RENEWABLE ENERGY INTEGRATION FOR SUSTAINABLE COMMUNITIES

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Renewable energy installation has seen a significant increase, especially with a movement from small-scale individual-owned projects to utility-scale projects that feed into the main transmission grid. Renewable energy, such as wind, solar and biomass, is installed for many reasons, including:

- Diversify the type of electricity in both urban and rural communities
- Reduce individual reliance on an electric utility providing electricity
- Provide electricity where connection to the grid is difficult or expensive
- Improve economic sustainability of a community
- Meet consumer preference to reduce environmental impacts from energy production
- Enhance grid reliability by providing energy in areas where increases are needed
- Reduced cost of technology, making it more competitive with other sources of electricity

DISTRIBUTED ENERGY GENERATION

Electrical generation, distribution and/or storage can be provided on a small scale by a variety of small-grid connected systems (wind, solar, methane turbines) to serve individual needs or on the local community level. These projects are defined by nameplate capacity of not more than one megawatt (MW) or less than the customer's average annual electricity consumption (in Indiana). This includes individual solar units and small wind or biogas generation facilities, to name a few, that are located on a customer's property and owned by a customer. To be grid-connected, an agreement with the utility company is needed to ensure electricity can be sent back out to the electrical distribution system so that ample safety oversight is in place as well as compensation to the system owner for supplying electricity to the grid. The future of distributed generation could include micro-grids, which are self-sustaining, or even battery storage for using those electrons at a future time. Before an investment is made, the consideration stage of a project should include careful calculations of return on investment, policy changes with the utility and early communication with the utility company.

COMMUNITY RENEWABLE ENERGY PROJECTS

There are examples of renewable energy projects where ownership can be shared among community members and/or a combination of a utility or businesses within a community. These projects can help overcome barriers, lock in price certainty and provide resiliency to power grids that might be susceptible to electricity loss due to long-distance transmission issues. There have been several projects involving wind and solar where a community cooperatively invests to meet their energy needs and initiates sustainability investments within community businesses. An organization named Windustry has created a set of tools for community wind projects that can be accessed at http://www.windustry.org/community_wind. The solar industry has also seen considerable growth of community solar installations across the country. Indiana's Tipmont REMC community solar project is an example of a utility-initiated solar project that allows member-owners of the cooperative to "subscribe" to a panel and receive credits for their share of energy production. You can learn more about the Tipmont project model at www.tipmont.org/solar.

For additional tools on implementing community solar projects, we suggest referring to the following resources:

- Community Solar Hub: www.communitysolarhub.com
- Ohio-Kentucky-Indiana (OKI) Regional Council of Governments guidelines, methods and best practices for integrating solar: www.oki.org/portfolio-items/solar-ready/

UTILITY SCALE ENERGY GENERATION

If a renewable energy project generates more than 1 megawatt (MW) of nameplate capacity and more than the annual average electricity consumption, the project will need a Power Purchase Agreement (PPA) to enter into a contractual supply to a utility company. Large-scale wind and solar projects require approval by local government ordinances and zoning (in counties with local zoning). These projects require large investments and often are located on leased land, where resource availability is ample and where access to large-scale interconnection to the grid is available to reach large-scale markets.

PREPARING FOR RENEWABLE ENERGY PROJECTS IN YOUR COMMUNITY

When integrating renewable energy, there are approaches to be considered for both the distributed and utility scale investments in the community. It is helpful to begin by contacting counties that have already adopted energy-specific ordinances when you being the ordinance development or revision process. It will help you understand how the process (which is often controversial) needs to be managed as well as the conditions that need to be addressed in an ordinance. Given the highly technical and evolving nature of renewable energy production, it is advisable to reach out to renewable energy project developers, installers and utilities for current information.

It is always good for counties to be proactive in having a renewable energy ordinance in place before developers approach them to propose projects. This alleviates many of the concerns that arise from ordinances being debated as specific projects are also discussed. It shows whether a community is prepared and willing to accept renewable energy and at what scale.

Keep in mind that time is required to move through the ordinance development process and prepare for construction. Benton County, the first county in Indiana to investigate and adopt a wind energy development plan, began the ordinance process in 2004, but wind farm development in the county did not begin until July of 2007.

WIND ENERGY ORDINANCE DEVELOPMENT

The development of wind energy in Indiana counties offers an opportunity to diversify economic development in rural areas where wind resources exist. Developers have approached landowners with ample wind resource capacity in many areas of Indiana with the hopes of leasing their properties for utility-scale wind production. Landowners and developers alike seek out local ordinances for the implementation of wind energy, approved by a local governing body (typically a planning board, board of commissioners or other local government entity). Counties equipped with wind energy ordinances and permitting processes offer a proactive approach to development for their residents. A library of ordinances can be found at the Purdue Extension Renewable Energy, https://ag.purdue.edu/extension/renewable-energy/Pages/Wind-Energy-Ordinance-Library.aspx.

A wind energy ordinance will address most of, but is not limited to, the following topics relating to wind energy development within a local community: economic benefits, application for a permit, design and installation

guidelines, setback guidelines (or distance from designated property), use of public roads, operations, liability insurance and decommissioning of wind-energy equipment (Constanti & Beltron, 2006). Several of the wind energy ordinances currently in Indiana counties also account for the installation of small-scale wind turbines for residential use, businesses and other institutions, such as schools.

The wind energy development process for local government and landowners to consider follows the seven "Ps," which are:

- **Potential:** Investigating what the wind resource is within the county and learning the basics of wind energy development
- **Promotion:** Allowing access and active promotion of the county's wind energy resource potential to local constituents and wind energy developers
- **Public outreach:** Providing educational information to the general public about wind energy and its potential benefits and impacts
- **Planning:** Creating an effective and comprehensive plan to facilitate the development of wind energy in the county
- **Permitting:** Creating and implementing effective permitting, zoning and siting processes for new wind energy developments within the county
- **Project construction**
- **Project operations and maintenance (O&M):** Keeping things going once the development has been constructed and the wind company oversees the wind farm

Source: Constanti & Beltron, 2006

CONSIDERATIONS FOR A WIND ENERGY ORDINANCE

There are several components to a comprehensive county wind energy ordinance. They often include, but are not limited to:

- A required distance for setbacks or distance of the wind towers from buildings or residential property. This will depend upon the scale and the speed of the wind turbines within a proposed development.
- A method for determining compensation to land owners and farmers due to crop or property damage resulting from transportation and/or construction. Transportation of large equipment and turbine components during construction may require the development company to include road expansions and repairs to roads, bridges and culverts damaged by the construction phase.
- A requirement that developers maintain adequate drainage in farm fields or other land affected by construction due to damage or interference with drainage infrastructure.
- A contractual arrangement describing how payments will be allocated to landowners from wind energy developers for use of the land for wind energy development.
- An evaluation and understanding of current infrastructure and construction needs before the development process begins.
- Noise standards for utility-scale wind turbines to properly integrate turbines with residential property.
- Decommissioning arrangements for the structures that will come into play once the wind turbines are no longer usable.
- Security and safety inspection measures to protect the area surrounding turbines and other infrastructure involving transmission, etc. to protect landowners and others using the property.
- Indemnification provisions should also be considered for individuals and businesses. These provisions should define which party agrees to pay for liabilities associated with the project.

The U.S. Department of Energy's National Renewable Energy Laboratory has created a resource guidebook titled Wind Energy Guide for County Commissioners, which can be accessed online at https://www.nrel.gov/docs/fy07osti/40403.pdf. It is a comprehensive resource for county planning commissions and other agencies to utilize while developing a local ordinance for wind energy development.

SOLAR ENERGY

Solar-generated electricity has become more affordable recently due to the reliability and efficiency of power production from advanced low-cost photovoltaic cells. There are two general types of solar energy collection methods. Photovoltaics, or PV systems, consist of cells connected in an array to create electricity for utility companies, or in distributed generation scenarios that involve individual homes, farms and businesses. The second type of solar system uses a concave solar collector to concentrate solar energy for heat generation as steam, which is used to run a turbine for electricity generation.

SOLAR ENERGY ORDINANCES

While wind energy production and ordinance development is becoming a mature process in Indiana, relatively few counties have ordinances in place to specifically address solar energy production. In some cases, counties are relying upon their utility siting requirements. However, they often fail to include considerations that are applicable to a several hundred or two-thousand acre solar farm. In those cases, the lack of specificity can create an additional set of challenges in seeking approval to site a solar farm. Because few counties in the Midwest have addressed the issue of solar siting, there are few examples to point to for direction, leading counties to start a process largely from scratch. However, this provides the opportunity to receive lots of input and technical information to develop an ordinance that specifically meets the needs of the local community.

CONSIDERATIONS FOR SOLAR ENERGY ORDINANCES

While there are few solar energy specific ordinances, an obvious list of considerations that need to be addressed has appeared. The ordinance may address these as well as other provisions:

- Site plans to identify location of the panels, electric and communication lines and site characteristics
- Setback requirements from property lines and structures
- Visibility from neighboring property
- Ground cover and buffers
- Decommissioning plans in the event the solar farm is no longer used for energy production
- Indemnification provisions
- Evaluation of infrastructure requirements (especially for sites that propose to generate electricity as they will need an appropriate connection to the grid for that purpose)

ANAEROBIC DIGESTION FOR ENERGY AND WASTE MANAGEMENT

Anaerobic digestion (AD) of livestock manure and other organic products is an alternative pathway for managing large organic waste loads. Livestock manure from confined feeding operations can be a source of energy production that not only provides an alternative energy source for on-farm use but can also mitigate the odor from livestock farms and create a byproduct that is easier to transport and land apply as a nutrient for crop production.

Biogas generated from manure can be used directly in a gas-fired combustion engine or a microturbine to create electricity. Some Indiana farms are using the cleaned and compressed biogas to power compressed natural gas (CNG) fuel vehicle fleets, such as those found at Fair Oaks Farms in Northwest Indiana. Additional energy in the form of waste heat from turbine operations can be used to provide heat or hot water for on-farm use, as well as maintain the temperature of a digester during a cold winter. When planned correctly, AD can result in revenue from energy sales or savings in on-farm energy generation. Even though AD is not a new technology, its practice on Indiana farms requires careful planning and implementation in order to reap its benefits.

BIOMASS DIGESTER REGULATION IN INDIANA

Digesters might only use biomass (such as agricultural crops or manure), or they might combine biomass with other appropriate feedstocks (such as food waste and cooking oil). These two types of digester facilities are regulated by the state through the confined feeding program (327 IAC 19) when the facility is at the site of a confined feeding operation (CFO) or by the Biomass Registration program (329 IAC 11.5) when the facility is not at the site of a CFO. A third category of digester, one that can commingle biomass, appropriate feedstock and solid waste, must obtain a solid waste processing permit (329 IAC 11.5).

In addition to these permits/registrations, some digesters burn digester gas releases. In these situations, state air permits may also be required.

CONSIDERATIONS FOR BIOMASS DIGESTER ORDINANCES

Digesters on the site of a confined feeding operation are part of that operation's manure handling/storage system. Local zoning requirements already in place for confined feeding operations may be adequate for these facilities. Special consideration should be made for zoning requirements when the energy production system is not part of a livestock production area, while also keeping in mind that the state, as discussed above, already regulates many of the environmental aspects of these facilities. Factors that might be addressed in an ordinance include:

- Setback requirements from property lines and structures
- Decommissioning arrangements
- Appropriate planning for truck traffic in and out of the facility
- Indemnification
- County drainage considerations (Lefeld, 2008)

BENEFITS OF ANAEROBIC DIGESTION

In a study commissioned by the Great Lakes Regional Biomass Energy Program, the following benefits were documented for dairy operations (Kramer, 2004):

- Revenue from annual electricity sales or cost offsets generated $32–$78 per head.*
- Annual bedding costs were reduced by using digested manure instead of other bedding materials.
- After digestion, manure has improved nutrient availability, reduced acidity and reduced odor. By avoiding fertilizer purchases, producers saved $41–$60 per head (from dairy cattle).
- Odor control is a key factor in being a good neighbor. It increased quality of life on and off the farm, helped producers avoid complaints and lawsuits, allowed continuation of the operation or the ability to site new facilities and increased operational flexibility.
- Anaerobic digestion reduced pathogens associated with manure discharges (Mosier, 1998).

* Resale of electricity depends on state and utility policies.

More resources about anaerobic digestion projects can be found online https://ag.purdue.edu/extension/renewable-energy/Pages/Bioenergy.aspx.

For more information on the adoption of renewable energy for both distributed and utility-scale energy projects, visit www.extension.purdue.edu/renewable-energy.

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