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Sustainable Energy

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Driven in part by issues like climate change, global interest in the development and deployment of sustainable energy technologies is rapidly growing. Interest in sustainable energy has championed the development of emerging technologies that generate and utilize clean energy more efficiently, and the development of potentially new markets.

Over the last decade, Pennsylvania has been a leader in the development and deployment of sustainable energy technologies. Pennsylvania?s Alternative Energy Portfolio Standards (AEPS) is expected to drive the installation of over 850 MW of solar electric in the state by 2021. Pennsylvania currently has 24 wind farms in operation, which have an installed capacity of 1,334 MW. Thermally-driven biomass heat & power projects are being installed in schools, hospitals, and community centers. High performance construction practices use Leadership in Energy and Environmental Design (LEED) for commercial buildings and ENERGY STAR for residential buildings as environmental responsible ways to construct new and renovate existing buildings.

Research

Bioenergy

Bioenergy technologies use renewable biomass resources to produce many energy-related products including electricity, liquid, solid, and gaseous fuels, heat, chemicals, and other materials. Bioenergy accounts for approximately 9% of the primary energy consumed in the United States; however, this is expected to increase over the coming years through legislative efforts to increase its use.
The Institute is active in the characterization and utilization of wood residues, herbaceous plants and crops, manures and litters, and animal fats, proteins, and tissue. Examples of technical expertise include:

- Bench-, pilot-, and full-scale combustion and gasification studies
- Lignin conversion to value-added materials
- Biomass processing
- Characterization of woody, herbaceous, and agricultural-derived biomass streams for cofiring applications

- Biofuel engine combustion performance and emissions characterizations
- Emissions characterization and control including development of emissions factors
- Application of thermodynamic modeling to predict ash deposition and agglomeration, particle formation, and emissions
- Advanced fuel characterization techniques to determine fundamental and applied behavior (pyrolysis, combustion, and gasification kinetics and ash deposition and agglomeration) in combustion and gasification systems
- Regional and state-wide biomass assessments

West Penn Power Sustainable Energy Fund

In December 1996, Pennsylvania enacted the Electricity Generation Customer Choice and Competition Act (Customer Choice Act) to restructure the electric industry in Pennsylvania. During this restructuring, Pennsylvania created four sustainable energy funds to promote the development and commercialization of sustainable energies technologies throughout the Commonwealth.

The EMS Energy Institute, administers the West Penn Power Sustainable Energy Fund (WPPSEF), which is focused on facilitating the promotion, development, and deployment of sustainable energy technologies throughout the 23 county West Penn service area in western and central Pennsylvania. Investments are made to: 1) Promote the use of renewable and clean energy; 2) Promote energy conservation and energy efficiency; and 3) Promote the attraction, establishment, and retention of sustainable energy businesses. For information on active invested projects visit the WPPSEF website. [2]

Carbon Capture

The emissions of anthropogenic CO_2 have increased the CO_2 concentration on the atmosphere by over 30% compared to preindustrial levels. Although there is a passionate debate regarding the impact of increasing CO_2 emissions on global climate change and global warming, there is a general agreement in the scientific community that doubling the CO_2 emissions will have a serious detrimental effect on the environment. Most of these anthropogenic emissions are caused by fossil fuel utilization, and about one third of these emissions are due to electricity generation from fossil fuel combustion. Furthermore, fossil fuel electricity generation units rank as the first target to reduce anthropogenic emissions due to their stationary nature.
Accordingly, the EMS Energy Institute is conducting research projects in the area of carbon capture and sequestration:

- Development of a high-capacity CO_2 molecular basket to remove CO_2 from power plant flue gas
- Development of a cogasification technology for in-bed carbon dioxide removal during coal/biomass gasification

Photovoltaics

Sustainable energy research at the EMS Energy Institute includes photovoltaics research. Photovoltaics is defined as the generation of electronic charges (e.g. electrons) by absorbed photons, followed by separation of those charges to their respective electrical (ohmic) contacts. Fundamental to the design of a photovoltaic device is the application of electric current to do work.

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