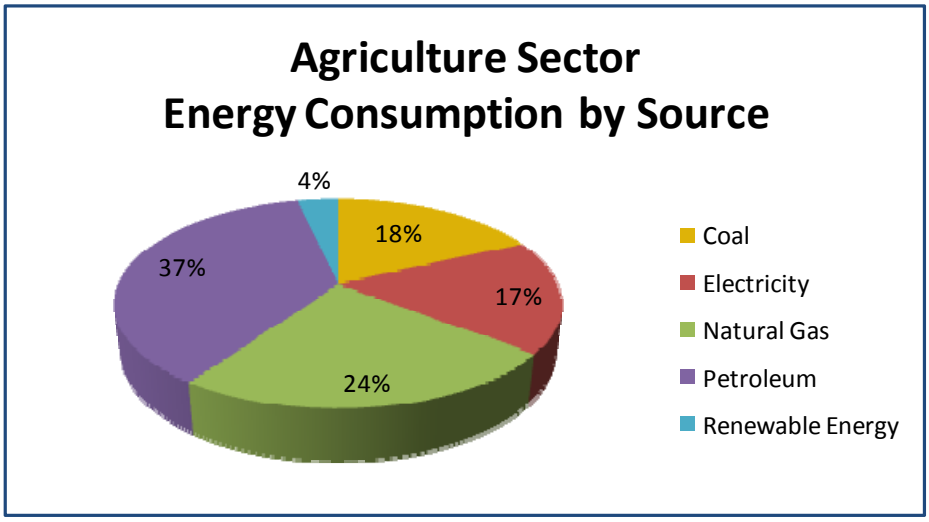
Based on the consumption calculations prepared for this report, natural gas is the most common energy source in Lycoming County among all the sectors.

It is anticipated that the use of natural gas as an energy source will continue to increase as new opportunities to increase its use will be made available through continued shale gas production. Renewable energy consumption is estimated at three percent in Lycoming County. While this is lower than eight percent at the national level, it provides an opportunity to increase renewable energy source development countywide.[47]

The following figures present year 2010 energy consumption for each sector by source. This information is useful to understand the energy sources used by establishments within each sector. Details on how these percentages were derived are discussed in Step 4. A figure was not included for the Transportation sector as consumption is derived from one source – Petroleum.

[47] U.S. Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, 2009. http://www.eia.gov/cneaf/alternate/page/renew_energy_consump/rea_prereport.html

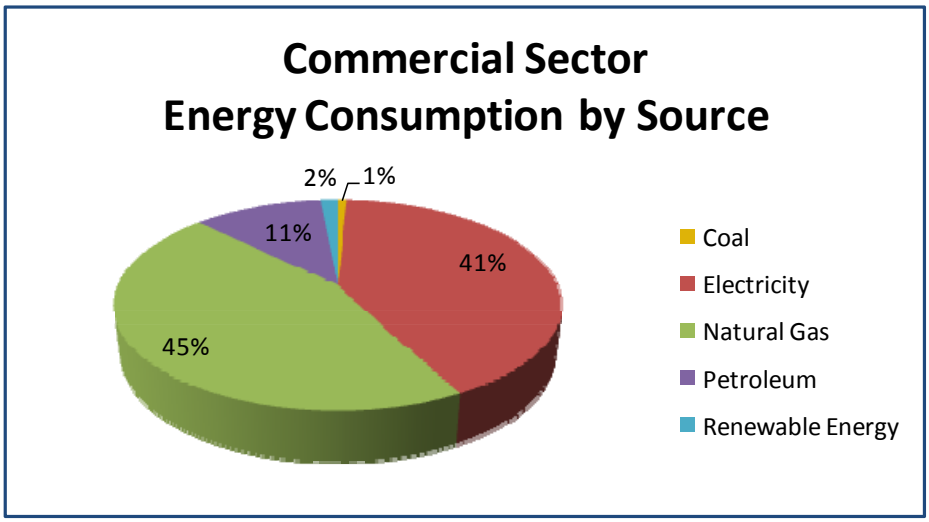
FIGURE 6 - AGRICULTURE SECTOR ENERGY CONSUMPTION BY SOURCE



Source: Delta Development Group, Inc.

The percentage of petroleum and coal consumed by the Agriculture sector is higher compared to the Commercial and Public/Non-Profit sectors. This is because Agriculture facilities, as well as Industrial facilities, rely on large quantities of these energy sources for production. The amount of renewable energy used in the Agriculture sector (4 percent) is higher than the county level percentage (3 percent). Outreach to agricultural businesses would be helpful to identify what types of renewable energy projects are being deployed and to encourage renewable energy projects in the future.

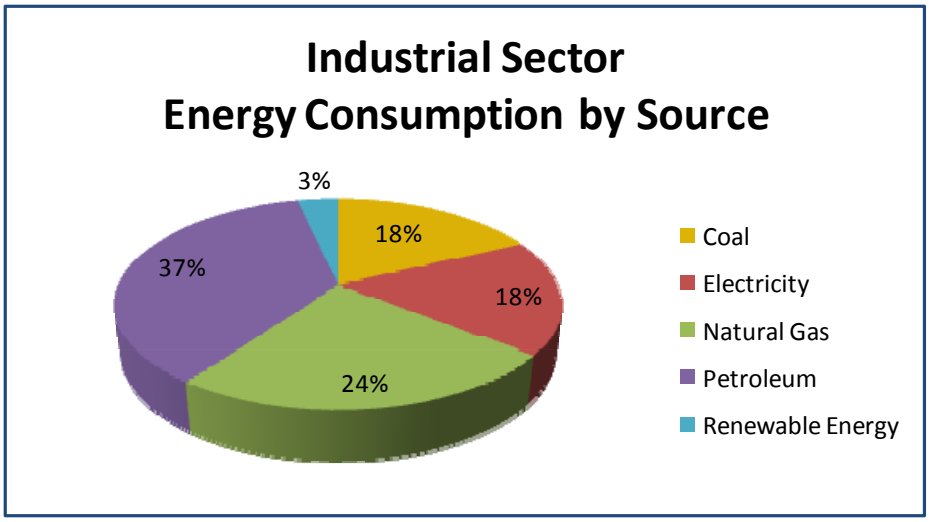
FIGURE 7 - COMMERCIAL SECTOR ENERGY CONSUMPTION BY SOURCE



Source: Delta Development Group, Inc.

Energy consumption in the Commercial sector is relatively consistent with the Public/Non-Profit sector. This is most likely because establishments in both sectors locate in similar types of buildings i.e. commercial and office structures. Renewable energy consumption in the Commercial sector is lower (2 percent) compared to the County (4 percent). This presents an opportunity for outreach and education as a way to increase the percentage of energy derived from renewable sources.

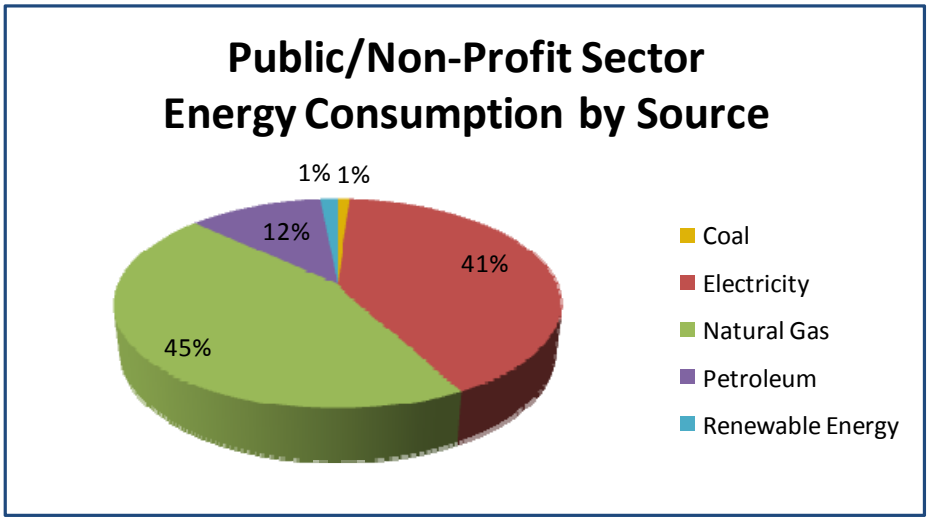
FIGURE 8 - INDUSTRIAL SECTOR ENERGY CONSUMPTION BY SOURCE



Source: Delta Development Group, Inc.

The percentage of energy sources consumed by the Industrial sector is similar to the Agriculture sector. Both sectors rely on large amounts of natural gas, petroleum, coal, and electricity for their production processes. It is expected natural gas consumption will increase in the Industrial sector as new industrial applications for natural gas are commercialized.

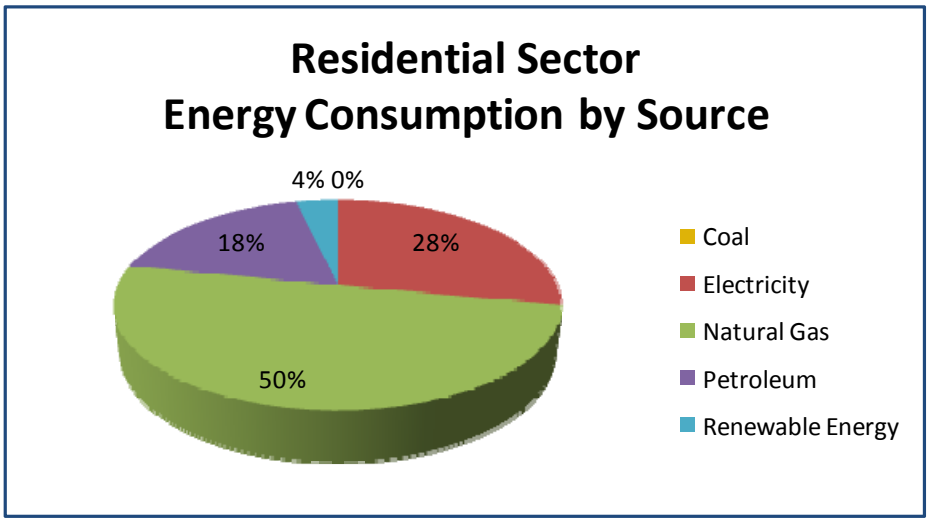
FIGURE 9 - PUBLIC/NON-PROFIT SECTOR ENERGY CONSUMPTION BY SOURCE



Source: Delta Development Group, Inc.

Similar to the Commercial sector, there is an opportunity to increase renewable energy use in the Public/Non-Profit sector beyond 1 percent. Outreach and education with local governments, schools, and non-profit organizations should be encouraged.

FIGURE 10 - RESIDENTIAL SECTOR ENERGY CONSUMPTION BY SOURCE



Source: Delta Development Group, Inc.

Natural gas accounts for 50 percent of Residential energy consumption in Lycoming County. Consumption of coal was less than 1 percent which is not surprising as coal declined as a home energy source in the mid-1900s. The Residential sector uses more renewable energy than any of Lycoming

County's sectors and the County as a whole, with the exception of Agriculture. Targeted outreach to homeowners should be considered to increase the amount of Residential renewable energy use.

METHODOLOGY

The methodology developed to estimate Lycoming County's existing energy consumption was based on the U.S. Energy Information Administration's (EIA) Annual Energy Outlook 2011 report (AEO 2011).[48] Several energy benchmarking studies, primarily the Regional Greenhouse Gas Emissions Inventory (March 2009, revised December 2010) conducted by the Delaware Valley Regional Planning Commission,[49] and the New Berlin Energy Independence project conducted by the SEDA-COG Energy Resource Center (SEDA-COG ERC) were also reviewed for methodology.[50]

Calculating *actual* energy consumption for Lycoming County would require the availability of a complete, consistently updated data set including energy sources and usage for each. As discussed earlier in this chapter, utility consumption data (utility electric and natural gas) was available for a few but not all utilities, and non-utility source data (fuel oil, coal, biomass, etc.) was not available at the County level. To make certain the energy consumption calculations were derived based on a complete, consistently updated data source, AEO 2011 data was used.

The methodology is detailed in this section to ensure successful replication in the future to measure progress of the Energy Plan's implementation. A full list of outcomes, metrics, and measures that will be used to measure the progress of the Energy Plan's implementation is found in Chapter 8.

The following steps were taken to derive the estimated energy consumption in Lycoming County. Accompanying AEO data source information is included in Appendix F.

STEP 1 IDENTIFY THE NUMBER OF ESTABLISHMENTS BY SECTOR

Since the Lycoming County Energy Plan is focused on collecting, analyzing, and reporting data by sectors useful to County planning and development activities (Residential, Commercial, Industrial, Public/Non-Profit, and Transportation), it was important to identify the number of (or count) of establishments (physical locations) in each of these sectors. Refer to the Energy Plan Sectors section at the beginning of this chapter for details regarding how sectors and number of establishments were identified. The

[48] U.S. Energy Information Administration, Annual Energy Outlook 2011, http://www.eia.gov/forecasts/aeo/.

[49] Delaware Valley Regional Planning Commission, Regional Greenhouse Gas Emissions Inventory (March 2009, Revised December 2010).

[50] New Berlin Borough, Union County, Pennsylvania, http://www.newberlinpa.us/Pages/New%20Berlin%20Energy%20Independence%20Project.aspx.

number of County establishments by sector was then apportioned to energy consumption data pulled from regional AEO 2011 data as described in the following steps.

Transportation is the only Energy Plan sector not reported by establishment; it was determined by mode instead of number of establishments. Refer to Step 6.

STEP 2 IDENTIFY A DATA SOURCE

While some utility data was available for Lycoming County, nonutility data was not readily available. Therefore, data obtained from the U.S. Energy Information Administration (EIA) was used to determine energy consumption. Using the EIA data ensured that estimated energy consumption for all sectors, with the exception of Transportation, was calculated based on the same data set.

The Annual Energy Outlook 2011 report (AEO 2011) outlines current energy usage and long-term projections of supply, demand, and prices through 2035 based on the results of a proprietary modeling system. The U.S. is separated into nine regions in the AEO. Pennsylvania is located in the Middle Atlantic Region, along with the states of New Jersey and New York. Consumption is identified in the AEO 2011 by sector and source and reported in quadrillion BTUs. The total number of establishments (for each sector) in New Jersey, New York, and Pennsylvania, was identified using the same methodology for Lycoming County as described under Step 1.

The calculations and projections contained in the AEO 2011 were used to analyze utilization trends in the Middle Atlantic Region as well as determine the consumption through 2035 in Lycoming County by energy source. This information will serve as a baseline to determine an increase in demand or the influence of other factors in the energy industry such as government regulations/legislation, renewable energy incentives and funding, changes in technology and consumer trends.

STEP 3 IDENTIFY REGIONAL ENERGY CONSUMPTION BY SECTOR

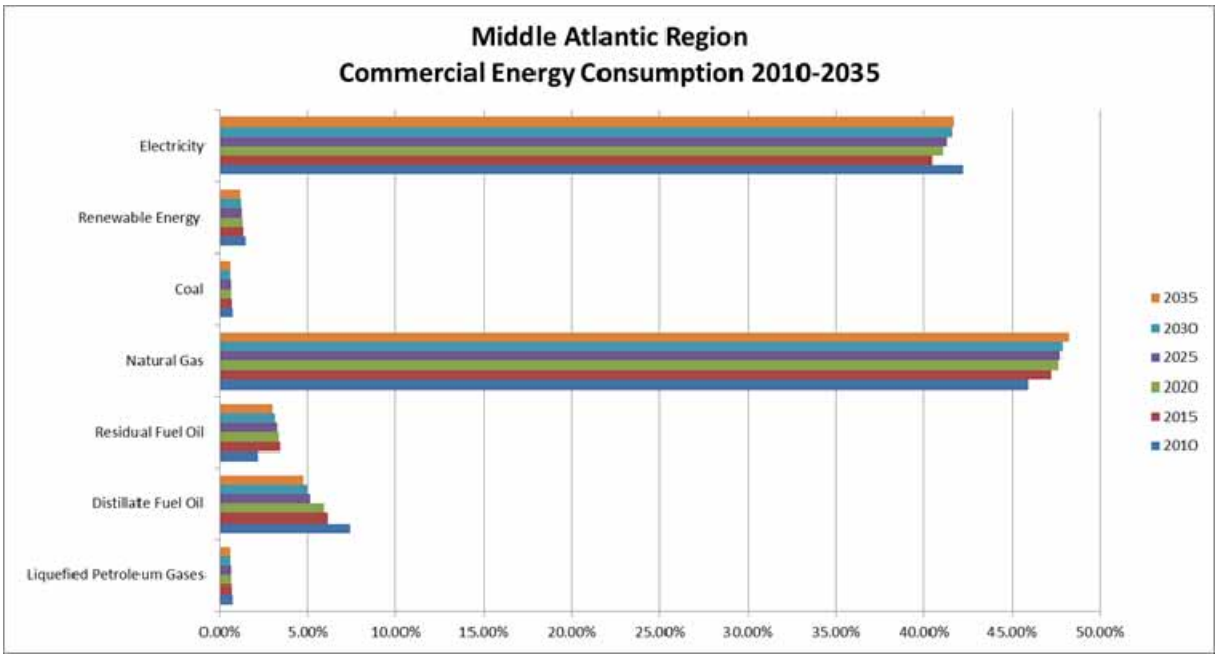
Energy consumption by source for the Middle Atlantic Region is defined by the AEO 2011 as a percentage of total consumption for 2010 to 2035. Once regional energy consumption was established, percentages were apportioned to Lycoming County as discussed in Step 4.

The EIA defines the Industrial sector as businesses with NAICS codes of manufacturing (NAICS codes 31-33); agriculture, forestry, and fisheries (NAICS code 11); mining, including oil and gas extraction (NAICS code 21); natural gas transmission (NAICS code 2212); and construction (NAICS code 23). The remaining businesses are classified as commercial. Farms operating as a business are reflected in the Industrial sector (NAICS 11); however, if a farm does not operate a registered business, they will be considered a private residence and calculated based on households in the Residential sector.

REGIONAL CONSUMPTION – COMMERCIAL

According to the AEO 2011, natural gas is the most consumed energy source in the Middle Atlantic Region, followed closely by electricity. Refer to Figure 11.

FIGURE 11 – MIDDLE ATLANTIC REGION COMMERCIAL ENERGY CONSUMPTION 2010-2035



Source: AEO 2011, Delta Development Group,Inc.

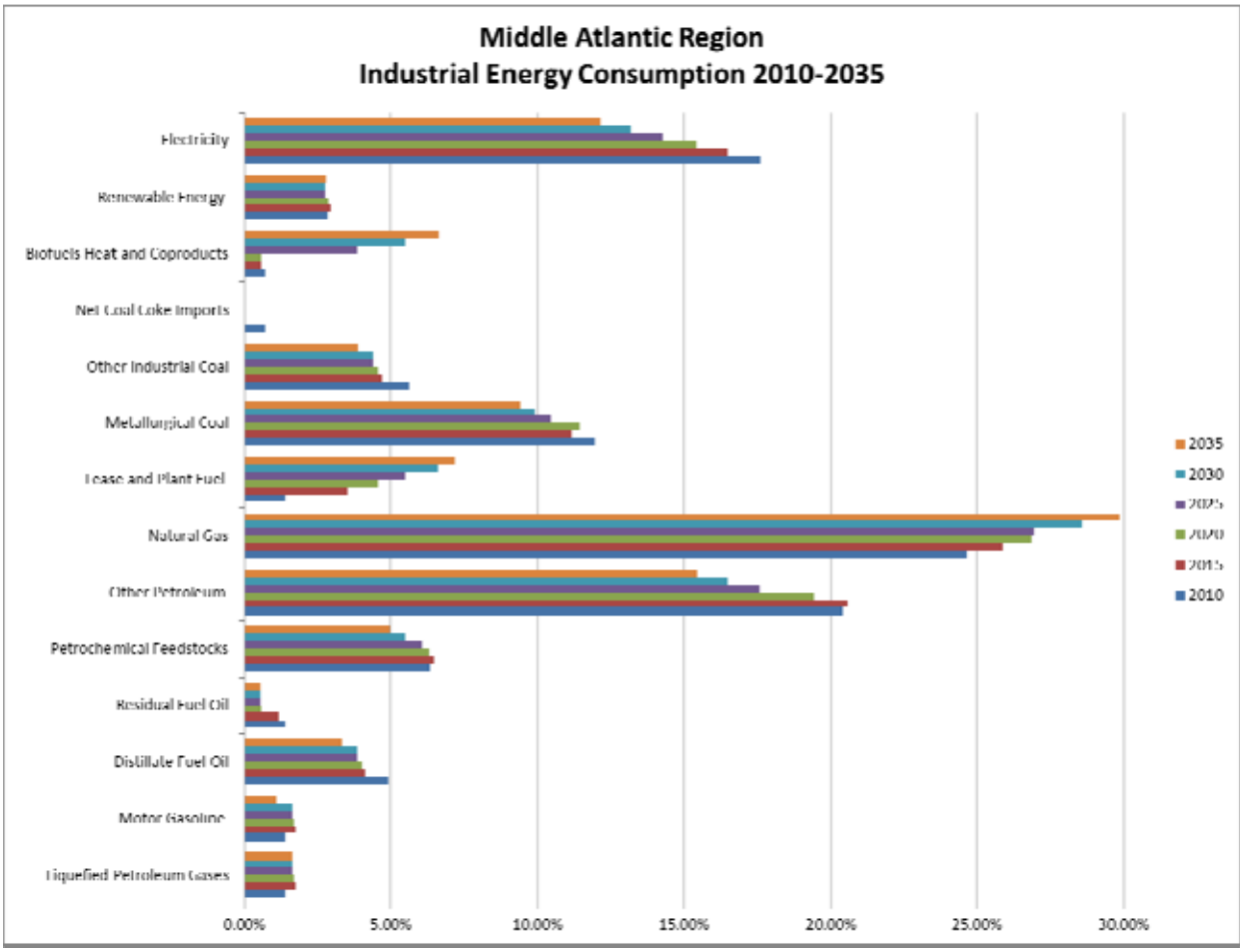
Natural gas consumption increases from approximately 43 percent in 2010 to over 48 percent in 2035, which could be attributed to the availability of natural gas resources due to the Marcellus and Utica Shale reserves. Based on shale gas exploration and production in Lycoming County over the past several years, this projection may be conservative and not represent the opportunity within Lycoming County for natural gas consumption. Natural gas utilization will vary based on the availability of gas, legislation, regulations, pricing, and the expansion of supportive infrastructure in the county. The shale gas industry is quickly emerging in Lycoming County and the region and significant historical trends are not yet available for analysis.

Electricity has seen a decrease from 2010 to 2015, but remains stable from 2020 to 2035 at approximately 41 percent. The stability may be associated with state and regional initiatives to reduce energy consumption through alternative energy development and conservation measures enforced in utility portfolio standards.

REGIONAL CONSUMPTION - INDUSTRIAL

Similar to the Commercial sector, natural gas is the most consumed energy source in the industrial sector of the Middle Atlantic Region. Refer to Figure 12.

FIGURE 12 – MIDDLE ATLANTIC REGION INDUSTRIAL ENERGY CONSUMPTION 2010-2035



Source: AEO 2011, Delta Development Group,Inc.

The next most consumed energy source is the "Other Petroleum" segment, which is expected to decline from nearly 21 percent in 2015 to 15 percent in 2035. "Other Petroleum" is defined by the EIA as the following types of fuel: Aviation Gasoline Blend Components, Asphalt and Road Oil, Crude Oil, Petrochemical Feedstocks, Petroleum Coke, Pentanes Plus, Still Gas, Unfinished Oils, and Remaining Miscellaneous Products. Natural gas consumption in the Industrial sector increases drastically from approximately 26 percent in 2010 to over 37 percent in 2035. As noted previously, the increase in consumption could be attributed to shale gas exploration and production in this region of the U.S. Electricity has seen a significant decrease of over 30 percent from 2010 to 2035.

STEP 4 DETERMINE LYCOMING COUNTY'S ENERGY CONSUMPTION BY SECTOR (EXCLUDING RESIDENTIAL)

To determine energy consumption within Lycoming County, a current listing of businesses within Lycoming County was identified using ESRI data as outlined in Step 1. To determine the local consumption by energy source for Lycoming County, the 2010 businesses within Lycoming County were categorized similar to those in the AEO 2011 dataset. The regional utilization by sector and source was then applied to the businesses at an employee level to account for business size.

For the Energy Plan, Lycoming County has segmented county businesses by Agriculture, Commercial, Industrial, and Public/Non-Profit sectors. To account for the business size and utilization of energy, an estimated consumption per employee was determined and then applied to employee figures reported by ESRI for businesses within Lycoming County. It was determined that approximately 66 million BTUs per commercial employee and 573 million BTUs per industrial employee are consumed annually.

The amount of energy consumed by the Agriculture, Industrial, Commercial, and Public/Non-Profit sectors is included in a summary table in Step 7.

STEP 5 DETERMINE LYCOMING COUNTY'S RESIDENTIAL ENERGY CONSUMPTION

Using the AEO 2011 residential consumption estimates, an annual consumption per household was determined. This figure was then applied to the households in Lycoming County. A household consumes approximately 109,594,314 BTUs annually. The following table displays the total energy consumption in Lycoming County, Pennsylvania, and the United States.

TABLE 4 - LYCOMING COUNTY RESIDENTIAL ENERGY CONSUMPTION BY AREA

Area	2010 Households	2010 Annual Consumption (BTU)
Lycoming County	47,262	5,179,646,468,268
Pennsylvania	4,950,056	542,497,991,581,584
United States	116,761,140	12,796,357,040,158,000

Source: ESRI, AEO 2011, and Delta Development Group, Inc.

The amount of energy consumed by the Residential sector is included in a summary table in Step 7.

STEP 6 DETERMINE LYCOMING COUNTY'S TRANSPORTATION ENERGY CONSUMPTION

Lycoming County's transportation energy consumption was derived by adding total consumption (in BTUs) for the following: vehicular energy consumption, airport energy consumption, and rail energy consumption. The Transportation consumption calculation does not reflect the increase in transportation activity due to shale gas exploration and production. This is because vehicular and air transportation data was from years 2008 and 2009.

VEHICULAR ENERGY CONSUMPTION

Annual vehicle-miles travelled (VMT) was obtained from the U.S. Department of Transportation, Research and Innovative Technology Administration (RITA).[51] The number of VMT was pulled for passenger car, motorcycle, other 2-axle, 4-tire vehicles, single-axle trucks with 6 tires or more, combo trucks, and buses, and was then converted to percentages. The most current year this data was available was 2008.

51 U.S. DOT, RITA http://www.bts.gov/publications/national_transportation_statistics/html/table_01_32.html.

The annual number of VMT travelled in Lycoming County was determined by multiplying the number of days in a year by Lycoming County's daily VMT (year: 2009).[52] The vehicular type percentages were applied to Lycoming County's daily VMT to arrive at annual VMT. VMT for each vehicle type was divided by the average miles per gallon to arrive at the total amount of fuel consumed by vehicles on an annual basis.[53]

The final calculation needed to estimate vehicular energy consumption required a determination of how many gallons of diesel versus gasoline fuel were consumed. The percentage of diesel versus gasoline usage for passenger vehicles, trucks, and buses was obtained from the DOE, Center for Transportation Analysis.[54] The gasoline or diesel fuel percentage was multiplied by total fuel used to derive the total amount of diesel and gasoline consumed. The final step required conversion of the gallons of each fuel type consumed to BTUs.[55]

AIRPORT ENERGY CONSUMPTION

Williamsport Regional Airport was contacted to identify the amount of fuel sold in 2010. The number of gallons of Jet (A) Fuel (used for gas-turbine aircraft) and Avgas (used for piston-engine aircraft) were reported. These numbers were converted to BTUs. Since jet fuel sold in Lycoming County is not consumed entirely in Lycoming County, the air energy consumption is over reported.

RAIL ENERGY CONSUMPTION

Two railroads traverse Lycoming County: the Lycoming Valley Railroad (LVRR) and the Norfolk Southern Harrisburg-Buffalo Main Line. The total number of carloads travelling on the railroads during 2010 was obtained from the SEDA-COG Joint Rail Authority and the North Shore Railroad. The carloads were converted to tons by multiplying each carload by 100 tons per carload.

Next, the total number of miles that each railroad traverses in Lycoming County was obtained from PennDOT's Pennsylvania Railroad Map.[56] The number of miles was multiplied by tons to determine ton miles on each railroad. Ton miles were divided by 484 to derive total gallons of diesel fuel consumed. Each ton is equivalent to 484 miles per gallon.[57] Finally, gallons of diesel fuel were converted to BTUs.

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[52] PennDOT Bureau of Planning and Research, Transportation Planning Division.

[53] Average miles per gallon were obtained from the Federal Highway Administration, http://www.fhwa.dot.gov/policyinformation/statistics/2008/vm1.cfm.

[54] U.S. DOE, Center for Transportation Analysis, *Transportation Energy Data Book: Edition 29-2010*.

[55] Each gallon of gasoline is equivalent to 124,238 BTUs; each gallon of diesel fuel is equivalent to 138,690 BTUs.

[56] PennDOT, Pennsylvania Railroad Map (January 2010).

[57] According to the Association of American Railroads, a freight train can move a ton of freight an average of 484 miles on a single gallon of diesel fuel.

Final Transportation consumption was obtained by adding vehicular, airport, and rail energy consumption. The amount of energy consumed by the Transportation sector is included in a summary table under Step 7.

STEP 7 CALCULATE TOTAL ENERGY CONSUMPTION

Total energy consumption for each sector by source was derived by adding the total consumption calculated in steps 4, 5, and 6. Spreadsheets

The distribution of energy sources shown in the following table is useful to understand the type of energy used by establishments within each sector. The following table is presented in BTUs to reflect consumption amounts. This information is presented in percentages in Figures 6 – 10 at the beginning of this section.

TABLE 5 - LYCOMING COUNTY ENERGY CONSUMPTION BY SECTOR

Energy Source	Agriculture	Commercial	Industrial	Public / Non-Profit	Residential	Transportation	Total
Coal	5,878,265,799	15,698,083,330	1,288,208,906,618	12,445,990,247	--	--	**1,322,231,245,993**
Electricity	5,652,178,652	753,615,476,140	1,263,813,626,583	450,600,109,031	1,440,493,396,501	--	**3,914,174,786,908**
Natural Gas	7,913,050,113	820,478,553,847	1,761,350,070,396	491,513,272,205	2,605,147,631,969	--	**5,686,402,578,530**
Petroleum	11,982,618,743	202,804,627,591	2,631,781,266,395	126,817,379,879	950,112,665,777	102,562,837,653	**4,026,061,396,038**
Renewable Energy	1,130,435,730	26,842,125,574	248,543,811,602	16,542,905,170	183,892,774,021	--	**476,952,052,098**
Delivered Energy	**32,556,549,038**	**1,819,438,866,481**	**7,193,697,681,594**	**1,097,919,656,531**	**5,179,646,468,268**	**102,562,837,653**	15,425,822,059,566

Source: ESRI, AEO 2011, and Delta Development Group, Inc.

CHAPTER 4 ENERGY SOURCE MARKET ANALYSIS

This chapter provides an assessment of nonrenewable and renewable energy sources and an analysis of existing and future markets for each. The chapter answers the following questions:

- What energy sources are renewable? What sources are nonrenewable?
- What energy is produced in the County now and what types of energy might be produced in the future?

Energy sources are nonrenewable and renewable. Nonrenewable energy sources cannot be replenished in a short period of time. Renewable energy is derived from resources that are naturally regenerative or are practically inexhaustible (such as biomass), heat (geothermal, solar), moving water (hydropower), and wind energy.

NONRENEWABLE ENERGY RESOURCE EXTRACTION

Natural gas and coal are the only reported nonrenewable energy resources extracted in Lycoming County. Summaries of the reported levels of resource extraction and market observations are included in this section.

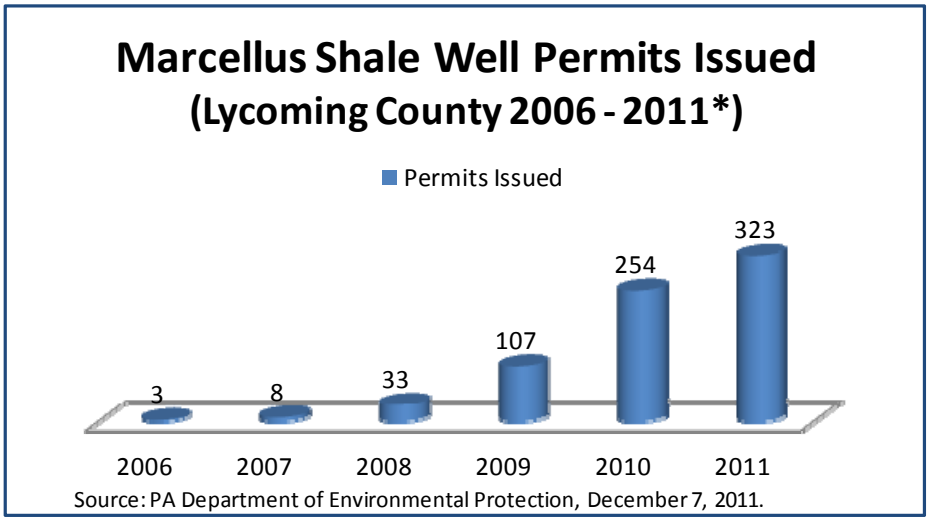
NATURAL GAS EXTRACTION

Nonrenewable energy resource extraction activities are quite active in Lycoming County primarily due to Marcellus Shale natural gas exploration and production. While natural gas is not renewable, it is considered an alternative in that it is a nonrenewable energy source extracted and used in a way that differs from traditional energy technology.

Conventional natural gas drilling has not been particularly prevalent in Lycoming County. For example, only one permit to drill and operate a well was issued in Lycoming County between January 1, 1995, and December 31, 2005.[58] This number has increased significantly starting in 2008 due to Marcellus Shale natural gas exploration and production. Based on DEP's records, the number of Marcellus Shale well permits issued increased substantially between 2006, when only three (3) permits were issued, to 2011 when more than 323 permits were issued (see Figure 13 below).

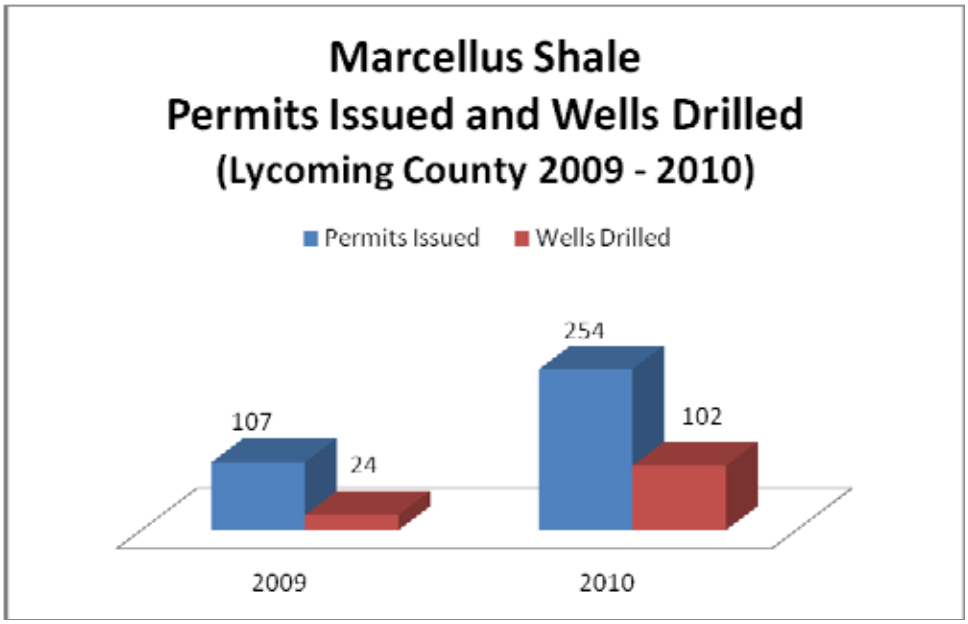
[58] PA Department of Environmental Protection, eFacts, accessed January 25, 2011, http://www.ahs2.dep.state.pa.us/eFACTSWeb/criteria_auth.aspx.

FIGURE 13 - MARCELLUS SHALE WELL PERMITS ISSUED (LYCOMING COUNTY 2006 - 2010)



Between 2009 and 2010 alone the number of Marcellus Shale well permits issued in Lycoming County increased by 165 percent (see Figure 14 below).

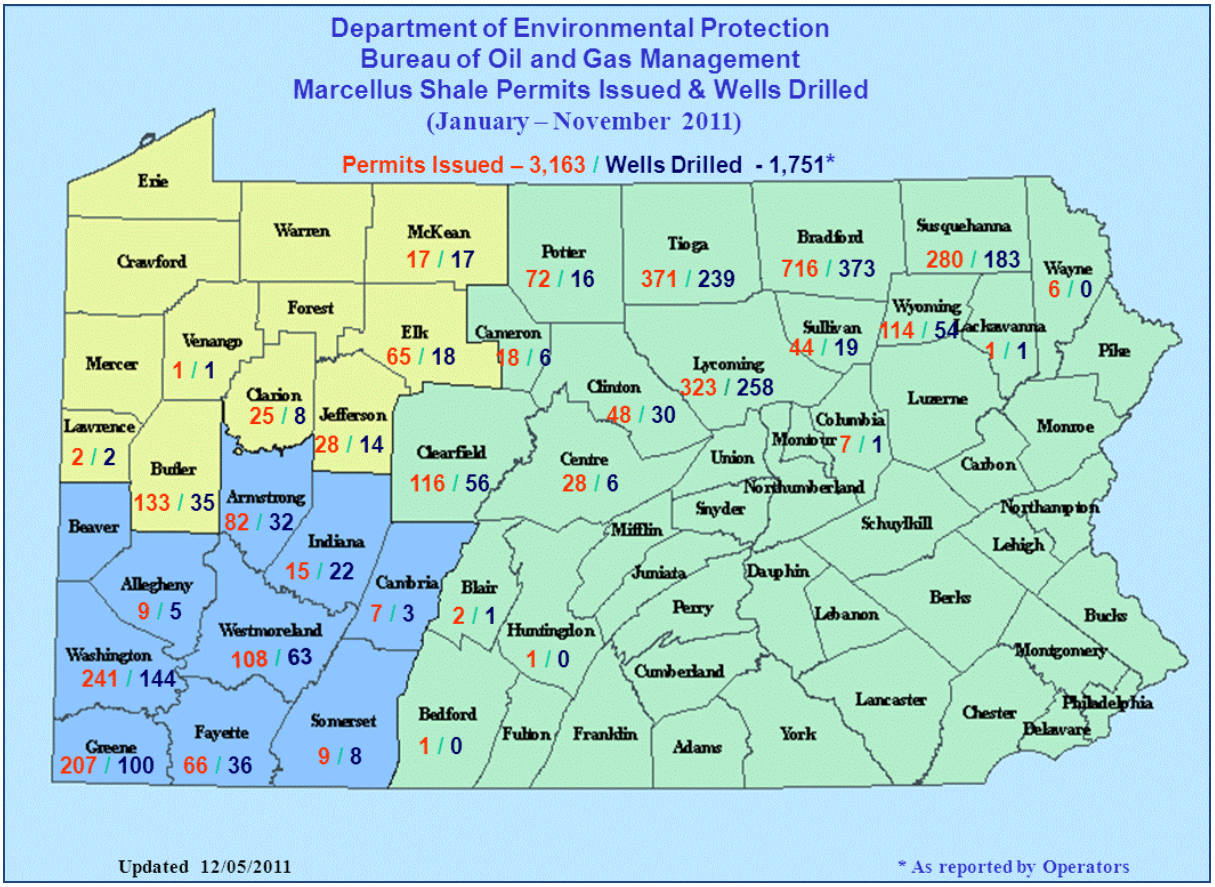
FIGURE 14 – MARCELLUS SHALE PERMITS ISSUED AND WELLS DRILLED



The number of well permits issued and drilled in Lycoming County in 2011 is continuing to rise as shale gas exploration and production activities intensify across Pennsylvania. Between January and November 2011, only two counties surpassed Lycoming County in the number of well permits issued – Bradford and Tioga. Similarly, Lycoming County was surpassed only by Bradford County in the number of Marcellus Shale wells drilled during the same time frame. As shown in the following figure compiled by DEP, counties in Pennsylvania's Northern Tier as well as Lycoming County, and to lesser extent counties

in Southwestern Pennsylvania, are facing tremendous impacts associated with shale gas exploration and production in 2011.

FIGURE 15 – MARCELLUS SHALE PERMITS ISSUED & WELLS DRILLED (JANUARY – NOVEMBER 2011)

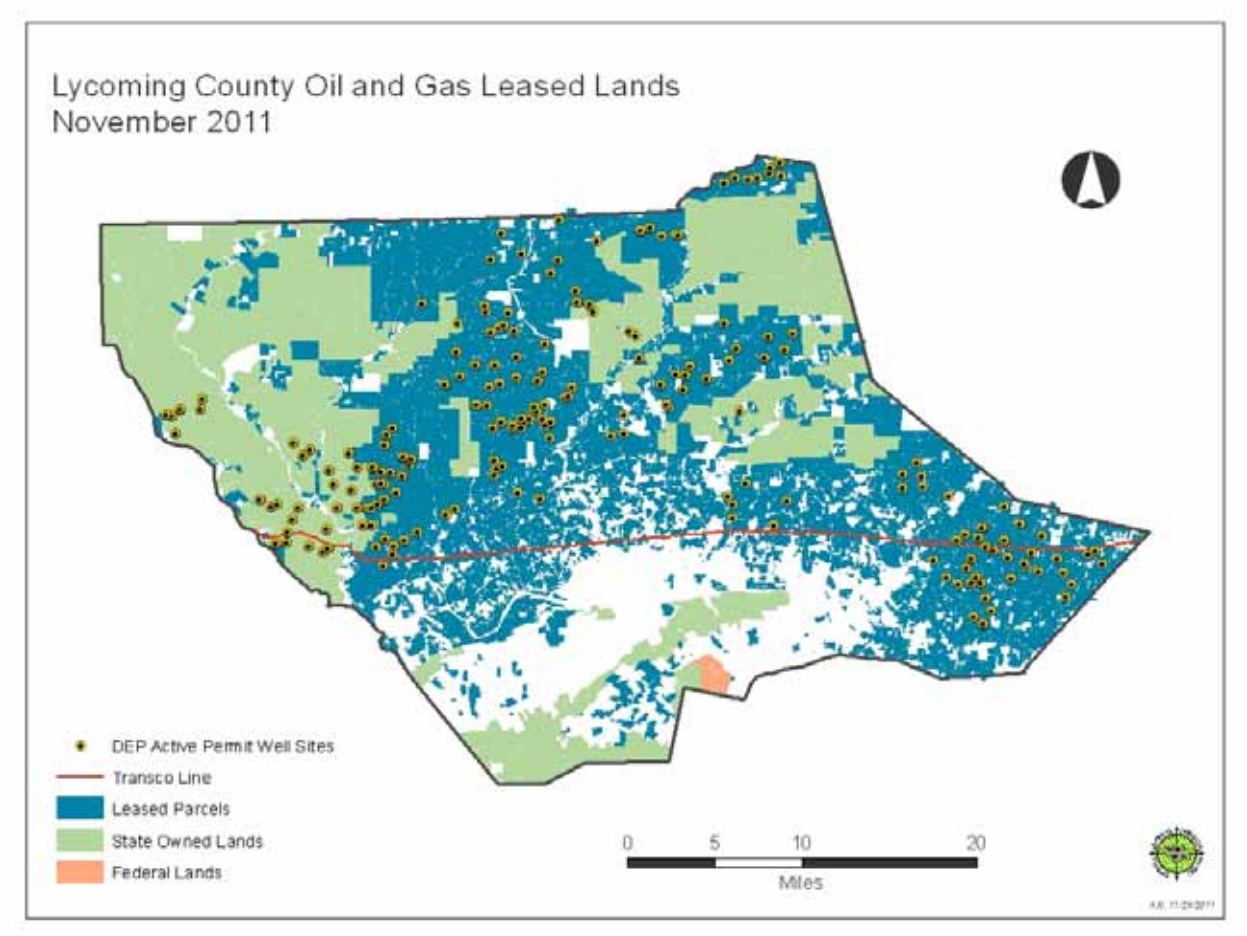


Source: PA Department of Environmental Protection accessed December 7, 2011.

COMMUNITY AND ECONOMIC IMPACTS

The impact of natural gas extraction activities on Lycoming County's overall community and economic development patterns is intense. This statement is demonstrated by the number of Marcellus Shale natural gas well permits issued and drilled as shown in Figure 15 and the dispersion of active well sites throughout most of the County as shown in Figure 16.

FIGURE 16 - LOCATION OF MARCELLUS SHALE WELL SITES IN LYCOMING COUNTY



Source: Lycoming County Planning and Community Development, November 29, 2011.

The positive impact on the community from an economic perspective is noteworthy. Over the past three (3) years:

- The rail industry has experienced explosive growth, revitalizing the industry and revitalizing adjacent brownfield properties. A total of 80 rail carloads related to Marcellus Shale natural gas were handled on the SEDA-COG Joint Rail Authority's Lycoming Valley Railroad in 2008. This number increased to over 6,000 in 2010. Since 2008, a total of eight Well Service Companies have located along SEDA-COG JRA rail lines, with five companies currently considering locations.
- Lycoming County, particularly the Williamsport area, is a commerce hub for the shale gas industry in eastern Pennsylvania. Companies are seeking the county for Pennsylvania headquarters, lodging, and services.
- Over 120 companies have located or expanded in Lycoming County including major well service companies such as Halliburton and Weatherford.
- Collectively, these companies have invested over $300 million in Lycoming County and created more than 5,000 jobs

Along with positive impacts, there are also negative impacts that appear with rapid growth. These negative impacts include, but are not limited to, the following:

- Increased need for emergency response personnel, preparedness, equipment, and training
- Increased housing costs for lifelong residents who can no longer afford housing
- Impacts on roads, bridges, and other types of infrastructure due to increased truck traffic
- Increased need to protect surface and subsurface water supplies
- Increased need for upgrades and expansion to water and wastewater facilities
- Increased demand on County and local services for records management and mapping
- Increased need for social services such as domestic relations, drug and alcohol treatment, and job training
- Increased demand on the County court system

Lycoming County is in the process of quantifying these impacts in an effort to identify needs and priorities as the shale gas industry continues to expand. With this information readily available, the County will be positioned to quickly respond to potential impact fee funding that could help mitigate impacts.

NATURAL GAS MARKETS

The rapid increase in the exploration and production of Marcellus Shale natural gas provides an unsurpassed opportunity for expanding energy production using natural gas as an energy source to generate electricity, supporting the expansion of well service companies that support the natural gas industry, finding new ways to use natural gas in industry production, and using natural gas to power vehicles. Each of these markets is either occurring or being considered in Lycoming County.

NATURAL GAS AND TRANSPORTATION

The shale gas industry is already having a significant impact on transportation in Lycoming County for exploration and production activities. Beyond exploration and production, the abundance of natural gas can provide a catalyst for the conversion of vehicles from conventional gasoline and diesel. Natural gas is a clean burning fuel mostly made up of methane (CH4). It can be used as a transportation fuel to power spark-ignited engines and as a supplemental fuel to compression-ignited engines.

Both the Corbett Administration as well as pending legislation advocates the development of the infrastructure to support the development of compressed natural gas (CNG). By developing refueling stations at least every 50 miles and within two miles of key highways, the infrastructure will be in place to facilitate a conversion of vehicles to natural gas. This conversion would start with fleet vehicles and ultimately result in ample demand to promote the eventual conversion of passenger vehicles.

The focus of utilizing natural gas for transportation should be targeted to fleets that consume a large volume of fuel. Of special interest are those fleets that have returned to base operations. Examples of vehicles that are excellent for CNG conversion are regional transit buses, refuse trucks, local delivery vans (i.e., bread trucks, uniform delivery trucks, beverage trucks, etc.).

These types of fleets use a large amount of fuel, typically diesel, and to a lesser extent gasoline. Many of these trucks use diesel because it has greater energy output per gallon, and the diesel engines that use this fuel produce a lot of torque and have the power needed to operate the vehicles in demanding

situations, such as traversing hills and moving heavy loads. Large advances have been made to engines of Natural Gas Vehicles (NGVs), and they are now capable of performing many of the tasks commonly performed by diesel- and gasoline-powered vehicles.

Liquefied Natural Gas (LNG) differs from CNG in it is typically used in over-the-road trucking applications that need more fuel density to travel longer distances. LNG and CNG are sometimes provided at the same fueling station. In this application, LNG is delivered by truck and stored in a cryogenic tank as a liquid. It can be dispensed as a liquid into LNG tanks on over-the-road trucks. Additionally, the LNG can be evaporated and converted to CNG for dispensing as traditional CNG through a dispenser.

One of the challenges with NGVs is the ability to fuel these types of vehicles in Lycoming County, as there is a lack of fueling station infrastructure. Most urbanized areas of Lycoming County have a gas distribution utility system. However, there are no normally operated CNG filling stations at this time to serve fleets or the general public. Penn College maintains a small CNG fueling facility used for training purposes and at least one fueling station is proposed in Lycoming County.

How does a CNG filling station work? In a fast-fill application, typically the gas is compressed to up to 4,500 psi and stored in high-pressure storage vessels for dispensing into vehicles at 3,600 psi. Time-fill applications slowly fill the vehicles over time by continuing to expand the onboard vehicle tank(s) up to 3,600 psi. A fast-fill fueling facility basically functions in this manner: natural gas from the distribution utility's pipeline network (the same natural gas delivered to your kitchen stove or water heater by UGI) is processed by using an inlet side gas dryer (removes water vapor from the natural gas vapor); next, the gas enters a compressor, and then it is forced into storage vessels at high pressure awaiting dispensing to the vehicle. Time-fill systems work similarly, but typically have smaller compressors since they spread out their capacity (flow volume) over time, and they typically do not include high-pressure storage vessels. Often, vehicles fuel overnight or on a downtime shift.

Four key items are required to make CNG Stations viable:

- Access to highway/road systems
- Anchor fleet (heavy vehicles)
- Natural gas line with adequate pressure and capacity
- Compatible land use/zoning

Provided these items are met, there are potential roadblocks associated with fully developing CNG infrastructure in the County and across the country. Each of the items identified below can be addressed over time through partnerships with the private and public sectors:

- Supply and demand is in two separate, but linked industries – vehicle manufacturing and fueling infrastructure. Both industry sectors need to communicate and jointly plan for market development.
- There is a need for bi-fuel vehicles for transition to balance the vehicle stock as CNG fueling stations and distribution infrastructure are developed.
- Prior to embarking on a CNG infrastructure project, the life cycle cost of an entire system should be considered by analyzing the cost per mile for CNG infrastructure versus the cost per mile for

conventional gasoline. As the CNG market is undeveloped in Lycoming County, there is a potential for financial risk.

An item that has been addressed recently is California Air Resources Board (CARB) certification. In December 2011 DEP issued technical guidance on Natural Gas Vehicle (NGV) conversion systems. The guidance clarifies that natural gas conversions are authorized under the Pennsylvania Clean Vehicles Program. In 2006 Pennsylvania adopted low-emission vehicle standards based on the CARB regulations. DEP issued the technical guidance as the Pennsylvania Clean Vehicles Program did not address alternative fuel conversion systems.

An additional advancement in deploying CNG infrastructure is the installation of a home refueling appliance. Should a homeowner or small business use CNG on a small scale (1 to 4 vehicles), there is the opportunity to install a CNG home refueling appliance. A prerequisite to installation of this appliance is existing natural gas distribution to the home or business. The units would be classified as appliances, similar to gas-fired clothes dryer, or a gas-fired hot water heater. Installations would be made by a commercial or residential mechanical/electrical contractor following the manufacturer's instructions. Use of such appliances would require review of local building codes and permit procedures. Zoning for such appliances should be considered and the units should be considered a permitted use as an appliance.

Local governments can play a key role in the development of CNG infrastructure by helping to open up the market. For example, a government entity could sponsor and support the investment into CNG fueling infrastructure as private developers may not want to assume the risk, particularly in an undeveloped market. As a starting point, anchor fleets (such as municipal vehicles and transit buses), could be converted as they have adequate CNG demand sufficient to build the infrastructure for their own use. The role of the government as the anchor fleet is to share with others until market demand is increased enough for private developers to invest in a CNG station to service the general public. Private investment comes into play as the market matures and private fleets and personal vehicles are converted.

At the national level, the U.S. is in the early stages of using natural gas for transportation. Pockets of NGVs and CNG exist in some states such as California, Oklahoma, and Texas, but the use of natural gas does not currently have critical mass to support the private market. Many other countries are well ahead of the U.S. As the market develops more innovations will be identified, better technology will be put into place, declining infrastructure costs and declining vehicle costs will occur, and competition for market share will play out.

Within Lycoming County there has been growing interest in the development of CNG infrastructure, which led to the formation of the CNG Focus Group (www.cngfocusgroup.com). Over 100 community leaders committed to take part in an Education Day in May of 2011, which solidified the formation of the CNG Focus Group. Spearheaded by Larson Design Group (LDG), the CNG Focus Group is evolving to meet the current needs in the community and provide information about CNG. River Valley Transit (RVT) tapped into the CNG Focus Group to gain support for a project which includes construction of a CNG Pumping Station to be used for both public and private fleet vehicles and purchase of CNG transit buses. RVT was awarded a $3.5 million Federal Transit Administration (FTA) Clean Fuels Grant and a

$400,000 DEP Alternative Fuels Incentive Grant (AFIG) in 2011. RVT will use general operational funds to convert buses to CNG over a 10-year period, resulting in significantly decreased fuel costs once the conversion is complete. Three key items are required to make CNG viable, which RVT has in place or plans to fulfill:

- Access to highway
- Anchor fleet (heavy vehicles)
- Natural gas line with high pressure

The first two items are in place and grant funding will help to offset the costs of achieving the third.

There are several areas in which the CNG Focus Group can continue its efforts to advance the build-out of CNG infrastructure in Lycoming County, as well as share best practices with other parts of the state. Educating and creating partnerships to advance CNG infrastructure and the conversion to natural gas-powered vehicles is the first step. In addition, providing incentives would help offset the costs, which would accelerate the conversion to CNG. The following are steps that Lycoming County and Pennsylvania could take to advance CNG infrastructure and natural gas-powered vehicle use:

- Increase the supply of CNG-powered vehicles
    - At the local and regional levels take the following steps:
        - Learn how to perform vehicle conversions using approved EPA and CARB certified conversion kits
        - Train service technicians to understand CNG vehicle systems
        - Provide technical education through Penn College on vehicles and fueling infrastructure
        - Through local colleges, educate businesses on the reasons to use natural gas as a transportation fuel
    - At the state and national levels take the following steps:
        - Reach out to American automakers and ask them to help build Pennsylvania's CNG fleets
        - Promote legislative changes that support recommendations identified in the MSAC report
        - Use the momentum of grassroots organizations such as the CNG Focus Group to amplify the message to automakers and legislators
- Develop natural gas fueling infrastructure
    - At the local and regional levels take the following steps:
        - Identify key fleets for conversion
        - Perform feasibility studies at key fleet and highway locations
        - Pursue public funding opportunities as they become available
        - Design fueling stations
        - Develop the capability to construct CNG fueling stations, including installing fueling equipment
        - Promote the use of small-scale CNG home refueling stations
- Understand and act on the economic development drivers that facilitate industry development
    - At the local and regional levels take the following steps:
        - Understand the trickle-down economic effect on businesses with fleets
        - Work with regional manufacturers to let them know of the opportunity to make CNG vehicle components and fueling infrastructure components

        - Engage the Williamsport/Lycoming KIZ and Manufacturers and Business Association, as well as the Governor's Action Team on specific opportunities
        - Encourage innovation to create new products for the developing market through organizations such as the Williamsport/Lycoming KIZ Inventor's Club
        - Create more cost-effective CNG solutions (i.e., products and service solutions, business models)
- Engage workforce development agencies/organizations
    - At the state and national levels take the following steps:
        - Tap into other states' experience in investing in CNG infrastructure (such as California, Oklahoma, and Texas)
        - Explore best practices for implementation
        - Tap into colleges and universities for research, national, and global perspectives
        - Use national trade associations and other resources (i.e., NGVAmerica and the Clean Vehicle Education Foundation, also AGA-ANGA's collaborative effort: Clean American Transportation Alliance)

Facilitating the development of CNG infrastructure will have a multiplier effect on job creation and ancillary businesses in Lycoming County and the region including the following: fuel station design, construction, manufacturing of parts for CNG, vehicle upfitter shops, and specialized CNG mechanics. By making natural gas for transportation part of the Lycoming County Energy Plan, the County has the opportunity to be a part of the market development, innovation, and change to domestic transportation fuels.

Pending legislation at the federal and state levels also supports the development of natural gas for transportation. At the federal level, the New Alternative Transportation to Give America Solutions (NAT GAS) Act was introduced on April 6, 2011 (H.R. 1380). The NAT GAS Act would provide expanded tax credits for natural gas used as vehicle fuel, as well as credits for the purchase of NGVs. The bill would also encourage manufacturers to produce dedicated NGVs, and includes tax incentives for developing natural gas fueling infrastructure. The last legislative action was referred to the following committees on April 6, 2011: the House Energy and Commerce Committee; the House Science, Space, and Technology Committee; and the House Ways and Means Committee. Similar legislation was introduced in the Senate on November 15, 2011. The New Alternative Transportation to Give Americans Solutions Act (NAT GAS Act – S. 1863) includes expanding income tax credits for natural gas vehicle purchase and the installation of natural gas fueling infrastructure. It also includes a production tax credit for auto, truck, and buses manufacturers to produce natural gas vehicles. Each of the incentives would be available for five years.

Marcellus Works is a package of six (6) Pennsylvania House bills introduced on April 6, 2011. Each bill was referred to the House Environmental Resources and Energy Committee on April 20, 2011. As of the date that this plan was finalized, each bill was still pending. A summary of each bill follows.

HB 1083 – NATURAL GAS FLEET VEHICLE TAX CREDIT

An Act amending the act of March 4, 1971 (P.L.6, No. 2), known as the Tax Reform Code of 1971, providing for a natural gas fleet vehicle tax credit and imposing penalties.

HB 1084 – KEYSTONE TRANSIT PROGRAM
An Act establishing the Keystone Transit Program and providing a transfer of funds from the Oil and Gas Lease Fund to DEP for a competitive grant program for the transition of small mass transit bus fleets to compressed natural gas.

HB 1085 – CLEAN TRANSIT PROGRAM
An Act establishing the Clean Transit Program and providing a transfer of funds from the Oil and Gas Lease Fund to DEP for a loan program to transition large, mass transit bus fleets to compressed natural gas.

HB 1086 – PUBLIC TRANSPORTATION AND NATURAL GAS ACT
An Act requiring certain large, mass transit agencies to purchase buses that meet certain criteria within a specific implementation schedule and providing for the powers and duties of PennDOT.

HB 1087 – NATURAL GAS CORRIDOR TAX CREDIT
An Act amending the act of March 4, 1971 (P.L.6, No. 2), known as the Tax Reform Code of 1971, providing for a natural gas corridor tax credit and imposing penalties.

HB 1088 – KEYSTONE FUEL INCENTIVE FUND
An Act amending the act of November 29, 2004 (P.L.1376, No. 178), known as the Alternative Fuels Incentive Act, further providing for title of act, for short title, for definitions, for the Alternative Fuels Incentive Fund, and for biomass-based diesel production incentives, and making editorial changes.

HB 1089 – PENNSYLVANIA CLEAN VEHICLES PROGRAM
An Act amending the act of January 8, 1960 (1959 P.L.2119, No. 787), known as the Air Pollution Control Act, providing for the Pennsylvania Clean Vehicles Program.

The status of these bills will be monitored as part of the Energy Plan's implementation.

NATURAL GAS PIPELINES

Additional natural gas-gathering lines and inter- and intrastate pipelines will be constructed within Pennsylvania's shale gas regions. NiSource and UGI are currently partnering on an inter-state pipeline to carry Marcellus Shale natural gas. An estimated 500,000 Dth/day of transportation capacity will be made available for increased production along NiSource's Columbia Gas Transmission pipeline system in Clearfield, Centre, and Clinton counties. This system will interconnect with Transcontinental Gas Pipeline Corp., Tennessee Gas Pipeline Company, Dominion Gas Transmission, Inc., and Millennium Pipeline Company in north-central Pennsylvania and southern New York, as well as connect to UGI's Tioga/Meeker natural gas storage facilities, an extensive gas distribution network.[59]

UGI is also responding to the increase in shale gas development by committing to switch their source of natural gas from other states or countries to Pennsylvania. Currently, 75 percent of UGI's natural gas

[59] FERC, *Major Pipeline Projects on the Horizon* (April 2008 to September 2011).

supply is from out-of-state sources. Marcellus Shale gas will be added to the company's distribution system starting in the fall of 2011.[60] The conversion to Pennsylvania gas will require the construction of additional intrastate pipelines, which could impact Lycoming County.

NATURAL GAS-FIRED POWER PLANTS

There has been interest at locations in both Lycoming and Bradford counties to take advantage of natural gas resources by building two new natural gas-fired power plants. Virginia-based Moxie Energy proposes to invest $800 million in each county to construct the power plants, which are projected to provide energy for up to 1.4 million people.[61] According to the company, the Moxie Patriot Generation Plant would be constructed in Clinton Township, Lycoming County, and the Moxie Liberty Generation Plant would be constructed in Asylum Township, Bradford County. The company has held preliminary discussions with DEP and anticipates starting construction in 2012, with completion of the Liberty Plant in the first quarter of 2015 and completion of the Patriot Plant in the second quarter of 2015. Between 200 and 500 construction jobs will be created with 30 permanent jobs at each plant for operations. Moxie Energy has also indicated that local workers will be hired likely resulting in job opportunities for Lycoming County residents.

The proposed power plants are combined heat and power plants, which are more efficient than traditional fossil-fueled plants as the plants capture a large portion of the energy contained in the heat exhaust from natural gas combustion turbines to generate additional electricity. Carbon monoxide emissions from the power plants are estimated at 80 percent less than coal-fired plants, carbon dioxide emissions about 45 percent less than coal-fired plants, and sulfur dioxide and particulate emissions great than 99 percent less than coal-fired plants.

Susquehanna Health has also recently installed a cogeneration plant fueled by natural gas. The project is highlighted as a case study in Chapter 6.

INCREASED CONVERSION TO NATURAL GAS

According to UGI Utilities, companies are beginning to request natural gas as an energy source due to its abundance, stable supply, and lower cost.[62] In the Commercial sector, there has been an increase in natural gas conversion primarily for businesses supporting the shale gas industry. Conversions in the Manufacturing sector are not occurring as quickly as the Commercial sector, but there are a few commercial support service businesses that are requesting natural gas. According to UGI, Moran Industries in Montgomery County would like to use natural gas at their facility. The costs outweigh the revenue; therefore, a private investor has been asked to contribute to the infrastructure upgrade needed. If such pipeline infrastructure is developed it will benefit residential natural gas connections if it can be delivered at a reasonable rate.

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[60] The Times-Tribune.com, "UGI to Sell Homegrown Gas" (August 16, 2011), accessed October 5, 2011, http://thetimes-tribune.com/ugi-to-sell-homegrown-gas.

[61] *Williamsport Sun-Gazette*, "Natural Gas Power Plants Planned Locally" (July 13, 2011).

[62] Information provided via an interview with Dave Columbine from UGI Utilities.

UGI recently completed a project to move more gas into downtown Williamsport to increase capacity load for the Pennsylvania College of Technology, Eureka Resources, and Susquehanna Health.

UGI uses the following standard decision-making process to evaluate the feasibility of commercial or industrial natural gas connections:

- Determine the connection load based on projected natural gas requirements.
- Evaluate the pressure system and distribution of natural gas. Is it sufficient or should it be increased?
- UGI's Planning Division runs models based on projected use and existing capacity of the overall system.
- Owners may need to help fill the cost gap to make the project financially viable.

UGI reports conversions to natural gas in the Residential sector where infrastructure currently exists has increased, particularly in the Williamsport and Loyalsock areas. As noted in the energy consumption component of this section, it is highly likely that natural gas consumption will noticeably increase when energy consumption calculations are revisited as part of the Energy Plan's implementation. There is a strong push for residential conversions at the same time as sewer lateral repair work is being completed; however, in order to make conversion viable, a balance between construction costs and revenue must be achieved. The timetable for conversions is three to four years. In areas where natural gas infrastructure does not exist, it is much more difficult to achieve a balanced cost ratio to make the installation viable.

PETROCHEMICAL PRODUCTION

America's chemical industry uses natural gas not only to heat and power facilities, but also as a raw material to develop many types of industrial and consumer products. American chemical companies use ethane, a natural gas liquid that can be extracted from shale gas as a feedstock for many products. Domestic natural gas at a lower price gives American manufacturers an advantage over many competitors around the world that rely on naptha, a more expensive oil-based feedstock. Access to shale gas provides American chemical firms with a new competitive advantage – lower priced ethane from a stable, domestic supply. The American Chemistry Council in its report *Shale Gas and New Petrochemicals Investment: Benefits for the Economy, Jobs and US Manufacturing*, projected the impact of a "hypothetical, but realistic" 25 percent increase in ethane supply on growth in the petrochemical sector.[63] The increase in ethane supply would generate 17,000 jobs in the U.S chemical industry, an additional 395,000 outside of the chemical industry, which includes 165,000 in supply chain industries, and 230,000 jobs from new capital investment from the industry, resulting in $4.4 billion per year in additional federal, state, and local tax revenues.

WORKFORCE CONSIDERATIONS

A significant amount of drilling activity requires a skilled workforce to meet the needs of exploration and production companies and associated well service companies. The Pennsylvania College of Technology (Penn College) and the Penn State Cooperative Extension formed the Marcellus Shale Education and

[63] American Chemical Council, *Shale Gas and New Petrochemicals Investment: Benefits for the Economy, Jobs and US Manufacturing (*March 2011), p. 1.

Training Center (MSETC) in 2008. Located in Williamsport on the Penn College campus, the MSETC provides not only education, but research of the primary needs associated with Marcellus Shale, particularly the workforce. According to a Workforce Needs Study conducted by MSETC in 2009, by 2013 the Northern Tier Workforce Investment Board (WIB) region can expect between 3,218 and 5,468 direct, full-time positions associated with Marcellus Shale exploration and production, and the Central WIB region can expect between 1,347 and 2,245 positions by 2013.[64]

The demand for developing qualified personnel is so high to meet the needs of the gas drilling industry in Pennsylvania, Ohio, West Virginia, and New York that the U.S. Department of Labor has provided a $4.9 million grant to Westmoreland County Community College (WCCC) and Penn College to launch a comprehensive recruitment, training, placement, and retention strategy for jobs in the Marcellus Shale gas industry.

COAL

One active bituminous surface coalmine holding two permits are reported in Lycoming County, which are operated by one company. The total permitted acreage of the two surface mining sites is 894 with an annual production of 244,565 tons.[65] It is anticipated that extraction will continue at these locations but with no significant increase in activity.

RENEWABLE ENERGY PRODUCTION AND FEASIBILITY

Renewable energy sources are derived from resources that are naturally regenerative or are practically inexhaustible, such as biomass, heat (geothermal, solar), moving water (hydropower), and wind energy. Pursuing renewable energy deployment requires that a community analyze its inventory of natural resources and choose to pursue those resources that provide the best ”fit” geographically, economically (a good payback), and with practicality.

According to the U.S. Energy Information Administration, renewable energy sources account for 8 percent of total energy consumption in the United States, up from 7 percent in 2006.[66] Of that 8 percent, biomass accounts for 50 percent, followed by hydropower at 35 percent (see Figures 17 and 18 below). Biomass can be further subdivided into the following: wood, which accounts for 24 percent of total biomass; biofuels at 20 percent; and biomass waste at 6 percent.

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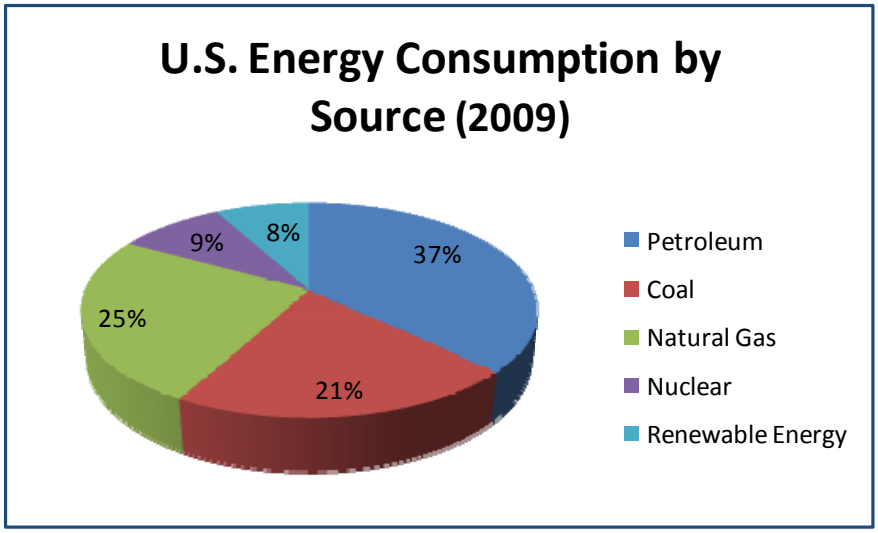
[64] Marcellus Shale Education and Training Center, Marcellus Shale Workforce Needs Assessment, June 2009, p. 5.

[65] PA Department of Environmental Protection, 2009 Bituminous Operators and Production Sites, Operators by County, accessed January 18, 2011, http://www.dep.state.pa.us/dep/deputate/minres/bmr/annualreport/2009/table09_bituminous_operators_and_sites_summary.htm.

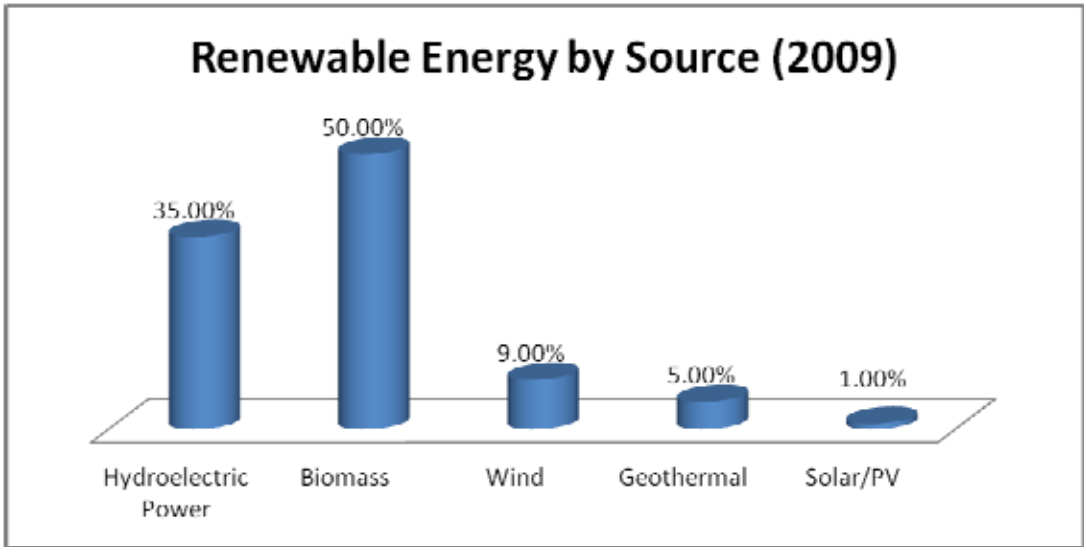
[66] U.S. Energy Information Administration, Office of Coal, Nuclear, Electric and Alternate Fuels, Renewable Energy Consumption and Electricity Preliminary Statistics 2009, http://www.eia.gov/cneaf/alternate/page/renew_energy_consump/rea_prereport.html.

FIGURE 17 – U.S. ENERGY CONSUMPTION BY SOURCE (2009)



Source: U.S. Energy Information Administration

FIGURE 18 – U. S. RENEWABLE ENERGY BY SOURCE (2009)



Source: U.S. Energy Information Administration

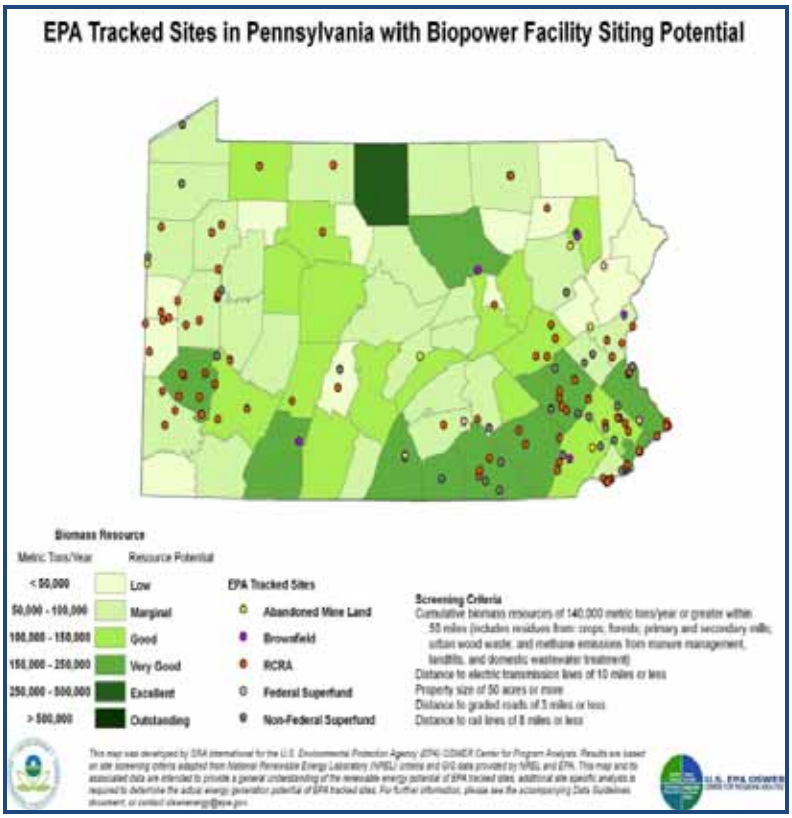
While the actual amount of renewable energy consumption in Lycoming County is rather hard to track as discussed in the consumption calculations earlier in this chapter, there are solid examples of each in the County and the potential to increase their deployment in the future. This section discusses the status of renewable energy source deployment in Lycoming County and potential feasibility of each in the future.

BIOMASS

Biomass is biological material derived from living or recently living organisms. While energy derived from biomass is typically thought of as plant-based materials, biomass can also apply to animal-based material. Examples of fuel sources for biomass energy include the following: lumber, agricultural residues, compost, energy crops (short-rotation woody crops grown specifically as an energy source for heat or biofuels), food and restaurant waste, and manure (from beef cattle, dairy cows, poultry, horses, etc.).

As discussed in Chapter 2, the EPA and DOE have developed mapping showing potential feasibility to site different types of renewable energy projects. Mapping has been developed for each state to determine the potential to site biopower facilities (see Figure 19 below). Screening criteria not only included the amount of cumulative biomass resources, but proximity to infrastructure required to process raw materials and transport the finished fuel. While this mapping was prepared specifically to revitalize EPA-tracked sites such as Brownfields, RCRA, Superfund, and abandoned mine sites, it provides a good tool for assessing how Lycoming County's biomass resources are positioned compared to other Pennsylvania counties. The mapping demonstrates that Lycoming County is well-suited as a location for a biopower facility; however, with the availability of natural gas, the market demand for such a facility is likely to be low.

FIGURE 19 - EPA BIOPOWER FACILITY SITING POTENTIAL (PENNSYLVANIA)

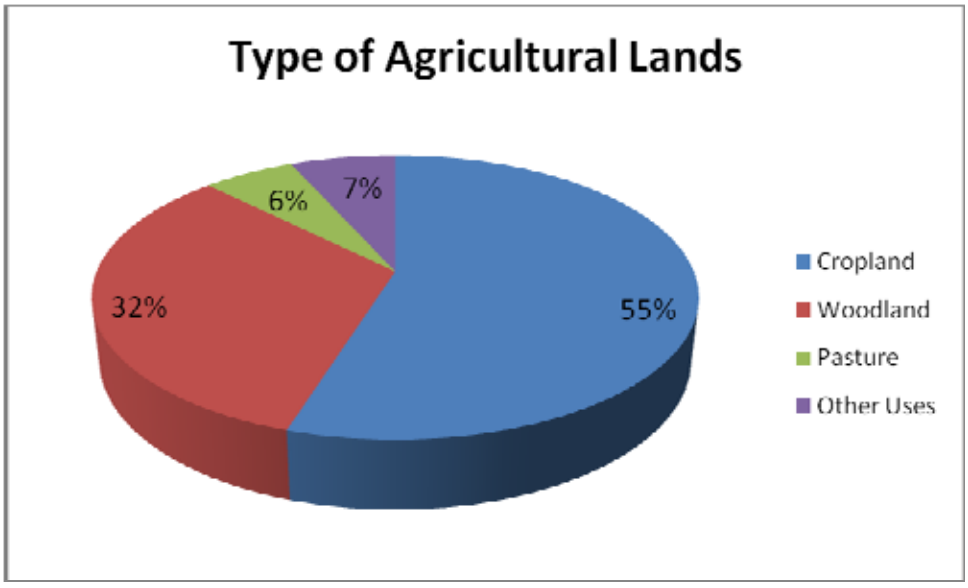


Source: U.S. EPA and DOE

From a Lycoming County perspective, its agricultural lands have been classified by the USDA as part of the 2007 Census of Agriculture. Refer to Figure 20 below, which shows that 55 percent of the County's

agricultural lands are designated cropland while 32 percent are designated woodland, which provides opportunity to increase the use of woody biomass.

FIGURE 20 - LYCOMING COUNTY AGRICULTURAL LANDS



Source: USDA 2007 Census of Agriculture.

WOODY BIOMASS

With a rich lumbering history, Lycoming County's biomass resources are predominantly wood based. The history associated with Lycoming County's timber industry is preserved as part of Pennsylvania's 15-county landscape initiative, the Lumber Heritage Region. The Lumber Heritage Region was designated in 2001 as one of 12 Pennsylvania heritage regions and its purpose is to:

- Preserve the region's historic resources
- Educate citizens about Pennsylvania's rich lumbering history
- Promote outdoor recreation in the region
- Increase partnerships among entities that value the lumber region
- Promote economic development resulting from sustainable forest management.[67]

Today, 32 percent of Lycoming County's agricultural land is classified as woodland or forest land.[68] While lumbering and wood product manufacturing still remain a key component of the County's

[67] Lumber Heritage Region of Pennsylvania, *Management Action Plan* (May 2001), p. iii.

economy, the use of Lycoming County's timber resources as a source of fuel both in and outside of the County is viable and has future potential.

To understand the energy supply potential from wood-based biomass and what products are being generated from Lycoming County's feedstock, the Pennsylvania DCNR Bureau of Forestry will be updating the Timber Product Output Survey for Pennsylvania in 2012. The Timber Product Output Survey estimates and tracks timber removal and the impact on forests and regional economies. The most recent survey, conducted in Pennsylvania in the early 1990s, is outdated. While Forest Inventory & Analysis data are collected on an annual basis to determine what resources are growing, the amount of timber being harvested and the end products produced are not tracked annually. Currently, the survey does not track the amount of short-rotation woody crops used as a biomass energy source. An example is hybrid willow planted by East Lycoming School District. This project is highlighted in a case study included in Chapter 6. Monitoring the growth and usage of these types of wood resources will need to be addressed in the upcoming survey.

From a national perspective, Pennsylvania is interested in helping the country meet the increasing demand to use renewable energy sources. The sustainable utilization of woody biomass is one way to help achieve that demand. Woody biomass utilization is a key component of restoring and maintaining ecosystem health and the increased use of renewable biomass energy improves markets for low quality and underutilized wood and wood waste, and improves forest health across the region. It also increases local jobs, keeping dollars spent on energy within the local economy, and reduces annual energy costs for residents and businesses that install wood energy systems.

There is significant need for an independent, third-party feasibility analyses to help agencies, communities, and businesses evaluate how wood energy can meet local energy needs; what technologies are available; at what scale and cost; and what benefits could result. Such assistance is not widely available throughout either Pennsylvania or the northeastern United States.

The U.S. Forest Service Wood Education and Resource Center (WERC) has partnered with the Bureau of Forestry to provide and fund technical assistance to public- and private-sector owners for evaluation and development of community-scale biomass thermal and thermally-led combined heat and power projects. DCNR's Bureau of Forestry selects the projects the Bureau would like to see move to the feasibility stage. The Bureau's Biomass Energy Specialist identifies potential projects and gathers preliminary data on the projects. These renewable energy projects utilize local, sustainably harvested wood, wood residues, and wood wastes to offset the use of fossil fuels, saving owners money while reducing net greenhouse gas emissions and boosting local economies.

WERC administers the Woody Biomass Technical Support Program. The Program provides an initial evaluation of potential projects identified, ranks the projects against other projects under consideration, and then provides feasibility studies for projects that have a high potential for implementation. Once a decision is made to move forward with implementation of a project, WERC may provide other technical services associated with development of the wood energy project. WERC uses the services of two contractors to conduct feasibility analyses and additional woody biomass energy-related work, and also

[68] USDA, 2007 Census of Agriculture.

to develop awareness about the sustainable use of local forest resources to meet local renewable energy needs.

Renewable energy projects promoted through this program are typically implemented at hospitals, schools, jails, universities, district energy systems manufacturing plants, and industrial facilities. Projects that move forward to implementation are truly sustainable, providing short- and long-term economic, environmental, and social benefits.

One such project is under development at the Sullivan County School District in north-central Pennsylvania. The Bureau of Forestry worked with school administrators to perform an initial review of the District's opportunity to utilize local wood as fuel to replace fuel oil. WERC's technical assistance to the District for a feasibility study and general technical support helped the District develop a project scope and reach a decision point to proceed with project implementation. The project is a biomass district energy system supplying heat and hot water for the District's elementary school, high school, and new administrative offices. The system will replace 85 percent of fuel oil used at the facility, reducing annual heating costs by $115,000. It will effectively eliminate 830 pounds/year of sulfur dioxide emissions and will result in a net reduction of 1,000,000 lbs of CO2 annually. The wood-energy system was supplied by a local Pennsylvania manufacturer, AFS Energy Systems of Lemoyne, Pennsylvania. Additional feasibility studies planned for potential biomass projects in the region include Divine Providence Hospital, Williamsport, and Kurt Weis Greenhouse, Mount Carmel, Northumberland County.

In addition to residential usage, county wood-energy users include schools, manufacturers, and forest products sectors (such as sawmills, mulch producers, and loggers), transport wood chips to bioenergy facilities such as Viking Energy in Northumberland County for electricity, and Energex, one of the largest wood pellet manufacturers in the country located in Mifflin County.

Lycoming County School Districts that have either completed or have contemplated a biomass energy project include the following:

- East Lycoming School District has developed a significant biomass energy project at its Hughesville Campus. Hybrid willow, a short-rotation woody crop that reaches harvest three years after planting, has been planted on 60 acres of the Hughesville Campus. Harvested on a three-year rotation, the yield of this biomass energy source is 30 tons per acre. The crop is converted from wood to heat in a biomass energy plant and used for heat and hot water for Hughesville High School and the Lycoming County Career and Technology Center. From a cost perspective, purchasing wood chips for the biomass heating system is more cost effective than coal, oil, and natural gas, according to the East Lycoming School District. The cost for the school district to purchase wood chips is $4.25/MMBTU compared to $6.00 for coal, $25.71 for oil, and $10.35 for natural gas. A major consideration when contemplating the use of these types of energy crops is cost. Start-up costs per acre were greater than $1,000.
- This project is highlighted in a case study included in Chapter 6.
- Jersey Shore School District, Williamsport Area School District, and Divine Providence Hospital are interested in implementing a biomass energy project.

The wood energy systems being considered for Lycoming County school districts, hospitals, or other facilities are not to be mistaken for the outdoor wood-fired boilers (OWBs) popular with rural homeowners. Also known as hydronic heaters, OWBs are designed to burn wood or other fuel to heat water to warm a building. Resembling a small shed with a short smokestack on top, they are very popular throughout Pennsylvania and Lycoming County due to an abundance of all different forms of wood. Smoke from OWBs can contain particulate matter, carbon monoxide, and other pollutants. Smoke and pollutants from these residential appliances have led to an abundance of complaints throughout neighborhoods in 53 of Pennsylvania's 67 counties.[69] Woody biomass energy boilers used on a commercial scale to heat schools, hospitals, and other facilities are more sophisticated and employ force-draft combustion air and pollution control devices such as multi-clone precipitators and/or electrostatic precipitators that virtually eliminate smoke and particulates from their stack emissions.

Several advancements in the use of woody biomass are being deployed or are in the research and development phase. A few of these advancements are summarized below:[70]

- WOOD PELLETS AND SOLAR. New advances in woody biomass development, includes research into the use of wood pellets or wood chips in conjunction with solar thermal collectors and accumulator tanks to provide for steady, consistent energy production versus the on-and-off spiked production from more conventional systems.

- SWITCH GRASS AS A BOILER FUEL. The Benton Area School District in Columbia County is heating their high school with switch grass briquettes.

- TORREFACTION OF WOODY BIOMASS. Currently under development in Smethport, McKean County, Pennsylvania, torrefaction is a thermal process to convert biomass into a coal-like material. Torrefied biomass has better fuel characteristics than the original biomass without volatile emissions. Torrefied biomass is more brittle, making introduction of this form of biomass fuel into a utility boiler easier and less energy intensive compared to using conventional grinders or pulverizers. Plus, terrified wood is denser than green biomass; therefore, requires less storage space. (Example in photo at the right)

- BIOMASS DISTRICT HEATING SYSTEMS. Biomass district heating systems employ a centralized biomass energy plant to heat multiple community buildings. This form of community-based thermal energy production is more cost effective and energy efficient. Smethport in McKean County, Pennsylvania, has studied the feasibility of using biomass district heating in the community's downtown. This project could occur concurrently with reconstruction of the community's water

[69] Alan W. Flenner, "Who's Got the Power? Municipal Regulation of Residential Alternative Energy," *Pennsylvania Law Weekly* (November 30, 2010).

[70] Information provided via an interview with Mike Palko, DCNR Biomass Energy Specialist.

lines. Such a project could be considered in HUD Low-Income Housing developments as an alternative to individual hot water heaters, thermal heat for large apartment complexes, etc.

BIOFUELS

Growing crops such as corn, canola, and cassava for conversion into biofuel has been occurring for several decades. An example in Lycoming County is Susquehanna Mills Company located in Montoursville Borough. Susquehanna Mills contract with area farmers to grow canola, after processing the canola is converted into oil for food and restaurant use. The spent oil is then reprocessed into biofuel. The company refers to this process as a full-circle concept, converting energy grown in the field to a food source with food waste collected and converted into biofuel to be used to grow more crops.

Converting algae to biodiesel is in the research and development stages. The University of Pittsburgh is researching the use of algae to convert solids to ethanol and biodiesel. Feedstock for biodiesel has traditionally been either waste or virgin vegetable oils (waste or virgin oils). However, due to the competing demands with edible oil sources, there has been an interest in developing other nonedible feedstock sources, such as algae oils, for the production of algae biofuel. While algae, as a potentially viable biodiesel crop is increasingly gaining importance, there still are several challenges ahead for the cultivation and extraction of algal oil for large-scale production of biodiesel fuel. Several companies are working on bringing down the fixed and operational costs of the capital-intensive process to convert algae to a commercial biodiesel; however, companies are relying on government subsidies to do so. While an interesting prospect for Lycoming County to consider, the desire to advance such a technology is unlikely due to an abundance of natural gas.

BIOMASS WASTE

There are several opportunities to convert biomass waste into energy. Some are very advanced while others are in the research and development stages as discussed below.[71] The Lycoming County Landfill is perhaps the most significant of such projects in the County. The Lycoming County Landfill is managed by Lycoming County Resource Management Services (LCRMS), has been in operation since 1978, and accepts approximately 1,000 tons of waste per day. Since 1993, LCRMS has operated a one-megawatt cogeneration plant that includes two engines producing 1,000 kilowatts per hour, and through a partnership with PPL Renewable Energy, the energy is sold to the electrical grid. The cogeneration plant produces enough electricity to power approximately 1,400 homes per year and provides excess thermal energy to heat on-site County buildings. The existing cogeneration plant consumes only 23 percent of the available landfill gas. A detailed case study has been prepared for the Lycoming County Landfill Gas to Energy Project and is included in Chapter 6. Additional examples of cogeneration facilities in Lycoming County include Koppers, Inc., and Susquehanna Health Medical Center, both highlighted in Chapter 6.

[71] Information provided via an interview with Eric Moore from the Lycoming County Solid Waste Authority.

SEPTAGE TO ENERGY

An additional type of biomass energy in its exploratory stages is deriving energy from septage. Septage is material removed from septic tanks, cesspools, holding tanks, or other sewage treatment storage units, and excludes sewage sludge from public treatment works, industrial waste, and any other sludge. Septage must be removed on a regular basis and is transported for disposal at permitted sites or facilities for processing and treatment. Waste collected in a septic tank is known as septage. This includes all of the waste disposed of through plumbing, which is held in a septic tank for pumping. Septage is a large, untapped energy resource and, according to the Lycoming County Water & Sewer Authority (LCWSA), is 7 to 10 percent more powerful as an energy source due to the concentration of organics. The largest cost associated with converting septage to energy is transportation. Establishing a public/private partnership would help to make the cost of converting septage to energy more cost competitive.

A pilot project at the Smiths Creek Landfill in Smiths Creek, Michigan, included a three-acre septage bioreactor cell. The bioreactor cell provided a septage treatment capacity of four million gallons per year generating $200,000 in revenue. The project is projected to produce enough gas to heat 800 homes for 10 years with landfill space recovery revenue of $2,000,000.

CONVERTING SEWAGE TO ENERGY

Sewage has a significant energy value that remains largely untapped because it can be difficult to extract the energy efficiently. Most of the wastewater treatment plants in Lycoming County are not well-suited to high-efficiency "energy extraction." Wastewater treatment plants face treatment mandates such as Chesapeake Bay Tributary Strategy requirements, which demand specific actions with a high cost. The Jersey Shore, Williamsport, and Muncy-Montgomery wastewater treatment plants are looking into or have recently decided upon designs for plant upgrades that were mandated due to Chesapeake Bay requirements. The schedules and costs in addressing the requirements create pressure against investing in energy extraction at a time when it is most cost feasible to do so, which is when the wastewater treatment plants are making substantial improvements intended to last for 20 or more years.

The major cost of energy in sewage treatment is aeration for treatment of sewage and sludge. Conventional treatment does not extract energy from sewage rather it adds energy through aeration. Currently, energy extraction can be accomplished through anaerobic treatment of sludge to create methane. There are two primary ways to create energy: (1) methane converted directly to electricity or for heating by combustion, or (2) methane used for heat to dry the sludge and release more gas (pyrolysis) and to create a pelletized biomass that can be burned in a furnace to create heat or electricity.

While energy extraction can be built into a system after a major upgrade, most of the systems in Lycoming County use aerobic treatment, which makes it harder to extract energy from the sewage. Wastewater treatment plants may not be willing to change from their current aerobic treatment approach since this would require a more expensive upgrade. Designers of wastewater treatment plants are much more experienced in addressing energy efficiency now than even five years ago. Therefore, the following items can be addressed in current designs to cost-effectively reduce energy use:

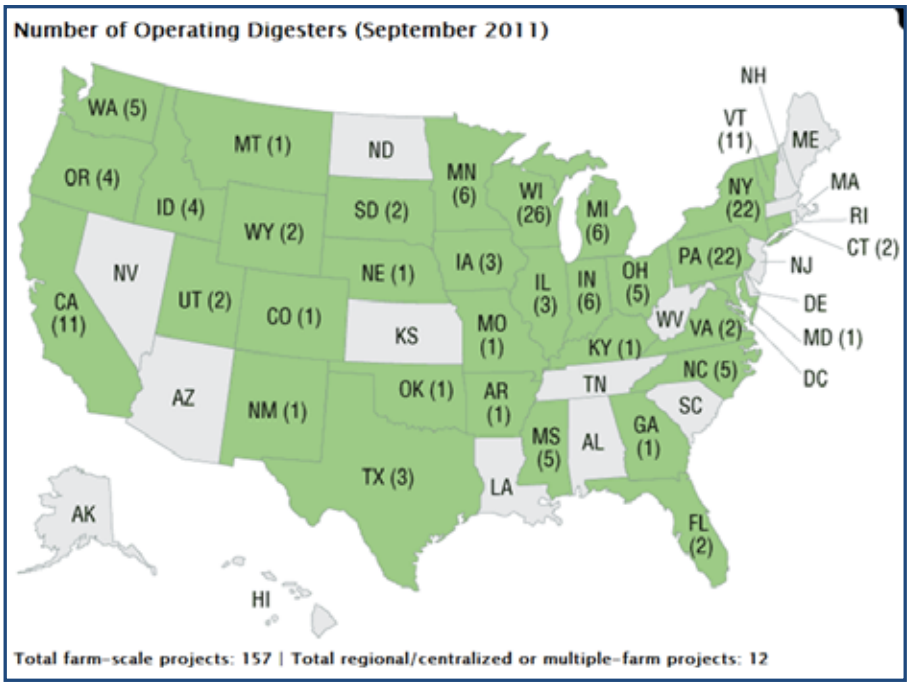
- Thickening the sludge through solar drying
- Anaerobic treatment process from start to finish through larger tanks at a slower process, which allows more recoverable energy. The Milton wastewater treatment plant is an example.

- Since small wastewater treatment plants often must meet an ammonia discharge limit, providing some additional tank volume and performing denitrification (converting nitrate to nitrogen gas) can create energy savings. This may be suitable for the Lairdsville Sewer Plant Project.
- Installing high-efficiency motors
- Installing variable Speed Drives
- Using effluent as a heat sink for "geothermal" heat exchange similar to the Water Tower Square project highlighted in Chapter 6

MANURE FOR BIOMASS FEEDSTOCK

Using manure as biomass feedstock for either combustion as a heat source or for conversion into biogas as a vehicle fuel source are existing technologies but are not readily being deployed in Lycoming County. Manure digesters use anaerobic digestion to convert livestock and poultry manure (primary catalyst) into biogas, which is generally burned on-site to produce electricity, heat, and water. Manure digesters can include "co-digestion" in which the livestock and poultry manure (primary catalyst) are mixed with other organic materials (secondary catalysts). Types of manure digesters include covered anaerobic lagoons, plug-flow, and/or complete mix (or continually stirred tank reactor), in addition to associated structures and buildings, electrical infrastructure, and transmission lines. AgSTAR, the partnership between the USDA, EPA, and DOE to advance the recovery and use of methane from animal manure, maintains an online database of anaerobic digester projects from across the country. As of September 2011, 157 digesters are operating, with 22 located in Pennsylvania. None of the Pennsylvania-tracked projects are located in Lycoming County (see the map above). While no Lycoming County facilities are listed, ongoing biodigester discussions have been occurring as part of an informal group of digester owner/operators.

FIGURE 21 - AGSTAR TRACKED ANAEROBIC DIGESTERS



FEASIBILITY OF BIOMASS IN LYCOMING COUNTY

The potential to increase the use of biomass in Lycoming County, particularly woody biomass and biomass waste, should be pursued by the County. Natural and waste resources are in place, and abundant, while technical service providers at the regional, state, and federal levels can provide expertise and funding as available (although likely limited in the future).

While biofuel production is ongoing in the County, it is anticipated that the future interest in its deployment in Lycoming County will be limited to small, community-scale operations like Susquehanna Mills Company. This is due to the abundance of natural gas available with shale gas exploration and production. With state-level policy focused on commercializing natural gas for vehicular use, it will be more cost effective than a large-scale focus on biofuels.

Since the Commercial and Industrial sectors are not routinely using biomass as an energy source in Lycoming County, there is a great opportunity to build partnerships among loggers, wood haulers, and other industries. One way to improve the connection between biomass suppliers and end users is through Pennsylvania Biomass Trader (www.biomasstrader.org). As discussed in Chapter 2 under Technical Assistance, Pennsylvania's SBDCs have developed this online resource to match all categories of biomass suppliers with those businesses and organizations that are seeking supplies. This free resource is highly underutilized yet could provide an excellent resource to match Lycoming County loggers, sawmills, and mulch producers with consumers who could use the goods. Users of Pennsylvania Biomass Trader simply create an online account to either post available biomass products or seek wanted biomass products. Supply and demand can be searched statewide or by county with quantity, frequency, and price posted as well. Biomass listed on Pennsylvania Biomass Trader includes the following: agricultural residues, biofuels, compost, energy crops, food waste, manure, processing residues, restaurant waste, and woody material.

GEOTHERMAL

In total, the United States generates 2,700 megawatts of geothermal electricity, meeting the electricity needs of more than two million U.S. citizens.[72] Virtually all geothermal electricity generation takes place in California, Utah, Nevada, and the island of Hawaii. In fact, Hawaii generates 25 percent of its total power by means of geothermal power.

While Lycoming County does not have sufficient geothermal resources to generate electricity, it has moderate temperature resources and geology that can be tapped for direct heat or for geothermal heat pumps. Even though geothermal energy accounts for only five percent of the renewable energy sources in the country, it is a source which is conducive to Lycoming County's climate and geology.

Ground source or GeoExchange heat pumps, commonly referred to as geothermal heat pumps, offer an efficient and cost-effective way to both heat a home and/or provide hot water. While buildings can be retrofitted for geothermal heating and cooling, pumps are normally installed when a building is constructed because a large loop of tubing is installed several feet under the surface. Residential geothermal energy is normally used to heat water for the home, eliminating the need for a separate water heater (saving money) and performing more efficiently (saving energy). Geothermal heat pumps have dual functions – during the winter months, heat is drawn from the earth and released into the home, and during the summer months, heat from within the home is collected and released into the

[72] Clean Air Council, Plug Into Clean Power, November 2002, p. 32.

cooler earth. Geothermal heat pumps are both clean and efficient because they simply move heat from the home to the earth and vice versa; therefore, no heat is created.

According to the EPA, geothermal heat pump systems are the most energy-efficient, environmentally clean, and cost-effective space conditioning systems available. Residential geothermal heat pumps cost about $8,000 more than conventional heating and cooling systems, but the additional investment can be recouped rather quickly with the reduced savings in monthly utility bills. For commercial installation, geothermal installation costs are approximately $20.00 per square foot, which is often comparable to conventional systems.

In addition to single-user systems, using geothermal energy as a heating district has been used effectively in parts of the country. The City of Boise, Idaho, maintains a geothermal heating district system, which is the largest direct-use system in the U.S., supplying heat to over 55 businesses in the City's downtown. [73]

A few known geothermal heating systems have been installed in Lycoming County. East Lycoming School District has installed geothermal systems at Ferrell and Renn Elementary Schools. The systems will save the school district $17,000 in heating and cooling costs. Water Tower Square in Williamsport is also an example of a type of geothermal system. The climate control system at the 300,000-square-foot facility includes a geo exchange system that uses treated effluent from the neighboring municipal sewage treatment plant. This heating/cooling system is both environmentally safe and cost effective. The project is highlighted in a case study in Chapter 6.

Currently, there are no federal or state regulations regarding the construction of wells for geothermal systems. PSATS has developed a model ordinance to address geothermal energy and several municipalities have adopted ordinances. The Spring Creek Watershed Association in Centre County adopted a model ordinance for geothermal energy systems in 2010 based on a PSATS model ordinance for wells. The ordinance ensures that the space between a bore hole and well casing is sealed with an impermeable substance to prevent surface pollutants from reaching groundwater.

FEASIBILITY OF GEOTHERMAL IN LYCOMING COUNTY

Increasing the use of geothermal energy in Lycoming County has great potential. While the cost to install a ground source heat pump geothermal system is an $8,000 increase over traditional HVAC systems for residential, and $20 per square foot for commercial/industrial, the payback over time is much faster than other renewable energy sources. Several funding programs help to offset the costs of installing ground source geothermal systems. PPL maintains an E-Power Renewable Energy Program that offers rebates for the installation of ground source geothermal heat pumps, the federal Business Energy Investment Tax Credit provides a credit of up to 10 percent of the system cost, and there is the federal Residential Renewable Energy Tax Credit, which is a 30 percent tax credit for installing a geothermal system. This is not an exhaustive list and Appendix B provides a list of current incentives as well as www.dsireusa.org.

[73] CityofBoise.org, http://www.cityofboise.org/Departments/Public_Works/Services/Geothermal/index.aspx.

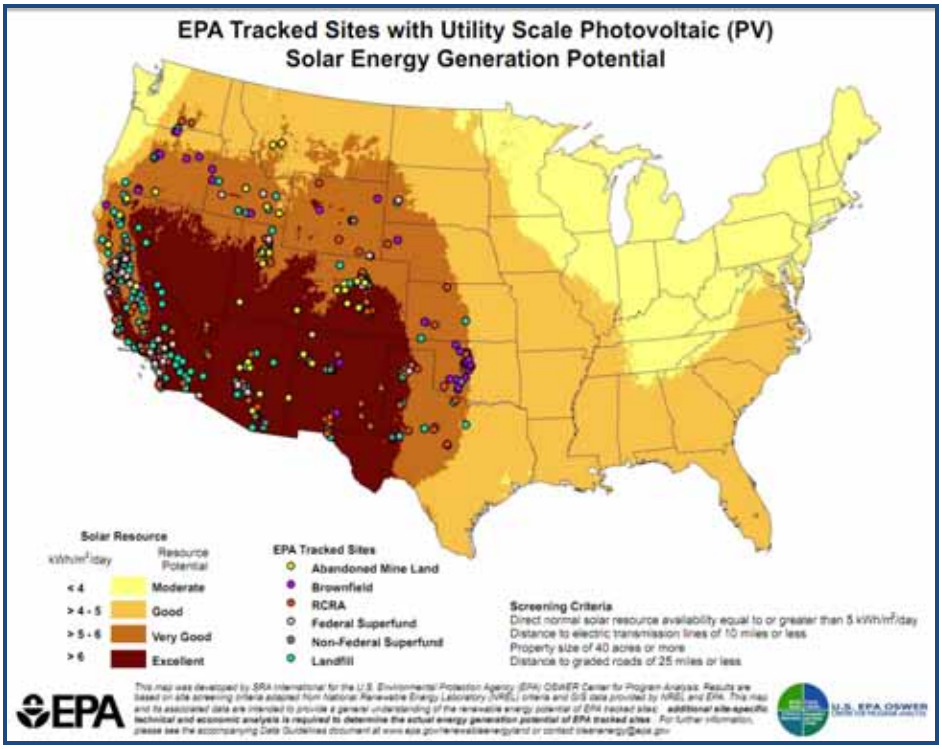
SOLAR ENERGY

Two types of solar energy provide a limitless energy source: Solar Photovoltaic (PV) and Solar Thermal. Solar PV systems convert sunlight into electricity, which can be used to augment or replace the electricity supplied by a utility. PV panels are most commonly installed on rooftops, and are most effective with a southerly exposure that provides full sun. Other possible installations include a ground mount, a pole mount, or other shaded, large surface area.

Solar thermal energy, or solar hot water, uses flat collector plates to capture the sun's energy to heat water. The installation and appearance are much like those of the PV panel, and the collectors are best installed facing south, under unobstructed sunlight. Unlike PV panels, solar thermal collectors do not convert sunlight to electricity, but rather transfer the energy directly to the water. Solar thermal systems displace the electricity or natural gas that would otherwise be required to heat water.

As discussed in Chapter 2, the EPA and DOE have developed mapping showing potential feasibility to site different types of renewable energy projects. Mapping has been developed on the national level, and in a few states, to identify locations with Utility-Scale Solar PV energy generation potential. Solar mapping has not been prepared for Pennsylvania (see Figure 22 below). Pennsylvania's utility-scale solar potential is moderate according to this mapping.

FIGURE 22 - EPA UTILITY-SCALE SOLAR PV POTENTIAL



According to DEP, the first utility-scale wind energy project installed east of the Mississippi was located in Southwestern Pennsylvania. Pennsylvania continues to be a leader in utility-scale wind with 293 MW of installed capacity, with approximately 1,000 MW in the planning stages. An estimated 4,000 MW of wind energy will be required to meet Pennsylvania's Alternative Energy Portfolio Standard (AEPS) requirements.[74]

Pennsylvania's solar mandate or solar share under Act 213 of 2004, is among the largest in the country and will require the installation of over 860 MW of solar PV in the next 15 years. As discussed in Chapter 2, EDCs may meet mandated solar PV requirements by acquiring bundled electricity along with solar renewable energy credits (S-RECs) or through purchase of S-RECs from solar PV projects. A long-term contract for S-RECs creates a revenue stream that can be used to finance solar PV installations. Utilities are able to recover the cost of S-REC purchases from their customer rate base, creating a revenue stream to support solar PV installations in Pennsylvania.

Several solar energy projects have been deployed in Lycoming County with upfront costs mitigated in several cases through federal and state incentives. A few examples follow below:

- The C.E. McCall Middle School in Montoursville has undergone extensive renovations, which include the construction and installation of a 20 kW photovoltaic array roof panel system. The Montoursville Area School District received a $35,000 solar energy program grant through the CFA Solar Energy Program to install the system. The project will generate approximately 22,000 kilowatt hours of electricity annually, which will offset district utility costs. The total project cost is $90,960.
- East Lycoming School District installed a 600 kW solar PV field at its Hughesville Campus. The solar field supplies 50 percent of the high school's annual electrical power (or 411,000 kilowatts). The district received a $1,000,000 grant from the CFA Solar Energy Program to install the system.
- The YWCA of Northcentral Pennsylvania recently rehabilitated its historic building located in downtown Williamsport. The rehabilitation project included energy efficiency measures such as new lighting, insulation, windows, and doors, as well as installation of solar panels. A total of sixteen (16) solar panels were added to the back side of the building. This project was provided $118,484 in funding through the State Energy Plan.

Ordinances regulating the use of solar energy are being adopted throughout Pennsylvania. As noted in Chapter 2, the Governor's Solar Working Group published *Solar Energy Systems, a Guide for Pennsylvania Municipal Officials* in 2009. This guide addresses the operation and regulation of solar energy systems and includes a model solar zoning ordinance.

[74] PA Department of Environmental Protection, *Pennsylvania's Solar Share, Mandated Solar PV Installations in the Commonwealth of Pennsylvania,* .

FEASIBILITY OF SOLAR POWER IN LYCOMING COUNTY

Pennsylvania's AEPS requires EDCs to meet 0.5 percent of solar production by 2021; therefore, opportunities exist to develop solar energy projects to help EDCs achieve these standards. The biggest challenge to increasing the use of solar energy in Lycoming County is the upfront cost. Several funding sources are available, but limited for businesses and public/non-profit organizations. Residential tax credits have been made available at the federal level and in Pennsylvania through EDCs. Refer to Appendix B for a current list of incentives as well as www.dsireusa.org, which regularly maintains a database of renewable energy incentives. Even with financial assistance, investing in solar energy is often cost prohibitive.

WIND ENERGY

Pennsylvania ranks 15th in the nation in wind power generation. The state's 10 wind farms have a combined capacity of 293.5 megawatts, generating 2.3 billion kWh. Potential capacity is estimated at 5,120 MW.[75] According to an energy impact assessment conducted for The Nature Conservancy, between 750 and 2,900 new wind turbines are projected to be constructed (currently there are approximately 500), depending on the wind share of electric generation by 2030.[76] It is anticipated that the majority of the turbines would be built along the Allegheny Front in western Pennsylvania and on high Appalachian ridge tops in central and northeastern Pennsylvania.

Wind energy is the amount of energy available in a given area due to the wind speeds at a given height. Wind speed is measured in meters per second (m/s) or miles per hour (mph), and wind power is divided into eight classes ranging from 0 to 7 on a wind map. A wind map indicates the potential wind speeds at various heights. Wind power classes of 1 or 2 are generally suitable for a small wind project. Small wind refers to turbines with blades of 4 to 8 feet in length with enough power output to power a single home. These types of blades require only moderate wind speeds. Wind power classes from 3 and greater are those that can produce enough energy to make the installation of a mid- to large-scale wind turbine economically feasible. Mid- to large-scale wind turbines have blades of 30 to 100 or more feet in length with enough power output for 40 to 600 homes. These turbines require faster and more consistent wind speeds.[77]

As noted in Chapter 2, state-level wind resource potential mapping developed by the EPA and DOE is available for community wind, utility-scale wind, and non-grid-connected wind. Pennsylvania mapping is available for both community wind and non-grid-connected wind.

[75] Natural Resources Defense Council, Renewable Energy for America, accessed October 5, 2011.

[76] The Nature Conservancy, *Pennsylvania Energy Impacts Assessment Report 1: Marcellus Shale Natural Gas and Wind,* p. 5.

[77] St. Francis University Renewable Energy Center, http://www.francis.edu/windpowerclasses.htm.

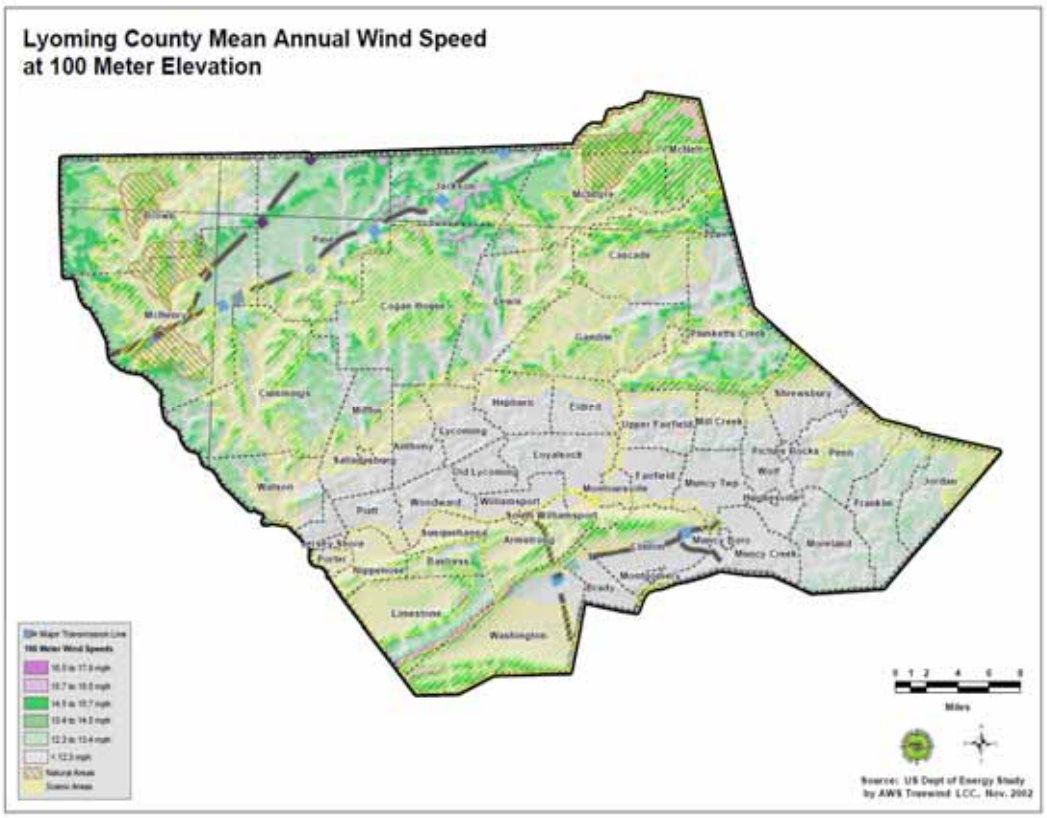
Wind power classes are shown in the following table along with a map showing Lycoming County's mean annual wind speed. As shown on the wind map, Jackson and Cogan House Townships have the greatest wind potential and are the most conducive to community and commercial wind projects. Several areas that are in wind power class 3 and still viable for community and commercial wind projects are also located in mapped scenic areas.

TABLE 6 - WIND POWER CLASSES

Wind Power Class	Wind Speed (m/s)	Wind Speed (mph)	Feasible Project Type
	<5.6	<12.5	
2	5.6 - 6.4	12.5 - 14.3	Small Wind
3	6.4 - 7.0	14.3 - 15.7	Community & Commercial Wind
4	7.0 - 7.5	15.7 - 16.8	Community & Commercial Wind
5	7.5 - 8.0	16.8 - 17.9	Community & Commercial Wind
6	8.0 - 8.8	17.9 - 19.7	Community & Commercial Wind
7	> 8.8	>19.7	

Source: U.S. EPA and DOE.

FIGURE 23 – LYCOMING COUNTY WIND MAPPING



As discussed in Chapter 2 under the Technical Assistance section, St. Francis University Renewable Energy Center provides technical assistance primarily for the feasibility of wind energy projects, particularly community wind. Community wind is large-scale wind power owned by either public- or private-sector organizations for on-site electricity production or sale to the electric grid. Projects can consist of one or more wind turbines and produce 100 kilowatts – 10 MW annually. This is enough power for 10 to 2,500 homes respectively. The local ownership of community wind maximizes overall community benefit. Project costs range between $300,000 to more than $3 million and take five years at a minimum to package. Key benefits to community wind include energy security, increased revenue, and community unity. There are two basic ways community wind projects can be structured:

- Electricity can be sold to the utility or to a consortium of end users. The owners and investors receive revenue from the sale of the electricity and possibly from federal incentives and/or renewable energy credits.
- Large energy users, such as a water treatment facility, prison, university, municipal utility, or business, can generate some or all of their electricity and sell their excess to the utility. This kind of arrangement is known as net metering.

The development of wind energy sources, particularly for either commercial or community wind, should consider the overall impact to Lycoming County's scenic resources. The Land and Resource Management Plan element of the County's Comprehensive Plan identifies ridge top development as an issue, as scenic landscapes are irreplaceable. This is in conflict with the development of wind energy

facilities for the purpose of harvesting wind, as a natural resource is maximized by placement on ridge tops.

Lycoming County has addressed wind energy in the County zoning ordinance. A Wind Energy Facility Use provision provides standards for the development, operation, and decommissioning of a wind energy facility as an Institutional use. The regulations address location, height, and setback, and also require a Community and Environmental Impact Analysis to addresses the site's hydrology, geology, and soils, and additionally considers impacts on land use, transportation, emergency and safety services, and economic impacts. Small Wind Energy Systems are permitted as an accessory use to an individual home, multifamily residential use, office or business, and industrial and agricultural uses located on the same lot.

Deployment of wind energy facilities in Lycoming County is limited to date. The East Lycoming School District has installed a small-scale, 115-foot-high wind turbine at its Hughesville Campus (see the case study in Chapter 6). One utility-scale project is under construction in Lycoming County. Duke Energy Renewables began construction of the Laurel Hill Windpower Project in August and plans to be operational by September of 2012. The company will own and operate the 69-megawatt Laurel Hill Windpower Project, which will include 30 Siemens wind turbines, each capable of generating 2.3 megawatts. The facility is projected to generate enough electricity to power more than 20,000 homes.[78]

FEASIBILITY OF WIND POWER IN LYCOMING COUNTY

AEPS standards require that EDCs meet renewable energy generation standards. While a utility-scale project might be developed, the cost to install small-scale wind for residential or commercial use is likely to be prohibitive. Federal tax credits are available to offset project costs for residential and business installations and limited state funding has been made available in the past. Small-scale residential or commercial projects would need to weigh the cost benefit of deploying wind energy versus other types of renewable energy sources.

HYDROPOWER

Pennsylvania's abundance of rapidly moving streams are ideal sources for water power. Water power was once the driving force behind Pennsylvania industry prior to discovery of fossil fuels. According to EIA data reported earlier in this chapter, the 35 percent share of hydropower as part of the nation's renewable energy sources is due to investments made in hydropower during the last century.

Hydropower systems use the energy in flowing water to generate electricity and are either low-impact hydropower, or large-scale hydropower facilities driven by the flow of energy moving over a dam.

[78] Wall Street Journal Market Watch, http://www.marketwatch.com/story/duke-energy-to-build-second-pennsylvania-wind-farm-2011-09-13, accessed October 5, 2011.

LOW-IMPACT HYDROPOWER

Low-impact hydropower includes small hydro systems and micro-hydro systems as follows:

- Small hydro systems serve a small community or industrial plant and maintain a generating capacity of 10 MW up to 30 MW.
- Micro-hydro systems are smaller and serve either homeowners or small businesses. Generating capacity of micro-hydro systems is up to 100 kW of electricity. A 10 kW system generally can provide enough power for a large home or small farm.
- For comparison, the Hoover Dam generates 2,074 MW.
- The common elements of a micro-hydro system include a water source, a penstock (i.e., pipe to convey water), a turbine, and an electric generator. The moving water rotates the turbine to turn the generator to generate electricity.
- Run-of-the-river systems that do not require large storage reservoirs, are often used for micro-hydro, and sometimes small hydro, projects. For run-of-the-river hydro projects, a portion of a river's water is diverted to a channel, pipeline, or pressurized pipeline (penstock) that delivers it to a waterwheel or turbine. The feasibility of a run-of-the-river system is dependent on head and flow.
    - Head is how far the flowing water drops in elevation. When the horizontal distance needed to gain an elevation drop is shorter, fewer pipes are needed and total system cost is reduced.
    - Flow is the volume of water that flows down the stream over time (usually measured in gallons per minute or cubic feet per second).

Low-impact hydro systems must comply with federal and state regulations that address water control and diversion and the physical alteration of streams and stream banks. To date, there is little if any local regulation of low-impact hydropower systems.

LARGE-SCALE HYDROPOWER

The DOE conducted a U.S. Hydropower Resource Assessment for Pennsylvania in December 1997 to identify the undeveloped hydropower potential across the country. The project was conducted for DOE by the Renewable Energy Products Department of the Idaho National Engineering and Environmental Laboratory. A total of 104 Pennsylvania sites were identified and assessed for undeveloped hydropower.

Each location was assigned a project environmental suitability factor (PESF) between 0.1 and 0.9, with 0.9 indicating the highest likelihood of development, and 0.1 indicating the lowest likelihood of development. Site capacities at each of the dams considered ranged from 20 kWh to 106 MW. Eighty-four percent of the sites in Pennsylvania are less than 10 MW. Over half, 56 percent, of the undeveloped hydropower potential within Pennsylvania is located in the Susquehanna River Basin.

Four (4) Lycoming County sites were identified in the study:

- Red Run, Lycoming Creek, Ralston – without power generation, low environmental suitability
- Little Pine Creek, Pine Creek – without power generation, medium environmental suitability
- West Branch Susquehanna River, Hepburn Street – undeveloped (no power generation nor developed impoundment or diversion structure), low environmental suitability
- West Branch Susquehanna River, Muncy – undeveloped, low environmental suitability

According to data obtained from the U.S. Federal Energy Regulatory Commission (FERC), Renew Hydro, LLC, filed an application for a preliminary permit, to study the feasibility of the proposed Hepburn Street Dam for hydroelectric on October 19, 2010. On July 11, 2011, an Order issuing a preliminary permit was issued by the FERC with the preliminary permit in effect for 36 months.[79] The proposed project would be located on the West Branch of the Susquehanna River near South Williamsport, would use the existing Hepburn Street Dam, and would include the following:

- Six, low-head turbines rated at 500 kWh each
- A new powerhouse
- A crest-mounted walkway carrying hydraulic and electrical conduits
- One, 600-foot-long, and one, 300-foot-long transmission line
- Appurtenant facilities

The estimated annual generation from the project would be 15,768,000 kWh.

FEASIBILITY OF HYDROPOWER IN LYCOMING COUNTY

Since both low-impact and large-scale hydropower are included as Tier 1 energy sources according to the Alternative Energy Portfolio Standards Act, the energy generated by both will be sought by EDCs. While no low-impact hydropower projects were identified in Lycoming County as part of the preparation of the Energy Plan, due diligence should be conducted to identify feasible locations. Federal tax credits and limited state funding are currently available for installation. Refer to Appendix B for a current list of incentives as well as www.dsireusa.org, which regularly maintains a database of renewable energy incentives.

FUEL CELLS

According to the DOE, "Fuel cells are an important enabling technology for the nation's energy portfolio and have the potential to revolutionize the way we power our nation, offering cleaner, more efficient alternatives to the combustion of gasoline and other fossil fuels. Fuel cells have the potential to replace the internal combustion engine in vehicles and provide power in stationary and portable power applications because they are energy efficient, clean and fuel flexible."[80]

Fuel cells use the chemical energy of hydrogen to produce electricity with water and heat as by-products. Compared to combustion-based technologies used in power plants and passenger vehicles, fuel cells are environmentally beneficial as they emit no emissions at the point of operation. If pure hydrogen is used as a fuel, fuel cells emit only heat and water as by-products. Fuel cells are flexible and can provide energy for systems as large as a city or as small as home appliances.

[79] Federal Energy Regulatory Commission, Order Issuing Preliminary Permit and Granting Priority to File License Application, Renew Hydro, LLC. Project No. 13872-000, issued July 20, 2011.

[80] DOE, Energy Efficiency & Renewable Energy, http://www1.eere.energy.gov/hydrogenandfuelcells/fuelcells/index.html.

A fuel cell uses a fuel and oxygen to create electricity by an electrochemical process. A single fuel cell consists of an electrolyte and two catalyst-coated electrodes (a porous anode and cathode).[81] While there are different types of fuel cells, all fuel cells are similar:

- A fuel (such as hydrogen) is fed to the anode where a catalyst separates hydrogen's negatively charged electrons from positively charged ions (protons).
- At the cathode, oxygen combines with electrons and, in some cases, with protons or water, resulting in either water or hydroxide ions.
- For polymer electrolyte membrane and phosphoric acid fuel cells, protons move through the electrolyte to the cathode to combine with oxygen and electrons, producing water and heat.
- For alkaline, molten carbonate, and solid oxide fuel cells, negative ions travel through the electrolyte to the anode where they combine with hydrogen to generate water and electrons.
- The electrons from the anode cannot pass through the electrolyte to the positively charged cathode; they must travel around it via an electrical circuit to reach the other side of the cell. This movement of electrons is an electrical current.

Currently, fuel cells are being used for: materials handling in distribution centers (powering forklift fleets), back-up and remote power (for companies like Sprint, AT&T, and PG&E), stationary power (Whole Foods has installed a fuel cell for combined heat and power), fuel cell vehicles, and fleet vehicles.[82]

According to a report prepared by the Clean Air Council, by producing electricity through chemical reactions rather than through combustion, the use of fuel cells eliminates much of the air pollution associated with traditional electricity generation. In the near future, hydrogen is most likely to come from natural gas.[83] A project was recently announced in British Columbia, Canada in which a power company will use fuel cell technology to generate 400 kW of electricity using natural gas as the input fuel.[84]

FEASIBILITY OF FUEL CELLS IN LYCOMING COUNTY

Fuel cells are beginning to be deployed commercially, but with research and development constantly evolving, using fuel cells commercially is not cost competitive. Therefore, current marketability is low. Several fuel cell projects have occurred in Pennsylvania with public funding to offset costs. ARRA funding provided a significant investment into the commercialization of fuel cells throughout the country with an allocation of $41.9 million.

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[81] Description of fuel cell operation as adapted from DOE, *Energy Efficiency & Renewable Energy*, http://www1.eere.energy.gov/hydrogenandfuelcells/fuelcells/basics.html.

[82] DOE, *Energy Efficiency & Renewable Energy*, 2010 Fuel Cell Technologies Market Report, p. 17.

[83] Clean Air Council, *Plug Into Clean Power. Your Options for Cleaner Energy in Pennsylvania*, November 2002, p. 41

[84] Business Wire, *IMW Industries Secures Long-Term Agreement from UTC Power to Provide Key Fuel Cell Modules on Exclusive Basis*, October 5, 2011.

Through ARRA, an award was made to GENCO based in Pittsburgh, Pennsylvania, for deploying over 350 fuel cell systems as battery replacements for fleets of electric lift trucks at five existing distribution centers: Coca Cola in Charlotte, North Caroline; Kimberly Clark in Graniteville, South Carolina; Sysco Foods in Philadelphia, Pennsylvania; Wegmans in Pottsville, Pennsylvania; and Whole Foods in Landover, Maryland. Based on the results of this project, fleet conversions at some of GENCO's other 109 distribution centers may take place.

The U.S. Department of Defense (DOD), Defense Logistics Agency's (DLA) Hydrogen Fuel Cell Pilot Program, seeks to stimulate commercial manufacturing of hydrogen and fuel cell technologies while at the same time evaluating their application for DOD. A pilot project is underway at the DLA's Susquehanna Distribution Center located in New Cumberland, Cumberland County, Pennsylvania. The pilot began in November 2008 with four fuel cell units and an outdoor mobile refueler. The two-year demonstration pilot ended in September of 2011. The companies involved in the pilot are Air Products, East Penn Manufacturing, and Plug Power. The project included retrofitting 20 existing forklifts and forward fitting 20 new forklifts with fuel cells, comparing products from two fuel cell producers, and setting up storage and indoor dispensing systems for delivered liquids.

Powering fuel cells with natural gas as the input fuel is a promising technology for Pennsylvania and an emerging technology that Lycoming County should continue to monitor as part of the Energy Plan's implementation.

CHAPTER 5 PUBLIC OUTREACH

ENERGY PLAN ADVISORY COMMITTEE

The Energy Plan Advisory Committee includes community leaders, citizens, citizen groups, business leaders, government officials, and energy industry experts with diverse viewpoints on energy-related issues and committed to ensuring that the Energy Plan is a multi-perspective plan. A list of Energy Plan Advisory Committee members is included in the Acknowledgements section of the Energy Plan.

The Energy Plan Advisory Committee met three times during the preparation of the Energy Plan and also participated in the Energy Plan Workshop. Advisory Committee members also developed specific sections of the Energy Plan based on their expertise. Energy Plan Advisory Committee meetings were held on February 16, 2011, August 3, 2011, and December 7, 2011.

ENERGY PLAN WORKSHOP

An Energy Plan Workshop was held on May 3, 2011, for the purpose of helping Lycoming County develop and implement steps to reduce energy costs through energy efficiency and identify ways to diversify the County's energy sources. The event was held at Lycoming College and attended by over 80 representatives from business, non-profits, schools, government, and citizens. The agenda for the workshop included the following items:

- Keynote remarks provided by the Governor's Energy Executive
- An overview of background information collected about energy-related projects and activities in Lycoming County as of the date of the workshop
- A summary of Lycoming County energy projects underway that are focused on the following sectors:
    - Residential - STEP, Inc.
    - Public/Non-Profit - Lycoming County Resource Management Services
    - Schools - East Lycoming School District
    - Commercial - Susquehanna Mills Company
    - Industrial - Koppers, Inc.
    - Transportation - Larson Design Group
- Break-out sessions for each of the energy sectors to further discuss opportunities and challenges
- Vision statement development

Results from the workshop, the break-out sessions in particular, were used to guide the development of the Energy Plan Vision and Energy Strategies and Strategic Actions presented in Chapter 7.

Feedback from the Energy Plan Workshop was positive, with participants agreeing the event was worthwhile to attend. Many break-out session participants sent follow-up e-mails expressing interest in continuing the discussion held at the workshop. Break-out session attendees were sent summaries of the session results as a follow-up. Continuing to follow up with Energy Plan Workshop attendees will be helpful as the Energy Plan is implemented.

STAKEHOLDER INTERVIEWS

To provide additional clarification and obtain additional information to complete background research, key stakeholder interviews were conducted after the workshop. Interviews were invaluable in collecting additional data to support recommendations provided at the Energy Plan Workshop and helping to shape draft energy strategies. Interviews were conducted with the following organizations:

- Lycoming County Solid Waste Authority – to discuss the Lycoming Landfill expansion and biomass waste opportunities
- DCNR – to discuss biomass potential
- UGI – to discuss trends in natural gas usage
- Larson Design Group – to discuss CNG and transportation

STUDENT ENGAGEMENT

While not included in the Energy Plan scope of work, students from Lycoming College participated in the preparation of the Energy Plan by helping to develop the case studies found in Chapter 6. Lycoming College approached the Lycoming County PCD about partnering on the development of the Energy Plan. Work completed by the students was part of the Energy Diversity Course. Approximately 23 students and their professor took part in tours, conducted over a period of two months, showcasing key energy projects in the County. Tours Included:

- Lycoming County Resource Management Services – Landfill/Methane
- Natural Gas Drilling & Development Site – Natural Gas
- East Lycoming School District – Biomass
- YWCA – Solar
- Loyalsock Township – Solar
- PPL Power Plant – Montour Preserve Location

After the tours, students drafted a summary case study that have been integrated into the Energy Plan.

Promoting education and communication about the Energy Plan to citizens, business and industry, students, and government was identified as an energy strategy prior to Lycoming County students becoming involved. Therefore, implementation of the Energy Plan began before the plan was finalized.

PUBLIC MEETING

A public meeting was held on December 15, 2011 and the Energy Plan was presented for review and comment.

CHAPTER 6 HELPFUL RESOURCES FOR EACH SECTOR

This chapter synthesizes information obtained from background research and public outreach and provides practical resources that can be used as Lycoming County's citizens, businesses, schools, and government officials find ways to use products and systems that require less energy, consume less energy, and deploy energy alternatives. The chapter includes a list of technical assistance providers by sector, checklists identifying ways to improve energy efficiency and reduce energy consumption, and funding sources. It also includes several case studies highlighting Lycoming County projects.

TECHNICAL ASSISTANCE BY SECTOR

Many organizations are in place to provide energy services and technical assistance to Lycoming County's residents and businesses. The following table lists by sector each of the organizations, contact information, websites, and services provided by each.

TABLE 7 - TECHNICAL ASSISTANCE BY SECTOR

Agency/Organization	Sectors Served	Services Provided
U.S. Department of Energy **http://energy.gov/** **http://www.energystar.gov**	All	✓ Technical Assistance ✓ Public funding
U.S. Department of Environmental Protection **http://www.epa.gov** **http://www.epa.gov/agstar**	All	✓ Technical Assistance ✓ Public funding
Appalachian Regional Commission **http://www.arc.gov/**	All	✓ Outreach ✓ Public Funding
PA Department of Environmental Protection **http://www.dep.state.pa.us/**	All	✓ Outreach ✓ Technical Assistance ✓ Public funding
PA Department of Community & Economic Development **http://www.newpa.com/**	All	✓ Outreach ✓ Technical Assistance ✓ Public funding
SEDA-COG Energy Resource Center **http://erc.sedacog.org** **570-524-4491**	All	✓ Outreach - Energizing Our Region educational series ✓ Local governments - SEDA-COG ERC provides utility bill analysis at no charge
St. Francis University Renewable Energy Center **http://www.francis.edu/REC.htm** **814-472-2872**	All	✓ Outreach ✓ Technical Assistance – Wind energy assessments
EDC Act 129 Programs **http://www.puc.state.pa.us/electric**	All	✓ EDCs – may provide energy audit rebates through Act 129
U.S. Green Building Council **http://www.usgbc.org** **800-795-1747**	All	✓ Outreach ✓ Technical Assistance

U.S. Department of Agriculture **http://www.rurdev.usda.gov** **http://www.nrcs.usda.gov** **http://www.fsa.usda.gov**	Agriculture Commercial Industrial	✓ Outreach ✓ USDA Natural Resource Conservation Service may provide reimbursement for energy audits through the Environmental Quality Incentives Program (EQIP)
Penn State SBDC **http://www.pasbdc.org/centers/penn-state-university** **814- 863-4293** **Lock Haven SBDC** **http://www.pasbdc.org/centers/lock-haven-university** **570- 484-2589**	Agriculture Commercial Industrial	✓ Technical Assistance ✓ Small businesses – Penn State SBDC may provide energy audits at no charge
Penn State Extension **http://extension.psu.edu/energy-natural-resources** **Lycoming County Extension Office** **570-433-3040**	Agriculture Commercial Industrial	✓ Outreach ✓ Technical Assistance
IMC **http://www.imcpa.com/** **570-329-3200**	Agriculture Commercial Industrial	✓ Outreach ✓ Technical Assistance
Williamsport/Lycoming KIZ **http://wlkiz.com/** **570-329-3200 Ext. 8083**	Agriculture Commercial Industrial	✓ Outreach ✓ Technical Assistance
PennTAP **http://www.penntap.psu.edu/** **814-865-0427**	Agriculture Industrial	✓ Technical Assistance ✓ May offer a 50% grant or up to $7,500 on investment grade energy audits
PA Department of Conservation & Natural Resources **http://www.dcnr.state.pa.us** **570-326-6020**	Agriculture Schools	✓ Outreach ✓ Technical Assistance
PA Department of Education **http://www.pde.state.pa.us/**	Schools	✓ Reimbursement through the Department for energy services including energy audits through the GESA (Act 77)
STEP, Inc. **http://stepcorp.org/** **570-326-0587**	Residential	✓ Low income residents - STEP, Inc. may provide energy audits at no charge residents through the Weatherization Assistance Program

In addition to organizations "on the ground" working with Lycoming County constituents, there are many online resources useful to provide background information about energy efficiency, demand reduction, renewable energy, sustainability, green building design, etc. Appendix A includes a list of these Web sites.

WAYS TO IMPROVE ENERGY EFFICIENCY AND REDUCE ENERGY CONSUMPTION

The following steps and checklists provide a road map for a home, business, school, or local government to start improving energy efficiency and reducing energy demand in buildings. It was adapted for Lycoming County from a checklist developed by the Rocky Mountain Institute. It also includes additional energy- and cost-saving suggestions for local governments, agricultural businesses, and transportation users.

GETTING STARTED

1. Collect fuel and electric bills for the past 12 months. Divide their total by the building's square footage. If you are a homeowner, do not include garages and unheated basements. Most annual bills range from 60¢ to 90¢ per square foot. If your bills fall in this range, or are even higher, you have many cost-effective opportunities to dramatically reduce your bills.

2. Note the age and condition of major heating and cooling equipment, appliances, the type of windows, and if the building's water heater is wrapped with an insulating jacket. How does the building feel? Is it drafty on windy days? Are occupants comfortable?

3. Call for help. An energy audit or assessment can provide a comprehensive analysis of steps you can take to improve your building's energy efficiency and identify ways to reduce energy demand.

   SEDA-COG ERC maintains an Energy Assessment Providers Directory, a listing of nearly 40 known for-profit and non-profit organizations that provide energy audit and assessment services to clients within the region. The listing includes an overview of each firm's capabilities and contact information. While the listing neither endorses nor speaks to the quality of service providers, it is an excellent reference about who provides energy audit and energy assessment services in the region. Further information is included in the following link: http://erc.sedacog.org/LinkClick.aspx?fileticket=rM2zoPuxflo=&tabid=303.

   If you retain an auditor to conduct a comprehensive energy audit or assessment, make certain the auditor is a trained professional with specialized test equipment such as infrared thermal imagers, duct airflow instruments, etc. Make sure recommendations are listed in order of importance to help you implement those items that require little effort or provide the greatest return on investment.

   Professional audits, including a blower door test, typically cost $200 to $350 for a home. If energy bills are high, this upfront investment can be recouped once energy-saving measures are implemented.

   Depending on your sector, there are resources are available to conduct an audit free of charge, pay for the cost hiring an auditor, or help offset the costs of conducting an audit. Availability of each resource is dependent on the specific agency/organization providing the incentive.

Residential	✓ Low-income residents - STEP, Inc. may provide energy audits at no charge to residents through the Weatherization Assistance Program ✓ EDCs – may provide energy audit rebates through Act 129
Public/Non-Profit	✓ Local governments - SEDA-COG ERC provides utility bill analysis at no charge ✓ Schools – reimbursement through the PA Department of Education for energy services including energy audits through the GESA (Act 77) ✓ EDCs – may provide energy audit rebates through Act 129
Commercial/ Industrial	✓ Small businesses – Penn State SBDC may provide energy audits at no charge ✓ Larger manufacturing operations – PennTAP may offer a 50% grant or up to $7,500 on investment-grade energy audits ✓ Small businesses – USDA Natural Resource Conservation Service may provide reimbursement for energy audits through EQIP ✓ EDCs – may provide energy audit rebates through Act 129
Agriculture	✓ USDA Natural Resource Conservation Service may provide reimbursement for energy audits through EQIP ✓ For larger agriculture operations – PennTAP may offer a 50% grant or up to $7,500 on investment-grade energy audits ✓ EDCs – may provide energy audit rebates through Act 129

4. Make an Action Plan. Once an audit is completed, decide where to start.

The following checklists are a useful starting point. Even if you do not do a full audit, the checklists on the following pages will assist in energy conservation and reduction measures.

ENERGY REDUCTION AND CONSERVATION CHECKLISTS

The Following Tool Can Be Used For Any of the Energy Sectors, Including Residential, Commercial, and Industrial

MEASURES THAT COST NOTHING AND SAVE MONEY

- ☐ Turn down the water heater thermostat to 120°F.
- ☐ Turn off lights when leaving a room.
- ☐ Use natural lighting as much as possible; do not turn on the lights unless you need to.
- ☐ Set thermostats from 68°F to 70°F in winter for your home or business if occupied, and down to 62°F when you are away and at night.
- ☐ Set thermostats from 76°F to 78°F when your building is occupied and 82°F when your building is not occupied in the summer.
- ☐ Use energy-saving settings on all appliances such as washing machines, clothes dryers, dishwashers, and refrigerators.
- ☐ Do not waste water, hot or cold, inside or outside your building.
- ☐ Clean refrigerator or freezer condenser coils once a year.
- ☐ If you are a homeowner, consider air-drying your clothes outdoors.
- ☐ Close heating vents in unused rooms.
- ☐ Repair leaky faucets and toilets (5 percent of water consumption is leakage).
- ☐ Close drapes (and windows) during sunny summer days and after sunset in the winter.
- ☐ Remove underused appliances and have them recycled.
- ☐ Research electric choice options for the best buy.

MEASURES THAT PAY FOR THEMSELVES IN LOWER ENERGY BILLS IN LESS THAN A YEAR

- ☐ Install a programmable thermostat ($26).
- ☐ In the attic and basement, plug the air leaks a cat could crawl through, and replace and re-putty any broken window panes (about $20).
- ☐ Install a water-saving 2.5-gallon-per-minute showerhead ($15).
- ☐ Install water-efficient faucet aerators in sinks and showers ($2 each).
- ☐ Clean or change the air filter on warm-air heating systems during winter and on air conditioning units in the summer ($2 - $15).
- ☐ Install an R-7 or R-11 water heater wrap ($12).
- ☐ Insulate the first six feet of hot and inlet cold water pipes ($6).
- ☐ Install a compact fluorescent light bulb in the fixture used the most ($15).
- ☐ Use a power strip to turn off electronic equipment with "instant on" features ($20)

MEASURES THAT COLLECTIVELY WILL COST UP TO $500 AND HAVE PAYBACKS OF ONE TO THREE YEARS

- ☐ Caulk and weatherize all leaks identified through an energy audit. Start with the attic and basement first (especially around plumbing and electrical penetrations, and around the framing that rests on the foundation), then weatherize windows and doors.
- ☐ Seal and weather-strip ducts, doors, and windows to keep warm air from leaking into buildings in summer and out of buildings in winter.
- ☐ Have heating and cooling systems tuned up every year or two.
- ☐ Install additional faucet aerators, efficient showerheads, and programmable thermostats.
- ☐ Make insulating shades for your windows, or add insulating storm windows (or, in a southern climate, shade sunny windows or add solar gain control films).
- ☐ Insulate hot water pipes in unheated basements or crawlspaces.
- ☐ Install more compact fluorescent bulbs. Put them in your most frequently used fixtures, including those located outdoors.
- ☐ Use task lighting; instead of brightly lighting an entire room, focus the light where you need it. For example, use fluorescent under-cabinet lighting for kitchen sinks and countertops under cabinets.
- ☐ Consider three-way lamps; they make it easier to keep lighting levels low when brighter light is not necessary.
- ☐ For spot lighting, consider Compact Fluorescent Lightbulbs (CFLs) with reflectors. The lamps range in wattage from 13 watts to 32 watts and provide a very directed light using a reflector and lens system.
- ☐ Take advantage of daylight by using light-colored, loose-weave curtains on your windows to allow daylight to penetrate the room while preserving indoor temperatures

MEASURES THAT WILL SAVE A LOT OF ENERGY AND MONEY,

BUT REQUIRE THREE TO FIFTEEN YEARS TO PAY FOR THEMSELVES

- ☐ Foundation: insulate inside rim joist and down the foundation wall to below frost line to R-10. Remember to caulk the rim joist and sill areas first.
- ☐ Basement: insulate the ceiling above crawlspaces or unheated basements to at least R-19. If your basement is heated, insulate the inside of basement walls to R-10.
- ☐ Attic: increase attic insulation to R-38.
- ☐ Walls: adding wall insulation is more difficult and expensive, but may be cost-effective if your building is uncomfortable and if you have empty wall cavities. Installing insulation at high density will also greatly reduce air leakage.
- ☐ Replace exterior incandescent lights with compact fluorescents and put them on a timer or motion sensor if they are on more than a few hours a night.
- ☐ Install occupancy sensors to automatically turn off the lights when rooms are unoccupied and back on whenever the room is entered for use.
- ☐ Install daylight sensors that automatically turn lights off when the available daylight provides the predetermined light level required for tasks at hand. With day lighting controls, lighting energy requirements have been reduced by up to 70 percent and cooling by as much as 20 percent.
- ☐ Install skylights or light pipes to increase the use of natural light.
- ☐ Consider converting to geothermal ground source heat pump for heating.
- ☐ Consider converting to solar water heating, and perhaps also supplementary solar space heating.
- ☐ Upgrade your water heater, furnace, boiler, air conditioners, and refrigerator to more efficient ENERGY STAR models.
- ☐ Upgrade to super insulating or at least low-emissivity windows in cold climates, if replacement is needed.
- ☐ Replace high-flow toilets with modern water-efficient toilets that use 50 to 80 percent less water.
- ☐ Install awnings or build removable trellises over windows that overheat your building in the summer.
- ☐ Consider installing systems to collect and reuse water (water harvesting).
- ☐ Plant deciduous trees (those that lose their leaves in the fall) around buildings. When selectively planted, they provide excellent protection from the summer sun but permit winter sunlight for natural warmth.
- ☐ Deflect winter winds by planting evergreen trees and shrubs on the north and west sides of buildings.

AGRICULTURE ENERGY REDUCTION

- ☐ Grow and sell local foods to reduce overall energy costs.
- ☐ Consider planting energy crops to sell as renewable energy feed stocks.
- ☐ Consider no-till agriculture.

TRANSPORTATION ENERGY REDUCTION

- ☐ Shift more freight from trucks to trains reduces the energy/ton of freight by several magnitudes.
- ☐ Dropping or reducing the trip frequency of low-usage public bus routes will save significant fuel.
- ☐ Increase bus ridership and reduce personal vehicle commuting by customizing bus routes to match industry and business schedules.
- ☐ Renew emphasis on and programs promoting car pooling and park and ride lots.
- ☐ Promote work-from-home options to reduce fuel consumption.
- ☐ Promote more efficient signaling and roundabouts to reduce congestion and idling.
- ☐ Maintain vehicles for optimum fuel economy.
- ☐ Walk or ride a bike, if feasible.

WAYS TO MINIMIZE WASTE TO REDUCE OVERALL ENERGY CONSUMPTION

One of the most effective ways to reduce waste is to not create it in the first place. By reducing and reusing, consumers and industry can save natural resources and reduce waste management costs. Waste generated per capita has dramatically increased from 2.7 to 4.3 pounds per day between 1960 and 2009. This resulted in approximately 243 million tons of waste generated in the United States in 2009.[85]

- ☐ Reduce the amount of consumer products you use, if possible.
- ☐ Reuse existing consumer products as much as possible.
- ☐ Go paperless. Many businesses and organizations are encouraging paperless practices by promoting the use of e-mail bills and notices as opposed to the paper alternatives.
- ☐ Recycle consumer products, including appliances and electronics, as much as possible.
- ☐ For local governments, consider Pay-as-You-Throw (PAYT). PAYT programs provide an incentive to residents and businesses to reduce the amount of trash by replacing flat fee trash collection with paying for the amount of trash that is thrown away.

[85] U.S. Environmental Protection Agency Web site, http://www.epa.gov/waste/conserve/rrr/reduce.htm.

REMEMBER EDC ACT 129 PROGRAMS

EDCs serving Lycoming County need to meet state requirements to reduce overall energy consumption. If your electricity is provided by Allegheny Power, Penelec (FirstEnergy), or PPL, you could take advantage of many programs offered to utility consumers such as appliance rebates, weatherization services, reduced and/or flexible rates, or free or reduced cost CFLs. Check with your EDC to see if any programs are useful for your home, business, school, or municipality.

CONSIDER LEED FOR NEW CONSTRUCTION

The LEED Green Building Rating system is the standard for rating the design, construction, and operation of energy-efficient, green buildings. While initial costs to construct at a LEED standard are higher, long-term energy costs savings can be realized. Individual LEED rating systems have been developed for the following:

- Commercial and industrial construction including interiors/exteriors and operations and maintenance
- Schools
- Retail
- Healthcare
- Homes

FUNDING SOURCES

Public funding is ever-changing, with availability highly dependent on political outcomes, legislation, and the economy. Over $11 million in known funding has been awarded to Lycoming County energy-related projects over the past five years. Refer to a list of funded projects in Appendix C. Appendix B includes a list of state and federal funding sources that are available for energy efficiency and renewable energy projects. As funding changes frequently, this list of sources is a snapshot in time.

At the national level, energy-related funding is continually tracked through DSIRE (www.dsireusa.org). Regionally, SEDA-COG ERC maintains a list of public funding sources.

LYCOMING COUNTY ENERGY CASE STUDIES

Case Study: Industrial

Koppers, Inc. Susquehanna Cogeneration Facility

Montgomery Borough, Lycoming County

PROJECT DESCRIPTION

Koppers, Inc. is a global company which manufactures treated wood products for the railroad and utility industries. Koppers Montgomery Plant produces approximately 1 million railroad ties per year. While new poles were being produced, a challenge arose regarding the disposal of used railroad ties and utility poles. Since treated wood cannot be burned in ordinary incinerators, most treated wood ends up in landfills or discarded along right-of-way. To respond to this challenge and opportunity, in 1988 Koppers constructed a co-generation plant on their 92 acre site. The co-generation plant accepts and burns utility poles and railroad ties removed from service in a permitted and controlled facility to co-generate power. Used ties and poles are accepted from railroads and regional utility companies. The electricity generated from the plant is sold to PP&L with approximately 54 million kilowatts produced each year. Steam from the plant is sent to the adjoining Koppers wood treating plant to fuel the treating process for new ties.

BENEFITS

- The co-generation plant recycles enough ties annually to fill a football field 100 feet high.
- To date, greater than 70 million cubic feet of treated wood has been converted to energy which in landfill space is equivalent to 1.25 times the size of the Sears Tower.
- Koppers Susquehanna co-generation facility generated 54,513,000 kilowatt hours of energy in 2010; enough energy to power 5,116 households.
- The steam produced through co-generation replaces a boiler that burns 1,700 gallons of fuel oil per day.

FOR MORE INFORMATION CONTACT:

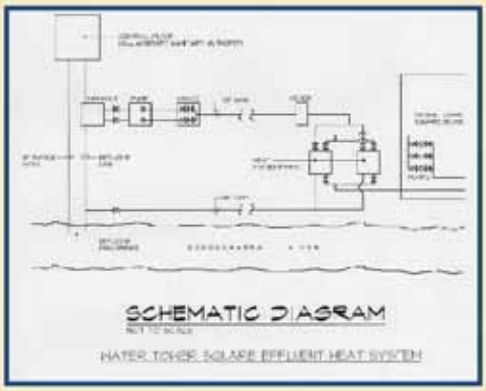
Jerry Horning, Koppers, Inc. 570-547-1651 HorningGA@koppers.com

http://koppers.com/

Case Study: Commercial

Water Tower Square Energy Efficiency/Geothermal Exchange

Williamsport, Lycoming County



PROJECT DESCRIPTION

The HVAC system at Water Tower Square office complex is unique and replaces the large boilers formerly used by C. A. Reed when the company manufactured paper in the 300,000 square foot facility. The HVAC system designers retained by Water Tower Square, LLC decided to implement a new and innovative system to update the building's heating system and add cooling. The climate control system consists of a geothermal exchange system that uses treated effluent from the neighboring Williamsport Sanitary Authority Sewage Treatment Plant which is both environmentally friendly and cost effective. Discharge from the adjacent municipal sewage treatment plant typically discharged to the river, is now used to heat and cool the new office complex.

Each 1,000 square foot heating zone in the building has its own temperature control system which is about the size of a school classroom. Upon renovation completion, the building has over 150 zones equating to approximately 550 tons of cooling capacity. To save on energy, only as much water as required by the system is pumped. Each heat pump has a switch that allows water to flow in only on an as-needed basis. Pressure sensors monitor the loop and control the loop pumps. The pumps that deliver effluent to the heat exchangers only operate when they are needed to keep the loop temperature within its preset range. At a time when some areas of the building need heating and others cooling, the HVAC system can balance itself without any additional effluent water.

BENEFITS

- The new building HVAC system operates on recycled sewage effluent.
- The new HVAC system reduces water consumption.
- The project results in reduced energy costs.

FOR MORE INFORMATION CONTACT:

Keith Eck, Water Tower Square, LLC 570-326-2686

http://www.wts-williamsport.com/

Case Study: Public / Non-Profit

YWCA Northcentral PA Energy Efficiency Improvements

Williamsport, Lycoming County

PROJECT DESCRIPTION

The YWCA Northcentral Pennsylvania recently rehabilitated its historic building which was constructed in the 1920s and is located in downtown Williamsport. The rehabilitation included energy efficiency measures such as new lighting, insulation, windows, and doors. The lighting portion of the energy efficiency project incorporates energy efficient fixtures which result in lower operating costs as well as increased exterior lighting to improve overall building safety. The rehabilitation project also included the installation of sixteen solar panels on the back of the building used to heat the building's hot water and a portion of its gymnasium. Installation of the solar panels has resulted in an annual energy reduction cost savings of 60%. The total cost of the solar installation project was $135,000 with $118,000 funded through a Pennsylvania Department of Environmental Protection Energy Harvest grant.

BENEFITS

- Increased energy efficiency resulting in decreasing the building's operating costs by 60%.
- Improved building comfort through building envelope modifications and upgrading HVAC systems.
- Deploying renewable, environmentally friendly solar energy.

FOR MORE INFORMATION CONTACT:

Diane Glenwright, YWCA Northcentral Pennsylvania 570- 322-4619

http://www.ywcawilliamsport.org/

Case Study: Commercial

Williamsport Hospital & Medical Center Cogeneration Project

Williamsport, Lycoming County

PROJECT DESCRIPTION

Through Project 2012, Susquehanna Health conducted a baseline assessment to support a system-wide update at Williamsport Regional Medical Center, Muncy Valley Hospital, and Divine Providence Hospital. As part of the project, the Williamsport Hospital & Medical Center developed a strategic energy plan to be implemented parallel with a hospital expansion project in which the hospital's physical footprint would be expanded from 500,000 to 800,000 square feet.

Co-generation using energy efficient reciprocating natural gas engines, was identified to implement part of the hospital's strategic energy plan. The 2 megawatt system increases energy efficiency and increases the reliability and response of emergency power. By replacing the hospital's two boilers, which were installed in 1947, carbon emissions are reduced by 50 percent. The final total energy plan included two high efficiency electric, water-cooled chillers; three dual fuel boilers for steam and hot water generation; two diesel emergency power generators; and one natural gas co-generation unit. In addition to the greatly needed hospital improvements, the $2.6 million project added 35 new jobs as well as short term construction jobs. Pennsylvania Energy Development Authority funding through the American Recovery and Reinvestment Act in the amount of $1 million was used to fund the project. The renovations at Williamsport Regional Medical Center are currently under review for LEED certification.

BENEFITS

- Replacing two boilers will reduce carbon emissions by 50%.
- Total hospital energy savings of more than $500,000 annually.
- Generating more than 15 million kilowatts of electricity annually, providing enough energy to power more than 1,500 homes.
- Co-generation by using steam produced during electric generation to provide heat and hot water for the hospital.

FOR MORE INFORMATION CONTACT:

Charles Santangelo, Susquehanna Health System 570-321-3171

http://www.susquehannahealth.org/

Case Study: Residential

STEP, Inc. Weatherization Assistance Program

Lycoming County and Clinton County

PROJECT DESCRIPTION

STEP, Inc. administers the Weatherization Assistance Program (WAP) for Lycoming and Clinton Counties. STEP's WAP is a federally funded program under the Department of Energy designed to help eligible residents reduce their home energy costs. Homeowners and renters are eligible. Weatherization measures are performed on houses, apartments, and mobile homes.

HOW DOES WAP WORK?After a client is determined eligible, an Energy Auditor visits the home, inspects the heating and water systems, and the dwelling. A blower door is used to determine air leakage into the home. The Energy Auditor reviews information to determine what type of measures will be performed. The job will be classified as either a LOW or FULL cost job. LOW cost Jobs are homes that are 'tight' in terms of air infiltration or heat loss. The measures taken to reach maximum energy efficiency include: water conservation measures such as wrapping the hot water heater and pipes, the installation of low flow shower heads and faucet aerators, and client energy education. FULL cost jobs will receive measures that may include the following: sealing structural bypasses which stop heat loss, water conservation measures, attic insulation and ventilation, wall, basement, and floor insulation, weather-stripping of doors and windows, and general airsealing. The average cost of a WAP job is $6,500, which translates into long-term savings for homeowners.

BENEFITS

* Average savings for homeowners: 23% of their overall energy consumption.
* Long term energy savings continue year after year through reduction in energy use.
* Energy education component of programs provides information to clients on how they can reduce energy use even further though small changes in their daily lives.
* For every $1.00 spent on Weatherizing a home, $1.53 is saved in energy-related benefits.

FOR MORE INFORMATION CONTACT:

Kevin Mitcheltree, Housing & WAP Director 570-601-9650 klmitcheltree@stepcorp.org

www.stepcorp.org

Case Study: Public / Non-Profit

Lycoming County Landfill Gas to Energy Expansion Project

Montgomery Borough, Lycoming County

PROJECT DESCRIPTION

The Lycoming County Landfill is managed by Lycoming County Resource Management Services (LCRMS), has been in operation since 1978, and accepts approximately 1,000 tons of waste per day. Since 1993, LCRMS has operated a 1 megawatt co-generation plant which includes 2 engines producing 1000 kilowatts per hour and through a partnership with Pennsylvania Power and Light (PPL) the energy is sold to the electrical grid. The co-generation plant produces enough electricity to power approximately 1,400 homes per year and provides excess thermal energy to heat on-site county buildings. The existing co-generation plant consumes only 23% of the available landfill gas.

Continuing the public-private partnership, PPL Renewable Energy and LCRMS announced in May 2011 that the methane-to-energy project will expand with PPL Renewable Energy designing, constructing, owning, and operating two 3 megawatt landfill gas-to-energy plants at the landfill. The two existing engines will be replaced with 4 new engines producing 6,000 kilowatts per hour. Two (2) engines will provide electricity needs for the adjacent Allenwood Federal Correctional Complex and 2 engines will produce electricity which will be sold to the grid. Excess thermal energy will be used to heat county landfill buildings.

BENEFITS

- Generation of 50 million kilowatt-hours per year, enough electricity to power approximately 4,300 homes
- Removing 40,000 tons of carbon dioxide emissions per year which is the equivalent of removing 7,000 cars from the road, not consuming 4 million gallons of gasoline, or reducing the import of 83,000 barrels of oil
- Lycoming County: increased revenues, increased energy efficiency, energy cost reduction (thermal heat for landfill buildings).

FOR MORE INFORMATION CONTACT:

Michael Hnatin, LCRMS 800-326-9571 Michael.Hnatin@lcrms.com

http://www.lyco.org/Departments/ResourceManagementServices.aspx

Case Study: Public / Non-Profit

East Lycoming School District Energy Projects

Hughesville, Lycoming County

PROJECT DESCRIPTION

East Lycoming School District (ELSD) provides education for approximately 1,800 K – 12 students in eastern Lycoming County. The district has developed the following energy mission: "To reduce our impact on the environment, save our taxpayers money, become an example, and help other schools and businesses become greener. " ELSD began developing an energy strategy in 2002 when a district wide energy audit was conducted. The audit resulted in implementation of several energy efficiency improvements including: new windows, insulation, and lighting retrofits in many of its buildings.

ELSD has implemented 4 types of renewable energy projects at buildings throughout the Hughesville Campus. 1) Biomass Hybrid willow, a short rotation woody crop which reaches harvest 3 years after planting, has been planted on 60 acres of the Hughesville Campus. Harvested on a 3 year rotation, the yield of this biomass energy source is 30 tons per acre. The crop is converted from wood to heat in a biomass energy plant and used for heat and hot water for Hughesville High School and the Lycoming County Career and Technology Center. 2) Solar Photovoltaic A 600 kilowatt solar field has been installed at the Hughesville Campus which supplies 50% of the high school's annual electrical power (or 411,000 kilowatts). 3) Geothermal A closed loop geothermal system, with a wellhead area 10 acres in size, has been installed to heat and cool Ferrell and Renn Elementary Schools. The geothermal system saves ELSD $17,000 per year in heating and air conditioning costs. 4) Wind ELSD has installed a 115' horizontal axis wind turbine rated at 2.5 kilowatts annually.

BENEFITS

- Increased energy efficiency resulting in decreasing facility operating costs by 60%.
- Improved building comfort through building envelope modifications and upgrading HVAC systems.
- The biomass system will reduce ELSD's carbon emissions by 800,000 pounds annually.
- ELSD will generate an additional revenue stream of approximately $95,000 per year through the sale of Solar Renewable Energy Credits (SRECs).

FOR MORE INFORMATION CONTACT:

Dave Maciejewski, East Lycoming School District 570-584-2870

http://energy.elsd.org/schoolenergy/index.html

CHAPTER 7 ENERGY STRATEGIES AND STRATEGIC ACTIONS

The following Energy Strategies and Strategic Actions have been developed based on results of tasks 1 through 6 of the Energy Plan scope of work (refer to Chapter 1). The Observations and Analysis section under each energy strategy serves to weave together information obtained during the background research and public outreach tasks and provides the supporting documentation to substantiate each energy strategy.

Upon adoption of the Energy Plan, Lycoming County will work with the Lycoming County Energy Advisory Council (refer to Strategy 1) to provide direction, coordination, monitoring, and resources for plan implementation.

STRATEGY 1: ADVANCE LOCAL, STATE, AND FEDERAL ENERGY POLICY

OBSERVATIONS AND ANALYSIS

Lycoming County, through the Office of the Commissioners, has worked cooperatively and effectively with state and federal political and agency officials to secure support and public funding for many County projects. The County is well-recognized as a leader in tackling numerous public policy issues. As an example, Lycoming County's Chesapeake Bay nutrient credit trading strategy is a model that has been publicly acclaimed by both EPA and DEP. Similarly, the Lycoming County Brownfields Corridor Plan has been acknowledged by both EPA and DEP as an effective redevelopment strategy, with those efforts resulting in both public funding for the project and several state and federal speaking engagements that benefit the County by publicizing the planning efforts. Lycoming County has been a leader in land use planning for many years, with the County's leadership being looked to most recently as a best management practice by Pennsylvania communities experiencing growth pressures from Marcellus Shale natural gas development. Lycoming County is one of a handful of counties within the Commonwealth developing an energy plan to help guide energy efficiency, demand reduction, and energy deployment.

Since the County is a well–recognized leader in formulating new policy, working cooperatively with state and federal officials to help shape energy policy not only benefits other communities throughout Pennsylvania and the country but may also help to position the County for new public funding opportunities to implement the Energy Plan.

Through the Energy Plan Workshop, attendees identified specific suggestions regarding a message that should be conveyed to state and federal officials.

- Create a comprehensive energy policy at the local, state, and federal levels.
- Partner with the natural gas industry to develop efficient use of natural gas, build the distribution system for use of natural gas in homes, seek reduced rates, and promote competitive advantages.
- Enact regulations that allow flexibility to consider local conditions; however, be consistent in developing an overall energy strategy.
- Position Lycoming County as a leader in energy policy development.

- Remember the value of public-private partnerships and pursue them
- Develop a set of robust incentives such as tax credits and rebates to encourage energy policy implementation and continue existing, effective incentives such as ENERGY STAR.
- Ensure natural gas companies provide funding for community economic and environmental impacts while being selective with land development to ensure communities remain as environmentally protected as possible. Encourage a balanced approach to shale gas development to the maximum extent possible.
- Repeal the California Air Resources Board (CARB) standard that discourages the use of natural gas-powered vehicles.[86]
- Transportation policy should address alternative fuels and potential transportation revenue shortfalls. Such shortfalls could arise due to the loss of liquid fuels tax dollars as less gasoline and diesel are consumed.

With these considerations in mind, the following strategic actions are proposed.

STRATEGIC ACTIONS

1.1 ADOPT AND PERIODICALLY UPDATE THE COUNTY ENERGY POLICY

The Energy Plan should serve as Lycoming County's energy policy upon adoption. The Energy Plan should be updated as required in accordance with the plan monitoring and evaluation discussed in Chapter 8.

1.2 CREATE THE LYCOMING COUNTY ENERGY ADVISORY COUNCIL

Lycoming County could work with public and private County partners to create a Lycoming County Energy Advisory Council. The Energy Advisory Council will spearhead the implementation of the County Energy Plan and serve as a conduit between federal, state, and local energy strategy and policy development. It is recommended membership to the Energy Council include at least one representative from each of the Energy Plan sectors (e.g., residential, commercial, industrial [preferably from a utility and/or natural gas company], public/non-profit [including at least two local municipalities], agriculture, and transportation and key stakeholder organizations such as Lycoming PCD, Williamsport/Lycoming Chamber, STEP, Inc., and DEP). To ensure the Energy Advisory Council is well equipped to handle technical energy issues in addition to policy, at least one of the members should include an electrical engineer or technician skilled in working with electrical equipment. The Energy Advisory Council should meet quarterly and disseminate progress on the Energy Plan's implementation electronically as discussed in Strategy 2.

[86] Legislation has been introduced at the state level through Pennsylvania House Bill 1089 Session of 2011 to repeal the CARB standard, which will eliminate duplication of EPA and CARB certifications for natural gas-powered vehicles.

Creation of the Lycoming County Energy Advisory Council is consistent with Strategy #3 of the Community and Economic Development Plan of the County's Comprehensive Plan. Strategy #3 calls for the creation of a "County Partnership Forum" to create strategic partnerships and coordinate mutual initiatives to achieve economies of scale.

1.3 BRIEF AND REGULARLY UPDATE THE GOVERNOR'S ENERGY EXECUTIVE

It is recommended, Lycoming County meet with the Governor's Energy Executive to discuss the Energy Plan's strategies and provide recommendations on statewide policy for energy efficiency, demand reduction, and energy deployment. The Energy Executive should be updated annually.

1.4 BRIEF AND REGULARLY UPDATE PENNSYLVANIA STATE LEGISLATIVE REPRESENTATIVES

It is recommended, Lycoming County meet with Pennsylvania state legislative representatives who serve the County, to discuss the plan's Energy Strategies and provide recommendations on statewide policy for energy efficiency, demand reduction, and energy deployment. The state legislators should be updated annually.

1.5 BRIEF AND REGULARLY UPDATE PENNSYLVANIA FEDERAL CONGRESSIONAL REPRESENTATIVES

It is recommended, Lycoming County meet with Pennsylvania federal congressional representatives who serve the County, to discuss the plan's Energy Strategies and provide recommendations on federal policy for energy efficiency, demand reduction, and energy deployment. The federal legislators should be updated annually.

1.6 BRIEF AND REGULARLY UPDATE FEDERAL AGENCIES

It is recommended Lycoming County, meet with DOE and EPA representatives to discuss the plan's Energy Strategies and provide recommendations on federal policy for energy efficiency, demand reduction, and energy deployment. The federal agency officials should be updated annually.

STRATEGY 2: PROMOTE ENERGY EDUCATION, PARTNERSHIPS, AND COMMUNICATION

OBSERVATIONS AND ANALYSIS

Public education and outreach is key and critical to any effective planning process – Lycoming County's Energy Plan is no exception. Repeated and consistent education and outreach at all levels helps to effectively move a plan into implementation. For energy planning, while the concept of energy efficiency and saving energy has been around for years – for example, the public in general is fairly familiar with the ENERGY STAR logo and branding – it takes time and effort to effectively convey the purpose of such planning. Questions such as "What is the purpose of the Energy Plan?" and more importantly "How can it benefit me?" should be asked and answered repeatedly and consistently. Similar to the federal government's effective branding campaign for ENERGY STAR, implementing Lycoming County's Energy Plan requires constant, consistent messaging.

The need for energy education and public outreach was echoed at the Energy Plan Workshop held in conjunction with the planning efforts. Participants in the breakout sessions for each of the energy sectors suggested Lycoming County spearhead efforts to provide energy education. Specific activities were recommended included:

- Providing educational opportunities to the public about energy programs and the benefits of alternative energy use, conservation, and infrastructure
- Facilitating communication and information sharing, using electronic sources as much as possible
- Promoting best management practices or use case studies to "tell the back story" about Lycoming County energy projects
- Facilitating energy curriculum development in schools; establishing a clearinghouse of energy resources
- Utilizing existing resources such as SEDA-COG ERC in the education and outreach efforts

Education and outreach are currently a core focus of many regional organizations and state and federal agencies serving Lycoming County. SEDA-COG ERC has provided numerous outreach sessions on varied energy topics through its Energizing Our Region breakfast seminar series; the monthly Building Green breakfast series; and the Managing Energy as a Resource technical training workshop series. Similarly, the SBDCs serving Lycoming County and agencies such as USDA and DCNR as well as Penn College hold seminars to educate their constituents about energy-related topics. DEP provides one-day workshops for educators focusing on the basics of sustainable energy sources and technologies such as solar, wind, hydropower, biomass, geothermal, alternative transportation fuels, and energy efficiency and conservation. Utilizing the existing resources of these organizations as much as possible and developing partnerships with each will leverage limited resources available for education and outreach.

Outreach also includes invaluable information regarding energy efficiency and demand reduction that exists on federal, state, and regional websites. Having information accessible to the public 24 hours a day is a useful way to make certain that citizens can stay informed. At the federal level, DOE's website provides comprehensive energy resources and tools (http://energy.gov/). Regionally, SEDA-COG ERC's Web site has assembled tools that are relevant to Central Pennsylvania's public and private sectors (http://erc.sedacog.org/). A good example of a county-based energy portal is the Lancaster County Center of Excellence in Renewable Energy. The organization's Web site effectively communicates the organization's mission and vision, local service providers, green jobs, project examples, and energy resources (http://lancastercountyrenewableenergy.com/). The Williamsport/Lycoming KIZ also maintains a website focused on entrepreneurial and green development, which could be a resource for local content.

In addition to providing education relative to energy efficiency and demand reduction, any outreach strategy should include a discussion of the potential public funding sources available for implementing energy efforts. While Lycoming County businesses, non-profits, and local governments have received an estimated $13.8 million over the past five years in state and federal incentives, there are several energy-related public funding sources available but some, particularly for agriculture, are underutilized. The USDA representatives through the FSA, Rural Development, and NRCS serve Lycoming County. There

may be an opportunity for PCD to assist County farmers by supporting the USDA in increasing awareness of existing programs such as REAP, FSFL, the Biomass Crop Assistance Program, and CIG. These programs could help reduce overall operational costs to Lycoming County farmers and small businesses.

Promoting energy education, partnerships with technical assistance providers, and the sharing of energy information will be an effective way for Lycoming County to have a positive impact on energy reduction and renewable energy deployment. With many programs and services provided by different federal and state agencies and organizations, Lycoming County is uniquely positioned to be the conduit for energy information for each energy sector as discussed in the following strategic actions.

STRATEGIC ACTIONS

2.1 DEVELOP AND MAINTAIN PARTNERSHIPS WITH TECHNICAL ASSISTANCE PROVIDERS

Numerous technical assistance organizations deliver high–quality energy services to Lycoming County's sectors. Refer to the list of Technical Assistance by Sector in Chapter 6. Lycoming Energy Advisory Council should develop and maintain partnerships with these organizations to increase the amount of energy services delivered to Lycoming County citizens, businesses, and local governments.

2.2 MARKET EXISTING ENERGY EDUCATION PROGRAMS

Educating Lycoming County citizens about the benefits of energy efficiency, energy reduction, and energy sources is a valuable way to introduce, promote, and increase the implementation of energy efficiency, demand reduction, and alternative energy deployment energy in the County. It is recommended, Lycoming County work with organizations/agencies such as, but not limited to, DEP, DCNR, the Williamsport-Lycoming County Chamber, SEDA-COG ERC, STEP, Inc., USDA, and PPL Electric Utilities to hold a series of educational sessions for the benefit of County residents. Specifically, the County will support the marketing of the SEDA-COG ERC breakfast series and encourage SEDA-COG ERC to hold at least one event in Lycoming County annually.

Content for the educational sessions should use existing curriculum already developed, such as DEP's Introductory Alternative Energy Educator's Workshop and SEDA-COG ERC's workshops. Energy-related career opportunities should be highlighted to demonstrate lifelong careers are available in the energy field. It is suggested the following broad messages be conveyed:

- Energy conservation and demand reduction will reduce overall energy demand, not only reducing costs for energy consumers, but reducing the dependence on foreign sources of fuel.
- Local energy deployment will lesson dependence on foreign sources of fuel and make Lycoming County more energy self-sufficient.
- Many opportunities for energy-related careers are available.

Available funding sources through state or federal agencies such as DEP, DCNR, DCED, USDA, DOE, HUD, or USDA will be used to implement this strategic action.

2.3 FOSTER SECONDARY AND HIGHER EDUCATION STUDENT INTEREST IN ENERGY ISSUES

As found during preparation of the Lycoming County Corridor Plan, which focused on brownfield redevelopment, engaging students is an effective way to promote interest by parents and the community at large in planning related issues. For the Energy Plan, it also helps set the groundwork for future careers in energy-related fields.

Lycoming County has already begun implementing this strategy by working collaboratively with Lycoming College. As part of their course work in the *Energy Diversity Course* Lycoming College students helped to develop the case studies included in Chapter 6. Similar collaboration and partnerships will engage County students in energy-related issues. Participation in national and statewide energy competitions such as Igniting Creative Energy (http://www.ignitingcreativeenergy.org/), Odyssey of the Mind (http://odysseyofthemind.com/), National Science Bowl (http://science.energy.gov/nsb/), GreenSylvania (greensylvania.org), and the Greenovation Competition of Central PA (http://wlkiz.com/greenovation/greenovation-2010) will be encouraged. These types of competitions increase awareness about energy efficiency, demand reduction, and renewable energy sources for students, their families, and the community.

2.4 ESTABLISH A LYCOMING COUNTY ENERGY INFORMATION PORTAL

A great deal of existing information is available about energy efficiency, demand reduction, and renewable energy sources. Tracking various resources and having information readily available, up to date, in a streamlined format could be a daunting task. To facilitate the effective transfer of this information to the public, it is recommended Lycoming County develop an online energy portal. A similar tool was suggested as part of Strategy #3 in the Community and Economic Development Plan of the County's Comprehensive Plan. The Comprehensive Plan calls for the establishment of an Internet Community Resource Center to serve as a clearinghouse for community information.

The energy portal could provide the following types of information:

- Real-time updates on implementation efforts associated with each Energy Strategy and energy sector as links to extensive online energy resources such as the U.S. Department of Energy (energy.gov) and ENERGY STAR (energystar.gov)
- Education and credential requirements for energy jobs
- Links to educational institutions that provide education and training
- Promoting energy-related jobs through links to regional businesses that could potentially hire Lycoming County residents and college graduates
- Calendar and updates on County and regional energy-related events such as SEDA-COG ERC's Energizing Our Region Breakfast Series
- Online access to existing educational seminars and Webinars

The Lycoming County Energy Advisory Council could solicit a host for the energy portal and potentially partner with local educational institutions and area businesses to develop and maintain the energy portal.

In addition to the Energy Portal, the Lycoming County Energy Advisory Council will also consider the use of social media tools such as Facebook and Twitter to ensure current Energy Plan implementation efforts are communicated with as wide an audience as possible.

As a companion to the energy portal, an e-mail alert system could be developed to send updates on information related to the Energy Plan. Energy Plan Workshop attendees could be included in the e-mail distribution list, and the distribution list should be updated continually.

2.5 HIGHLIGHT THE BENEFITS OF ENERGY EFFICIENCY AND DEMAND REDUCTION AT EVENTS

To maximize opportunities to educate the public about the Energy Plan, it is recommended Lycoming County set up display booths at community events to showcase current and future energy-related projects in Lycoming County and the region. Similarly, kiosks could be placed at County recycling centers in an effort to reach as many citizens as possible. The County could also encourage the discussion of the Energy Plan at professional conferences such as the Pennsylvania Planning Association Annual Conference and Pennsylvania local government association annual conferences.

STRATEGY 3: PROMOTE ENERGY EFFICIENCY AND DEMAND REDUCTION

OBSERVATIONS AND ANALYSIS

Buildings account for nearly 40 percent of U.S. energy consumption and carbon emissions. Efforts to improve energy efficiency and reduce energy consumption will result in an ultimate cost savings to the consumer, whether that consumer is a homeowner, a business, or a local government. For new construction or major reconstruction, adopting LEED standards established through the U.S. Green Building Council will result in a more energy-efficient structure.

One starting point to address energy efficiency, beyond basics such as replacing incandescent light bulbs with CFL bulbs or turning off lights when not needed, is the completion of utility bill analysis and an energy audit. Several municipalities in Lycoming County have received a utility bill analysis through SEDA-COG ERC including: Loyalsock Township, Montgomery Borough, Hughesville Borough, and Montoursville Borough. The utility bill analysis provides a starting point to identify the costs associated with energy. An effective energy audit provides the blueprint for improvements that will result in an eventual return on investment. Since such audits are not necessarily top budgetary priorities for most local governments, homeowners, or businesses, demonstrating the value of conducting an energy audit by showing resultant savings could be beneficial.

One potential way to demonstrate the long-term value of energy audits and resultant energy efficiency projects is for government to lead by example. Local governments within Lycoming County could use best management practices outlined in the Energy Plan to not only reduce municipal budgets but demonstrate to citizens and businesses the return on investment associated with implementing energy

efficiency improvements. Employing County and local government energy efficiency and demand reduction practices could have a multiplier effect throughout the County.

Energy efficiency improvements and demand reduction will result in overall lower energy costs. Another way to reduce costs is through shopping for electric rates. The Pennsylvania Electricity Generation Choice and Competition Act of 1996 resulted in electric competition whereby consumers are able to shop the best price from electric suppliers.

STRATEGIC ACTIONS

3.1 ENCOURAGE ELECTRIC CHOICE IN ALL SECTORS

As noted throughout the Energy Plan, one of the major reasons to prepare a plan is to identify ways for each sector to reduce its overall energy costs. One easy way to do so is to shop for electric suppliers as permitted through the Pennsylvania Electricity Generation Choice and Competition Act of 1996. It is recommended, Lycoming County encourage electric choice throughout the County.

3.2 ENCOURAGE LEED CONSTRUCTION IN ALL SECTORS

It is recommended, Lycoming County encourage municipalities to adopt LEED building standards set forth through the U.S. Green Building Council and support the construction of LEED facilities in all sectors. Lycoming County could work to identify funding sources such as federal, state, or Lycoming Energy Now, proposed as part of Energy Strategy 7, for LEED projects as necessary.

3.3 PROMOTE ENERGY EFFICIENCY AND DEMAND REDUCTION IN COUNTY AND LOCAL GOVERNMENTS

It is recommended, Lycoming County develop an energy efficiency and demand reduction program for local municipalities. The checklists in Chapter 6 provide examples of ways to improve energy efficiency and reduce energy demand. This program could potentially begin by working with SEDA-COG ERC to conduct utility bill analysis followed by detailed energy audits and audit recommendation implementation. Lycoming County could share the costs of the energy-saving improvements with local municipalities. Funds for such a program can be designated through various state and federal funding sources or the Lycoming Energy Now program proposed as part of Energy Strategy #7 as well as existing resources available through PPL's Act 129 programs.

As part of this strategic action, benchmarking data gathered before and after energy efficiency and improvements and demand reduction efforts would be used to illustrate the compounded financial impact of improvements.

3.4 MARKET EXISTING ENERGY EFFICIENCY AND DEMAND REDUCTION PROGRAMS FOR RESIDENTS

Existing residential energy efficiency and demand reduction programs are currently in place throughout the community and provided through STEP, Inc. The checklists in Chapter 6 provide examples of ways to improve energy efficiency and reduce energy demand. The County should continue to support STEP,

Inc.'s existing weatherization program by designating a portion of the County's annual Act 137 and CDBG funding to support the implementation of energy efficiency and reduction measures in low- and moderate-income households. In addition, it is recommended Lycoming County help market existing EDC energy efficiency and demand reduction programs mandated through Act 129. These programs are open to all PPL residential customers, designated by an "RS" rate schedule. Programs currently open to low-income households include direct load control, E-Power Wise, efficient equipment rebates, low-income WRAP, and residential lighting. Programs currently open to all households include appliance recycling, direct load control, efficiency equipment rebates, home assessment and weatherization, and residential lighting.

3.5 MARKET ENERGY EFFICIENCY AND DEMAND REDUCTION PROGRAMS FOR BUSINESSES

Several energy efficiency and demand reduction programs are currently in place for businesses through non-profit organizations such as the SBDCs and for-profit EDCs that are required to provide energy efficiency programs through Act 129. It is recommended Lycoming County support these efforts by linking businesses with existing programs. These linkages would occur either through the energy information portal or through referrals made through the Lycoming County Energy Advisory Council. The checklists in Chapter 6 provide examples of ways for businesses to improve energy efficiency and reduce energy demand.

3.6 MARKET ENERGY EFFICIENCY AND DEMAND REDUCTION PROGRAMS FOR AGRICULTURAL BUSINESSES

The USDA through the FSA, Rural Development, and NRCS has tools and funding available to promote energy efficiency and demand reduction for farmers and small businesses. It is recommended Lycoming County work with the USDA representatives that serve Lycoming County to market these existing programs to County businesses. PPL also provides Act 129 programs for agricultural businesses with program availability depending on the type of electric service provided, either single-phase service or three-phase service.

3.7 PROMOTE "REDUCE, REUSE, AND RECYCLE"'

It is recommended Lycoming County support the concept of Reduce, Reuse, and Recycle through steps such as reducing the amount of paper consumed, aiming for a paperless or at least a less-paper society, supporting County and municipal recycling efforts, including recycling of electronics, and evaluating Pay-as-You-Throw (PAYT) programs for applicability in Lycoming County.

STRATEGY 4: PROMOTE RENEWABLE ENERGY DEPLOYMENT THAT ENCOURAGES SUPPLY CHAIN DEVELOPMENT AND ENERGY INDEPENDENCE

OBSERVATIONS AND ANALYSIS

Over time, investment in renewable energy provides low-cost energy with minimal environmental impact. However, the initial, upfront investment compared to the long-term return on investment should be evaluated prior to embarking on any renewable energy project. As renewable energy

generation is not mainstream, the initial cost investment can be significant. In some cases, without public investment some types of renewable energy generation are not economically viable.

For example, it is less expensive during new home construction to provide a home's electricity through a utility rather than installing a solar PV system. The initial investment would likely be paid back over time, but that initial investment is not often feasible for most homeowners or businesses. Similarly, conventional heating such as natural gas, electric, wood/wood pellets, propane, and oil are less expensive than installing a ground source geothermal system. Over the long term, a geothermal system will result in a return on investment.

Incorporating energy efficiency upgrades during new home construction typically increases the home's cost by 10 to 15 percent. Incentive programs through federal and state agencies have been used to offset the investments to incorporate energy efficiency improvements and deploy renewable energy sources. Combined with an end user's equity, the public incentives can make the use of renewable energy sources such as geothermal or solar economically feasible. Since the long-term investing in geothermal or solar energy sources is a renewable "free" resource, the long-term return on investment should be considered carefully.

While investing in renewable energy can be a significant cost investment, it can also be a significant value in terms of sparking new job growth in professions that require both technical and nontechnical personnel to determine the feasibility, design, installation and/or construction, and maintenance of renewable energy projects. These job opportunities encourage the development of a supply chain that encourages renewable energy investment. If there are viable, long-term job opportunities, a local economy benefits by not only tax revenues, but diversification in the labor market.

For Lycoming County, the key is to encourage renewable energy investment in those sources that are consistent with the resources Lycoming County has to offer. The following list of renewable energy sources are those that are most strategically aligned with Lycoming County's natural resources.

- Geothermal. Installing geothermal heat pump systems to provide heat/cooling and hot water to buildings provides cost-efficient energy once the investment in equipment is paid off. Installing a closed-loop geothermal system in a home raises construction costs by approximately $8,000 over conventional heating and cooling systems. The cost for commercial and industrial buildings is approximately $20.00 per square foot.

- Biomass. There are several ways to effectively match the use of biomass with each of the energy sectors and effectively leverage Lycoming County's lumbering heritage into a future opportunity. While biomass energy has been used historically to provide heat, the use of other heat sources such as natural gas, coal, oil, and propane has replaced its prominence. The use of wood-based biomass to heat homes, businesses, and schools is increasing. As an example, East Lycoming School District is growing short-term woody rotation crops for the specific purpose of combusting the crops for fuel. Beyond biomass for a heat source, local sawmills, mulch producers, and loggers transport wood chips to biomass energy companies, which produce electricity or manufacture wood chips into wood pellets.

- Biofuels. The biofuels market in Pennsylvania has been sparked by recent regulation and incentives. While it has not been particularly economically viable in other parts of the Commonwealth, Susquehanna Mills Company has developed a link between the agriculture,

commercial, and industrial sectors – a full-circle concept – that begins with growing canola on farms within a 50-mile radius of the company's Montoursville facility. Keeping the market local, the company can efficiently and cost effectively supply canola oil for local restaurants and convert the used cooking oil to biofuels to sell back to farmers to run equipment. This local/regional cradle-to-grave operation is a model that could be potentially replicated by other businesses in Lycoming County.

- Biomass Waste. There are several opportunities to convert biomass waste into energy in Lycoming County. Some are very advanced while others are still in the research and development stages. Landfill gas is currently being deployed and the use of septage, sewage, and manure are potentially viable.

- Combined Heat and Power. Encouraging combined heat and power projects that reuse heat generated during electricity production provides both increased energy efficiency and cost savings. The Lycoming County Landfill project is a good example. PPL Renewable Energy and Lycoming County recently announced a project at the Lycoming County Landfill in which PPL Renewable Energy will construct the energy generation facilities and sell the electricity back to the electric grid and to the adjacent Allenwood Federal Correctional Complex, with residual heat supplied to landfill facility buildings. While this project demonstrates the economic viability of selling electricity back to the grid, all combined heat and power projects should consider the impacts of deregulation to ensure the project can be economically viable. As an example, Koppers, Inc., has experienced a 30 percent decrease in revenue from the sale of electricity since deregulation in 2010.

Encouraging the development of renewable energy sources that support regional sustainable supply chain development, as noted in the preceding examples, would be an effective use of limited County resources. The following items were frequently suggested at the Energy Plan Workshop:

- Develop competitive economic advantage, drawing upon regional industrial capabilities and efficiencies and natural resources.
- Promote Food-Fiber-Fuel using renewable energy to power farms and sell energy.
- Buy local. Encourage the concept of producing local and buying local in everything from manufacturing, agriculture, food supplies, to services. Make Lycoming County as self-sustaining as possible. Promote "cradle-to-grave" manufacturing as much as possible.
- Be more energy self-sufficient by using local energy resources to meet local energy needs and save costs.
- Examine lifestyles and invest in strategies that extend natural resources, reduce consumer costs, and increase personal energy independence.

The concept of energy self-sufficiency and energy independence is being explored in other communities in Pennsylvania. The Smethport Biomass Project in Smethport Borough, McKean County, is in the implementation phase and is focused on the feasibility of using woody biomass as an energy alternative to fossil fuels. The larger community is also studying the feasibility of constructing a combined heat and power system in Smethport to supply district heat and electricity to local residents, businesses, and government buildings within the Borough's service area. Exploring this type of small-scale community

system in Lycoming County would require a community with a dense concentration of businesses and residents. Areas such as Jersey Shore, Hughesville, Muncy, Montgomery, and Montoursville may support a critical mass to explore a community-scale energy project. Muncy Borough has a potential community project in the development stages. The Borough is in the process of designing a community streetscape project. As part of the project the Borough is exploring incorporating plug-ins for electric cars or 'Smart Curbs' that could benefit the downtown.

While short-term efforts should focus on activities that promote existing renewable energy source development including, but not limited to, biomass, biofuels, and combined heat and power, Lycoming County should encourage the development of longer-term renewable energy efforts such as septage and/or sewage to energy.

Lycoming County should proactively support renewable energy projects. Support should come in the form of the following:

- Education to inform businesses and residents of the types, feasibility, and costs of renewable energy sources
- Working with educational institutions and the Central Pennsylvania Workforce Development Corporation to support education and training of local workforce to support supply chain opportunities in renewable energy sectors
- Adopting land use regulations that are supportive of renewable energy development
- Developing letters for various regional, state, or federal officials in support of Lycoming County's renewable energy projects
- Supporting the efforts of the Williamsport Lycoming Chamber on business-related renewable energy investment
- Investing in renewable energy projects through Lycoming Energy Now (refer to Strategic Action 7.3)

STRATEGIC ACTIONS

4.1 EXPAND BIOMASS ENERGY DEPLOYMENT

There are many opportunities to expand biomass development in Lycoming County that include, but go beyond, the agriculture industry. Biomass is currently being used as a fuel stock to heat schools, hospitals, and nursing homes, as well as many homes and small commercial operations. Biomass energy is also being used as an energy source in manufacturing operations and for biofuels. Working with DCNR, Lycoming County should take a comprehensive look at the County's woodland and cropland resources and develop a plan to expand biomass energy use in each of the County's industry sectors. The County should explore ways to replicate the full-circle concept developed by Susquehanna Mills Company – having local farmers grow short-rotation woody crops that are converted into both food and fuel, with the fuel used by farms. Growing short-rotation woody crops as a biomass feedstock for heat should also provide a source of revenue for farmers. Additional opportunities might be available to reuse biomass from shale gas exploration and production (lumber and wood chips from road and well pad activity) as biomass feedstock.

Existing technical resources are in place, such as Pennsylvania Biomass Trader (http://www.biomasstrader.org/pennsylvania/), should be promoted to match biomass producers with biomass consumers. For livestock farmers, exploring the use of biodigesters to convert methane into energy and using dried manure as an energy feedstock also promotes the concept of full-circle or "cradle-to-grave" energy use. There are several opportunities through either biomass energy or other types of renewable energy sources to benefit Lycoming County's agriculture industries. With 55 percent of Lycoming County's agricultural land in cropland according to the 2007 Census of Agriculture, matching agriculture businesses with renewable energy opportunities should be explored.

4.2 ENCOURAGE COGENERATION PROJECTS

Similar to promoting energy efficiency and energy conservation in government operations, Lycoming County should lead by example by exploring the feasibility of using renewable energy sources in local government operations. The Lycoming County Landfill project is a good example of a successful County renewable energy project. Lycoming County's Lysock View Complex also provides an area where there are opportunities for renewable energy demonstration projects, such as wind energy, solar, or geothermal.

4.3 ENCOURAGE THE DEPLOYMENT OF SOLAR ENERGY PROJECTS

It is recommended Lycoming County encourage the award of federal and state funding for the promotion of renewable energy sources. Funding for residential and commercial-scale uses should focus on incentives for solar hot water heaters and solar heat exchange pumps. The Loyalsock Township building is an example of solar energy used in a government facility.

4.4 PROMOTE THE INSTALLATION OF GEOTHERMAL SYSTEMS

Geothermal energy provides a real opportunity for having an independent energy source. Through the Lycoming Energy Now fund discussed in Strategy #7, the Lycoming County Energy Advisory Council should provide assistance to economic development projects that deploy a renewable energy source such as geothermal.

4.5 SUPPORT THE USE OF HYDROPOWER

The County should pursue an inventory to determine the feasibility of low-impact hydropower at sites along the County's waterways. A feasibility study would be the first step in developing a low-impact hydropower program in the County.

4.6 ADVANCE THE DEPLOYMENT OF BIOMASS WASTE PROJECTS

Both septage and sewage are potential, untapped sources of energy that could be converted to heat and electricity. While the technologies to convert the waste into energy are emerging, Lycoming County should take the lead to advance a pilot project at one of the County's wastewater treatment facilities. Several of the County's wastewater treatment facilities, such as Jersey Shore, Williamsport, and Muncy-Montgomery are in the process of designing, permitting, and constructing plant upgrades required as

part of Chesapeake Bay Tributary Strategy requirements. Investing in a sewage or septage to energy pilot project while upgrades are being planned would leverage limited financial resources available to wastewater treatment plant operators. Examples of the types of pilot projects include, but are not limited to, the following: using algae to convert solids to ethanol and biodiesel, anaerobic sewer treatment systems to produce electricity, and the use of biomass in sewer treatment facilities to create heat or electricity.

4.7 CONSIDER THE DEVELOPMENT OF A COMMUNITYWIDE ENERGY INDEPENDENCE PROJECT

The concentration of homes and businesses in existing Lycoming County communities such as Jersey Shore, Hughesville, Muncy, Montgomery, South Williamsport, and Montoursville might provide an opportunity for a pilot small, communitywide energy project. The use of district heating systems, which works best when multiple buildings in close proximity can use the same power source, is an option to be explored. It is recommended Lycoming County work collaboratively with SEDA-COG ERC to explore the feasibly of such a pilot project. SEDA-COG ERC has undertaken an energy efficiency project in New Berlin Borough, Union County, a small community of 838 residents that has an overall goal of achieving energy independence.

4.8 MONITOR DEVELOPMENTS IN RENEWABLE ENERGY

While renewable energy provides a small portion of the nation's energy supply at only 8 percent, it has increased from 6.2 percent in 2004. Nationwide efforts to improve the commercial viability of cutting-edge renewable technologies such as powering fuel cells with natural gas-powered fuel are increasing. Therefore, it is in Lycoming County's best interest to monitor changes in renewable energy development and modify the Energy Plan to reflect those changes as required. Biomass and fuel cells are examples of renewable sectors where technology advances are being made through ongoing research and development. The Lycoming County Energy Advisory Council should identify a group or organization to accomplish this task and to post relevant information on the County's energy portal.

STRATEGY 5: ENCOURAGE THE ECONOMIC BENEFITS AND MONITOR THE IMPACTS OF SHALE GAS EXPLORATION AND PRODUCTION

OBSERVATIONS AND ANALYSIS

The long-term projected economic benefits associated with shale gas development and development of additional gas shales that underlie Pennsylvania are significant. This is reflected in the increase in natural gas well activity in the County. The number of Marcellus Shale permits issued in Lycoming County has increased from 33 in 2008 to 254 in 2010. Between January and November 2011, 323 permits for Marcellus Shale wells were issued by DEP.

Efforts to capture some of the economic potential of using natural gas for local, regional, and statewide economic benefit are well-underway in Lycoming County, as the County serves as a logistics, commerce, and production hub for Marcellus Shale natural gas development in central and northeastern Pennsylvania. Transportation infrastructure, particularly rail and road, have experienced increased

volumes due to well service companies transporting commodities such as pipe, sand, and other products via rail and out-to-drill sites via truck. The number of rail-served sites in Lycoming County that have redeveloped into logistics points for the natural gas industry have increased tremendously over the last several years. The economic development activity is not solely limited to rail-served sites. Many new business locations can be attributed to Marcellus Shale natural gas production. In addition the number of new commercial operations due to Marcellus Shale natural gas development - hotels, restaurants, professional service firms – has increased significantly over the last several years.

The increase in economic activity in Lycoming County reflects input obtained at the Energy Plan Workshop. Several workshop participants suggested developing competitive economic advantage using natural resources such as natural gas.

Opportunities for developing a competitive economic advantage are not limited to industrial and commercial activity, but transportation as well. The CNG Focus Group spearheaded by Larson Design Group has been focused on implementing a compressed natural gas (CNG) project in Lycoming County. River Valley Transit will construct a CNG fueling station in Williamsport with access for both public and private vehicles. Through the efforts of River Valley Transit and the CNG Focus Group a $3.5 million Federal Transit Administration (FTA) Clean Fuels Grant and a $400,000 DEP Alternative Fuels Incentive Grant (AFIG) were awarded to the project in 2011.

Establishing a natural gas filling station in Lycoming County was suggested by the Energy Plan Advisory Committee, recommended at the Energy Plan Workshop, and is consistent with "*Marcellus Works*" legislation introduced in April 2011. In addition, according to a recommendation in the Governor's Marcellus Shale Advisory Commission report released July 22, 2011, "Pennsylvania should develop 'Green Corridors' for natural gas-fueled vehicles, including Compressed Natural Gas (CNG) and Liquefied Natural Gas (LNG) fueling stations, located at least every 50 miles and within 2 miles of designated highways."[87]

Energy Plan Advisory Committee members also suggested at least two ways to reuse wood chips, which are the by-product from road clearing associated with well pad development: (1) Wood chips can potentially be used to "absorb" extra free liquid in drilling residuals to make them acceptable for landfill disposal. Using residual wood chips in this manner would require regulatory modifications; and (2) Wood chips could also be used as biomass feedstock and used to fuel Lycoming County schools that use biomass as an energy source to heat buildings.

[87] Governor's Marcellus Shale Advisory Commission Report, July 22, 2011, p. 115.

STRATEGIC ACTIONS

5.1 SUPPORT THE FACILITATION OF ECONOMIC DEVELOPMENT FOCUSED ON NATURAL GAS PRODUCTION AND USE WITHIN NEW AND EXISTING INDUSTRIES

Lycoming County should continue to support business expansion and attraction focused on natural gas. Not only should the County facilitate new business starts and business expansion to aid in well drilling and production, but the County should also support businesses to use natural gas as an energy source, manufacture parts that enable the use of natural gas, or provide professional or support services for the natural gas industry.

5.2 EVALUATE THE POTENTIAL LOCATION OF INTRASTATE NATURAL GAS PIPELINES IN LYCOMING COUNTY

The aforementioned Marcellus Shale Advisory Commission report recommends Pennsylvania provide incentives for the development of intrastate natural gas pipelines to ensure citizens and businesses in the Commonwealth have access to lower natural gas costs by avoiding interstate pipeline transmission costs.[88] Lycoming County should assess the potential locations of intrastate natural gas pipelines in the County and update land use regulations as required.

5.3 PROMOTE NATURAL GAS-FIRED POWER PLANTS

It is recommended, Lycoming County support natural gas-fired power plants. These combined heat and power plants are more efficient than traditional plants as the plants capture a large portion of the energy contained in the heat exhaust from natural gas combustion turbines to generate additional electricity. Virginia-based Moxie Energy proposes building a new natural gas-fired power plant in Clinton Township. The $800 million project will generate short term construction and permanent jobs and provide energy for up to 1.4 million people.

5.4 PLAN AND PREPARE FOR NATURAL GAS-POWERED VEHICLES BY PROMOTING CNG INFRASTRUCTURE COUNTYWIDE

Working through the CNG Focus Group, Lycoming County should strive to make certain CNG fueling stations are located at major highway intersections throughout the County and plan for the future development of CNG fueling stations so both fleet vehicles and passenger vehicles will have access to natural gas to power vehicles in the future. This will require working with the natural gas industry to construct not only fueling stations but high-pressure natural gas lines. In addition, policy issues such as modifying the CARB standard should be addressed, as well as a review of land use regulations to make certain that natural gas fueling stations can be constructed as efficiently. Specific steps to implement this strategic action are outlined in Chapter 4.

[88] Ibid., 116.

5.5 EDUCATE THE PUBLIC AND BUSINESSES ABOUT THE ADVANTAGES OF USING NATURAL GAS FUELED VEHICLES

Once Lycoming County in partnership with the CNG Focus Group has developed a plan using natural gas in vehicles, a countywide campaign should be launched to educate the public and businesses about the reasons why natural gas is a good choice to power vehicles. While it will likely take several decades for a major shift from conventional to natural gas-fueled vehicles, showing progress such as conversion of fleet vehicles to CNG will demonstrate to the public that such a goal is obtainable. Specific steps to implement this strategic action are outlined in Chapter 4.

5.6 PREPARE LYCOMING COUNTY BUSINESSES AND WORKFORCE TO SERVICE CNG FUELING OPERATIONS

Planning and constructing CNG infrastructure throughout Lycoming County will require ancillary support services such as vehicle upfitter shops, specialized CNG mechanics, fuel station design, and manufacturing parts associated with CNG fueling facilities or vehicle retrofits. Lycoming County should prepare to be the hub for such activity by working collectively with private industry through the Williamsport/Lycoming Chamber of Commerce, Penn College and other educational institutions, and state government. Specific steps to implement this strategic action are outlined in Chapter 4.

5.7 MONITOR THE ECONOMIC, ENVIRONMENTAL, AND SOCIAL IMPACTS OF SHALE GAS EXPLORATION AND PRODUCTION

While the Energy Plan was being prepared, Lycoming County initiated a study to monitor the impacts – both positive and negative – of shale gas development. This includes identifying and tracking baseline economic, environmental, and social conditions such as, but not limited to, the following: number of new businesses, job creation, investment, unemployment rate, rental rates, vacancy rates, crime, EMS services, school enrollment, hotel vacancy rates, housing values, etc. Lycoming County should develop a system to monitor the impacts on an annual basis and disseminate the data with County partners as well as the state.

STRATEGY 6: HELP PREPARE LOCAL GOVERNMENTS TO ADDRESS ENERGY-RELATED LAND USE CONSIDERATIONS

OBSERVATIONS AND ANALYSIS

Lycoming County has a well-developed series of planning documents and land use regulations. In addition to a Countywide Comprehensive Plan, in which this document will be part, the County has addressed planning for recreation, transportation, hazard reduction, stormwater management, environment, and brownfield redevelopment. The County has countywide subdivision and land development ordinances as well as a County zoning ordinance. The County's zoning ordinance was amended in 2010 to address oil and gas extraction in response to Marcellus Shale natural gas development. Wind energy development has also been addressed in the zoning ordinance.

In addition to land use impacts associated with natural gas extraction and wind energy development, encouraging the use of renewable energy sources will require modification of the County's zoning ordinance, particularly as renewable energy technologies continue to evolve. Model ordinances for

solar and geothermal are available through Pennsylvania's local government associations and provide a good starting point for the County to make land use regulation modifications, as necessary.

STRATEGIC ACTIONS

6.1 UPDATE LAND USE PLANS AND REGULATIONS AS REQUIRED

Lycoming County should adopt the Energy Plan as part of the County's Comprehensive Plan. A review of ordinances should also be conducted at both the County and municipal levels to ensure that development restrictions are eased to the maximum extent possible for energy efficiency improvements, LEED standards, and renewable energy facilities such as geothermal and solar. Such a review is consistent with Strategy #1 of the Community and Economic Development Plan of the County's Comprehensive Plan. Lycoming County has addressed wind energy facilities in the County zoning ordinance and should address solar and geothermal energy projects as well.

6.2 PROVIDE OUTREACH TO LYCOMING COUNTY LOCAL GOVERNMENTS

Lycoming County should educate Lycoming County local governments about the contents of the Energy Plan and facilitate the update to land use regulations, as required.

STRATEGY 7: FACILITATE THE AWARD OF ENERGY INCENTIVES TO LYCOMING COUNTY PROJECTS

OBSERVATIONS AND ANALYSIS

Installing renewable energy source systems is more expensive compared to traditional energy systems. Consider that the cost of installing solar and energy efficiency design elements typically increases the cost of building a home by 10 to 15 percent over average construction costs. While the initial outlay is more expensive, the long-term benefits are significantly reduced energy costs (in some cases up to 80 percent) once the initial investment is recouped.

To offset these costs, state and federal funding sources are available. Programs are in place to cover the costs of conducting an energy audit, implementing energy audit improvements, or exploring and deploying renewable energy sources.

While the longevity of these sources is dependent upon state and federal budgets, it is nonetheless worth the effort for Lycoming County to monitor and secure public funding sources as appropriate.
Lycoming County is particularly skilled at obtaining public funding for projects. Identifying public funding sources was identified in several of the breakout sessions held as part of the Energy Plan Workshop.

STRATEGIC ACTIONS

7.1 MONITOR AND SECURE ENERGY-RELATED INCENTIVES THAT MAY BE APPLICABLE FOR EACH ENERGY STRATEGY

Federal, state, industry, and foundation funding is ever changing. While funding opportunities are currently at a premium, Lycoming County should monitor funding sources to offset the costs of implementing each of the Energy Strategies. Funding to offset the costs of deploying new energy technology applications, such as developing renewable energy from sewage or septage, is necessary to advance these sources in the County. Additional funding is also helpful for residences and businesses to offset the costs of conducting energy audits and implementing energy efficiency recommendations identified in energy audits.

Lycoming County should post information pertaining to funding sources on its energy portal, prepare funding applications as appropriate, and work cooperatively with the Williamsport-Lycoming Chamber on funding sources that would benefit Lycoming County businesses.

7.2 PROVIDE COUNTY-LEVEL SUPPORT FOR ENERGY PROJECTS

It is recommended Lycoming County provide letters of support and contact agency and elected officials as required to champion Lycoming County projects.

7.3 DEVELOP AND IMPLEMENT *LYCOMING ENERGY NOW*

It is recommended Lycoming Energy Now be a new funding source created in Lycoming County by Lycoming County to fund County renewable energy projects. To develop the funding source, Lycoming County could use renewable energy to generate electricity, which could be sold back to the electric grid. Proceeds from the sale of electricity could be used to fund high-priority renewable energy projects in Lycoming County. Lycoming County could also purchase and sell excess energy with the proceeds used to fund high-priority renewable energy project.

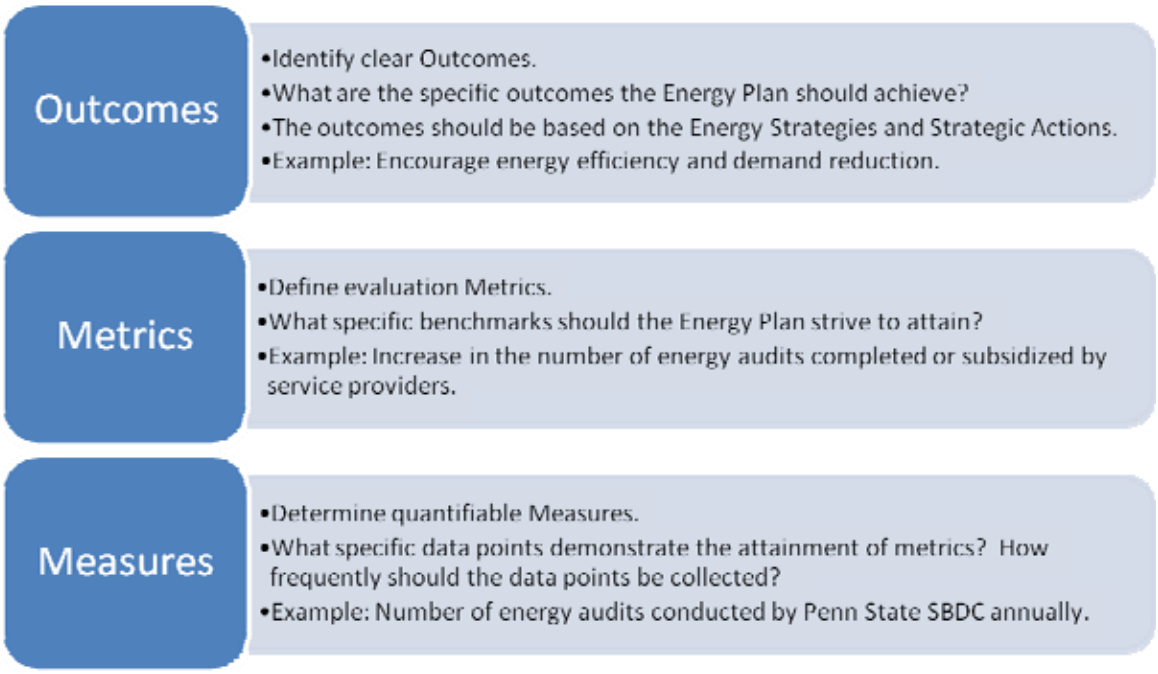
Such a funding source would be consistent with Lycoming County's energy vision "to meet local energy needs, making Lycoming County more energy self-sufficient." Maintaining a sustainable funding source would go a long way towards increasing the use of renewable energy sources in the County. Potential energy sources to be considered include biomass such as landfill gas, wind, or solar. While natural gas is not considered renewable, rather alternative, it should be considered as well. Priority projects and program details would be determined by the Energy Advisory Council.

CHAPTER 8 MONITORING AND EVALUATING ENERGY PLAN IMPLEMENTATION

Measuring the effectiveness of the Energy Strategies and Strategic Actions discussed in Chapter 7 requires continual monitoring and evaluation. As part of the follow up for Energy Plan implementation, an annual report will be prepared by the Lycoming Energy Council. The annual report will contain a high-level overview providing the status of each Energy Strategy and Strategic Action and an evaluation of implementation efforts. Implementation successes that occur throughout a given year (prior to the issuance of an annual report) should be reported to the public through electronic means so that progress is demonstrated on a continual basis.

To augment the annual report, the Lycoming Energy Council will adopt specific outcomes and metrics and collect corresponding measures as a way to benchmark implementation success. Refer to the following figure.

FIGURE 24 - OUTCOMES, METRICS, AND MEASURES



The following table lists sample Outcomes, Metrics, and Measures developed to monitor the implementation of Lycoming County's Energy Plan. This list is not exhaustive and will be reviewed, modified, and adopted by the Lycoming Energy Council. Most of the Measures are scheduled to be collected annually.

TABLE 8 – SAMPLE OUTCOMES, METRICS, AND MEASURES

Outcomes	Metrics	Measures
Encourage energy efficiency and demand reduction	Increase in the number of energy audits completed or subsidized by service providers	• # of energy audits conducted by STEP, Inc., annually • # of energy audits conducted by EDCs, annually • # of municipal utility bill analysis performed by SEDA-COG ERC, annually • # of energy audits conducted by Penn State SBDC, annually • # of energy audits reimbursed by USDA through EQIP, annually • # of investment-grade energy audits underwritten by PennTAP, annually
	Increase in the number of Act 129 EDC incentives by Lycoming County sectors	• # of incentives provided by EDCs, annually • Total energy savings (MW), annually
	Decrease in the amount of utility electric consumed	# of customers and usage data (kWh) provided by electric utilities, every 3 years
	Increase in technical assistance provided to the Agriculture sector	• # of agriculture businesses provided technical assistance by USDA • # of agriculture businesses provided technical assistance by DCNR
Support and encourage county-derived renewable energy generation	Increase in planned renewable energy projects in county school districts	• # of planned renewable energy projects obtained from school districts, annually
	Increase in implemented renewable energy projects in county school districts	• # of planned renewable energy projects obtained from school districts, annually
	Increase in geothermal, solar, and wind projects	• # of projects obtained from local building permits, annually

	Increase in the amount of energy–related funding awarded for Lycoming County projects	• Total dollar invested in Lycoming County projects obtained from DCED by source, annually • Total dollar invested in Lycoming County projects obtained from DEP by source, annually • Value of dollars invested in Lycoming County by EDCs, annually
Encourage the economic benefits of shale gas usage	Increase in the number of planned CNG fueling stations	# of planned CNG projects obtained from CNG Focus Group, annually
	Increase in the number of constructed CNG fueling stations	# of constructed CNG projects obtained from CNG Focus Group, annually
Market existing energy education programs and encourage energy events	Increase in the number of energy-related events held in Lycoming County	# of events obtained from technical assistance providers, annually

APPENDICES

APPENDIX A ONLINE ENERGY RESOURCES

FEDERAL, STATE, REGIONAL, AND LOCAL ENERGY RESOURCES

U.S. Department of Energy (DOE) Energy Information Portal

http://techportal.eere.energy.gov/

http://energy.gov/

SEDA-COG Energy Resource Center
http://erc.sedacog.org/

SEDA- COG Energy Resource Center, Energy Assessment Providers Directory
http://erc.sedacog.org/LinkClick.aspx?fileticket=rM2zoPuxflo=&tabid=303

St. Francis University Renewable Energy Center
http://www.francis.edu/REC.htm

Williamsport/Lycoming Keystone Innovation Zone (K12)
http://wlkiz.com/

Pennsylvania Biomass Trader
http://www.biomasstrader.org/pennsylvania/

Pennsylvania Fuels for Schools & Beyond Program
http://www.pafuelsforschools.psu.edu/

Biomass Energy Resource Center

http://www.biomasscenter.org/

GREEN BUILDINGS

U.S. Environmental Protection Agency (EPA) Sustainable Design and Green Building Toolkit

www.epa.gov/region4/recycle/green-building-toolkit.pdf

International Green Construction Code, International Code Council

http://www.iccsafe.org/cs/IGCC/Pages/default.aspx

LEED for Neighborhood Development

http://www.usgb.org/DisplayPage.aspx?CMSPageID=148

SUSTAINABILITY PLANNING

U.S. EPA Green Communities

http://www.epa.gov/greenkit/index.htm

International Council for Local Environmental Initiatives (ICLEI) Sustainability Planning Toolkit

http://www.icleiusa.org/programs/sustainability

Lancaster County Center of Excellence in Renewable Energy

http://lancastercountyrenewableenergy.com/

MODEL ENERGY ORDINANCES

Model Wind Ordinance for Local Government

http://www.pawindenergynow.org/pa/Model_Wind_Ordinance_Final_3_21_06.pdf

Solar Energy Systems/Draft Ordinance

http://solarpropa.com/images/PA_MunicipalSolarGuide.pdf

Rapho Township, Lancaster County Alternative Energy Ordinance

http://www.raphotownship.com/rapho/cwp/view.asp?a=5&Q=642218&raphoNav=|

FUNDING SOURCES

Database of State Incentives for Renewables and Efficiency (DSIRE)

http://dsireusa.org/

Pennsylvania Department of Community and Economic Development (DCED)

Funding and Program Finder

http://www.newpa.com/find-and-apply-for-funding/funding-and-program-finder

SEDA-COG Energy Resource Center

http://erc.sedacog.org/

APPENDIX B ENERGY FUNDING PROGRAMS

Lycoming County Energy Plan - Energy Funding Programs (as of November 2011)									
Federal / State / EDC	Agency/ Organization	Program Name	Program Summary	Funding Source	Industry Sector				
					Residential	Commercial	Public / Non-Profit	Industrial	Agricultural
Federal	IRS	Energy Efficient Building Tax Deduction	A tax deduction of up to $1.80 per square foot is available to owners of new or existing buildings who install (1) interior lighting; (2) building envelope, or (3) heating, cooling, ventilation, or hot water systems that reduce the building's total energy and power cost by 50% or more in comparison to a building meeting minimum requirements set by ASHRAE Standard 90.1-2001. Deductions of $0.60 per square foot are available to owners of buildings in which individual lighting, building envelope, or heating and cooling systems meet target levels that would reasonably contribute to an overall building savings of 50% if additional systems were installed.	Tax Deduction		X	X		
Federal	IRS	Business Energy Investment Tax Credit (ITC)	A Corporate tax credit for a percentage of the cost of installation of renewable energy systems including solar, wind, biomass, geothermal, fuel cells, microturbines and CHP. Solar, fuel cells and small wind systems are eligible for a 30% credit. Geothermal, microturbines and CHP can receive a credit of up to 10% of the system cost. In 2009, the option of receiving the tax credit in the form of a federal grant was included.	Tax Deduction		X		X	X

Federal	IRS	Renewable Electricity Production Tax Credit	A corporate tax credit for the production of electricity from sources including landfill gas, wind, biomass, and hydropower. The tax credit is $.022/kWh for wind, geothermal and biomass and $.011/kWh for other technologies and is available for electricity generated and sold by the taxpayer. The credit is typically available for a 10-year term.	Tax Deduction		X		X	
Federal	IRS	Residential Energy Efficiency Tax Credit	Personal tax credit of up to 30%, depending on the improvement, of the cost of efficient water heaters, furnaces, boilers, heat pumps, air conditioners. The tax credit also applies to insulation, efficient windows doors, and roofs. The maximum tax credit is $1,500.	Tax Deduction	X				
Federal	IRS	Residential Renewable Energy Tax Credit	A personal tax credit of 30% of the installation cost is provided for the installation of renewable energy systems including solar, wind, fuel cells, and geothermal. There is no maximum credit amount except for fuel cells which are limited to $500.	Tax Deduction	X				
Federal	USDA	USDA Rural Energy for America Program (REAP)	Through the USDA Rural Development REAP provides grants and loan guarantees for agriculture producers and rural small businesses in eligible rural areas for energy efficiency improvements and renewable energy systems. Funding is also available to conduct relevant feasibility studies. Eligible renewable energy projects include wind, solar, biomass and geothermal systems. Grants of up to 25% and loans up to 75% of total project cost are available. 2010 applications were due on June 30. The program typically opens in April.	USDA		X			X

Federal	USDA	USDA Farm Storage Facility Loan Program	Through the USDA Farm Service Agency (FSA) the Farm Storage Facility Loan Program (FSFL) provides low-interest financing for producers to build or upgrade farm storage and handling facilities. The loan program helps to finance facilities and upgrades for farm storage facilities such as but not limited to grain cribs and bins, electrical equipment integral to prospering operation grain storage, updating existing grain drying facilities with more energy efficient units, and equipment to improve and maintain the quality of store grain such as moisture and heat detectors. Applicants may borrow up to 85 percent of the eligible project costs to build or upgrade a storage facility. Maximum loan amounts are $500,000. Terms are for 12 years maximum with payments made annually on the date of disbursement.	USDA Commodity Credit Corporation (CCC)					**X**
Federal	USDA	USDA Biomass Crop Assistance Program	The Biomass Crop Assistance Program (BCAP) provides financial assistance to owners and operators of agricultural and non-industrial private forest land who wish to establish, produce, and deliver biomass crops for heat, power, bio-based products and biofuels. With the enactment of the updated federal Renewable Fuels Standard, which requires 36 billion gallons of advanced biofuels in the national fuel supply by 2022, new crops must keep pace with these revised Federal targets. Many bioenergy crops need several years to become established. Many bioenergy facilities need several years to reach commercial scale. BCAP serves as catalyst to unite these multiple dynamics by reducing the financial risk for landowners who switch from familiar, revenue-generating crops to new, unconventional crops in preparation for these emerging markets. BCAP provides two categories of assistance: 1) Matching payments may be available for the delivery of eligible material to qualified biomass conversion facilities by eligible material owners. Qualified biomass conversion facilities produce heat, power, biobased products, or advanced biofuels from biomass feedstocks. 2) Establishment and annual payments may be available to	USDA					**X**

			certain producers who enter into contracts with the Commodity Credit Corporation (CCC) to produce eligible biomass crops on contract acres within BCAP project areas.						
Federal		Environmental Quality Incentives Program (EQIP)	EQIP is a voluntary conservation program that helps farmers and owners of agricultural land, including forest landowners, reduce pollution and improve natural resources. EQIP provides technical and financial assistance to help people plan, install and implement structural, vegetative and management conservation practices on agricultural land and forest land. Financial assistance is provided through practice payments based on average costs to implement conservation practices. Payment rates are listed on the annual Practice Payment Rate Schedule. Limited resource Farmers, Beginning Farmers and Ranchers, and Socially Disadvantaged Farmers are eligible for higher payment rates. EQIP contracts can be as short as one year with a one year maintenance period. Most contracts are for work that can be completed within four years. Total financial assistance payments are limited to $300,000 per person or entity over the six-year period from 2009 through 2014, including payments from prior contracts and new payments from the 2008 Farm Bill.						**X**
Federal		Conservation Innovation Grant (CIG)	CIG is a voluntary program that uses Environmental Quality Incentives Program funds to award competitive resource conservation grants to non-Federal governmental or non-governmental organizations, Tribes, or individuals. CIG funds projects targeting innovative on-the-ground conservation.						**X**
Federal	ARC	ARC Renewable Energy and Energy Efficiency Grant Competition	The Renewable Energy and Energy Efficiency Grant Competition funds renewable-energy production, energy-efficient facilities, green business financing programs, and workforce training and certification programs in Appalachia. Eligible grantees include K-12 schools, vocational schools, community colleges, nonprofits, and universities. Since 2007, ARC has funded	ARC			**X**		

			39 projects totaling nearly $2 million.						
State	Commonwealth Financing Authority (CFA)	Alternative and Clean Energy Program	Grants and loans are provided through this program for the installation of alternative energy systems and the construction or development of alternative energy production projects. Loans of up to $5 million or 50 percent of the total project cost are offered with an amortization of 25 years and a 10-year term. Grants of up to $2 million are available. The current interest rate for the program is 1 percent for energy-efficient and conservation projects, and 5 percent for all other projects. The amount of the matching investment must be at least $1 for every $1 of program funds. Municipalities, counties, and economic development organizations may apply for grants under this program. Private businesses may apply for grants, loans, or a combination thereof. Applications for this program are accepted on a rolling basis.	DCED/DEP		X	X	X	X
State	Pennsylvania Department of Environmental Protection	Alternative Fuels Incentive Grant	Funding can be used for advanced or renewable energy projects, including: vehicle retrofits to operate on alternative fuels (fleet only); purchase of alternative fuel vehicles (fleet only); cost to install refueling equipment for alternative fuel vehicles; incremental cost associated with purchasing biofuels. The maximum award is $1 million. Average $200,000 -$400,000.	PA General Fund	X	X	X	X	X

State	PA Department of Environmental Protection	Energy Harvest Program	Provides funding for renewable energy deployment; biomass energy projects; coal-mine methane, waste coal reclamation for energy; implementation of innovative energy efficiency technologies; or clean distributed generation infrastructure improvements. Projects must address both energy and environmental concerns. Coordination with DEP regional contact should occur prior to submitting application. Average award is $200,000. Maximum request $500,000.	DEP			X		
State	PA Department of Environmental Protection	Pennsylvania Energy Development Authority (PEDA)	Funding can be used for equipment purchase and installation, as well as renovations to a major facility that would make it more energy-efficient. To utilize PEDA funding for facility renovations, the renovations must save at least 25% of the energy currently used by the system being replaced OR save at least 25% of the entire facility's energy consumption. Solar energy; wind energy; low-impact hydropower; geothermal; biologically derived methane gas; biomass; fuel cells; coal mine methane & waste coal; integrated gasification combined cycle; demand management measures (e.g., recycled energy; energy recovery); energy efficiency; load management. Maximum grant of $1 million. Average is $375,000.	American Recovery and Reinvestment Act (ARRA); Duquesne Light regulatory settlement	X	X	X	X	X
State	PA Department of Environmental Protection	PA Sunshine Program	$100 million in rebates to help fund solar electric (solar photovoltaic), solar hot water (solar thermal) projects, and battery backup systems for homeowners and small businesses in Pennsylvania	Alternative Energy Investment Act, Act and American Recovery and Reinvestment Act	X	X		X	

State	CFA	High Performance Building Program	This program provides financial assistance in the form of grant or loan funds to individuals or small businesses underwrite the cost premiums associated with the design and construction or major renovation of high performance buildings. The amount of the matching investment must be at least $1 for every $1 of program funds. The maximum grant award is $500,000 or 10% of the project cost (whichever is less). The maximum loan for individuals is $100,000 and $2 million for small businesses.	DCED/DEP	X	X	X		
State	CFA	Solar Energy Program	The Solar Energy Program provides financial assistance in the form of grant and loan funds to businesses, economic development agencies, or government agencies, that will be used to promote the generation and use of solar energy and the manufacture or assembly of solar equipment. Loan and grant amounts vary based on intended use of the funds. The amount of the matching investment must be at least $1 for every $1 of program funds.	DCED/DEP		X	X	X	
State	CFA	Renewable Energy Program - Geothermal and Wind Projects	Through this program, grants and loans are available to economic development organizations, municipalities, counties, and private businesses to finance geothermal systems and wind energy generation or distribution projects. Grants of up to $1 million are available for wind energy projects. Loans of up to $5 million are available for wind energy and geothermal projects. Funds are also available to manufacturers of renewable energy generation equipment. The amount of the matching investment must be at least $1 for every $1 of program funds. Loan terms are currently 10 years for equipment and 15 years for real estate. Interest rates are 1 percent for geothermal projects and 5 percent for wind energy projects. Planning grants of up to 50 percent of the cost of the planning project (up to $175,000) are also available through this program. Applications for this program are accepted on a rolling basis.	DCED/DEP	X	X	X	X	X

State	The Reinvestment Fun	Green Energy Loan Fund	The Green Energy Loan Fund (GELF) is a newly funded program that can provide loans for energy conservation and efficiency improvements in commercial, nonprofit, government, multifamily residential, and industrial buildings and facilities. Projects must result in a 25 percent reduction in energy consumption. GELF can provide financing to commercial, nonprofit, government, multi-family residential, and industrial entities throughout Pennsylvania. Applicants may include building owners, developers, or commercial tenants. GELF is managed by TRF.	American Recovery and Reinvestment Act / DEP	X	X	X	X	X
State	PA Department of Environmental Protection	Environmental Education Grant Program	Provides up to $7,500 for environmental education including sustainable energy sources and technologies including solar, wind, hydropower, microhydro, biomass, geothermal, alternative transportation fuels and energy efficiency and conservation.	Pollution fines and penalties collected by DEP			X		
EDC	Penelec	Penelec Energy Save PA	This program offers rebates for energy efficient lighting, HVAC systems including ground source heat pumps, motors and drives as well as specialty equipment for business, industry and public customers. Larger efficiency improvements can qualify for custom incentives.	Rebate Program		X		X	
EDC	PPL	PPL e-power Rebate Program	Provides rebates for the installation of efficient appliances, HVAC systems, lighting, including traffic signals as well as building insulation.	Rebate Program		X	X		
EDC	PPL	PPL e-power Renewable Energy Program	This program offers rebates for the installation geothermal (ground source) energy systems of $217/ton (solar incentives are no longer available).	Rebate Program	X	X		X	
EDC	Allegheny Power	Allegheny Power (West Penn Power) Watt Watcher Program	Rebates are available for the installation of efficient lighting, including traffic signals, HVAC, and Variable Frequency Drives. Custom incentives for large users (usage greater than 2,500,000 kwhs) of up to $500,000 or 50% of total project cost. Smaller users (1,000,000 kwhs to 2,500,000 kwhs) can receive up to $100,000 or 25% of total project cost for efficiency and demand reduction improvements.	Rebate Program	X	X		X	

EDC	West Penn Power	West Penn Power Sustainable Energy Fund	The WPPSEF is a nonprofit that provides grants and loans to projects within the Allegheny Power Service territory. Within Lycoming County, this includes the Townships of Brown, McHenry, Cummings, Pine and Cogan House. The fund has limited grant capacity that is provided through an RFP process. Business investments are available for renewable energy including wind, solar, bio-energy, landfill gas and hydropower. The fund also provides financing for clean energy technologies and energy efficiency and conservation projects.	Non-profit funding		X	X	X	
EDC		Sustainable Energy Fund	Non-profit associated with PJM that provides financing to businesses in renewable and clean energy sectors and projects that involve renewable energy, energy efficiency, green buildings and efficient transportation. The organization also provides energy education. Financing can be in the form of loans or leases. Loans payments are customized to be lower than the energy savings. The program can provide financing of up to 1005 of project cost with a maximum of $1, 000,000.	Non-profit funding	X	X	X	X	X
EDC	Penelec	Penelec Sustainable Energy Fund of the Community Foundation for the Alleghenies	Provides grants to support energy conservation and environmental projects in the Penelec service territory which includes the Township's of Lewis, Gambe, Jackson, McIntyre, McNett, Cascade, and Plunkett's Creek in Lycoming County. Loans and equity financing can be provided for businesses that develop sustainable energy technologies or for the use of renewable energy. The fund also provides loans to businesses that enhance energy efficiency and conservation. Grants of up to $25,000 are available to educate power users about renewable energy and energy conservation. Project feasibility studies are also an eligible use of grant funds from this program	Non-profit funding	X	X	X	X	X

APPENDIX C PUBLIC FUNDING AWARDED TO LYCOMING COUNTY ENERGY PROJECTS

The following Lycoming County energy projects have been awarded public funding over the past five years.

Entity	Project Type/ Energy Source	Project Description	Funding Source (Program)	Agency	Amount
Susquehanna Smart Fuel, LLC	Energy Efficiency Biofuel/Ethanol	Susquehanna Smart Fuel, LLC seeks $462,000 to expand their canola oil producing operations in Lycoming County. The canola oil is used partly as an additive for biofuel production. The applicant indicates that the project will result in increased canola oil production of 120,000 gallons/yr, the reduction of NOx, SOx, CO2, mercury and particulates air emissions, and the creation of 5 permanent full-time jobs.	GG II - PEDA	DEP	$462,000
East Lycoming School District	Energy Efficiency Biomass	This project focuses on converting the Hughesville Junior/Senior High School and Lycoming Career & Technology Center primary heating source from oil/natural gas to biomass. With this conversion, the district is evaluating the potential to grow on-site hybrid willow, black locust, or American chestnut which will serve as a primary fuel source for the biomass boiler. The district has approximately 60 acres of available farmland to utilize for the	GG II - PEDA	DEP	$800,000

		on-site growth of these crops.			
East Lycoming School District	Energy Efficiency Energy Efficiency and Distributed Generation	East Lycoming School District is requesting $382,230 for an Automatic Temperature Control system, commissioning, lighting retrofits, a 2.2 kW solar pv system, two small wind turbines, on various school buildings. The energy conservation and renewable energy generation is expected to save $13,701 per year. The anticipated environmental savings is 192,162 lbs of CO2, 896 lbs of SOx, and 269 lbs of NOX per year.	GG-Energy Harvest	DEP	$338,230
YWCA of Northcentral Pennsylvania	Energy Efficiency Solar Energy	Project to help rehabilitate an historic building by maximizing the energy-efficient operation of the YWCA's therapeutic warm water pool. Adds a solar thermal supplement and a high-efficiency pool dehumidification system to efficiently pump waste heat back into the pool and pool room. Will supplement domestic water heat. Requested funding is $118,484 (49.7% of total project cost). Projected to save $23,016/yr, full grant funding would reduce payback from 10.4 to 5.2 yrs (adjusted). . The warm water	State Energy Plan	DEP	$118,484

		therapy pool saves the community $231,000 annually. Retains 2 full-time and 16 part-time jobs. Expected to avoid energy consumption of 261,488 kWh/yr and 0.068 MMcf/yr of natural gas. Estimated to reduce air pollutants by 555,070 lbs/yr (550,179 lbs CO2; 4,080 lbs SOx; 810 lbs NOx and 7,247mg Hg) and conserve approximately 1,269 MMgal/yr of water (values standardized).			
The Williamsport Hospital & Medical Center			OETD - SEP - PEDA 2008 *ARRA Funding*	DEP	$1,000,000
Selectrim Corp dba Woodicelli Enterprises	Energy Efficiency	Purchase and install closed-loop geothermal heat pump.	Small Business Energy Efficiency Grants	DEP	$10,705.00
West Branch Tennis Club	Energy Efficiency	To purchase and install upgraded insulation.	2010-11 Small Business Advantage Grant Program	DEP	$6,570
Oval Country Store	Energy Efficiency	To purchase and install heating, ventilation and air conditioning upgrades to conserve energy.	2010-11 Small Business Advantage Grant Program	DEP	$7,500
K. S. Bridge Inc. (DBA Bridge Tavern and Restaurant)	Energy Efficiency	To purchase and install heating, ventilation and air conditioning upgrades to conserve energy.	2010-11 Small Business Advantage Grant Program	DEP	$7,500
Faxon Cleaners Inc.	Energy Efficiency	To purchase and install a new high efficiency washing machine and dryer to conserve energy.	2010-11 Small Business Advantage Grant Program	DEP	$7,500

KM Harmon Inc.	Energy Efficiency	To purchase and install heating, ventilation and air conditioning upgrades to conserve energy.	2009-2010 Small Business Advantage Grant Program	DEP	$7,140
Transport Designs	Energy Efficiency	Upgrade interior insulation	2009-2010 Small Business Advantage Grant Program	DEP	$7,500
Grit Commercial Printing Inc	Energy Efficiency	Upgrade lighting	2009-2010 Small Business Advantage Grant Program	DEP	$7,500
Palcon LLC	Energy Efficiency	Upgrade kiln insulation	2009-2010 Small Business Advantage Grant Program	DEP	$6,750
Norge Valley Dry Cleaners	Energy Efficiency	Wet cleaning process installation	2009-2010 Small Business Advantage Grant Program	DEP	$7,500
Covenant Builders Inc	Energy Efficiency	HVAC upgrade	2009-2010 Small Business Advantage Grant Program	DEP	$7,500
Landis Tank Lines	Energy Efficiency	Auxiliary power units to reduce idling during layovers	2009-2010 Small Business Advantage Grant Program	DEP	$7,500
West Branch Tennis Club	Energy Efficiency	Upgrade interior insulation	2009-2010 Small Business Advantage Grant Program	DEP	$7,500
The Pine Creek Inn Inc	Energy Efficiency	HVAC upgrade	2009-2010 Small Business Advantage Grant Program	DEP	$4,766
Creekside Country Market	Energy Efficiency	Refrigeration upgrade	2008-2009 Small Business Advantage Grant Program	DEP	$1,929

DiSalvo's Restaurant	Energy Efficiency	Lighting project	2008-2009 Small Business Advantage Grant Program	DEP	$2560
Hermance Machine Co.	Energy Efficiency	HVAC upgrade	2008-2009 Small Business Advantage Grant Program	DEP	$7,500
Palmer Industrial Coating	Energy Efficiency	Oil furnace replacement	2008-2009 Small Business Advantage Grant Program	DEP	$5,198
James Vanderlin Co.	Energy Efficiency	Insulation install	2008-2009 Small Business Advantage Grant Program	DEP	$6,080
West Branch Tennis Club, LLC	Energy Efficiency	Lighting upgrade	2008-2009 Small Business Advantage Grant Program	DEP	$7,500
West Branch Tennis Club, LLC	Energy Efficiency	Showerhead and hot water heater upgrade	2007-2008 Small Business Advantage Grant Program	DEP	$3,647
Creekside Country Market	Energy Efficiency	HVAC upgrade	2007-2008 Small Business Advantage Grant Program	DEP	$4,825
James Ely Insurance Agency	Energy Efficiency	Boiler upgrade	2007-2008 Small Business Advantage Grant Program	DEP	$5,708
Don & Bill's Inc., Norge Village Dry Cleaners	Energy Efficiency	Shirt finisher upgrade	2007-2008 Small Business Advantage Grant Program	DEP	$7,500
Thirty-Three East	Energy Efficiency	Boiler upgrade	2007-2008 Small Business Advantage Grant Program	DEP	$7,500

Faxon Cleaners, Inc.	Energy Efficiency	Purchase and installation of Hurst Vertical Steam Boiler	2007-2008 Small Business Advantage Grant Program	DEP	$7,500
Lehman Trucking	Energy Efficiency	purchase and install direct fired bunk heater in long haul trailer to eliminate idling during layovers	2007-2008 Small Business Advantage Grant Program	DEP	$622
L&S Trucking	Energy Efficiency	purchase and install APU in long haul trailer to eliminate idling during layovers	2007-2008 Small Business Advantage Grant Program	DEP	$4,825
West Branch Tennis Club	Energy Efficiency	purchase and install high efficiency boiler with zone controls to conserve energy	2007-2008 Small Business Advantage Grant Program	DEP	$6,450
DiSalvo's Restaurant	Energy Efficiency	purchase and install high efficiency boiler with zone controls to conserve energy	2007-2008 Small Business Advantage Grant Program	DEP	$7,500
East Lycoming School District	Solar Energy	600 kW Photovoltaic Solar Field	Solar Energy Program - Grants	DCED	$1,000,000
Montoursville Area School District	Solar Energy	Montoursville Area School District Solar Energy Project	Solar Energy Program - Grants	DCED	$35,000
East Lycoming School District	Geothermal	Installation of geothermal heating and cooling systems in Ferrell and Renn Elementary Schools	Alternative & Clean Energy Program (Loan)	DCED	$111,882
Lycoming Clinton Counties Community For Community Action (Step), Inc.	Weatherization	Weatherization	Weatherization Assistance Program	DCED	$707,368
Lycoming Clinton Counties Comm For Community Action (Step) Inc	Weatherization	Weatherization Assistance Program (2010 – 2011)	Weatherization Assistance Program	DCED	$423,579
Pennsylvania College Of Technology	Weatherization	Weatherization Training Center - Penn College	Weatherization Assistance Program	DCED	$316,000

Pennsylvania College Of Technology	Weatherization	Weatherization Training Center - Penn College	Weatherization Assistance Program	DCED	$320,000
Pennsylvania College Of Technology	Weatherization	Weatherization Training Center - Penn College	Weatherization Assistance Program	DCED	$907,588
Lycoming-Clinton Counties Commission for Community Action (STEP, Inc.)	Weatherization	WX Assistance 2007-08	Weatherization Assistance Program	DCED	$796,834
Lycoming/Clinton Counties Commission for Community Action (STEP), Inc.	Weatherization	Weatherization-ARRA	Weatherization Assistance Program	DCED	$3,741,446
					$11,264,197

Note: This table was prepared based on data supplied by PA DCED and PA DEP. It is not meant to be a finite accounting of funding provided. ARRA related funding includes $4.7 million of the funding awarded.

APPENDIX D NON-UTILITY ENERGY SOURCE PROVIDERS

OIL

Dittmar Plumbing Heating AC & Oil Service

Superior Plus Energy Services

Pickelner Fuel Co., Inc.

A-1 Oil Co.

Bilo Oil Co.

Choice Fuel Corp., Inc.

Fry's Gas & Oil Co.

Gfi Oil And Gas

Hiller's Fuel Oil Service

COAL

Eck's Coal Yard

Jim Hollicks Coal Yard Heating Services

Kings Coal

Manbeck Coal Dealer

Miller's Coal Company

Valley Coal Sales

Choice Fuel Corp., Inc.

Fisher Mining Company

UGI Energy Services, Inc.

PROPANE

Agway Energy Products

Amerigas

Heller's, Inc.

Montour Oil Service Company

Suburban Propane

BIOMASS

Firewood

American Wood Company

Choice Fuel Corp Inc

UGI Energy Services Inc

Loyalsock Firewood, Co.

Buttonwood Lumber Co., Inc.

Lauchle Lumber

Palcon, LLC

Wheeland Lumber Co., Inc.

Wood Pellets

R E Smith, Co.

The Warm-Up Shop, Inc.

Terrys Coal & Wood Stoves & Welding Shop

R & T Stoves

APPENDIX E ACT 129 PROGRAM STATUS

The status of progress of each EDC operating in Lycoming County follows. It should be noted that with the recent FirstEnergy mergers, data submitted to the Statewide Evaluator is reported from Penelec or FirstEnergy.

ALLEGHENY POWER (WEST PENN POWER)

- Residential/Efficient Equipment Programs – No issues were identified in the numbers reported by Allegheny Power.
- Residential/Appliance Recycling Programs – No issues were identified in the numbers reported by Allegheny Power.
- Residential/Lighting Programs – Allegheny Power reported 67,702 participants in PY2Q2 for a total reported savings of 8,981 mWh. A discrepancy was identified in the reported energy savings and energy savings calculated from Allegheny Power's Energy Savings Calculator.
- Low-Income Programs – Allegheny Power identified discrepancies in its calculations as reported in the Quarterly Report. Allegheny Power corrected the discrepancies and provided the documentation with both pre- and post-correction calculations.[89]
- Nonresidential Programs – Allegheny Power reported 11 nonresidential programs: four achieved energy and demand savings; two did not achieve savings; and five were not launched (see Table 3 below).

[89] Data obtained from 1st Quarter, Program Year 2 report since a low-income audit was not conducted for the 2nd Quarter, Program Year 2 report.

ALLEGHENY POWER NONRESIDENTIAL PROGRAMS QUARTERLY SUMMARY

Program	No. of Participants	mWh Energy Savings	MW Demand Savings
Government & Non-Profit Lighting Efficiency	65	1,221	0.80
Commercial Lighting Efficiency	34	1,668	0.30
Custom Technology Applications	1	272	0.00
Custom Applications	1	674	0.10
Commercial HVAC Efficiency	0	0	0.00
Commercial Drives	0	0	0.00
Customer Resources Demand Response	Inactive	N/A	N/A
Distributed Generation	Inactive	N/A	N/A
Time of Use with Critical Peak Pricing Rate	Inactive	N/A	N/A
Hourly Pricing Option	Inactive	N/A	N/A
Customer Load Response	Inactive	N/A	N/A
TOTAL	**101**	**3,835**	**1.20**

Source: GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 27.

FIRSTENERGY (PENELEC)

- Residential/Efficient Equipment Programs – No issues were identified in the numbers reported by FirstEnergy.
- Residential/Appliance Recycling Programs – No issues were identified in the numbers Penelec reported.
- Residential/Lighting Programs – FirstEnergy reports CFL results as part of its Energy Efficient Equipment Program.
- Low-Income Programs – FirstEnergy was not able to supply the required reporting data.[90]
- Nonresidential Programs – FirstEnergy reported seven nonresidential programs; six achieved energy and demand savings and one was not launched (see Table 4 below).

[90]Data obtained from 1st Quarter, Program Year 2 report since a low-income audit was not conducted for the 2nd Quarter, Program Year 2 report.

FIRSTENERGY NONRESIDENTIAL PROGRAMS QUARTERLY SUMMARY

Program	No. of Participants	mWh Energy Savings	MW Demand Savings
Energy Audit, Assessment and Equipment Rebate	168	9,176	1.31
C/I Performance Contracting/Equipment	42	7,392	0.92
Industrial Motors and VSD	1	2,313	0.20
PJM Demand Response	Inactive	N/A	N/A
Streetlighting	67	302	0.00
Non-Profit	9	118	0.02
Remaining Government/Non-Profit	101	2,117	0.37
TOTAL	388	21,418	2.82

Source: GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 32.

PPL ELECTRIC UTILITIES

- Residential/Efficient Equipment Programs – No issues were identified in the numbers reported by PPL.
- Residential/Appliance Recycling Programs - No issues were identified in the numbers reported by PPL.
- Residential/Lighting Programs - PPL reported 102,425 participants or 988,915 bulbs in PY2Q2 for a total savings of 46,977 mWh. No issues were identified in the numbers reported by PPL.
- Low-Income Programs – No issues were identified in the numbers reported by PPL.[91]
- Nonresidential Programs – PPL reported six nonresidential programs, each of which are cross-cutting allowing customers from all rate classes to participate in the programs. Each program demonstrated energy efficiency and demand savings as shown in Table 5 below.

[91]Data obtained from 1st Quarter, Program Year 2 report since a low-income audit was not conducted for the 2nd Quarter, Program Year 2 report.

PPL ELECTRIC UTILITIES NONRESIDENTIAL PROGRAMS QUARTERLY SUMMARY

Program	No. of Participants	mWh Energy Savings	MW Demand Savings
Appliance Recycling	50	105	0.02
Custom Incentive	3	246	0.04
Efficient Equipment	711	3,456	0.64
Efficient Equipment C&I Lighting	694	66,085	13.98
Renewable Energy	25	1,183	0.15
HVAC Tune-Up	144	53	0.00
TOTAL	**1,627**	**71,128**	**14.83**

Source: GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 31.

ACT 129 PROGRAM STATUS FOR EDCS OPERATING IN LYCOMING COUNTY (NOVEMBER 2010)

Allegheny Power
Programs Implemented and Reporting Savings
Residential ENERGY STAR and High Efficiency Appliance Program
Residential Home Performance Program
Residential HVAC Efficiency Program
Residential Low Income Home Performance Check-Up Audit & Appliance Replacement Program
Residential Low Income Joint Utility Usage Management Program
Government/Non-Profit Lighting Efficiency Program
Commercial HVAC Efficiency Program
Commercial Lighting Efficiency Program
Custom Technology Applications Program
Custom Applications Program
Commercial and Industrial Drives Program
Programs Evaluated
None Reported
Programs to be Implemented or with No Reported Savings
Critical Peak Rebate (CPR) Rate
Programmable Controllable Thermostat (PCT) Program
Residential Efficiency Rewards Rate
Residential Low Income Room Air Conditioner Replacement Program
Customer Resources Demand Response Program
Distributed Generation Program
Time of Use (TOU) with Critical Peak Pricing Rate
Hourly Pricing Option (HPO) Rate

Customer Load Response Program
Pay Ahead (Smart) Service Rate
Residential Home Performance Program – Check-up and Comprehensive Measures
Critical Peak Rebate Program
Time of Use (TOU) with Critical Peak Pricing Rebate
Customer Load Response Program
Customer Resources Demand Response Program
Distributed Generation Program
Penelec
Programs Implemented and Reporting Savings
Home Energy Audits
Appliance Turn-In
EE HVAC
EE Products
WARM Programs
Energy Audit, Assessment and Equipment Rebate
C/I Performance Contracting/Equipment
Industrial Motors and VSD
Streetlighting
Non-Profit
Remaining Government/Non-Profit
Programs Evaluated
Home Energy Audits
Appliance Turn-In
EE HVAC
EE Products
WARM Programs
Energy Audit, Assessment and Equipment Rebate
C/I Performance Contracting/Equipment
Industrial Motors and VSD
Streetlighting
Non-Profit
Remaining Government/Non-Profit
Programs to be Implemented or with No Reported Savings
Demand Reduction
New Construction
Whole Building
Multiple Family
PJM Demand Response
PPL
Programs Implemented and Reporting Savings
Appliance Recycling Program (ARP)
Efficient Equipment Incentive Program

Custom Incentive Program
CFL Distribution Program
Renewables Program
Low-Income Winter Relief Assistance Program (WRAP)
E-Power Wise
Residential Energy Assessment & Weatherization
Programs Evaluated
Appliance Recycling
CFL Campaign
Custom Incentives Program
Efficiency Equipment Incentive Program
Efficiency Equipment Incentive Program - Commercial & Industrial Lighting
E-Power Wise
Low-Income WRAP
Renewable Energy Program
HVAC Tune-up Program
Residential Energy Assessment and Weatherization Program
Programs to be Implemented or with No Reported Savings
Energy Efficiency Behavior & Education
Residential New Construction Program
Direct Load Control Program
Load Curtailment Program
Time of Use Program

Source: GDS Associates, Inc. et al., *Act 129 Statewide Evaluator Quarterly Report, 2nd Quarter, Program Year 2*, April 4, 2011, p. 10.

APPENDIX F ENERGY CONSUMPTION DATA

Energy Consumption by Sector and Source, Middle Atlantic, Reference case
(quadrillion Btu, unless otherwise noted)
Delta Development Group, Inc. - October 2011

Sector and Source	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	Growth Rate (2009-2035)
Residential																											
Liquefied Petroleum Gases	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	-0.30%
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.40%
Distillate Fuel Oil	0.27	0.26	0.27	0.26	0.26	0.25	0.25	0.24	0.23	0.23	0.22	0.22	0.21	0.21	0.21	0.2	0.2	0.2	0.19	0.19	0.19	0.18	0.18	0.18	0.17	0.17	-1.70%
Liquid Fuels Subtotal	0.31	0.33	0.31	0.31	0.3	0.3	0.29	0.28	0.28	0.27	0.27	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.23	0.22	0.22	0.22	0.22	-1.50%
Natural Gas	0.85	0.9	0.88	0.88	0.89	0.89	0.89	0.89	0.9	0.9	0.9	0.9	0.9	0.9	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.10%
Coal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.50%
Renewable Energy 1/	0.06	0.07	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.40%
Electricity	0.47	0.44	0.44	0.43	0.43	0.42	0.42	0.43	0.43	0.43	0.43	0.44	0.44	0.45	0.45	0.46	0.46	0.47	0.47	0.47	0.48	0.48	0.49	0.49	0.49	0.5	0.50%
Delivered Energy	**1.69**	**1.73**	**1.7**	**1.68**	**1.68**	**1.67**	**1.68**	**1.67**	**1.67**	**1.67**	**1.67**	**1.67**	**1.67**	**1.68**	**1.68**	**1.68**	**1.68**	**1.69**	**1.69**	**1.69**	**1.69**	**1.69**	**1.7**	**1.69**	**1.69**	**1.69**	**0.00%**
Electricity Related Losses	1.07	1	0.97	0.96	0.95	0.92	0.92	0.93	0.92	0.92	0.89	0.89	0.9	0.92	0.93	0.94	0.95	0.96	0.97	0.97	0.98	0.99	0.99	1	1	1.02	0.10%
Total	**2.77**	**2.73**	**2.67**	**2.65**	**2.63**	**2.6**	**2.6**	**2.6**	**2.59**	**2.59**	**2.57**	**2.57**	**2.58**	**2.6**	**2.62**	**2.62**	**2.63**	**2.65**	**2.66**	**2.66**	**2.67**	**2.68**	**2.69**	**2.69**	**2.7**	**2.71**	**0.00%**
Commercial																											
Liquefied Petroleum Gases	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00%
Motor Gasoline 2/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.70%
Kerosene	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3.30%
Distillate Fuel Oil	0.1	0.1	0.1	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	-1.30%
Residual Fuel Oil	0.03	0.04	0.05	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.40%
Liquid Fuels Subtotal	0.15	0.16	0.17	0.16	0.15	0.16	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.14	0.14	0.14	-0.60%
Natural Gas	*0.62*	*0.67*	*0.66*	*0.67*	*0.68*	*0.69*	*0.7*	*0.71*	*0.71*	*0.72*	*0.72*	*0.72*	*0.73*	*0.73*	*0.74*	*0.74*	*0.75*	*0.75*	*0.76*	*0.77*	*0.77*	*0.78*	*0.79*	*0.79*	*0.8*	*0.81*	*1.00%*
Coal	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00%
Renewable Energy 3/	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00%
Electricity	0.57	0.56	0.57	0.58	0.58	0.59	0.6	0.6	0.61	0.61	0.62	0.62	0.63	0.63	0.64	0.64	0.65	0.66	0.66	0.67	0.67	0.68	0.69	0.69	0.69	0.7	0.90%
Delivered Energy	**1.35**	**1.41**	**1.42**	**1.43**	**1.44**	**1.46**	**1.47**	**1.48**	**1.49**	**1.5**	**1.51**	**1.52**	**1.52**	**1.53**	**1.54**	**1.55**	**1.56**	**1.58**	**1.59**	**1.6**	**1.61**	**1.63**	**1.64**	**1.65**	**1.66**	**1.68**	**0.80%**
Electricity Related Losses	1.3	1.28	1.26	1.29	1.31	1.28	1.29	1.32	1.31	1.31	1.28	1.27	1.27	1.3	1.31	1.33	1.34	1.36	1.36	1.37	1.38	1.39	1.4	1.41	1.42	1.43	0.50%
Total	**2.65**	**2.69**	**2.68**	**2.72**	**2.75**	**2.75**	**2.76**	**2.8**	**2.81**	**2.82**	**2.79**	**2.78**	**2.8**	**2.83**	**2.86**	**2.88**	**2.9**	**2.93**	**2.95**	**2.97**	**2.99**	**3.01**	**3.03**	**3.06**	**3.08**	**3.11**	**0.70%**
Industrial 4/																											
Liquefied Petroleum Gases	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.50%
Motor Gasoline 2/	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	1.20%
Distillate Fuel Oil	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.06	0.06	0.06	0.06	0.06	-0.10%
Residual Fuel Oil	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.70%
Petrochemical Feedstocks	0.09	0.1	0.1	0.1	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.09	0.30%
Other Petroleum 5/	0.29	0.3	0.31	0.35	0.35	0.35	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.33	0.32	0.32	0.32	0.32	0.31	0.3	0.29	0.28	0.28	0.27	0.28	0.30%
Liquid Fuels Subtotal	0.5	0.52	0.55	0.59	0.6	0.6	0.6	0.59	0.59	0.59	0.59	0.59	0.59	0.59	0.57	0.56	0.56	0.56	0.55	0.54	0.53	0.52	0.51	0.5	0.5	0.5	-0.10%
Natural Gas	0.35	0.37	0.39	0.42	0.43	0.44	0.45	0.45	0.46	0.46	0.47	0.47	0.48	0.49	0.49	0.49	0.5	0.5	0.51	0.51	0.52	0.52	0.53	0.53	0.54	0.54	2.00%
Natural Gas-to-Liquids Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	- -
Lease and Plant Fuel 6/	0.02	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.1	0.1	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13	11.00%
Natural Gas Subtotal	0.37	0.4	0.43	0.47	0.48	0.5	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.6	0.6	0.61	0.62	0.63	0.64	0.64	0.65	0.66	0.66	0.67	2.70%
Metallurgical Coal	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	1.40%
Other Industrial Coal	0.08	0.08	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	-0.10%
Coal-to-Liquids Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-30.90%
Net Coal Coke Imports	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-7.20%
Coal Subtotal	0.26	0.26	0.27	0.28	0.27	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.24	0.24	1.00%
Biofuels Heat and Coproducts	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.04	0.07	0.07	0.08	0.09	0.09	0.1	0.1	0.1	0.1	0.12	0.12	0.12	12.50%
Renewable Energy 7/	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	1.70%
Electricity	0.25	0.26	0.26	0.27	0.27	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.26	0.26	0.26	0.25	0.25	0.25	0.24	0.24	0.24	0.23	0.23	0.22	-0.10%
Delivered Energy	**1.42**	**1.49**	**1.55**	**1.67**	**1.68**	**1.7**	**1.71**	**1.72**	**1.73**	**1.74**	**1.75**	**1.75**	**1.79**	**1.81**	**1.82**	**1.82**	**1.82**	**1.83**	**1.82**	**1.82**	**1.82**	**1.8**	**1.79**	**1.81**	**1.8**	**1.81**	**1.30%**
Electricity Related Losses	0.56	0.59	0.57	0.61	0.61	0.6	0.6	0.6	0.59	0.58	0.56	0.55	0.55	0.55	0.54	0.54	0.53	0.52	0.51	0.51	0.5	0.49	0.48	0.47	0.46	0.46	-0.50%
Total	**1.99**	**2.08**	**2.13**	**2.28**	**2.29**	**2.3**	**2.31**	**2.32**	**2.32**	**2.32**	**2.31**	**2.31**	**2.33**	**2.35**	**2.36**	**2.35**	**2.35**	**2.35**	**2.34**	**2.33**	**2.32**	**2.29**	**2.27**	**2.28**	**2.27**	**2.27**	**0.90%**
Transportation																											
Liquefied Petroleum Gases	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-0.50%
E85 8/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.05	0.07	0.1	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	26.40%
Motor Gasoline 2/	1.86	1.85	1.84	1.83	1.82	1.81	1.8	1.78	1.77	1.75	1.73	1.72	1.7	1.69	1.65	1.61	1.59	1.56	1.53	1.52	1.52	1.51	1.51	1.51	1.51	1.51	-0.80%
Jet Fuel 9/	0.35	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.00%
Distillate Fuel Oil 10/	0.48	0.5	0.52	0.54	0.54	0.55	0.55	0.55	0.56	0.56	0.56	0.57	0.57	0.57	0.58	0.58	0.58	0.58	0.59	0.59	0.59	0.6	0.6	0.6	0.61	0.61	1.00%
Residual Fuel Oil	0.2	0.2	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	-0.40%
Other Petroleum 11/	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-0.50%
Liquid Fuels Subtotal	2.92	2.92	2.92	2.94	2.93	2.92	2.92	2.9	2.89	2.87	2.86	2.85	2.84	2.83	2.82	2.81	2.8	2.79	2.79	2.79	2.79	2.79	2.79	2.8	2.8	2.8	-0.10%
Pipeline Fuel Natural Gas	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.60%
Compressed Natural Gas	0	0	0	0	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.03	0.03	9.30%
Liquid Hydrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	- -
Electricity	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	1.80%
Delivered Energy	**2.98**	**2.98**	**2.99**	**3**	**3**	**2.99**	**2.99**	**2.98**	**2.96**	**2.95**	**2.94**	**2.93**	**2.92**	**2.91**	**2.9**	**2.9**	**2.89**	**2.89**	**2.89**	**2.88**	**2.89**	**2.89**	**2.9**	**2.9**	**2.91**	**2.91**	**-0.10%**
Electricity Related Losses	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	1.40%
Total	**3.01**	**3.01**	**3.02**	**3.03**	**3.03**	**3.02**	**3.02**	**3.01**	**3**	**2.98**	**2.97**	**2.96**	**2.95**	**2.94**	**2.94**	**2.93**	**2.93**	**2.92**	**2.92**	**2.92**	**2.93**	**2.93**	**2.94**	**2.94**	**2.95**	**2.96**	**-0.10%**

Percent of Total Consumption

Sector and Source	2010	2015	2020	2025	2030	2035
Residential						
Liquefied Petroleum Gases	2.37%	2.40%	2.40%	2.38%	2.37%	2.37%
Kerosene	0.59%	0.60%	0.60%	0.60%	0.59%	0.59%
Distillate Fuel Oil	15.98%	14.97%	13.17%	11.90%	11.24%	10.06%
Liquid Fuels Subtotal	18.34%	17.96%	16.17%	14.88%	13.61%	13.02%
Natural Gas	50.30%	53.29%	53.89%	54.17%	53.85%	53.85%
Coal	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Renewable Energy 1/	3.55%	3.59%	4.19%	4.17%	4.14%	4.14%
Electricity	27.81%	25.15%	25.75%	27.38%	28.40%	29.59%
Delivered Energy	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Electricity Related Losses						
Total						
Commercial						
Liquefied Petroleum Gases	0.74%	0.68%	0.66%	0.65%	0.62%	0.60%
Motor Gasoline 2/	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Kerosene	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Distillate Fuel Oil	7.41%	6.16%	5.96%	5.16%	4.97%	4.76%
Residual Fuel Oil	2.22%	3.42%	3.31%	3.23%	3.11%	2.98%
Liquid Fuels Subtotal	11.11%	10.96%	9.93%	9.68%	9.32%	8.33%
Natural Gas	*45.93%*	*47.26%*	*47.68%*	*47.74%*	*47.83%*	*48.21%*
Coal	0.74%	0.68%	0.66%	0.65%	0.62%	0.60%
Renewable Energy 3/	1.48%	1.37%	1.32%	1.29%	1.24%	1.19%
Electricity	42.22%	40.41%	41.06%	41.29%	41.61%	41.67%
Delivered Energy	**1.0000**	**1**	**1**	**1**	**1**	**1**
Electricity Related Losses						
Total						
Industrial 4/						
Liquefied Petroleum Gases	1.41%	1.76%	1.71%	1.65%	1.65%	1.66%
Motor Gasoline 2/	1.41%	1.76%	1.71%	1.65%	1.65%	1.10%
Distillate Fuel Oil	4.93%	4.12%	4.00%	3.85%	3.85%	3.31%
Residual Fuel Oil	1.41%	1.18%	0.57%	0.55%	0.55%	0.55%
Petrochemical Feedstocks	6.34%	6.47%	6.29%	6.04%	5.49%	4.97%
Other Petroleum 5/	20.42%	20.59%	19.43%	17.58%	16.48%	15.47%
Liquid Fuels Subtotal	35.21%	35.29%	33.71%	30.77%	29.12%	27.62%
Natural Gas	24.65%	25.88%	26.86%	26.92%	28.57%	29.83%
Natural Gas-to-Liquids Heat and Power	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Lease and Plant Fuel 6/	1.41%	3.53%	4.57%	5.49%	6.59%	7.18%
Natural Gas Subtotal	26.06%	29.41%	31.43%	32.97%	35.16%	37.02%
Metallurgical Coal	11.97%	11.18%	11.43%	10.44%	9.89%	9.39%
Other Industrial Coal	5.63%	4.71%	4.57%	4.40%	4.40%	3.87%
Coal-to-Liquids Heat and Power	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Net Coal Coke Imports	0.70%	0.00%	0.00%	0.00%	0.00%	0.00%
Coal Subtotal	18.31%	16.47%	16.00%	14.84%	13.74%	13.26%
Biofuels Heat and Coproducts	0.70%	0.59%	0.57%	3.85%	5.49%	6.63%
Renewable Energy 7/	2.82%	2.94%	2.86%	2.75%	2.75%	2.76%
Electricity	17.61%	16.47%	15.43%	14.29%	13.19%	12.15%
Delivered Energy	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**	**100.00%**
Electricity Related Losses						
Total						
Transportation						
Liquefied Petroleum Gases						
E85 8/						
Motor Gasoline 2/						
Jet Fuel 9/						
Distillate Fuel Oil 10/						
Residual Fuel Oil						
Other Petroleum 11/						
Liquid Fuels Subtotal						
Pipeline Fuel Natural Gas						
Compressed Natural Gas						
Liquid Hydrogen						
Electricity						
Delivered Energy						
Electricity Related Losses						
Total						

Delivered Energy Consumption, All Sectors																										
Liquefied Petroleum Gases	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.00%
E85 8/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.05	0.07	0.1	0.11	0.12	0.12	0.12	0.13	0.13	0.13	26.40%
Motor Gasoline 2/	1.88	1.87	1.86	1.86	1.85	1.84	1.83	1.81	1.79	1.77	1.76	1.74	1.73	1.72	1.68	1.64	1.61	1.58	1.56	1.55	1.54	1.54	1.54	1.54	1.53	-0.80%
Jet Fuel 9/	0.35	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.00%
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.40%
Distillate Fuel Oil	0.92	0.95	0.95	0.97	0.96	0.96	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.92	0.92	0.92	0.92	0.92	0.92	0.93	0.00%
Residual Fuel Oil	0.25	0.26	0.27	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	-0.30%
Petrochemical Feedstocks	0.09	0.1	0.1	0.1	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.30%
Other Petroleum 12/	0.3	0.31	0.32	0.36	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.35	0.35	0.36	0.34	0.34	0.34	0.33	0.33	0.32	0.32	0.3	0.29	0.29	0.29	-0.30%
Liquid Fuels Subtotal	3.88	3.93	3.95	3.99	3.99	3.97	3.96	3.93	3.91	3.88	3.86	3.85	3.83	3.81	3.79	3.77	3.75	3.74	3.73	3.7	3.7	3.68	3.67	3.66	3.66	-0.20%
Natural Gas	1.82	1.94	1.94	1.98	2	2.03	2.05	2.06	2.07	2.08	2.1	2.11	2.12	2.13	2.15	2.16	2.17	2.18	2.2	2.21	2.22	2.23	2.25	2.26	2.28	2.29	0.90%
Natural-Gas-to-Liquids Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	- -
Lease and Plant Fuel 6/	0.02	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.1	0.1	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13	11.00%
Pipeline Natural Gas	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.60%
Natural Gas Subtotal	1.89	2.01	2.02	2.08	2.1	2.14	2.16	2.18	2.2	2.22	2.23	2.25	2.26	2.28	2.3	2.31	2.33	2.35	2.37	2.38	2.4	2.41	2.43	2.44	2.46	2.48	1.00%
Metallurgical Coal	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	1.40%
Other Coal	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	-0.10%
Coal-to-Liquids Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-30.90%
Net Coal Coke Imports	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-7.20%
Coal Subtotal	0.26	0.27	0.27	0.29	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.29	0.28	0.28	0.27	0.27	0.27	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.90%
Biofuels Heat and Coproducts	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.04	0.07	0.07	0.08	0.09	0.09	0.1	0.1	0.1	0.1	0.12	0.12	0.12	12.80%
Renewable Energy 13/	0.11	0.12	0.12	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.80%
Liquid Hydrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	- -
Electricity	1.29	1.27	1.29	1.29	1.29	1.3	1.31	1.32	1.33	1.33	1.34	1.35	1.36	1.36	1.37	1.38	1.39	1.39	1.4	1.41	1.41	1.42	1.43	1.43	1.44	1.44	0.60%
Delivered Energy	**7.45**	**7.62**	**7.66**	**7.78**	**7.8**	**7.83**	**7.85**	**7.85**	**7.86**	**7.86**	**7.86**	**7.87**	**7.9**	**7.92**	**7.94**	**7.95**	**7.96**	**7.98**	**7.99**	**8**	**8.02**	**8.01**	**8.02**	**8.05**	**8.07**	**8.09**	**0.40%**
Electricity Related Losses	2.97	2.89	2.83	2.9	2.9	2.84	2.84	2.88	2.86	2.85	2.76	2.74	2.75	2.8	2.82	2.84	2.86	2.88	2.88	2.89	2.89	2.9	2.91	2.92	2.93	2.95	0.20%
Total	**10.41**	**10.51**	**10.49**	**10.68**	**10.7**	**10.67**	**10.69**	**10.73**	**10.71**	**10.71**	**10.63**	**10.61**	**10.66**	**10.72**	**10.77**	**10.78**	**10.82**	**10.85**	**10.87**	**10.89**	**10.91**	**10.91**	**10.93**	**10.97**	**10.99**	**11.05**	**0.30%**
Electric Power 14/																										
Distillate Fuel Oil	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	1.10%
Residual Fuel Oil	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	3.30%
Liquid Fuels Subtotal	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	3.00%
Natural Gas	0.79	0.76	0.75	0.75	0.76	0.79	0.78	0.8	0.79	0.79	0.73	0.71	0.73	0.74	0.75	0.77	0.78	0.81	0.83	0.84	0.85	0.87	0.88	0.89	0.9	0.93	0.70%
Steam Coal	1.42	1.35	1.27	1.32	1.27	1.17	1.17	1.2	1.19	1.19	1.22	1.22	1.22	1.26	1.29	1.29	1.31	1.33	1.32	1.35	1.35	1.35	1.35	1.36	1.36	1.36	0.30%
Nuclear Power	1.57	1.57	1.59	1.61	1.61	1.63	1.63	1.63	1.63	1.63	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.57	1.57	0.00%
Renewable Energy 15/	0.29	0.31	0.32	0.34	0.37	0.36	0.38	0.38	0.39	0.39	0.39	0.4	0.4	0.4	0.4	0.4	0.4	0.38	0.38	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.60%
Electricity Imports	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	-3.40%
Total 16/	**4.26**	**4.16**	**4.12**	**4.19**	**4.2**	**4.14**	**4.15**	**4.2**	**4.18**	**4.18**	**4.1**	**4.09**	**4.11**	**4.16**	**4.19**	**4.22**	**4.24**	**4.27**	**4.28**	**4.3**	**4.31**	**4.32**	**4.33**	**4.35**	**4.36**	**4.39**	**0.30%**
Total Energy Consumption																										
Liquefied Petroleum Gases	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.00%
E85 8/	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03	0.05	0.07	0.1	0.11	0.12	0.12	0.12	0.13	0.13	0.13	0.13	26.40%
Motor Gasoline 2/	1.88	1.87	1.86	1.86	1.85	1.84	1.83	1.81	1.79	1.77	1.76	1.74	1.73	1.72	1.68	1.64	1.61	1.58	1.56	1.55	1.54	1.54	1.54	1.54	1.53	1.54	-0.80%
Jet Fuel 9/	0.35	0.35	0.35	0.35	0.35	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.00%
Kerosene	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.40%
Distillate Fuel Oil	0.93	0.96	0.96	0.97	0.97	0.97	0.96	0.96	0.96	0.95	0.95	0.95	0.95	0.94	0.94	0.94	0.94	0.94	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.94	0.00%
Residual Fuel Oil	0.33	0.34	0.34	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.33	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.32	0.30%
Petrochemical Feedstocks	0.09	0.1	0.1	0.1	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.09	0.09	0.30%
Other Petroleum 12/	0.3	0.31	0.32	0.36	0.37	0.36	0.36	0.36	0.36	0.36	0.36	0.35	0.35	0.36	0.34	0.34	0.34	0.33	0.33	0.32	0.32	0.3	0.29	0.29	0.29	0.29	-0.30%
Liquid Fuels Subtotal	3.97	4.01	4.03	4.08	4.08	4.06	4.04	4.02	4	3.97	3.95	3.93	3.92	3.9	3.88	3.85	3.84	3.83	3.81	3.79	3.79	3.77	3.76	3.75	3.75	3.75	-0.20%
Natural Gas	2.61	2.7	2.69	2.73	2.76	2.82	2.83	2.86	2.86	2.88	2.83	2.82	2.85	2.88	2.9	2.93	2.95	2.99	3.03	3.04	3.07	3.1	3.13	3.15	3.17	3.22	0.80%
Natural-Gas-to-Liquids Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	- -
Lease and Plant Fuel 6/	0.02	0.03	0.04	0.05	0.05	0.06	0.06	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.1	0.1	0.11	0.11	0.11	0.12	0.12	0.12	0.12	0.12	0.13	0.13	11.00%
Pipeline Natural Gas	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.60%
Natural Gas Subtotal	2.68	2.77	2.77	2.83	2.87	2.93	2.94	2.98	2.99	3.01	2.96	2.96	2.99	3.02	3.05	3.09	3.11	3.16	3.2	3.22	3.25	3.28	3.31	3.34	3.36	3.41	0.90%
Metallurgical Coal	0.17	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.2	0.2	0.2	0.2	0.19	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.17	0.17	0.17	1.40%

Other Coal	1.5	1.44	1.36	1.41	1.36	1.26	1.26	1.29	1.28	1.28	1.31	1.31	1.31	1.35	1.37	1.37	1.39	1.41	1.41	1.43	1.43	1.43	1.43	1.44	1.44	1.44	0.30%
Coal-to-Liquids Heat and Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-30.90%
Net Coal Coke Imports	0.01	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-7.20%
Coal Subtotal	1.68	1.62	1.54	1.61	1.55	1.45	1.45	1.48	1.48	1.47	1.51	1.51	1.51	1.55	1.57	1.56	1.58	1.59	1.59	1.61	1.61	1.61	1.61	1.61	1.61	1.61	0.40%
Nuclear Power	1.57	1.57	1.59	1.61	1.61	1.63	1.63	1.63	1.63	1.63	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.57	1.57	0.00%
Biofuels Heat and Coproducts	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03	0.04	0.07	0.07	0.08	0.09	0.09	0.1	0.1	0.1	0.1	0.12	0.12	0.12	12.80%
Renewable Energy 17/	0.41	0.43	0.45	0.46	0.49	0.49	0.51	0.52	0.52	0.52	0.53	0.53	0.53	0.54	0.54	0.54	0.54	0.52	0.52	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.60%
Liquid Hydrogen	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0 - -	
Electricity Imports	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01	-3.40%
Total	**10.41**	**10.51**	**10.49**	**10.68**	**10.7**	**10.67**	**10.69**	**10.73**	**10.71**	**10.71**	**10.63**	**10.61**	**10.66**	**10.72**	**10.77**	**10.78**	**10.82**	**10.85**	**10.87**	**10.89**	**10.91**	**10.91**	**10.93**	**10.97**	**10.99**	**11.05**	**0.30%**
Energy Use and Related Statistics																											
Delivered Energy Use	7.45	7.62	7.66	7.78	7.8	7.83	7.85	7.85	7.86	7.86	7.86	7.87	7.9	7.92	7.94	7.95	7.96	7.98	7.99	8	8.02	8.01	8.02	8.05	8.07	8.09	0.40%
Total Energy Use	10.41	10.51	10.49	10.68	10.7	10.67	10.69	10.73	10.71	10.71	10.63	10.61	10.66	10.72	10.77	10.78	10.82	10.85	10.87	10.89	10.91	10.91	10.93	10.97	10.99	11.05	0.30%
Ethanol Consumed in Motor Gasoline and E85	0.13	0.13	0.13	0.14	0.14	0.14	0.14	0.14	0.15	0.16	0.16	0.16	0.16	0.16	0.17	0.19	0.2	0.21	0.22	0.22	0.22	0.23	0.23	0.23	0.23	0.24	2.80%
Population (millions)	41.13	41.32	41.49	41.65	41.8	41.95	42.11	42.26	42.41	42.56	42.7	42.85	43	43.14	43.28	43.41	43.54	43.67	43.79	43.92	44.05	44.17	44.3	44.42	44.55	44.68	0.30%
US GDP (billion 2005 dollars)	13221	13506	14088	14586	14913	15336	15753	16168	16577	16977	17421	17903	18427	18948	19475	20020	20553	21078	21610	22153	22731	23311	23877	24461	25071	25692	2.70%
Carbon Dioxide Emissions (million metric																											
tons carbon dioxide equivalent)	571.6	572.4	564.1	575.2	571.6	564.2	562.6	565.3	563.6	562.6	561.6	560.4	561.1	565.2	565.8	565.2	566.3	568.3	568.9	570.6	571.7	572.1	572.6	574.1	575.1	577.9	0.20%

1/ Includes wood used for residential heating. See Table 4 and/or Table 17 for estimates of nonmarketed renewable energy consumption for geothermal heat pumps, solar thermal hot water heating, and electricity generation from wind and solar photovoltaic sources.
2/ Includes ethanol (blends of 10 percent or less) and ethers blended into gasoline.
3/ Excludes ethanol. Includes commercial sector consumption of wood and wood waste, landfill gas, municipal waste, and other biomass for combined heat and power. See Table 5 and/or Table 17 for estimates of nonmarketed renewable energy consumption for solar thermal hot water heating and electricity generation from wind and solar photovoltaic sources.
4/ Includes energy for combined heat and power plants, except those whose primary business is to sell electricity, or electricity and heat, to the public.
5/ Includes petroleum coke, asphalt, road oil, lubricants, still gas, and miscellaneous petroleum products.
6/ Represents natural gas used in well, field, and lease operations, and in natural gas processing plant machinery.
7/ Includes consumption of energy produced from hydroelectric, wood and wood waste, municipal waste, and other biomass sources. Excludes ethanol blends (10 percent or less) in motor gasoline.
8/ E85 refers to a blend of 85 percent ethanol (renewable) and 15 percent motor gasoline (nonrenewable). To address cold starting issues, the percentage of ethanol varies seasonally. The annual average ethanol content of 74 percent is used for this forecast.
9/ Includes only kerosene type.
10/ Diesel fuel for on- and off- road use.
11/ Includes aviation gasoline and lubricants.
12/ Includes unfinished oils, natural gasoline, motor gasoline blending components, aviation gasoline, lubricants, still gas, asphalt, road oil, petroleum coke, and miscellaneous petroleum products.
13/ Includes electricity generated for sale to the grid and for own use from renewable sources, and non-electric energy from renewable sources. Excludes ethanol and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.
14/ Includes consumption of energy by electricity-only and combined heat and power plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes small power producers and exempt wholesale generators.
15/ Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes net electricity imports.
16/ Includes non-biogenic municipal waste not included above.
17/ Includes conventional hydroelectric, geothermal, wood and wood waste, biogenic municipal waste, other biomass, wind, photovoltaic, and solar thermal sources. Excludes ethanol, net electricity imports, and nonmarketed renewable energy consumption for geothermal heat pumps, buildings photovoltaic systems, and solar thermal hot water heaters.
Btu = British thermal unit.
- - = Not applicable.
Note: Totals may not equal sum of components due to independent rounding. Data for 2008 and 2009 are model results and may differ slightly from official EIA data reports.
Sources: 2008 and 2009 consumption based on: U.S. Energy Information Administration (EIA), Annual Energy Review 2009, DOE/EIA-0384(2009) (Washington, DC, August 2010).
2008 and 2009 population and gross domestic product: IHS Global Insight Industry and Employment models, September 2010. 2008 and 2009 carbon dioxide emissions: EIA, Emissions of Greenhouse Gases in the United States 2009, DOE/EIA-0573(2009) (Washington, DC, December 2010).
Projections: EIA, AEO2011 National Energy Modeling System.

Energy Consumption by Secto
(quadrillion Btu, unless other
Delta Development Group, In

Consumption by Quadrillions

Sector and Source	2010	2015	2020	2025	2030	2035
Residential						
Liquefied Petroleum Gases	40,000,000,000,000	40,000,000,000,000	40,000,000,000,000	40,000,000,000,000	40,000,000,000,000	40,000,000,000,000
Kerosene	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000
Distillate Fuel Oil	270,000,000,000,000	280,000,000,000,000	270,000,000,000,000	260,000,000,000,000	260,000,000,000,000	250,000,000,000,000
Liquid Fuels Subtotal	310,000,000,000,000	330,000,000,000,000	310,000,000,000,000	310,000,000,000,000	300,000,000,000,000	300,000,000,000,000
Natural Gas	850,000,000,000,000	800,000,000,000,000	880,000,000,000,000	880,000,000,000,000	890,000,000,000,000	890,000,000,000,000
Coal	0	0	0	0	0	0
Renewable Energy 1/	60,000,000,000,000	70,000,000,000,000	60,000,000,000,000	60,000,000,000,000	60,000,000,000,000	60,000,000,000,000
Electricity	470,000,000,000,000	440,000,000,000,000	440,000,000,000,000	430,000,000,000,000	430,000,000,000,000	420,000,000,000,000
Delivered Energy	1,690,000,000,000,000	1,730,000,000,000,000	1,700,000,000,000,000	1,680,000,000,000,000	1,680,000,000,000,000	1,670,000,000,000,000
Electricity Related Losses						
Total						
Commercial						
Liquefied Petroleum Gases	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000
Motor Gasoline 2/	0	0	0	0	0	0
Kerosene	0	0	0	0	0	0
Distillate Fuel Oil	100,000,000,000,000	100,000,000,000,000	100,000,000,000,000	90,000,000,000,000	90,000,000,000,000	90,000,000,000,000
Residual Fuel Oil	30,000,000,000,000	40,000,000,000,000	50,000,000,000,000	40,000,000,000,000	40,000,000,000,000	50,000,000,000,000
Liquid Fuels Subtotal	150,000,000,000,000	160,000,000,000,000	170,000,000,000,000	160,000,000,000,000	150,000,000,000,000	160,000,000,000,000
Natural Gas	620,000,000,000,000	670,000,000,000,000	660,000,000,000,000	670,000,000,000,000	680,000,000,000,000	690,000,000,000,000
Coal	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000
Renewable Energy 3/	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000
Electricity	570,000,000,000,000	560,000,000,000,000	570,000,000,000,000	580,000,000,000,000	580,000,000,000,000	590,000,000,000,000
Delivered Energy	1,350,000,000,000,000	1,410,000,000,000,000	1,420,000,000,000,000	1,430,000,000,000,000	1,440,000,000,000,000	1,460,000,000,000,000
Electricity Related Losses						
Total						
Industrial 4/						
Liquefied Petroleum Gases	20,000,000,000,000	20,000,000,000,000	30,000,000,000,000	30,000,000,000,000	30,000,000,000,000	30,000,000,000,000
Motor Gasoline 2/	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	30,000,000,000,000
Distillate Fuel Oil	70,000,000,000,000	70,000,000,000,000	70,000,000,000,000	70,000,000,000,000	70,000,000,000,000	70,000,000,000,000
Residual Fuel Oil	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000
Petrochemical Feedstocks	90,000,000,000,000	100,000,000,000,000	100,000,000,000,000	100,000,000,000,000	110,000,000,000,000	110,000,000,000,000
Other Petroleum 5/	290,000,000,000,000	300,000,000,000,000	310,000,000,000,000	350,000,000,000,000	350,000,000,000,000	350,000,000,000,000
Liquid Fuels Subtotal	500,000,000,000,000	520,000,000,000,000	550,000,000,000,000	590,000,000,000,000	600,000,000,000,000	620,000,000,000,000
Natural Gas	350,000,000,000,000	370,000,000,000,000	390,000,000,000,000	420,000,000,000,000	430,000,000,000,000	440,000,000,000,000
Natural Gas-to-Liquids Heat and Power	0	0	0	0	0	0
Lease and Plant Fuel 6/	20,000,000,000,000	30,000,000,000,000	40,000,000,000,000	50,000,000,000,000	50,000,000,000,000	60,000,000,000,000
Natural Gas Subtotal	370,000,000,000,000	400,000,000,000,000	430,000,000,000,000	470,000,000,000,000	480,000,000,000,000	500,000,000,000,000
Metallurgical Coal	170,000,000,000,000	180,000,000,000,000	180,000,000,000,000	190,000,000,000,000	190,000,000,000,000	190,000,000,000,000
Other Industrial Coal	80,000,000,000,000	80,000,000,000,000	80,000,000,000,000	90,000,000,000,000	80,000,000,000,000	80,000,000,000,000
Coal-to-Liquids Heat and Power	0	0	0	0	0	0
Net Coal Coke Imports	10,000,000,000,000	0	0	0	0	0
Coal Subtotal	260,000,000,000,000	260,000,000,000,000	270,000,000,000,000	280,000,000,000,000	270,000,000,000,000	280,000,000,000,000
Biofuels Heat and Coproducts	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000
Renewable Energy 7/	40,000,000,000,000	40,000,000,000,000	40,000,000,000,000	50,000,000,000,000	50,000,000,000,000	50,000,000,000,000
Electricity	250,000,000,000,000	260,000,000,000,000	260,000,000,000,000	270,000,000,000,000	270,000,000,000,000	280,000,000,000,000
Delivered Energy	1,420,000,000,000,000	1,490,000,000,000,000	1,550,000,000,000,000	1,670,000,000,000,000	1,680,000,000,000,000	1,700,000,000,000,000
Electricity Related Losses						
Total						
Transportation						
Liquefied Petroleum Gases	0	0	0	0	0	0
E85 8/	0	0	0	0	0	0
Motor Gasoline 2/	1,860,000,000,000,000	1,850,000,000,000,000	1,840,000,000,000,000	1,830,000,000,000,000	1,820,000,000,000,000	1,810,000,000,000,000
Jet Fuel 9/	350,000,000,000,000	350,000,000,000,000	350,000,000,000,000	350,000,000,000,000	350,000,000,000,000	360,000,000,000,000
Distillate Fuel Oil 10/	480,000,000,000,000	500,000,000,000,000	520,000,000,000,000	540,000,000,000,000	540,000,000,000,000	550,000,000,000,000
Residual Fuel Oil	200,000,000,000,000	200,000,000,000,000	190,000,000,000,000	190,000,000,000,000	190,000,000,000,000	190,000,000,000,000
Other Petroleum 11/	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000	20,000,000,000,000
Liquid Fuels Subtotal	2,920,000,000,000,000	2,920,000,000,000,000	2,920,000,000,000,000	2,940,000,000,000,000	2,930,000,000,000,000	2,920,000,000,000,000
Pipeline Fuel Natural Gas	50,000,000,000,000	50,000,000,000,000	50,000,000,000,000	50,000,000,000,000	50,000,000,000,000	50,000,000,000,000
Compressed Natural Gas	0	0	0	0	10,000,000,000,000	10,000,000,000,000
Liquid Hydrogen	0	0	0	0	0	0
Electricity	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000	10,000,000,000,000
Delivered Energy	2,980,000,000,000,000	2,980,000,000,000,000	2,990,000,000,000,000	3,000,000,000,000,000	3,000,000,000,000,000	2,990,000,000,000,000
Electricity Related Losses	30,000,000,000,000	30,000,000,000,000	30,000,000,000,000	30,000,000,000,000	30,000,000,000,000	30,000,000,000,000
Total	3,010,000,000,000,000	3,010,000,000,000,000	3,020,000,000,000,000	3,030,000,000,000,000	3,030,000,000,000,000	3,020,000,000,000,000