MUNICIPAL GUIDE TO PLANNING FOR AND REGULATING ALTERATIVE ENERGY SYSTEMS

Lancaster County Planning Commission

October 2010

Contents

DEFINITIONS

1. ACCESSORY ANAEROBIC DIGESTER – An anaerobic digester used to convert biogas into electricity, heat, and water and is intended to primarily reduce on-site consumption of utility power. A system is considered a small anaerobic digester only if it supplies electrical or thermal power for on-site use, except that when a property upon which the facility is installed also receives electrical power supplied by a utility company, excess electrical power generated and not presently needed for on-site use may be used by the utility company. Small anaerobic digesters use livestock and poultry manure generated on-site from one (1) farm, and is designed and intended solely to generate power to off-set utility costs. Small anaerobic digesters may include "co-digestion" in which the livestock and poultry manure (primary catalyst) may be mixed with other organic materials (secondary catalysts).

2. ACCESSORY SOLAR ENERGY SYSTEM – A solar collection system consisting of one or more roof and/or ground mounted solar collector devices and solar related equipment, which has a rated capacity of less than or equal to ten (10) kilowatts (for electricity) or rated storage volume of the system of less than or equal to two hundred forty (240) gallons or that has a collector area of less than or equal to one thousand (1,000) square feet (for thermal), and is intended to primarily reduce on-site consumption of utility power. A system is considered a small solar energy system only if it supplies electrical or thermal power solely for on-site use, except that when a property upon which the facility is installed also receives electrical power supplied by a utility company, excess electrical power generated and not presently needed for on-site use may be used by the utility company.

3. ACCESSORY WIND ENERGY SYSTEM – A wind energy conversion system consisting of a wind turbine, tower, and associated control or conversion electronics, which has a rated capacity of less than or equal to hundred (100) kilowatts and is intended to primarily reduce on-site consumption of utility power. A system is considered a small wind energy system only if it supplies electrical power solely for on-site use, except that when a parcel on which the system is installed also receives electrical power supplied by a utility company, excess electrical power generated and not presently needed for on-site use may be used by the utility company.

4. ACIDITY(BASICITY) - the amount of acid present in a solution

5. APPLICANT – The person or entity filing application under this ordinance.

6. ANAEROBIC DIGESTER – A facility which main purpose is to use anaerobic digestion processes to convert livestock manure (primary catalyst) and feedstock into biogas, which is generally burned on-site to produce electricity, heat, and water; as well as to manage livestock and poultry manure. Anaerobic digesters may include "co-digestion" in which

the livestock and poultry manure (primary catalyst) may be mixed with other organic materials (secondary catalysts). Types of anaerobic digesters include covered anaerobic lagoons, plug-flow, and/or complete mix (or continually stirred tank reactor), along with other appurtenant sites, structures and buildings, electrical infrastructure, transmission lines and other appurtenant structures and facilities.

7. ANAEROBIC DIGESTION - is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen, used for industrial or domestic purposes to manage waste and/or to release energy.

8. ANSI – The American National Standards Institute

9. APCA – Air Pollution Control Act

10. APPURTENANCES – The visible, functional, or ornamental objects accessory to and part of buildings.

11. ASTM – The American Society for Testing and Materials

12. BIOGAS – A fuel consisting of methane, carbon dioxide, and small amounts of water and other compounds produced as part of anaerobic digestion processes.

13. BUILDING CODE – The Municipal Uniform Construction Code Ordinance

14. CLEAN WOOD – Natural wood that has that has been seasoned to reduce its water content and provide more efficient combustion. The term clean wood does not include wood:

    a. Coated with paint, stain, oil, resin or any other preservative, fire retardant or decorative materials;
    b. Impregnated with preservatives or fire retardants;
    c. Exposed to salt water; nor
    d. Manufactured with use of adhesives, polymers or resins, such as strand, particle and veneer lumber and recycled lumber.

15. EPA – United States Environmental Protection Agency

16. GEOTHERMAL TERMS –

    a. Closed Horizontal Loop Geothermal System: A mechanism for heat exchange which consists of the following basic elements: underground loops of piping; heat transfer fluid; a heat pump; an air distribution system. An opening is made in the Earth. A series of pipes are installed into the opening and connected to a heat

exchange system in the building. The pipes form a closed loop and are filled with a heat transfer fluid. The fluid is circulated through the piping from the opening into the heat exchanger and back. The system functions in the same manner as the open loop system except there is no pumping of groundwater. A horizontal closed loop system shall be no more than twenty (20) feet deep.

b. Closed Vertical Loop Geothermal System: A borehole that extends beneath the surface. Pipes are installed with U-bends at the bottom of the borehole. The pipes are connected to the heat exchanger and heat transfer fluid is circulated through the pipes.

c. Geothermal Boreholes: A hole drilled or bored into the earth into which piping is inserted for use in a closed vertical loop geothermal system.

d. Geothermal Energy System: An energy generating system that uses the Earth's thermal properties in conjunction with electricity to provide greater efficiency in the heating and cooling of buildings.

e. Open Horizontal Loop Geothermal System: Water is pumped from a water well or other water source into a heat exchanger located in a surface building. The water drawn from the Earth is then pumped back into the ground through a different well or in some cases the same well, also known as "re-injection". Alternatively, the groundwater could be discharged to a surface water body also known as a "pump and dump". In the heating mode, cooler water is returned to the Earth, and in the cooling mode, warmer water is returned to the surface water body or well.

17. HUB HEIGHT – The distances measured from the surface of the tower foundation to the height of the Wind Turbine hub, to which the blade is attached.

18. METHANOGENS –bacteria found in anaerobic environments such as animal intestinal tracts or sediments or sewage and capable of producing methane.

19. NET METERING – A mechanism that provides a simplified approach for interconnecting and metering on-site renewable generating facilities, such as a solar PV system. It allows customers to use excess solar electric generation to offset utility-purchased electricity on a monthly or annual basis.

20. OCCUPIED BUILDING means a residence, school, hospital, church, public library or other building used for public gathering that is occupied or in use when the permit application is submitted.

21. OUTDOOR WOOD-FIRED BOILER (HYDRONIC HEATER) – A fuel-burning device, also known as an "outdoor hydronic heater", "outdoor wood-fired furnace", and "outdoor wood-burning appliance", designed:

a. to burn clean wood or other fuels specifically tested and listed for use by the manufacturer;
b. by the manufacturer specifically for outdoor installation or installation in structures not normally intended for habitation by humans or domestic animals (e.g., garages); and
c. to heat building space and/or water via distribution, typically through pipes, of a fluid heated in the device, typically water or a water/antifreeze mixture.

22. PHASE 2 OUTDOOR WOOD-FIRED BOILER (HYDRONIC HEATER) – An outdoor wood-fired boiler that has been certified or qualified by the EPA as meeting a particulate matter emission limit of 0.32 pounds per million British Thermal Units (BTU) output and is labeled accordingly, with a white "hang" tag.

23. PHOTOVOLTAIC (PV) – The technology that uses a semiconductor to convert light directly into electricity.

24. PRINCIPAL ANAEROBIC DIGESTER – An anaerobic digester principally used to convert biogas into electricity, heat, and water. Large anaerobic digesters accept both livestock manure (primary catalyst) and feedstock, generated off-site or from more than one (1) farm. Large anaerobic digesters may include "co-digestion" in which the livestock and poultry manure (primary catalyst) may be mixed with other organic materials (secondary catalysts).

25. PRINCIPAL SOLAR ENERGY PRODUCTION FACILITY – An area of land or other area used for a solar collection system principally used to capture solar energy and convert it to electrical energy. Large solar energy production facilities consist of one or more free-standing ground, or roof mounted solar collector devices, solar related equipment and other accessory structures and buildings including light reflectors, concentrators, and heat exchangers, substations, electrical infrastructure, transmission lines and other appurtenant structures and facilities, which has a rated capacity of more ten (10) kilowatts (for electricity) or rated storage volume of the system of more than two hundred forty (240) gallons or that has a collector area of more than one thousand (1,000) square feet (for thermal).

26. PRINCIPAL WIND ENERGY PRODUCTION FACILITY – An area of land or other area used for a wind energy conversion system principally used to capture wind energy and convert it to electrical energy. Large wind energy production facilities consist of one or more wind turbines, tower, and associated control or conversion electronics and other accessory structures and buildings including substations, electrical infrastructure, transmission lines and other appurtenant structures and facilities, which has a rated capacity of more than one hundred (100) kilowatts.

27. RESPONSIBLE OFFICIAL– Person designated by the municipality to be responsible for the administration and enforcement of this ordinance.

28. SOLAR COLLECTION SYSTEM – A solar photovoltaic cell, panel, or array, or solar hot air or water collector device, which relies upon solar radiation as an energy source for collection, inversion, storage, and distribution of solar energy for electricity generation or transfer of stored heat.

29. SOLAR RELATED EQUIPMENT – Items including a solar photovoltaic cell, panel, or array, or solar hot air or water collector device panels, lines, pumps, batteries, mounting brackets, framing and possibly foundations used for or intended to be used for collection of solar energy.

30. STACK – Any vertical structure enclosing a flue(s) that carry off smoke or exhaust from a furnace or other fuel-burning device, especially that part of a structure extending above a roof.

31. WET STAMP- A from-scratch calculation performed by a structural engineer of the tower's integrity.

Municipal Guide to Planning for and Regulating

Alternative Energy Systems

The production of alternative forms of energy, either for individual or utility consumption, is a land use not often addressed in most comprehensive plans or zoning ordinances in Lancaster County. However, some municipalities in recent years have often been faced with decisions regarding the appropriate scale and location of these uses in their community. The Pennsylvania Municipalities Planning Code gives local municipalities the authority through comprehensive plans and ordinances to set provisions regulating the placement, construction, operation and maintenance of alternative energy projects. (MPC Sections 105, 301.4.1, and 707.4.viii.1)

The types of alternative energy systems most commonly seen in Lancaster County currently are wind, solar, manure digesters, outdoor wood-fired boilers, and geothermal. Some of these systems, particularly wind, solar, and manure digesters, can vary in the size of the system, the amount of energy produced, and whether that energy is produced primarily for consumption by the property owner or is intended to be transmitted to and sold for the electrical grid.

Before adopting zoning or subdivision and land development ordinance regulations for alternative energy systems, municipalities should first examine and decide the proper location for these uses. The elected and appointed officials should review the land use goals and objectives identified in their comprehensive plan, and the purpose statements for specific zoning districts in their zoning ordinance. These planning documents provide a context to evaluate the appropriateness of specific uses in specific areas of the municipality.

The following is a list of policy points that municipal officials should address in determining the appropriate location and scale of these uses. The list addresses both smaller scale accessory-type applications most typically seen in residential and in some non-residential zoning districts, as well as more land-consumptive and impact-intensive uses typically seen in rural and agricultural zoning districts. A second part of this guide (beginning on page 10) will provide examples of specific zoning ordinance language.

<u>Smaller-scale alternative energy uses</u>

Municipalities should first decide how to allow these types of uses. It is recommended that an alternative energy system, designed primarily to provide energy for a home or business, be allowed as other accessory structures and buildings are. Most often these structures and buildings are permitted by right.

The primary consideration in the approval process for almost all accessory uses, especially in residential zoning districts, is the impact on neighboring properties. These include appearance, odor, noise, increased traffic, and others. Most alternative energy systems pose minimal impacts.

One exception are outdoor wood-fired boilers which because of the emissions produced are usually not permitted in residential zoning districts. The following list examines potential impacts from specific alternative energy systems. The second part of this report will provide examples of zoning ordinance language municipalities have adopted to address these impacts:

1. Height- This is almost exclusively a concern for wind energy systems. These systems will almost always be among the highest structures within a residential, and even a commercial or industrial, zoning district. One wind energy association report recommends that that the bottom of the wind turbine rotor should clear the highest wind obstacle within a 500 foot radius by at least 30 feet. The higher the tower height the more wind power will be produced. Therefore, a municipality must balance neighborhood aesthetics with the energy efficiency of the unit. Although there is no ideal height that balances these concerns, municipal officials should look at the maximum height of similar structures, such as cell tower, flagpoles, and antennas that are allowed in these zoning districts.
2. Setbacks- Most municipalities have required these systems, like other accessory uses, to be located in side or rear yards. Setback distances should be the same as other accessory structures. Because wind turbines have generally been designed to withstand hurricane force winds, requiring an applicant to submit the manufacturer's engineering specifications should be sufficient proof to determine that the system will not fall onto a neighboring property.
3. Signage- Signage should not be permitted on any alternative energy system other than the manufacturer's label or sign.
4. Screening and fencing- Most municipalities do not require applicants to screen or fence these systems. In many instances, especially for solar systems, screening will reduce the energy efficiency of the unit.

<u>Larger-scale alternative energy uses</u>

These types of systems are designed to produce greater levels of energy, either for consumers with higher energy demand levels such as farms or industrial uses, or designed primarily to produce energy to be supplied directly to the electrical grid. Municipalities must look not only at the operational impacts of these uses but also locational concerns as well.

Developers of utility-scale alternative energy systems, especially those designed primarily to produce energy for the electrical grid, often require relatively large parcels of land to locate their facility. Similar to other land-consumptive uses such as school campuses and recreational uses, applicants usually wish to locate these uses in rural areas where it is easier to assemble the required land and the per acreage cost of the land is lower than within a Designated Growth Area. In determining whether to permit these uses, municipalities must first review their land use objectives in their comprehensive plan and the purpose statement of the specific zoning districts.

Most often, the great majority of land in rural areas of Lancaster County is zoned agricultural. Most local and regional comprehensive plans recommend that only agricultural uses, or uses that support the agricultural industry, be allowed. Balance: The Growth Management Element of the Lancaster County Comprehensive Plan also recommends that only land uses that support the agricultural economy be permitted in agricultural areas. Therefore, the Lancaster County Planning Commission has recommended that only electricity produced from manure digesters be permitted as the primary use in the agricultural zoning district. Solar, wind, and other alternative energy sources can be allowed but only as an accessory use. Some municipalities have limited the total amount of land dedicated to this use as a percentage of the total acreage of the farm, oftentimes no more than one or two per cent of the total.

Because most alternative energy uses are not recommended to be the primary land use for properties within the agricultural zoning district, municipalities whether this should be allowed in other zoning districts. However, a municipality may determine that this type of use is also not appropriate in an industrial district because of the large land needs and the lack of employment provided. In these circumstances, larger-scale alternative energy systems may only be permitted as an accessory use.

The following is a list of operational impacts to be considered when permitting larger-scale alternative energy uses:

1. Large-scale, or regional manure digesters bring manure to a site by truck. The municipality should review the number and schedule of truck traffic with the applicant to minimize impacts.
2. Screening of alternative-energy systems in rural areas is generally less of a concern than in residential zoning districts. However, the municipality should look at the proximity of the proposed system to neighboring residences and road frontages and determine whether screening would be appropriate.
3. Outdoor wood-fired boilers should only be allowed in rural or agricultural areas because of the potential airborne impacts from emissions. The PA DEP has produced a Model Ordinance for Outdoor Wood-Fired Boilers that addresses many of the land use issues involved with these uses.

ACCESSORY SOLAR ENERGY SYSTEMS

How Accessory solar energy systems Work

There are two major forms of solar energy technology: photovoltaic (PV) systems and solar thermal systems.

Photovoltaic Systems

Solar electric systems, also known as photovoltaic (PV) systems, convert sunlight into electricity. Photovoltaic power generation employs solar panels comprising a number of cells containing a photovoltaic material. When sunlight is absorbed by these materials, the solar energy knocks electrons loose from their atoms. This phenomenon is called the "photoelectric effect." These free electrons then travel into a circuit built into the solar cell to form electrical current. Only sunlight of certain wavelengths will efficiently create electricity. PV systems still produce electricity on cloudy days, but not as much as on a sunny day.

The basic PV or solar cell typically produces only a small amount of power. To produce more power, solar cells (about 40) can be interconnected to form panels or modules. PV modules range in output from 10 to 300 watts. If more power is needed, several modules can be installed on a building or at ground-level in a rack to form a PV array.

PV arrays can be mounted at a fixed angle facing south, or they can be mounted on a tracking device that follows the sun, allowing them to capture the most sunlight over the course of a day.

(References: *U.S. Department of Energy: Energy Efficiency and Renewable Energy, PA Solar Municipal Guide)*

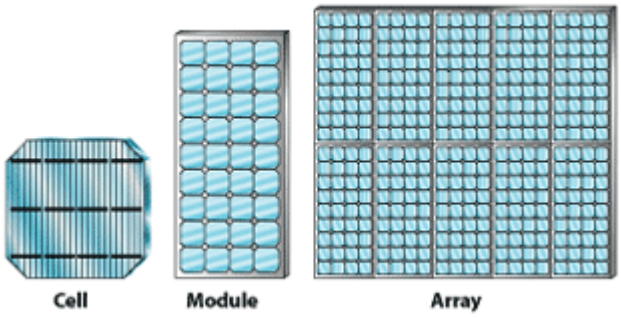


Illustration ***from U.S. Department of Energy***

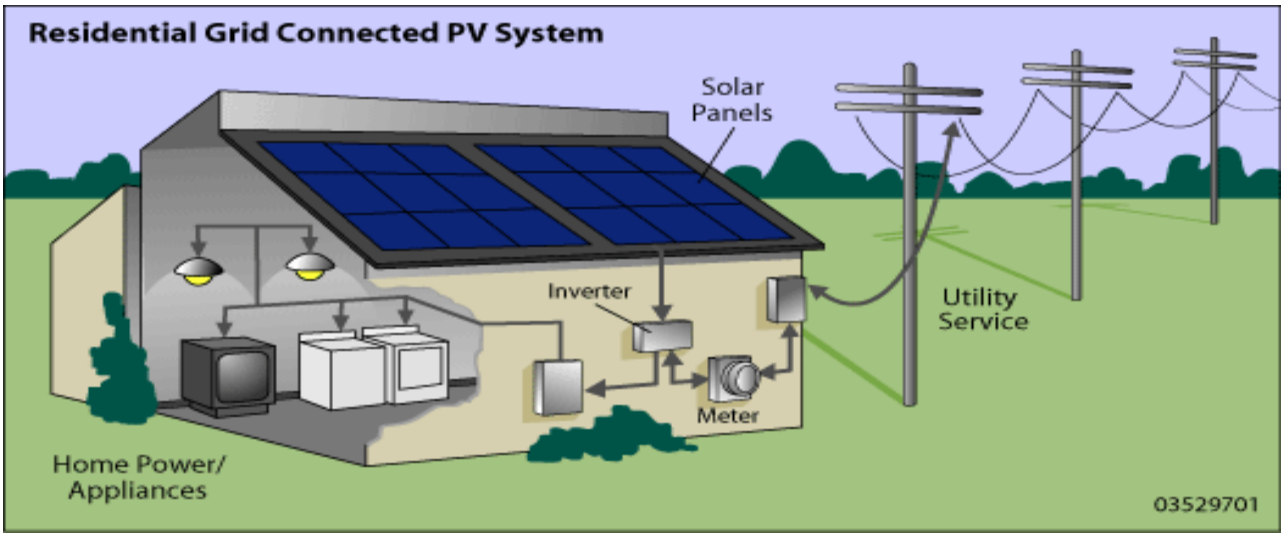


Illustration *from U.S. Department of Energy*

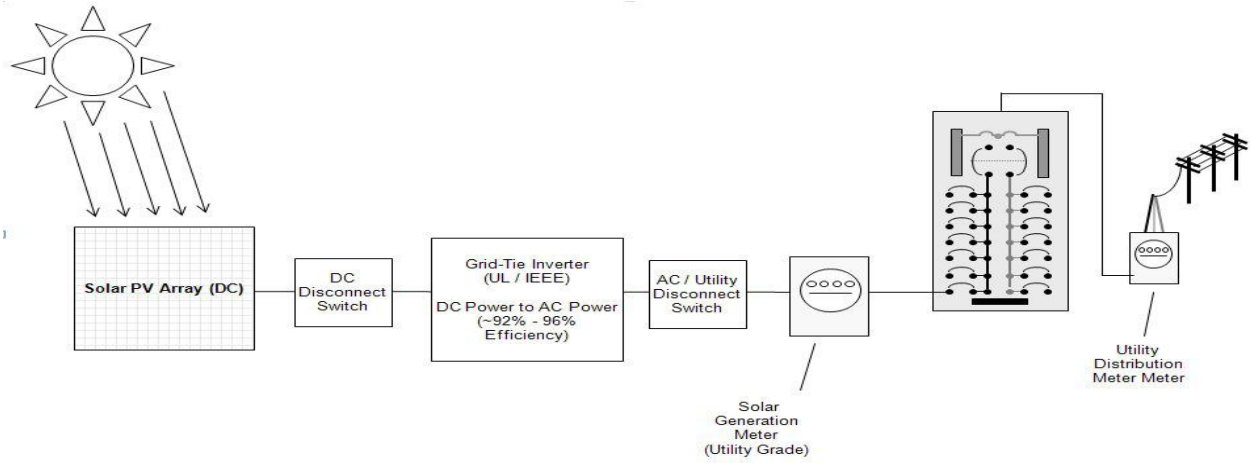


Illustration *from PA Solar Energy Guide*

Illustration *from U.S. Department of Energy*

Solar Thermal Systems

Solar thermal systems use solar energy to typically heat a fluid, such as water or an antifreeze solution, or heat a gas, such as air. Solar thermal systems are most commonly utilized for heating residential hot water systems, though they are also used for space heating, spas or swimming pools, and even space cooling.

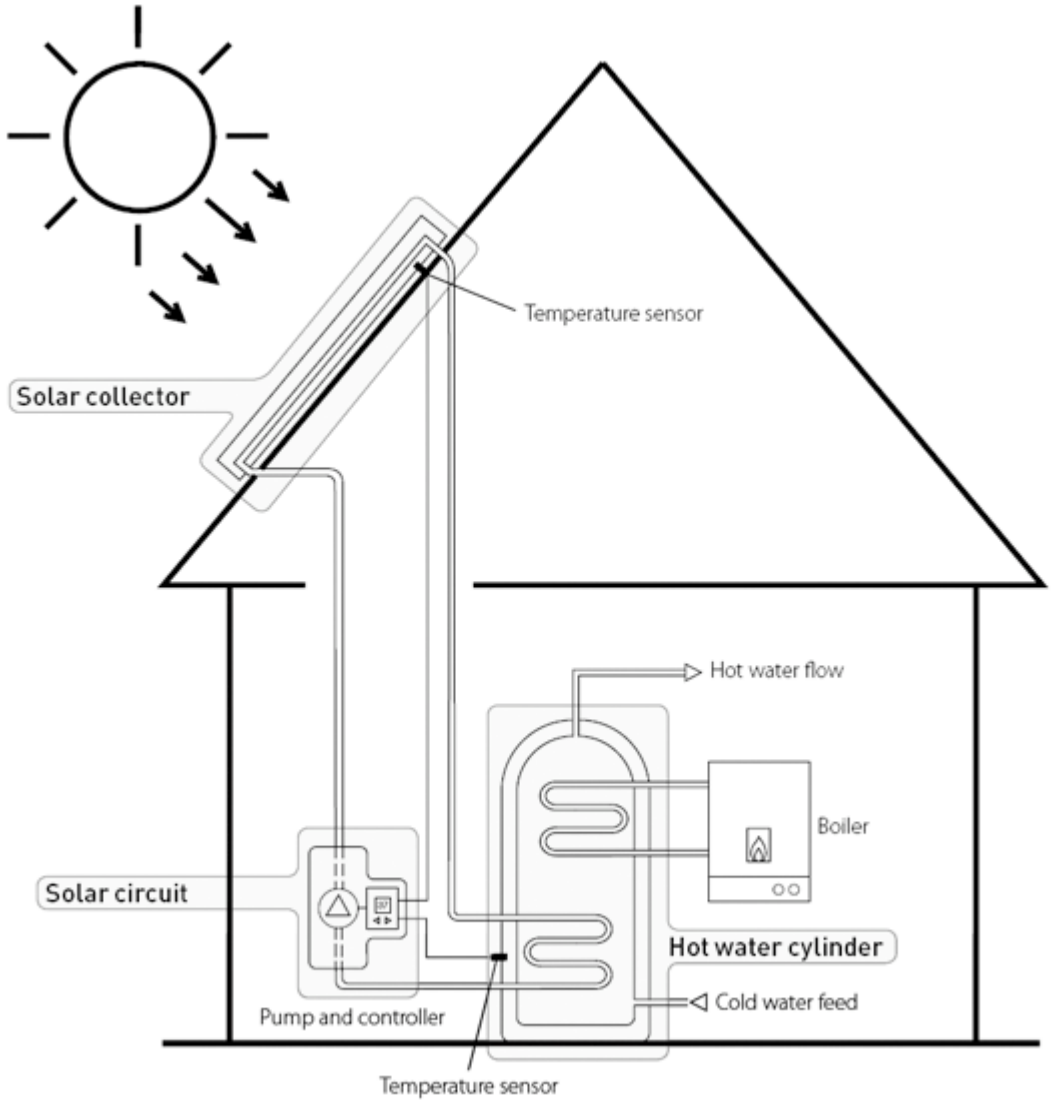


Illustration ***from PA Solar Energy Guide***

Municipal Authority

The Pennsylvania Municipalities Planning Code gives municipalities the authority to adopt comprehensive plans (MPC Sections 301a.4.1 and 301.1) and ordinances (MPC Sections503.6 and 604.1) to ensure solar and other alternative energy access, including solar access ordinances, development guidelines requiring proper street orientation, and zoning ordinances that contain building height restrictions to avoid shading neighboring solar panels.

Restrictive Covenants

Despite the recent surge for renewable energy development at the state and local levels, many consumers still face local ordinances and homeowner's association rules that prohibit, restrict, or drastically increase the cost of installing a solar energy system. More than half of U.S. States have solar rights laws that protect consumers from any restrictive covenant. Pennsylvania is not one of the states that have a solar right's or access law.

(References: ***Database for State Incentives for Renewables and Efficiency website)***

Model Zoning Language

As solar energy systems become increasingly commonplace in local communities, zoning and subdivision ordinances can provide significant legal structure for ensuring that the integration of solar systems into new and existing building construction and land development aligns with the regulations, goals and expectations of a specific municipality.

Here is an example of model zoning language for solar energy systems:

- **ACCESSORY SOLAR ENERGY SYSTEMS**: Permitted by right as an accessory use in all zoning districts where structures of any sort are allowed, as long as it meets the requirements of this Chapter and all other applicable construction codes as set forth below:

- **Applicability**

    - A system is considered an accessory solar energy system only if it supplies electrical or thermal power primarily for on-site use, except that when a property upon which the facility is installed also receives electrical power supplied by a utility company, excess electrical power generated and not presently needed for on-site use may be used by the utility company. The owner of the accessory solar energy system shall provide written confirmation that the public utility company has been informed of the customer's intent to install an interconnected customer-owned generator and also approves of such connection. Off-grid systems shall be exempt from this requirement.

    - This ordinance applies to Solar Energy Systems to be installed and constructed after the effective date of the ordinance, and all applications for Solar Energy Systems on existing structures or property.

    - Any upgrades, modifications or changes that materially alter the size or placement of an existing Solar Energy System shall comply with the provisions of this Chapter.

- **Design and Installation**

- To the extent applicable, the Solar Energy System shall comply with all applicable building and construction codes as amended and any regulations adopted by the Department of Labor and Industry.

- The design and installation of accessory solar energy systems shall conform to applicable industry standards, including those of the American National Standards Institute (ANSI), Underwriters Laboratories (UL), the American Society for Testing and Materials (ASTM), or other similar certifying organizations, and shall comply with the Municipal Building Code and with all other applicable fire and life safety requirements. The manufacturer specifications shall be submitted as part of the application.

- All exterior electrical and/or plumbing lines must be buried below the surface of the ground and be placed in a conduit.

    - Whenever practical, all accessory solar energy systems shall be attached to a building, or located on an impervious surface. If not designed to be attached to the building, the applicant shall demonstrate by credible evidence that such systems cannot feasibly be attached to a building due to structural imitations of the building.

    - Accessory solar energy systems shall be designed and located in order to prevent reflective glare toward any inhabited structure on adjacent properties as well as adjacent street rights-of-way.

    - No portion of an accessory solar energy system shall be located within or above any front yard, along any street frontage, nor within any required setback of any property.

(This Section is from the PA Municipal Guide for solar Energy Systems and Rapho Township's Alternative Energy Ordinance)

- **Height Restrictions**– Active solar energy systems must meet the following requirements:

    - Building- or roof- mounted solar energy systems shall not exceed the maximum allowed height in any zoning district. For purposes for the height measurement, solar energy systems other than building-integrated systems shall be considered to be mechanical devices and are restricted consistent with other building-mounted mechanical devices

    - Ground- or pole-mounted solar energy systems shall not exceed the minimum accessory structure height within the underlying district.

- **Setback** - Active solar energy systems must meet the accessory structure setback for the zoning district and primary land use associated with the lot on which the system is located.

    - **Roof-mounted Solar Energy Systems** - In addition to the building setback, the collector surface and mounting devices for roof-mounted solar energy systems shall not extend beyond the exterior perimeter of the building on which the system is mounted or built. Exterior piping for solar hot water systems shall be allowed to extend beyond the perimeter of the building on a side yard exposure.

    - **Ground-mounted Solar Energy Systems** - Ground-mounted solar energy systems may not extend into the side-yard or rear setback when oriented at minimum design tilt.
      (Sections 3 and 4 are from the City of Woodbury, MN ordinance for alternative energy)

- **Plan Approval Required** - All solar energy systems shall require administrative plan approval by municipal zoning officials

    - **Plan Applications** - Plan applications for solar energy systems shall be accompanied by to-scale horizontal and vertical (elevation) drawings. The drawings must show the location of the system on the building or on the property for a ground-mount system, including the property lines. Applicants must use an installer who is on DEP's approved list

        - **Pitched Roof Mounted Solar Energy Systems** - For all roof-mounted systems other than a flat roof the elevation must show the highest finished slope of the solar collector and the slope of the finished roof surface on which it is mounted.

        - **Flat Roof Mounted Solar Energy Systems** - For flat roof applications a drawing shall be submitted showing the distance to the roof edge and any parapets on the building and shall identify the height of the building on the street frontage side, the shortest distance of the system from the street frontage edge of the building, and the highest finished height of the solar collector above the finished surface of the roof.

    - **Plan Approvals** - Applications that meet the design requirements of this ordinance, and do not require a conditional use permit, shall be granted administrative approval by the zoning official and shall not require Planning Commission review. Plan approval does not indicate compliance with Building Code or Electric Code.
      (Section 5 is from the PA Municipal Guide for solar Energy Systems)

- **Utility Notification** - The owner of the small solar energy system shall provide written authorization that the public utility company has been informed of the customer's intent to install an interconnected customer-owned generator and also approves of such connection. Off-grid systems shall be exempt from this requirement.
  (This section is from the City of Woodbury, MN ordinance for alternative energy.)

- **Restrictions on Solar energy systems Limited *(Optional)*** - No homeowners' agreement, covenant, common interest community, or other contract between multiple property owners within a subdivision shall restrict or limit solar energy systems to a greater extent than solar performance standards.

  (This section is from the City of Woodbury, MN ordinance for alternative energy. As stated above, there is no solar access 'protection' law in Pennsylvania.)

ACCESSORY WIND ENERGY SYSTEMS

How an Accessory Wind Energy System Works

Wind is created by the unequal heating of the Earth's surface by the sun. Wind turbines convert the kinetic energy in wind into electricity.

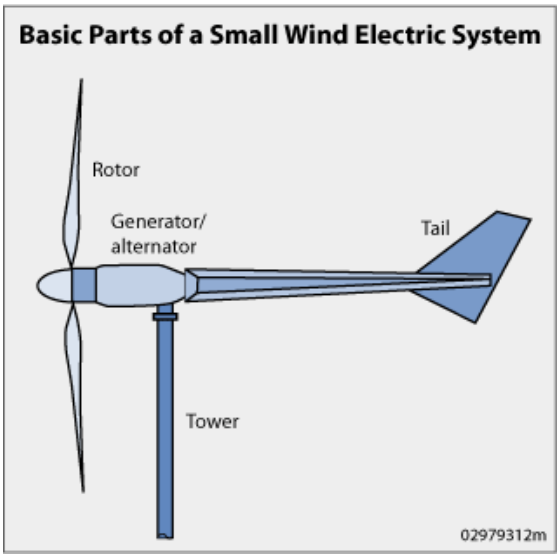
When the wind spins the wind turbine's blades, a rotor captures the kinetic energy of the wind and converts it into rotary motion to drive the generator. The manufacturer can provide information on the maximum wind speed at which the turbine is designed to operate safely. Most turbines have automatic overspeed-governing systems to keep the rotor from spinning out of control in very high winds. A small wind system can be connected to an electric distribution system (grid-connected) or it can stand alone (off-grid).

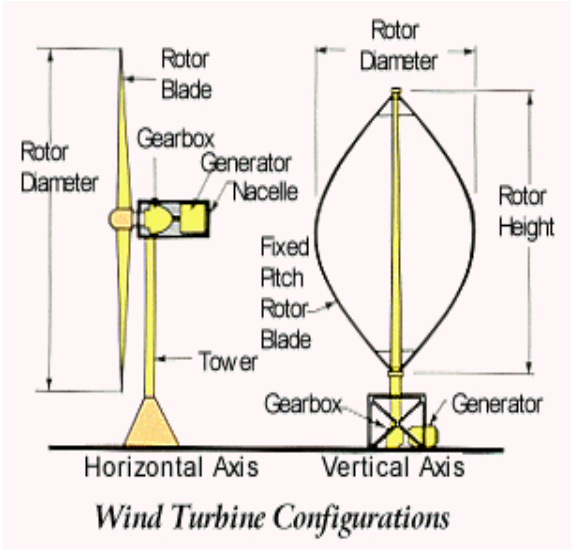
(References: American Wind Energy Association website**)**

Types of Wind Turbines

Industrial wind turbines fall into two general classes depending on how they spin: horizontal axis and vertical axis, also known as "eggbeater" turbines. Vertical axis machines, which spin about an axis perpendicular to the ground, have advantages in efficiency and serviceability when all of the control equipment is at ground level. The main drawback to this configuration, however, is that the blades cannot be easily elevated high into the air where the best winds blow. As a result, horizontal axis machines — which spin about an axis parallel to the ground rather than perpendicular to it — have come to dominate today's markets.

(References: American Wind Energy Association website, *U.S. Department of Energy: Energy Efficiency and Renewable Energy***)**





Illustrations from AWEA website

In rare instances turbines are installed directly onto building rooftops or designed as part of the building itself (known as "architecturally integrated"). These installations appear mostly in urban or densely-built areas where small property sizes may prevent the use of towers elsewhere on a property. These types of installations currently account for less than 1% of all applications, but interest is increasing rapidly and zoning officials may receive permit applications for urban or rooftop installations.

Siting becomes especially important for turbines in urban settings. Wind patterns behave very differently around buildings and in densely-built areas, so a turbine must be sited very precisely in order to gain access to wind of sufficient quality. Height, for example, becomes increasingly important in order for the turbine to rise above aerodynamic obstacles and turbulence.

(References: American Wind Energy Association website)

Illustrations from AWEA website

Industry Standards

Height

By industry standards, the height of a tower is the single most important factor in the economic viability of a small wind system. Tall towers (150 ft. or greater) enable turbines to access faster and better quality winds, and even small increases in wind speed translate to exponentially more energy the turbine can generate. In other words, a taller tower means far more - and cheaper - energy. The best sites for turbines are those where the wind is least obstructed, which is often the highest point on a property. The bottom of the turbine rotor should clear the highest wind obstacle (rooftop, mature tree, etc.) within a 500 foot radius by at least 30 feet. Doing so ensures the turbine reaches consistent, fast wind speeds and prolongs the life of the turbine by avoiding stressful air turbulence.

(References: American Wind Energy Association website**)**

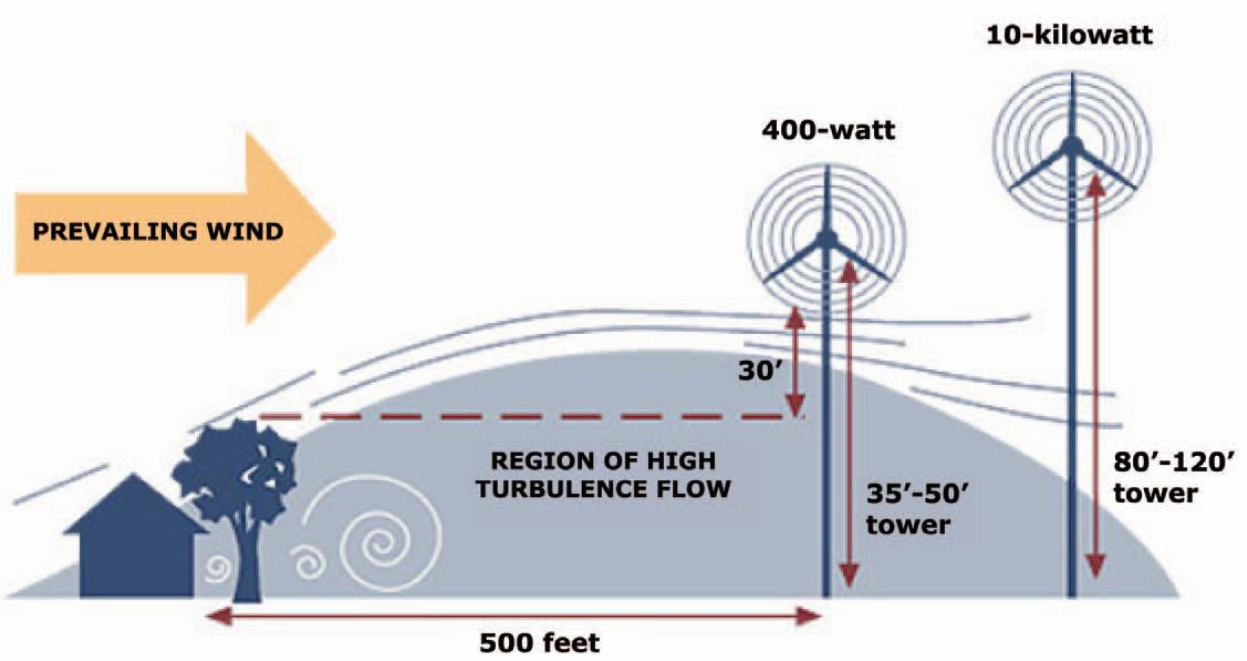


Illustration from AWEA website

Ordinance Language

Most often, local governments streamline the permitting process by listing accessory wind energy systems as a conditional or accessory use. Other zoning requirements for accessory wind energy systems vary amongst local governments. There are municipalities that allow these accessory wind energy systems in all zoning districts and there are municipalities that restrict them to certain zoning districts (such as Agricultural or Industrial/Commercial). Height regulations have ranged from 65 to 100 feet. There are local ordinances that base the height

requirements by the zoning district where the small wind energy system is constructed in. All ordinances stress the prevention of unauthorized climbing by not allowing foot pegs or rungs below 12-15 feet. Below is an example of model zoning language from the American Wind Energy Association:

- Number of accessory wind systems per property: Shall be limited to one

- **Setback:** The base of the tower shall be set back from all property lines, public right-of-ways, and public utility lines a distance equal to the total extended height. Turbines shall be allowed closer to a property line than its total extended height if the abutting property owner(s) grants written permission and the installation poses no interference with public utility lines or public road and rail right-of-ways.

- **Tower Height:** So long as the total extended height meets noise and set-back requirements, there shall be no specific height limitation, except as imposed by Federal Aviation Administration regulations.

- **Sound:** Sound produced by the turbine under normal operating conditions, as measured at the property line, shall not exceed the definition of nuisance noise. Sound levels, however, may be exceeded during short-term events out of anyone's control such as utility outages and/or severe wind storms.

- **Wind Turbine Equipment:** The design and installation of all accessory wind energy systems shall conform to applicable industry standards, including those of the American National Standards Institute (ANSI), Underwriters Laboratories, Det Norske Veritas, Germanischer Lloyd Wind Energies, the American Society for Testing and Materials (ASTM), or other similar certifying organizations, and shall comply with the Township Building Code and with all other applicable fire and life safety requirements. The manufacturer specifications shall be submitted as part of the application.

- When an accessory building is necessary for storage cells or related mechanical equipment, the accessory building shall not have a floor area exceeding??? square feet, and shall comply with the accessory building requirements specified within the underlying zoning district

- **Requirement for Engineered Drawings:** Building permit applications for accessory wind energy systems shall be accompanied by standard drawings of the wind turbine structure and stamped engineered drawings of the tower, base, footings, and/or foundation as provided by the manufacturer. Wet stamps shall not be required.

- **Soil Studies:** For standard soil conditions (not including gravel, sand, or muck), foundations developed by the wind turbine manufacturer shall be acceptable for

turbine installations of 20kW or less and will not require project-specific soils studies or an engineer's wet stamp.

- **Compliance with FAA Regulations:** No accessory wind energy system shall be constructed, altered, or maintained so as to project above any of the imaginary airspace surfaces described in FAR Part 77 of the FAA guidance on airspace protection.

- **Compliance with National Electric Code:** Building permit applications for accessory wind energy systems shall be accompanied by a line drawing of the electrical components, as supplied by the manufacturer, in sufficient detail to allow for a determination that the manner of installation conforms to the National Electrical Code.

- **Utility Notification:** No small wind energy system shall be installed until evidence has been given that the utility company has been informed of the customer's intent to install an interconnected customer-owned generator. Off-grid systems shall be exempt from this requirement.

- **Insurance:** Additional insurance beyond homeowners' coverage may not be required.

- **Abandonment:** If a wind turbine is inoperable for six consecutive months the owner shall be notified that they must, within six months of receiving the notice, restore their system to operating condition. If the owner(s) fails to restore their system to operating condition within the six-month time frame, then the owner shall be required, at his expense, to remove the wind turbine from the tower for safety reasons. The tower then would be subject to the Public Nuisance provisions of the Municipal code.

- **Signage:** All signs, other than the manufacturer's or installer's identification, appropriate warning signs, or owner identification on a wind generator, tower, building, or other structure associated with a small wind energy system visible from any public road shall be prohibited.

- **Lighting:** No illumination of the turbine or tower shall be allowed unless required by the FAA.

- **Access:** Any climbing foot pegs or rungs below 12 feet of a freestanding tower shall be removed to prevent unauthorized climbing. For lattice or guyed towers, sheets of metal or wood may be fastened

ACCESSORY ANAEROBIC DIGESTERS

What are they?

An anaerobic digester is used to convert gasses ("biogas") produced by bacterial degradation of organic matter into electricity, heat, and water and is intended to primarily reduce on-site consumption of utility power. Biogas can be produced from a wide range of energy crops, animal manures and organic wastes. Thus, it offers a high flexibility and can be adapted to the specific needs of contrasting locations and farm managements. After anaerobic digestion, the digestion residues can be used as fertilizer for agricultural crops.

A system is considered a accessory anaerobic digester only if it supplies electrical or thermal power for on-site use, except that when a property upon which the facility is installed also receives electrical power supplied by a utility company, excess electrical power generated and not presently needed for on-site use may be used by the utility company. Accessory anaerobic digesters use livestock and poultry manure generated on-site from one farm, and is designed and intended solely to generate power to off-set utility costs. Accessory anaerobic digesters may include "co-digestion" in which the livestock and poultry manure (primary catalyst) may be mixed with other organic materials (secondary catalysts).

(Reference: The AD Community: Independent Website)

Illustration from wikipedia.org

Brubaker Farm Mount Joy Twp

Types of Digester Systems

There is a wide variety of anaerobic digesters, each performing this basic function in a subtly different way. Construction and material handling techniques can vary greatly within three main categories:

- **Passive Systems**: Biogas recovery is added to an existing treatment component.
- **Low Rate Systems**: Manure flowing through the digester is the main source of methane-forming microorganisms.
- **High Rate Systems**: Methane-forming microorganisms are trapped in the digester to increase efficiency.

What goes into a digester?

Livestock manure is the most popular material, or feedstock, for anaerobic digestion on the farm, but almost any type of organic matter can be digested, including food waste, forestry residue, animal processing waste, and field crops. The energy production potential of feedstock varies depending on the type, level of processing/pretreatment and concentration of biodegradable material. Materials that should be excluded as feedstock from anaerobic digesters include those containing compounds known to be toxic to anaerobic bacteria, poorly degradable material, and biomass containing significant concentrations of inorganic material.
(Reference: The AD Community: Independent Website)

Possible Risks

Probably the biggest problem in a digester occurs when the digester's pH (measure of the acidity or basicity) drops too low. In general, acid-forming bacteria grow much faster than methane-

forming bacteria. This can reduce the pH to an unfavorable level for methane-forming bacteria, thus inhibiting the activity of methanogens. This is referred to souring and may result in failure or crashing of the anaerobic digester.
(Reference: The AD Community: Independent Website)

Model Zoning Language

Accessory anaerobic digesters are normally allowed as accessory uses to farming operations in Agricultural and Industrial Districts. Design and construction of these facilities must comply with State manure storage and environmental laws.

ACCESSORY ANAEROBIC DIGESTER SYSTEMS: Accessory methane digester systems are permitted as an accessory uses to farming operations in the Agricultural District

Setback:

- Minimum lot area-Ten (10) acres.

- Accessory anaerobic digesters shall not be located within fifty (50) feet of any side property line, seventy-five (75) feet of any rear property line, one hundred and fifty (150) feet from any residential structure other than that of the property owner, and one hundred (100) feet from any public road right-of-way. There shall be no discharge of any type onto such road right-of-way.

Design and Installation:

- The applicant shall address and document performance standards for citing to minimize impacts on neighboring properties which shall include considerations of odor, prevailing wind patterns, proximity to non-agricultural properties, operational noise, and specific hours of operation.

- Anaerobic digester systems shall be designed and constructed in compliance with the guidelines outlined in the Pennsylvania Department of Environmental Protection's Bureau of Water Quality Management publication, and any revisions, supplements and successors thereto, of the Pennsylvania Department of Environmental Protection as of this date.

- Anaerobic digester systems shall be designed and constructed in compliance with applicable local, State and Federal codes and regulations. Evidence of all Federal and State regulatory agencies' approvals shall be included with the application.

- A certified professional, qualified to do such, shall furnish and explain all details of construction, operation, maintenance and necessary controls related to

the anaerobic digester system.

- The applicant shall provide either (1) a letter from the Lancaster County Conservation District stating that the applicant's anaerobic digester system design has been reviewed and approved by the Lancaster County Conservation District and that all regulations and requirements of the State manure management program have been satisfied, or (2) submit a letter from the Lancaster County Conservation District stating that it will not review the plan or that no review is required under applicable ordinances, or (3) submit evidence that such a letter has been requested and the Lancaster County Conservation District has failed to respond.

Utility Notification: No anaerobic digester system shall be installed until evidence has been given that the utility company has been informed of the customer's intent to install an interconnected customer-owned generator. Off-grid systems shall be exempt from this requirement.

ACCESSORY GEOTHERMAL ENERGY SYSTEMS

How a Geothermal Energy System Works

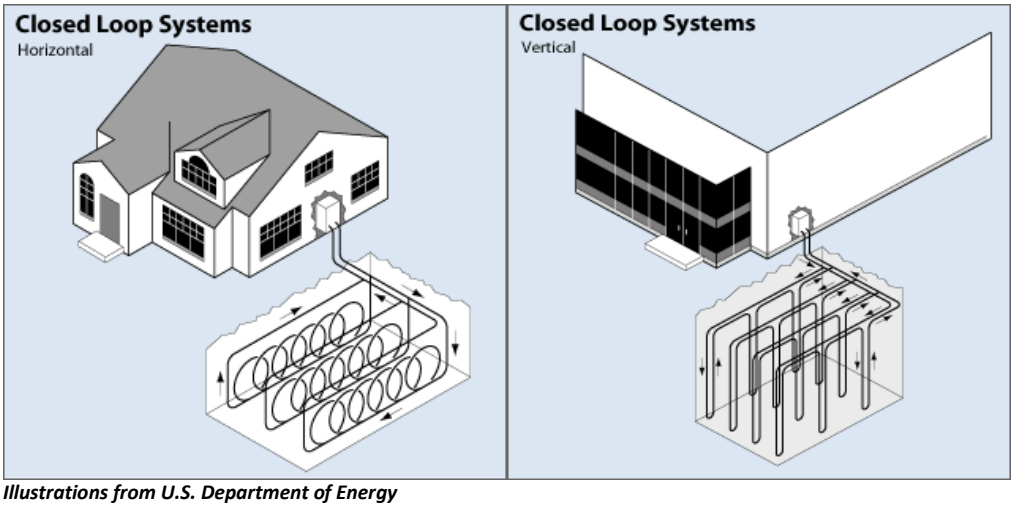
A geothermal energy system is a generating system that uses the Earth's thermal properties in conjunction with electricity to provide greater efficiency in the heating and cooling of buildings. Geothermal energy can be used in several different ways. At its most basic, heated water from springs can be employed for cooking or warmth. In areas of high geothermal energy, such as the west coast of the United States, steam from the hot water can turn turbines to create electricity. Geothermal is distinct from other renewable energy such as wind and solar, because it can provide electricity 24 hours a day, 365 days a year. Pennsylvania has the potential to increase its use of geothermal systems, according to the U.S. Department of Energy. The most common form of geothermal energy in Pennsylvania comes from shallow well heat pumps, which capitalize on the constant temperature within the earth's upper crust. A system of tubes pumps the energy above ground for use, providing warmth in the winter and cooling in the summer. Wells are dug and pipes buried in the ground. Fluid is circulated through the system. In winter, it absorbs heat from the earth and warms the building. In summer, it takes heat from the building and moves it to the earth. Geothermal heat pumps come in two basic configurations: closed loop (ground-coupled) and open loop (groundwater) systems.

Closed Loop Systems

There are two types of water based closed loop geothermal systems typically used: horizontal, and vertical. Water based means a mixture of water and antifreeze is the heat carrying medium pumped through the tubing/piping.

- **Horizontal Ground Closed Loop:** This type is usually the most cost effective when trenches are easy to dig and the size of the yard is adequate. Workers use a backhoe to dig the trenches three to six feet below the ground in which they lay a series of parallel plastic pipes. A typical horizontal loop will require 400-600 feet of tubing per ton of heating and cooling capacity.

- **Vertical Ground Loop:** this type is used where there is little yard space, when surface rocks make digging impractical, or when you want to disrupt the landscape as little as possible. Vertical holes 100 to 450 feet deep - much like wells - are bored in the ground, and a single loop of pipe with a U-bend at the bottom is inserted before the hole is backfilled.



Illustrations from U.S. Department of Energy

Open Loop Systems

An open loop system uses water from a surface or underground source, such as a pond, lake or well. The water is pumped into the heat pump unit where the heat is extracted; the water is then discharged back into the original source or into a return well. Since water quality may be an issue with open loop systems, they are generally avoided and even prohibited in some areas because of environmental concerns. Aquifers can be depleted if the water is not re-injected.

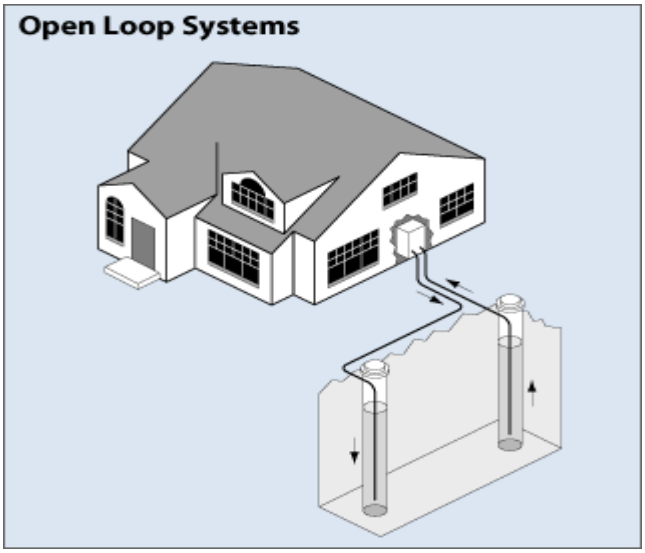


Illustration from U.S. Department of Energy

(References: Home Improvement with Alternative Energy Heating website**)**

Tonnage

It should be noted at this point, that in the United States, heat pumps are rated on tonnage (i.e. one ton of cooling power--produced by a ton of ice) and is equal to 12,000 Btu/hr or 3.51 kW. A typical U.S. residence of 2,000-2400 square feet will require a 3 to 4 ton unit.

Environmental Impact

The actual land used in geothermal operations is fairly small, and other applications such as crop growing or grazing can exist in proximity to the roads, wells, pipelines, and power plants of a geothermal field. Low-temperature geothermal applications are usually no more impact on the environment than a well. If drilling standards are appropriate, the use of geothermal energy through closed loop heat pump technology has almost no impact on the environment and has a beneficial effect in reducing the demand for electricity.

(References: PA Department of Environment Protection**)**

Model Zoning Language

- **GEOTHERMAL SYSTEMS:** Geothermal systems shall be permitted as an accessory use in all zoning districts and shall be subject to the following regulations:

- **Design and Installation:**

    - Only the following types of geothermal energy systems shall be permitted:

        - Closed horizontal loop;

        - Closed vertical loop; and

        - Open horizontal loop systems relying upon injection wells or water courses.

    - The design and installation of geothermal systems and related boreholes for geothermal heat pump systems shall conform to applicable industry standards, including those of the American National Standards Institute (ANSI), the International Ground Source Heat Pump Association (IGSHPA), the American Society for Testing and Materials (ASTM), the Air-Conditioning and Refrigeration Institute (ARI), or other similar certifying organizations, and shall comply with the Township Building Code and with all other applicable Township requirements. The manufacturer specifications shall be submitted as part of the application.

    - For closed loop systems, the following shall apply:

        - For all closed loop geothermal systems relying upon circulating fluids, only nontoxic, biodegradable circulating fluids such as food grade propylene glycol shall be permitted.

- All horizontal closed loop systems shall be no more than twenty (20) feet deep.

- For open horizontal loop systems, the following shall apply:

  - Water Extraction

    - Open loop systems may utilize a watercourse to the extent permissible under Federal, State, or local municipal laws or regulations.

    - All open loop systems which extract water from groundwater sources shall comply with extraction limitations set for potable water wells under Federal, State, or local municipal laws or regulations. Installation requirements for extraction wells shall be the same as those for potable water wells, with respect to those regulations designed to prevent aquifer contamination (grouting, etc.), or in conformance with IGSHPA standards, as determined by the Township Engineer.

  - Discharge of Water

    - Discharge of water from open loop systems into sanitary sewer systems shall be prohibited, except upon approval by the sanitary sewage system provider.

    - Discharge of water from open loop systems into storm sewers shall not be permitted.

    - Discharge of water from open loop systems into a watercourse shall require certification by a licensed professional engineer registered by the Commonwealth of Pennsylvania that the design of the watercourse is such that the watercourse can be expected to retain its capacity to meet the needs of the geothermal system over the lifetime of the system and of any other water discharges for which it is used.

    - Discharge of water from open loop systems into a watercourse, shall comply with all Federal, State, or local municipal laws or regulations.

    - Underground injection of water discharge from an open loop system shall be subject to the following conditions:

      - Returned water shall contain no treatment additives or other introduced chemicals.
      - The return well shall be located a minimum distance of two hundred (200) feet from wells on adjacent properties.
      - The return well shall be located a minimum distance of one hundred (100) feet from the on-site well.

        - The return well shall recharge the groundwater from which supply water is extracted.
        - Because such return wells are included as "Class V Underground Injection Wells," the applicant shall submit an "Inventory of injection Wells" form, available from the U.S. Environmental Protection Agency and shall comply with all Federal, State, or local municipal laws or regulations.

    - The use of open loop systems within identified well head protection areas is prohibited.

- Geothermal systems shall not encroach on public drainage, utility roadway or trail easements of any nature.

- **Height and Setback Restrictions:**

    - All horizontal closed loop systems shall be no more than twenty (20) feet deep.

    - Unless otherwise specified, geothermal system shall be located a minimum distance of twenty five feet (25) feet from any property line.

    - Above-ground equipment associated with geothermal pumps shall not be installed in the front yard of any lot or the side yard of a corner lot adjacent to a public right-of-way and shall meet all required setbacks for the applicable zoning district.

- Consider the following restrictions for open looped systems that rely on a water course or injection well

    - The use of an open loop system within an identified well head protection area is prohibited.

    - Open loop systems may utilize a watercourse to the extent permissible under Federal, State, or local municipal laws or regulations

    - All open loop systems which extract water from groundwater sources shall comply with extraction limitations set for potable water wells under Federal, State, or local municipal laws or regulations. Installation requirements for extraction wells shall be the same as those for potable water wells, with respect to those regulations designed to prevent aquifer contamination (grouting, etc.), or in conformance with IGSHPA standards as determined by the municipal engineer.

    - Discharge of water from open loop systems into sanitary sewer systems shall be prohibited, except upon approval by the sanitary sewer provider.

    - Discharge of water from open loop systems into storm sewers shall not be permitted.

- Discharge of water from open loop systems into a watercourse shall require certification by a licensed professional engineer registered by the Commonwealth of Pennsylvania that the design of the watercourse is such that the watercourse can be expected to retain its capacity to meet ht needs of the geothermal system over the lifetime of the system and of any other water discharges for which it is used.

- Discharge of water from open loop systems into a watercourse, shall comply with all Federal, State, or local municipal laws or regulations.

- Underground injection of water discharge form an open loop system shall be subject to the following conditions:

    - Returned water shall contain no treatment additives or other introduced chemicals.

    - The return well shall be located a minimum distance of two hundred (200) feet from wells on adjacent properties.

    - The return well shall be located a minimum distance of one hundred (100) feet from any on-site well.

    - The return well shall recharge the groundwater from which supply water is extracted.

    - Because such return wells are included as "Class V Underground Injection Wells," the applicant shall submit an "inventory of Injection Wells" form, available from the US Environmental Protection Agency and shall comply with all Federal, State, or local municipal laws or regulations.

      (These sections were derived from the Rapho Township, Lancaster County, PA Alternative Energy Ordinance)

- **Abandonment:** If the geothermal system remains nonfunctional or inoperative for a continuous period of one year, the system shall be deemed to be abandoned and shall constitute a public nuisance. The owner shall remove the abandoned system at their expense after a demolition permit has been obtained in accordance with the following:

- The heat pump and any external mechanical equipment shall be removed.

- Pipes or coils below the land surface shall be filled with grout to displace the heat transfer fluid. The heat transfer fluid shall be captured and disposed of in accordance with applicable regulations. The top of the pipe, coil or boring shall be uncovered and grouted.

- Lake geothermal systems shall be completely removed from the bottom of the body of water.

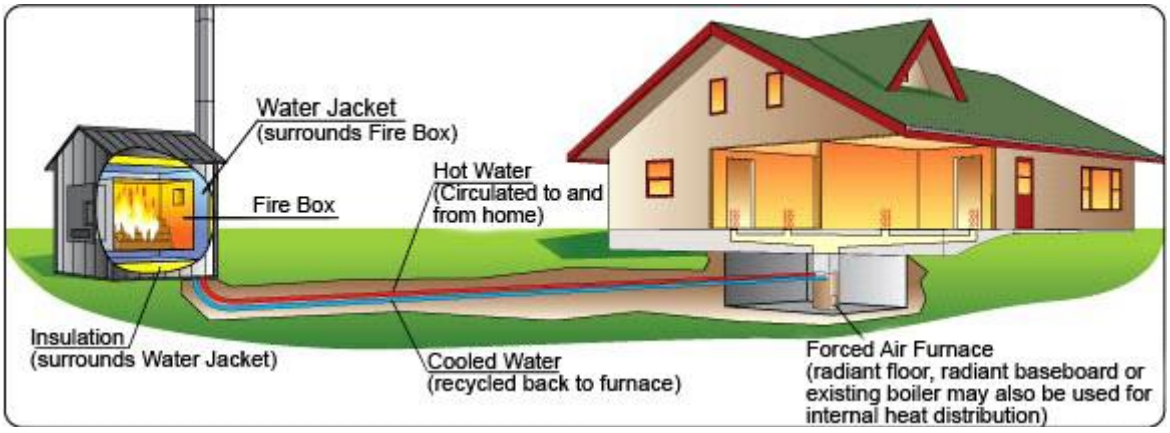
  (Section C was derived from the City of Woodbury, MN Alternative Energy Ordinance)

OUTDOOR WOOD-FIRED BOILERS (OWBs)

How They Work

The outdoor wood-fired boiler is a variant of the classic wood stove adapted for set-up outdoors while still transferring the heat to interior buildings. They resemble a small shed or mini-barn with a short smokestack on top. An outdoor wood boiler works by heating a water jacket that surrounds the firebox. That water then is used to transfer the heat to the existing heating system by a heat exchanger.

(References: *Pennsylvania Department of Environmental Protection Outdoor Wood-fired Boiler Fact Sheet***)**



Source: Hearth, Patio and Barbeque Association (from United States Environmental Protection Agency and New Hampshire website)

Environmental Impacts

Outdoor wood boilers are a topic of environmental controversy. An improperly used or built outdoor wood boiler can produce great amounts of wood smoke and waste material. Most also are known to be equipped with short stacks which can cause smoky conditions at or near ground level. Boilers installed within the Commonwealth of Pennsylvania must comply with PA DEP regulations for OWBs. The Northeast States for Coordinated Air Use Management has conducted stack tests on OWBs. Based on the test results, the average PM2.5 emissions from 1 OWB are equivalent to the emissions from 205 oil furnaces or as many as 8,000 natural gas furnaces. The U.S. Environmental Protection Agency does not have regulations specifically for outdoor wood-fired boilers. However, recently the EPA has worked with manufacturers to develop a method for manufacturers to identify outdoor wood-fired boilers that meet a voluntary emissions standard.

(References: *Pennsylvania Department of Environmental Protection Outdoor Wood-fired Boiler Fact Sheet***)**

Pennsylvania Regulations

On October 2, 2010, the Pennsylvania Department of Environmental Protection passed Title 25 PA. code chapters 121 AND 123, which sets State minimum criteria for new Phase 2 units as well as the basic criteria for cleaner fuel. Local municipalities can still enact ordinances that are stricter but would have to enforce their own ordinance. If a municipality does not have an ordinance that includes DEP regulatory requirements, it cannot enforce DEP regulation directly. The link for the new regulations is provided below:

http://www.pabulletin.com/secure/data/vol40/40-40/1876.html

Which zoning districts should allow OWBs?

The zoning districts that allow the construction of outdoor wood-fired boilers vary from each municipality. West Hempfield Township, Lancaster County, PA allows OWBs as an accessory use in all zoning districts. Mount Joy Township, Lancaster County, PA allows them as accessory uses within the Agricultural, Rural or Conservation Residential districts on lots that are three (3) acres are larger. Generally, the solution to this matter has depended on the municipality itself.

Pennsylvania DEP Model Ordinance

The following link is a model ordinance that was prepared on April 2010 by Pennsylvania DEP to assist local municipalities in enacting their own ordinance for outdoor wood-fired boilers. The link for new State regulations on outdoor wood-fired boilers is provided once again to compare to the model ordinance. The municipalities in Pennsylvania have generally followed this model ordinance when they prepare zoning laws for outdoor wood-fired boilers.

http://www.dep.state.pa.us/dep/DEPUTATE/AIRWASTE/AQ/openburn/docs/ModelBoilOrd.pdf

http://www.pabulletin.com/secure/data/vol40/40-40/1876.html

PRINCIPAL SOLAR ENERGY SYSTEMS

What Are Principal solar energy systems?

Principal solar energy systems or concentrated solar power (CSP) systems use lenses or mirrors to focus a large area of sunlight onto a small area. Electrical power is produced when the concentrated light is directed onto photovoltaic surfaces or used to heat a transfer fluid for a conventional power plant. Large solar energy production facilities consist of one or more free-standing ground, or roof mounted solar collector devices, solar related equipment and other accessory structures and buildings including light reflectors, concentrators, and heat exchangers, substations, electrical infrastructure, transmission lines and other appurtenant structures and facilities, which has a rated capacity of more ten (10) kilowatts (for electricity) or rated storage volume of the system of more than two hundred forty (240) gallons or that has a collector area of more than one thousand (1,000) square feet (for thermal). There are two types of large solar electric generating technologies: photovoltaic panels and solar thermal systems.

(References: ***U.S. Department of Energy: Energy Efficiency and Renewable Energy, Database for State Incentives for Renewables and Efficiency website*****)**

Photovoltaic Systems

Photovoltaic (PV) systems employ sunlight concentrated onto photovoltaic surfaces for the purpose of electrical power production. Solar concentrators of all varieties may be used, and these are often mounted on a solar tracker in order to keep the focal point upon the cell as the sun moves across the sky.

Illustration from U.S. Department of Energy

Solar Thermal Systems

Solar-thermal electric generation technology uses the sun's energy to power a steam turbine. Solar-thermal systems use lenses or mirrors and tracking systems to focus a large area of sunlight onto a small area. The concentrated light is then used as heat or as a heat source for a conventional power plant.

(References: ***U.S. Department of Energy: Energy Efficiency and Renewable Energy, Database for State Incentives for Renewables and Efficiency website*****)**

Illustration from U.S. Department of Energy

Illustration from U.S. Department of Energy

Power Tower Systems—includes links to R&D being done within other CSP areas, but that are relevant to heliostats, receivers, and overall systems issues for central-receiver solar plants.

Illustration from Exenewable website of Solar Farm in Puertollano, Spain

Pervious or impervious

With the recent trend to build solar energy plants, new land use questions concerning solar energy projects have been raised. One of the main questions local governments must deal with is: Do these ground-mounted solar panels constitute impervious coverage or not? This is an important question to consider if one of these large-scale projects is built on prime agricultural land or near a major water resource. Opinions on this issue vary. Professionals in the solar industry don't consider solar panels as a solid surface because of their slanted positions and the spacing between each panel, thereby they are not impervious. In April 2010, the State of New Jersey passed a law that exempts solar panels from the calculation of impervious cover under a number of state laws. Mount Joy and RaphoTownships, Lancaster County, PA consider solar panels as impervious cover. Currently, we are not aware of any studies proving either side.

Model Language

The following example is a summary of model zoning language from the model ordinance for energy projects written by the Oregon Department of Energy:

Use: A Solar Energy Production Facility shall be considered a permitted use in the industrial and commercial zones, and a special exception use in the agricultural district.

Acreage: The proposed solar energy project would occupy less than [ ] acres on land zoned for commercial or industrial use or for agricultural zoning districts less than [ ] acres on land zoned for agricultural use.

Height and Setback: For purposes of determining compliance with lot coverage standards of the underlying zone, the total surface area of all ground-mounted and freestanding solar collectors including

solar photovoltaic cells, panels, arrays, and solar hot air or water collector devices shall be considered impervious. Panels mounted on the roof of any building shall be subject to the maximum height regulations specified within each the underlying zone.

Design and Installation:

- All on-site utility and transmission lines shall, to the extent feasible, be placed underground.
- All large solar energy production facilities shall be designed and located in order to prevent reflective glare toward any inhabited buildings on adjacent properties as well as adjacent street rights-of-way.
- A clearly visible warning sign concerning voltage must be placed at the base of all pad-mounted transformers and substations.
- The proposed solar energy project is not located adjacent to, or within, the control zone of any airport.
- Whenever practical, all principal solar energy systems should be attached to a building; or if ground mounted and/or freestanding, the applicant shall demonstrate by credible evidence that 1) the area proposed for the principal solar energy system does not predominantly consist of Class I, II and/or III soils, as identified in the soil survey, and is generally unsuitable for agricultural purposes: and 2)such facilities cannot feasibly be attached to a building due to structural limitations of the building.
- All mechanical equipment of principal solar energy systems including any structure for batteries or storage cells, shall be completely enclosed by a minimum eight (8) foot high fence with a self-locking gate, and provided with screening in accordance with the landscaping provisions of the municipal subdivision and land development ordinance.

Use of Public Roads: The applicant has secured, or can secure, all necessary approvals from the local government or the State Highway Division of access points for project roads and parking areas at the project site.

Liability Insurance: There shall be maintained a current general liability policy covering bodily injury and property damage with limits of at least $1 million per occurrence and $1 million in the aggregate.

Decommissioning: The applicant agrees to the following as conditions of the land use permit:

- If the applicant ceases operation of the energy project or begins, but does not complete, construction of the project, the applicant shall restore the site according to a plan approved by the planning authority.
- The Large Solar Energy Production Facility owner is required to notify the [*municipality*] immediately upon cessation or abandonment of the operation. The owner shall be responsible for the removal of the facility within six (6) months from the date the applicant ceases use of the facility or the facility becomes obsolete. The owner shall then have twelve (12) months in which to dismantle and remove the Large Solar Energy Production Facility from the property. At the time of issuance of the permit for the construction of the Large Solar Energy Production Facility, the owner shall provide financial security in form and amount acceptable to the [*municipality*] to secure the expense of dismantling and removing said structures.

PRINCIPAL WIND ENERGY SYSTEMS

What Are Principal wind energy systems?

A principal wind energy facility is a group of wind turbines in the same location used for production of electric power. It may consist of a few dozen to several hundred individual wind turbines, and cover an extended area of hundreds of square miles, but the land between the turbines may be used for agricultural or other purposes.
(References: American Wind Energy Association)

Types of Wind Turbines

Industrial wind turbines fall into two general classes depending on how they spin: horizontal axis and vertical axis, also known as "eggbeater" turbines. Vertical axis machines, which spin about an axis perpendicular to the ground, have advantages in efficiency and serviceability since all of the control equipment is at ground level. The main drawback to this configuration, however, is that the blades cannot be easily elevated high into the air where the best winds blow.
As a result, horizontal axis machines — which spin about an axis parallel to the ground rather than perpendicular to it — have come to dominate today's markets.
(References: American Wind Energy Association)

Wind Policy Issues

Social Issues

Some landowners object to the visual impact that wind turbines create, especially near shore, mountainous, forested, protected, or other valuable areas. All wind turbines produce mechanical and aerodynamic noise. Noise is thus a siting criterion for regulatory purposes. There is also the social issue of shadow flicker (Visible shadows on the ground or on structures cast by low sunlight passing through the moving rotor of a turbine). Principal wind energy systems should be sited to prevent shadow flicker on any occupied building on adjacent properties.

FAA issues

Wind turbines can interfere with civilian and military radar at some locations. The potential interference occurs when wind turbines reflect radar waves and cause ghosting (false readings) or shadowing (dead zones) on receiving monitors. The FAA has oversight over any object that could have an impact on communications in navigable airspace, either commercial or military. The FAA requires that a Notice of Proposed Construction or Alteration be filed for any project that would extend more than 200 feet above ground level.

Environmental Impacts

The main environmental objection to wind power is concern about bird and bat collisions with wind turbines. The most common - and most exaggerated - misconception about both large and small turbines is that they are disproportionately harmful to bird and bat populations. Some dismiss the number of birds killed by wind turbines as negligible when compared to the number that die as a result of other human activities. The National Academy of Sciences provided a study that showed that utility-scale wind farms that are grouped closely in large arrays account for less than 0.003% of all human-caused bird deaths.
(References: American Wind Energy Association)

Transmission Constraints

Transmission constraints are considered to be one of the biggest challenges facing the U.S. wind industry. The electricity grid in the United States is aging and overloaded in some regions, and new investment is required to ensure reliable, efficient transmission of electricity. Siting new transmission lines is an expensive, time consuming, and often, controversial endeavor. Wind plant developers seek access to transmission capacity that allows them to send their electricity to market without having to build new lines, especially ones they need to pay for themselves.
(References: American Wind Energy Association)

Local Roads

The tall towers and blades up to 45 meters long are difficult to transport. Transportation can now amount to 20% of equipment costs for wind farm owners. Access roads must be designed for the extreme loads and turning requirements of the transporter trucks delivering materials and equipment to the site. Many local governments face issues with how to deal with the repair and maintenance of damaged roads that are caused by multiple truck trips made for these wind farm projects. It is suggested in the Pennsylvania Model Ordinance for Wind Energy Facilities that road damage caused by the applicant and his/her contractor should be repaired promptly at the applicant's expense.
(References: American Wind Energy Association. http://pressrepublican.com/0100_news/x155200391/Wind-farms-trucks-contributing-to-road-problems)

Illustration from wikipedia.org

Zoning

The ordinances used for this guide are very similar in the regulations of large wind facilities. Wind farms are generally restricted to agricultural, rural, industrial, and light industrial districts. How they are permitted vary from each municipality.

PA Model Ordinance for Wind Energy Facilities

The following link is a model ordinance that was created by a work group of the Governor's Office, DEP, DCNR, PA State Association of Township Supervisors, County Commissioners Association, Wind Energy Associations and Penn Future with the assistance of DCED:

Model Ordinance for Wind Energy Facilities in PA

REGIONAL ANAEROBIC DIGESTERS

What Are Regional Digesters?

Regional anaerobic digesters accept livestock and poultry manure (primary catalyst), generated off-site or from more than one (1) farm. Regional anaerobic digesters may include "co-digestion" in which the livestock and poultry manure (primary catalyst) may be mixed with other organic materials (secondary catalysts).

Here is an example of ordinance language from Leacock Township, Lancaster County, PA for regional anaerobic digesters:

> **REGIONAL ANAEROBIC DIGESTERS-** Regional anaerobic digester systems are permitted by conditional use in the Agricultural District, Subject to the following:
>
> - Minimum lot area – ( ) acres.
> - A traffic impact study analysis shall be provided, showing the following:
>   - Existing traffic volume data for all roadways within one-thousand ( ) feet, which provide access to the site;
>   - Anticipated traffic volumes for the area identified in subsection 1) above, resulting from the proposed use as well as background traffic growth;
>   - Analysis of current and future levels of service for all intersections identified in subsection I) above;
>   - Physical analysis of all roadways identified in subsection 1) above, including cartway width, shoulder width, pavement condition, horizontal and vertical curves, anticipated storm water drainage characteristics, and sight distances;
>   - The traffic analysis shall be reviewed by the Township Engineer.
>   - The applicant shall submit a transportation study, detailing the effect of the anaerobic digester system on local roadways, including effect of vehicle weight, congestion, and noise.
>   - All uses shall provide sufficiently-long stacking lanes into the facility, so that vehicles waiting to be loaded/unloaded will not back-up onto public roads,
> - All regional anaerobic digester systems also shall comply with the requirements of

Section _____.

- The Board of Supervisors can attach conditions which it feels are necessary to protect nearby properties, the intent of the Zoning Ordinance and/or the general public welfare

- **Applicability:** The applicant shall provide a detailed description of the proposed use in each of the following topics and a complete land development application shall be submitted to the [*municipality*] once the special exception application has been approved.

    - The nature of the on-site activities and operations, the types of materials stored and used, the frequency and duration period of storage of materials and the methods for use and disposal of materials. In addition the applicant shall furnish evidence that the use, handling, and disposal of materials will be accomplished in a manner that complies with State and Federal regulation.

    - The general scale of operation in terms of its market area, specific space and area requirements for each activity, the total number of employees of each shift, and an overall needed site size.

- **Design and Installation:**

    - The applicant shall address and document performance standards for citing to minimize impacts on neighboring properties which shall include considerations of odor, prevailing wind patterns, proximity to non-agricultural properties, operational noise, and specific hours of operation.

    - Anaerobic digester systems shall be designed and constructed in compliance with the guidelines outlined in the publication Manure Management for Environmental Protection, Bureau of Water Quality Management Publication, and any revisions, supplements and successors thereto, of the Pennsylvania Department of Environmental Protection.

    - Anaerobic digester systems shall be designed and constructed in compliance with applicable local, State and Federal codes and regulations. Evidence of all Federal and State regulatory agencies' approvals shall be included with the application.

    - A certified professional, qualified to do such, shall furnish and explain all details of construction, operation, maintenance and necessary controls related to the anaerobic digester system.

    - The applicant shall provide either (1) a letter from the Lancaster County Conservation District stating that the applicant's anaerobic digester

system design has been reviewed and approved by the Lancaster County Conservation District and that all regulations and requirements of the State manure management program have been satisfied, or (2) submit a letter from the Lancaster County Conservation District stating that it mil not review the plan or that no review is required under applicable ordinances, or (3) submit evidence that such a letter has been requested and the Lancaster County Conservation District has failed to respond.

- **Height and Setback requirements:** Except as otherwise provided for under the provisions of the Pennsylvania Nutrient Management Act, no underground storage, in ground storage, trench silo, earthen bank, stacking area or above ground storage facility related to the anaerobic digester system shall be located within two hundred (200) feet of from any property line. Additionally, no building, structures, or facility shall be located nearer than three hundred (300) feet to an existing residential building unless the owner of such residence waives this restriction in writing to the [*municipality*].

- **Decommissioning**

  The applicant shall submit a plan for the removal of the manure digestion facility when it becomes functionally obsolete or is no longer in use. The regional anaerobic digester owner is required to notify the [*municipality*] immediately upon cessation or abandonment of the operation. The owner shall be responsible for the removal of the facility within six (6) months from the date the applicant ceases use of the facility or the facility becomes obsolete. At the time of issuance of the permit for the construction of the regional anaerobic digester facility, the owner shall provide financial security in form and amount acceptable to the [*municipality*] to secure the expense of dismantling and removing said structures.

REFERENCES

Alternative- Heating Info website
http://www.alternative-heating-info.com/

American Wind Energy Association Website*:*
http://www.awea.org/

Anaerobic-Digestion: *The AD Community: Independent Website*
http://www.anaerobic-digestion.com/html/wastewater_sludge_hydrolysis_w.php

City of Woodbury, MN Alternative Energy Systems Ordinance

Database for State Incentives for Renewables and Efficiency website
http://www.dsireusa.org/solar/

Exenewable Website
http://www.exenewable.com/

Leacock Township Ordinance for Methane Digesters

Manheim Township Solar Energy Ordinance

Manheim Township Wind Energy Ordinance

Mount Joy Twp Lancaster Co Alternative Energy Use Zoning Ordinance

Pennsylvania Department of Environmental Protection Model Ordinance for Outdoor Wood-Fired Boilers

Pennsylvania Department of Environmental Protection Open Burning Home Page
http://www.dep.state.pa.us/dep/deputate/airwaste/aq/openburn/openburn.htm

Pennsylvania Department of Environmental Protection Outdoor Wood-fired Boiler Fact Sheet

Pennsylvania Model Ordinance for Wind Energy Facilities

Pennsylvania Municipalities Planning Code*: Sections 105, 301.4.1, 503.2i, 503.6, 603a, 603c.5, 604.1, 605.2.vii, and 707.4.viii.*

Pennsylvania Solar Municipal Guide

Rapho Township Alternative Energy Ordinance

U.S. Department of Energy: Energy Efficiency and Renewable Energy
http://www.eere.energy.gov/