TOOLS TO PROMOTE AND REGULATE THE DEPLOYMENT OF RENEWABLE ENERGY SYSTEMS

June 2017

Recommendations for Municipalities in Tompkins County

The deployment of renewable energy systems can have considerable land use implications. The Tompkins County Department of Planning and Sustainability has prepared this report to help assist municipalities as they work to prepare and to update their land use regulation of solar and wind energy systems.

Tools to Promote and Regulate the Deployment of Renewable Energy Systems

Recommendations for Municipalities in Tompkins County

TABLE OF CONTENTS

SUMMARY

Recommendations for Solar Energy Systems

Roof-Mounted and Building-Integrated

Accessory Ground-Mounted

Large-Scale

Recommendations for Wind Energy Systems

Small-Scale

Medium-Scale

Large-Scale

INTRODUCTION 1

THE ROLE OF TOMPKINS COUNTY 2

SOLAR ENERGY SYSTEMS

Definitions 5

Notes: Roof-Mounted and Building-Integrated Solar Energy Systems ... 7

Notes: Accessory Ground-Mounted Solar Energy Systems 7

Notes: Large-Scale Solar Energy Systems 8

WIND ENERGY SYSTEMS

Definitions 11

Notes: Small-Scale Wind Energy Systems 14

Notes: Medium-Scale Wind Energy Systems 14

Notes: Large-Scale Wind Energy Systems 15

More on Noise 19

APPENDIX A: REFERENCE MATERIAL 23

APPENDIX B: PUBLIC COMMENTS AND RESPONSES ... 27

Recommendations for Municipal Tools to Promote and Regulate the Deployment of Solar Energy Systems

Roof-Mounted and Building-Integrated Solar Energy Systems

Appropriate Locations. Roof-Mounted and Building-Integrated Solar Energy Systems should be permitted as-of-right on all other permitted buildings and structures throughout the community.

Height. Roof-Mounted and Building-Integrated Solar Energy Systems should be required to meet the same height restrictions as any other building or structure. In other words, if located on a principal building they should meet the height requirements of a principal building; if located on an accessory building, they should meet the height requirements of an accessory building.

***Historic Districts*. Municipalities with historic districts should establish specific guidelines and standards for building owners that wish to install solar energy systems. To the extent possible, the requirements should not involve any additional review beyond that required of any other alteration to an existing historic building.

Accessory Ground-Mounted Solar Energy Systems

Appropriate Locations. Accessory Ground-Mounted Solar Energy Systems should be permitted as-of-right accessory uses throughout the community.

Height. Accessory Ground-Mounted Solar Energy Systems should be required to meet the same height restrictions as any other accessory building or structure.

***Location on a Property*. (a) Accessory Ground-Mounted Solar Energy Systems should be required to meet the same setback requirements as any other accessory building or structure.

(b) In residential zoning districts, Accessory Ground-Mounted Solar Energy Systems should be located in side or rear yards, to the extent practical.

Large-Scale Solar Energy Systems

Appropriate Locations. (a) Communities should conduct a thorough review of all their zoning districts to determine in which Large-Scale Solar Energy Systems would be appropriate. As a general rule of thumb, Industrial Zoning Districts and Agricultural Zoning Districts would be appropriate, as would some Rural and Low-Density Residential Zoning Districts and some Commercial Zoning Districts. Other Zoning Districts may also be suited for such energy systems.

(b) Where the municipality's comprehensive plan does not address renewable energy systems, add language indicating the critical nature of these systems to our energy future and identify the types of areas where they are appropriate.

Height. Large-Scale Solar Energy Systems should be required to meet the same height restrictions as an accessory building or structure.

**See the notes section of this report for additional information about this recommendation.

Recommendations: Solar Energy Systems, cont.

Location on a Property. Large-Scale Solar Energy Systems should be required to meet the same setbacks as any other principal building, but not be required to have more than 30 foot rear or side setbacks.

Approval Process. Large-Scale Solar Energy Systems should be permitted either with a special use permit or with a site plan review and a public hearing on proposals should be required.

***Decommissioning*. There is no specific recommendation concerning decommissioning. Refer to the NYSERDA Decommissioning Fact Sheet for guidance.

***Glare from Systems*. When located where glare may be an issue for specific uses, communities should require the preparation of a glare analysis for proposed Large-Scale Solar Energy Systems.

***Stormwater Management.* Unless located over an existing parking lot or other already-paved area, a vegetative cover should be established and maintained underneath solar panels in Large-Scale Solar Energy Systems. Management of that vegetative cover should be reviewed as part of the local municipal review of the project. Natural hydrology should be maintained to the maximum extent practical and stormwater management plans required only when already required by a municipality's stormwater management law or where hydrology is being significantly modified.

Screening. Screening of Large-Scale Solar Energy Systems should only be required to address site-specific conditions identified during local municipal review.

***Agricultural Resources.* Large-Scale Solar Energy Systems should avoid large extents (10 acres or more) of actively-farmed prime agricultural soils. Land underneath solar panels within agricultural areas should be maintained as vegetative cover. For any proposed disturbance of ten acres or more of prime agricultural soils, communities should consider the value of requiring a soil reclamation plan and related financial guarantee of plan implementation.

***Natural Resources.* (a) Large-Scale Solar Energy Systems should avoid Critical Environmental Areas, Unique Natural Areas, slopes in excess of 15%, clearing extensive areas of forest, and previously-identified distinctive viewsheds. Any systems located in these areas should be required to take appropriate mitigation measures.

(b) NYS DEC regulated wetlands should be avoided. Development in federally-identified wetlands should be avoided, but could be considered where wetland hydrological function can be maintained and no endangered or threatened species would be impacted.

(c) Habitat loss, habitat fragmentation, and wildlife corridors should be reviewed for potential impacts on a case-by-case basis.

***Water Quality.* Large-Scale Solar Energy Systems should be prohibited within 100-foot buffers of perennial streams and 50-foot buffers of intermittent streams.

Flood Hazard Areas. Large-Scale Solar Energy Systems, including any related fill, should be prohibited within 100-year floodplains. Any incidental and unavoidable development within the floodplain should be required to assess changes to flood levels, runoff quantity, and velocity resulting from any structure, facility, or fill within a floodplain. No structure, facility, or fill of any kind should be permitted within a floodway.

**See the notes section of this report for additional information about this recommendation.

Recommendations for Municipal Tools to Promote and Regulate the Deployment of Wind Energy Systems

Small-Scale Wind Energy Systems

Appropriate Locations. Small-Scale Wind Energy Systems consisting of a single turbine should be a permitted as-of-right accessory use throughout the community.

***Setbacks*. Setbacks for Small-Scale Wind Energy Systems from lot lines should be the total height of the installation plus 10 feet, unless the affected adjoining property owner agrees otherwise in writing. This setback should be measured from the center of the tower.

Location on a Property. In residential zoning districts, Small-Scale Wind Energy Systems should be located in the side or rear yards, to the extent practical.

Height. Small-Scale Wind Energy Systems should be allowed to exceed otherwise-established maximum height requirements.

Medium-Scale Wind Energy Systems

Appropriate Locations. Communities should conduct a thorough review of all their zoning districts to determine in which Medium-Scale Wind Energy Systems would be appropriate. As a general rule of thumb, Industrial Zoning Districts and Agricultural Zoning Districts would be appropriate, as would some Rural Zoning Districts and some Commercial Zoning Districts. Other Zoning Districts may also be suited for such energy systems.

(b) Where the municipality's comprehensive plan does not address renewable energy systems, add language indicating the critical nature of these systems to our energy future and identify the types of areas where they are appropriate.

Approval Process. Medium-Scale Wind Energy Systems should be permitted through a site plan review process in order to ensure that proposed installations comply with the standards established by the community.

***Setbacks.* (a) Setbacks for Medium-Scale Wind Energy Systems from lot lines should be 1.5 times the total height of the installation.

(b) Setbacks from neighboring residences, schools, churches, and libraries should be 2 times the total height of the installation, unless the affected adjoining property owner agrees otherwise in writing.

Height. Medium-Scale Wind Energy Systems should be allowed to exceed otherwise-established maximum height requirements.

***Natural Resources*. Medium-Scale Wind Energy Systems should avoid Critical Environmental Areas, Unique Natural Areas, slopes in excess of 15%, and clearing extensive areas of forest. Any systems located in these areas should be required to take appropriate mitigation measures.

***Scenic Resources*. Medium-Scale Wind Energy Systems located in previously-identified distinctive or noteworthy viewsheds should be required to prepare a visual impact analysis.

**See the notes section of this report for additional information about this recommendation.

Recommendations: Wind Energy Systems, cont.

Large-Scale Wind Energy Systems

Approval Process. Large-Scale Wind Energy Systems should be permitted either with a special use permit or with a site plan review and a public hearing on proposals should be required.

***Setbacks.* (a) Setbacks for Large-Scale Wind Energy Systems from lot lines should be 1.5 times the total height of the installation.

(b) Setbacks from neighboring residences, schools, churches, and libraries should be 2 times the total height of the installation, unless the affected adjoining property owner agrees otherwise in writing.

Height. Large-Scale Wind Energy Systems should be allowed to exceed otherwise-established maximum height requirements.

***Decommissioning*. There is no specific recommendation concerning decommissioning. Refer to the NYSERDA Decommissioning Fact Sheet for guidance.

***Stormwater Management.* When stormwater management plans are required by the community under existing stormwater management ordinances, the impacts of towers, roads, utility lines, and all appurtenant facilities should be considered.

***Agricultural Resources.* Proposals for Large-Scale Wind Energy Systems should be reviewed for potential impacts on agricultural operations.

***Natural Resources.* Large-Scale Wind Energy Systems should avoid Critical Environmental Areas, Unique Natural Areas, slopes in excess of 15%, and clearing extensive areas of forest. Any systems located in these areas should be required to take appropriate mitigation measures.

***Water Quality*. (a) Large-Scale Wind Energy Systems should be prohibited within 100-foot buffers of perennial streams and 50-foot buffers of intermittent streams.

(b) Large-Scale Wind Energy Systems should be prohibited in wetlands.

***Scenic Resources.* Large-Scale Wind Energy Systems located in previously-identified distinctive or noteworthy viewsheds should be required to prepare a visual impact analysis.

***Wildlife.* Habitat loss, habitat fragmentation, and impacts on migratory routes and Important Bird Areas should be assessed on a case-by-case basis when proposals are reviewed by municipal officials.

***Birds and Bats.* Large-Scale Wind Energy Systems should be the subject of bird and bat studies performed in accordance with NYSDEC guidelines.

***Shadow Flicker.* Communities should require a preliminary (and, if indicated, a more comprehensive) shadow flicker analysis for all proposed Large-Scale Wind Energy Systems. If shadow flicker will occur for more than 30 hours per year on any one nearby residence or facility, mitigation steps should be required.

***Ice Throw.* No additional recommendations are provided for ice throw as the recommended setbacks are designed, in part, to minimize the impact of ice throw.

***Noise and Vibration.* Communities should <u>either</u> (a) establish the following noise standards to be measured at neighboring residences, schools, churches, and libraries:

- a design goal of 40 dBA;
- a long-term average sound limit of 45 dBA; and
- a short-term (10-20 minute) maximum sound limit of 50 dBA; <u>or</u>

(b) if the community wishes to use setbacks <u>instead of</u> sound measurements to address noise impacts, require that wind turbines be set back from residences, schools, churches and libraries by at least 1,150 feet.

**See the notes section of this report for additional information about this recommendation.

Municipal Tools to Promote and Regulate the Deployment of Renewable Energy Systems in Tompkins County

In 2016, the Tompkins County Department of Planning and Sustainability undertook an effort to work with municipalities to develop tools to encourage the widespread deployment of renewable energy systems. This action was one of the high priority action items identified in the *Tompkins County Comprehensive Plan*. This report summarizes the recommendations of the Department to local municipal officials in Tompkins County.

Introduction

It is the policy of Tompkins County to increase the use of local and regional renewable energy sources and technologies.

The deployment of renewable energy systems, particularly large-scale solar and wind installations, can have considerable land use implications. While many local communities have prepared land use regulations to address solar and wind installations, others have not. The Department's recommendations included in this report are intended to:

- Provide a framework for regulating various scales of renewable energy systems that recognizes the critical importance of these systems to our energy future.
- Assist municipalities in identifying potential land use impacts of different types and scales of renewable energy systems.
- Encourage consistency among municipalities in how they regulate renewable energy systems to provide developers of systems with a clearly defined list of expectations communities have for the deployment of renewable energy systems.
- Identify the issues likely to be raised by the County when reviewing proposed regulations and proposals for development of renewable energy systems.

The Role of Tompkins County

Tompkins County Comprehensive Plan

The Comprehensive Plan, adopted by the Legislature in 2015, presents a vision for the future of the community and is based on a set of twelve basic interlocking principles, one of which is that

> **Tompkins County should be a place where the energy system meets community needs without contributing additional greenhouse gases to the atmosphere.**

Towards that end, the County has a policy to reduce greenhouse gas emissions to reach a minimum 80 percent reduction from 2008 levels by 2050 and reduce reliance on fossil fuels across all sectors. In order to achieve that long-term goal, it is also the County's policy to

> **Increase the use of local and regional renewable energy sources and technologies.**

Local and regional interest in transitioning to renewables is driven by many factors, including the environmental and social costs of fossil fuel extraction; deep concern about the future impacts of climate change; and the desire for secure, reliable, and cost-effective energy supplies.

Developing an energy portfolio that increases supply from renewable energy sources will allow the Tompkins County community to meet its future energy needs in a responsible and sustainable manner. Tompkins County can draw on local renewable energy sources that include solar, wind, biomass, hydropower, and geothermal. While each of these sources have significant potential in the county, each faces its own obstacles to full deployment, ranging from shading that limits siting of roof-mounted solar, to local regulations limiting wind turbines, and to air quality concerns with biomass stoves.

Tompkins County Energy Roadmap

In order to evaluate realistic approaches to meeting our goal of reducing greenhouse gas emissions by 80%, the County prepared the *Tompkins County Energy Roadmap*. That Roadmap evaluated whether achieving the 80% goal is possible primarily using local renewables and demand reduction. It identified the local actions that can be taken, both short-term and long-term, to meet that goal. The Roadmap focused on technical feasibility and quantifies the potential energy that could be generated from solar, wind, micro-hydro, and biomass resources within Tompkins County. In brief, the Roadmap demonstrated that it is possible to achieve our goals.

One of the key strategies for reducing the county's greenhouse gas emissions is to move from grid-supplied electricity generated outside of Tompkins County to local renewable generation. Among several recommendations, the Roadmap identified the following:

- Develop at least half (at least 1,225 GWh) of the county's solar energy production potential. One way this could be accomplished is by doing all of the following:
    - 25% of urban residential properties install a 4 kW PV system;
    - 50% of suburban and rural properties install a 7 kW PV system;
    - 30% of commercial, institutional and industrial roof areas install PV; and
    - 944 MW of large-scale solar developed on 4,720 acres, or 1.5% of the county's total land area.
- Develop at least 20% (at least 530 GWh) of the county's wind energy production potential. This could be accomplished by installing 300 medium-scale 500 kW turbines and 20 large-scale 2.3 MW turbines.

Process for Identification of Recommendations

Research. The Department of Planning and Sustainability used several general sources of information in preparing its recommendations.

The Department started by reviewing several existing sources of information about local planning and regulation of renewable energy systems. These included:

- Research reports prepared by planning organizations, including the American Planning Association;
- Model regulations for deployment of solar and wind energy systems;
- Regulations prepared and adopted by municipalities in New York State and elsewhere in the United States; and
- Informal discussions with local planning staff about their experience with drafting and implementing local regulations.

The Department also relied upon its own previous work on the topic of renewables. This included the preparation of the *Tompkins County Energy Roadmap* and review of several proposed renewable energy systems in the county.

Based on this work, the Department identified a list of concerns with the deployment of renewable energy systems – both wind and solar. The Department focused its efforts on solar and wind energy systems at this point, instead of other alternatives such as micro-hydro, geothermal, and biomass, as solar and wind systems would have the most impacts on the community landscape. For each identified concern, the Department prepared recommendations to help address potential impacts.

This report consists of a series of recommendations for municipal consideration rather than a model ordinance for communities to adopt. This should make it easier for municipalities to incorporate the recommendations into their efforts to adopt regulations for renewable energy systems, whether incorporating them into an existing zoning ordinance, into a site plan review ordinance, or as a stand-alone ordinance.

Public Outreach. The Department conducted two public meetings to receive feedback. The purpose of these meetings was to identify any other concerns that had not already been identified and to get feedback on the appropriateness of the proposed recommendations.

There was a significant amount of public feedback and the public shared other sources of information for consideration by the Department.

Municipal Officials Meeting. The Department next shared its research and public comments at a meeting with municipal officials. Similar to the public meetings, municipal officials were asked to identify additional concerns and to give feedback on the proposed recommendations.

More Research. Afterwards, the Department reviewed all the comments and additional material received and conducted more research on those issues that raised the most concern. Most of the additional research focused on the potential impacts of noise from Large-Scale Wind Energy Systems.

Report Preparation. This report is the culmination of this research and outreach. It is important to note that the technology of solar and wind energy systems continues to evolve. While the recommendations in this report are appropriate as of this writing, they will need to be reconsidered in light of advances made in the deployment of renewable energy systems of the future.

SOLAR ENERGY SYSTEMS

Definitions

Solar energy systems convert energy from sunlight into electricity. Within this document, we use the term solar energy systems to mean the direct use of photovoltaic (PV) cells to generate an electric current. We do not include concentrated solar power systems that use lenses, mirrors and tracking systems to focus sunlight into a small beam which heats fluids to generate electricity.

Solar energy systems were divided into three types for the purpose of land use regulation:

Roof-Mounted and Building-Integrated[1]

ROOF-MOUNTED SOLAR ENERGY SYSTEM: A solar panel system located on the roof of any legally permitted building or structure for the purpose of producing electricity for onsite or offsite consumption. [2]

BUILDING INTEGRATED PHOTOVOLTAIC SYSTEM: A combination of photovoltaic building components integrated into any building envelope system such as vertical facades including glass and other facade material, semitransparent skylight systems, roofing materials, and shading over windows.[3]

Roof Mounted Solar Energy System in Ulysses

[1] These two solar energy systems, while different in nature, are similar in terms of land use impacts. Recommendations included in this report are identical for these two types of systems.
[2] New York State Model Solar Energy Law. May 2016. Primary Author: Sustainable CUNY of the City University of New York (CUNY). Supported by: Pace Law School Land Use Law Center and NYSolar Smart Planning and Zoning Working Group.
[3] Ibid.

ACCESSORY GROUND-MOUNTED SOLAR ENERGY SYSTEM: A Solar Energy System that is anchored to the ground and attached to a pole or other mounting system, detached from any other structure for the purpose of producing electricity for *onsite* consumption. It is *accessory* to the primary use of the property.

Accessory Ground Mounted Solar Energy System in Caroline

LARGE-SCALE SOLAR ENERGY SYSTEM: A Solar Energy System that produces energy primarily for the purpose of *offsite* sale or consumption.

Portion of a Large Scale Solar Energy System in Ulysses

Notes on Select Recommendations for Roof-Mounted and Building-Integrated Solar Energy Systems*

Historic Districts

As home and business owners consider converting to solar energy systems to meet their electrical needs, there will be proposals to develop these systems in existing historic districts. There is no single blanket standard that should be applied in all historic districts. It is recommended that

> Municipalities with historic districts should establish specific guidelines and standards for building owners that wish to install solar energy systems. To the extent possible, the requirements should not involve any additional review beyond that required of any other alteration to an existing historic building.

For example, the City of Ithaca has adopted the following design guideline: *"Roof mounted solar panels should be placed flat to the roof surface, rather than being angled up. In all cases, care should be taken to minimize the physical damage to the structure caused by penetrations or attachments and to maximize the reversibility of the work."*

The Secretary of the U.S. Department of the Interior has prepared Standards for the Treatment of Historic Properties. These include guidelines for the installation of solar technology.
See: https://www.nps.gov/tps/standards/rehabilitation/guidelines/solar-technology.htm

Notes on Select Recommendations for Accessory Ground-Mounted Solar Energy Systems*

Location on a Property

To the extent possible, accessory ground-mounted solar energy systems should meet the standards required of any other accessory structure. However, solar energy systems have specific siting requirements that may, in large part, limit where they can practically be located on a property. Municipalities adopting regulations for these systems should anticipate that there may be many requests for exceptions to any siting standards that may be adopted. It is recommended that:

> Accessory Ground-Mounted Solar Energy Systems should be required to meet the same setback requirements as any other accessory building or structure.

> In residential zoning districts, Accessory Ground-Mounted Solar Energy Systems should be located in side or rear yards, to the extent practical.

For properties where there is no practical location to install Accessory Ground-Mounted Solar Energy Systems other than a front yard (due to limited solar exposure, shading, or distance from principal use), a variance request could be submitted to the municipal Zoning Board.

*For all recommendations, see the Summary at the beginning of this report.

Notes on Select Recommendations for Large-Scale Solar Energy Systems*

Decommissioning

NYSERDA has prepared a fact sheet on the decommissioning of Large-Scale Solar Energy Systems that provides an overview of the process and a description of alternatives available to municipalities. See https://training.ny-sun.ny.gov/images/PDFs/Decommissioning-Solar-Systems.pdf. Communities should encourage developers of Large-Scale Solar Energy Systems to install such systems in a manner that facilitates their removal in the future.

There is no specific recommendation concerning decommissioning. Refer to the NYSERDA Decommissioning Fact Sheet for guidance.

Glare from Systems

Glare from solar energy systems depends on the angle of installation and on the specific product installed – different types of solar panels absorb different amounts of light. Newer panels generally include at least one anti-reflective layer to maximize absorption and minimize glare. The reflectivity of solar panels can be much lower than that of snow. Some nearby land uses may be particularly sensitive to impacts from glare (e.g., airports, heavily traveled highways, residential uses, some commercial uses, and some institutional uses). It is recommended that:

When located where glare may be an issue for specific uses, communities should require the preparation of a glare analysis for proposed Large-Scale Solar Energy Systems.

Stormwater Management

Installations of Large-Scale Solar Energy Systems may trigger the requirements for a stormwater management plan, generally when a project will disturb more than one acre of land. Maintaining a vegetative cover under the panels would help to manage drainage and runoff. Plans for management of that vegetative cover should be reviewed – herbicide and pesticide use should be restricted and management of the cover by grazing, or other agricultural activity if feasible, should be encouraged.

Large-Scale Solar Energy Systems can also be located above parking lots and other already-paved areas.

It is recommended that:

Unless located over an existing parking lot or other already-paved area, a vegetative cover should be established and maintained underneath solar panels in Large-Scale Solar Energy Systems. Management of that vegetative cover should be reviewed as part of the local municipal review of the project. Natural hydrology should be maintained to the maximum extent practical and stormwater management plans required only when already required by a municipality's stormwater management law or where hydrology is being significantly modified.

*For all recommendations, see the Summary at the beginning of this report.

Agricultural Resources
It is recommended that:

Large-Scale Solar Energy Systems should avoid large extents (10 acres or more) of actively-farmed prime agricultural soils. Land underneath solar panels within agricultural areas should be maintained as vegetative cover. For any proposed disturbance of ten acres or more of prime agricultural soils, communities should consider the value of requiring a soil reclamation plan and related financial guarantee of plan implementation.

Municipal officials can contact the Tompkins County Department of Planning and Sustainability for information about the location of prime agricultural soils.

Natural Resources
It is recommended that:

Large-Scale Solar Energy Systems should avoid Critical Environmental Areas, Unique Natural Areas, slopes in excess of 15%, clearing extensive areas of forest, and previously-identified distinctive viewsheds. Any systems located in these areas should be required to take appropriate mitigation measures.

Local and state agencies may designate Critical Environmental Areas (CEA) under the State's SEQR regulations. These areas must have an exceptional or unique character with respect to a benefit or threat to human health; a natural setting; agricultural, social, cultural, historic, archaeological, recreational or educational values; or an inherent ecological, geological, or hydrological sensitivity to change. As of this writing there is one CEA in Tompkins County – Coy Glen in the Town of Ithaca.

Unique Natural Areas (UNA) in Tompkins County are designated by the Tompkins County Environmental Management Council. UNAs include important natural plant or animal communities, the best representative of a particular resource in the county, rare or scarce plants or animals, geological importance, or cultural significance. There are nearly 200 UNAs in Tompkins County. Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of these resources.

Tompkins County has conducted a rigorous process to identify the most important scenic resources in the county. The *Tompkins County Scenic Resources Inventory* (2007) identified 25 Distinctive Views, defined as those views "that make a clear, unmistakable impression, and are distinguished as some of the best scenic views in the County." Maps of the locations of these Distinctive Views can be found on the Tompkins County Department of Planning and Sustainability's website. Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of the viewsheds located in their communities. For information about ways to protect scenic resources, see *Tompkins County: Protecting Our Scenic Resources – Tools to Safeguard Important Scenic Resources* (2010).

*For all recommendations, see the Summary at the beginning of this report.

It is also recommended that:

NYS DEC regulated wetlands should be avoided. Development in federally-identified wetlands should be avoided, but could be considered where wetland hydrological function can be maintained and no endangered or threatened species would be impacted.

Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of wetlands.

In addition, Large-Scale Solar Energy Systems could impact important habitat areas and wildlife migration routes not located within one of the natural resource areas listed above. The potential impacts and appropriate mitigation strategies can vary widely. It is recommended that:

Habitat loss, habitat fragmentation, and wildlife corridors should be reviewed for potential impacts on a case-by-case basis.

Water Quality

Protecting surface water quality can best be accomplished by protecting the quality of water that enters streams and lakes. Along the edges of streams, maintaining naturally vegetated buffers can help remove many of the pollutants carried via runoff. It is recommended that:

Large-Scale Solar Energy Systems should be prohibited within 100-foot buffers of perennial streams and 50-foot buffers of intermittent streams.

Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of recommended stream buffers.

*For all recommendations, see the Summary at the beginning of this report.

Wind Energy Systems

Definitions

Wind power is the use of air flow through wind turbines to mechanically power generators for electric power.

Wind energy systems are divided into three types for the purpose of land use regulation. The distinctions between the different scales of wind power were chosen because of how net metering laws are currently structured in New York State.

SMALL SCALE WIND ENERGY SYSTEM: An energy system consisting of a turbine with a rated capacity between 1 kW and 25 kW and appurtenant facilities. These will likely be used by individual homes.[4]

Small Scale Wind Energy System in Lansing

[4] Tompkins County Energy Roadmap. March 2016. Tompkins County Planning Department.

MEDIUM SCALE WIND ENERGY SYSTEM: An energy system consisting of one or more turbines, and appurtenant facilities, with a total rated capacity between 25 kW and 500 kW. These will likely be used for small businesses, especially agriculture, or for community shared turbines.[5]

Medium Scale Wind Energy System in Genesee County

[5] Ibid

LARGE SCALE WIND ENERGY SYSTEMS: An energy system consisting of one or more turbines, and appurtenant facilities, with a total rated capacity above 500 kW. These will likely be used in installations of multiple turbines with the electricity sold to utilities. [6]

Large Scale Wind Energy System: Fenner Wind Farm, Madison County

[6]Ibid

Notes on Select Recommendations for Small-Scale Wind Energy Systems*

Setbacks

Setbacks for Small-Scale Wind Energy Systems should be established to accommodate a "fall zone" where, if the structure were to fall, it would not fall onto a neighboring property. This requirement could be waived if adjoining property owners agree in writing to allow the "fall zone" on their property. It is recommended that:

Setbacks for Small-Scale Wind Energy Systems from lot lines should be the total height of the installation plus 10 feet, unless the affected adjoining property owner agrees otherwise in writing. This setback should be measured from the center of the tower.

Notes on Select Recommendations for Medium-Scale Wind Energy Systems*

Setbacks

Setbacks for Medium-Scale Wind Energy Systems should be sized to address some potential impacts of these systems on adjoining properties, including vibrations, shadow flicker, and ice throw. It is recommended that:

Setbacks for Medium-Scale Wind Energy Systems from lot lines should be 1.5 times the total height of the installation.

Setbacks from neighboring residences, schools, churches, and libraries should be 2 times the total height of the installation, unless the affected adjoining property owner agrees otherwise in writing.

These setbacks should be measured from the center of the tower.

Natural Resources

It is recommended that:

Medium-Scale Wind Energy Systems should avoid Critical Environmental Areas, Unique Natural Areas, slopes in excess of 15%, and clearing extensive areas of forest. Any systems located in these areas should be required to take appropriate mitigation measures.

Local and state agencies may designate Critical Environmental Areas (CEA) under the State's SEQR regulations. These areas must have an exceptional or unique character with respect to a benefit or threat to human health; a natural setting; agricultural, social, cultural, historic, archaeological, recreational or educational values; or an inherent ecological, geological, or hydrological sensitivity to change. As of this writing there is one CEA in Tompkins County – Coy Glen in the Town of Ithaca.

*For all recommendations, see the Summary at the beginning of this report.

Unique Natural Areas (UNA) in Tompkins County are designated by the Tompkins County Environmental Management Council. UNAs include important natural plant or animal communities, the best representative of a particular resource in the county, rare or scarce plants or animals, geological importance, or cultural significance. There are nearly 200 UNAs in Tompkins County.

Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of these areas.

Scenic Resources
It is recommended that:

Medium-Scale Wind Energy Systems located in previously-identified distinctive or noteworthy viewsheds should be required to prepare a visual impact analysis.

Tompkins County has conducted a rigorous process to identify the most important scenic resources in the county. The *Tompkins County Scenic Resources Inventory* (2007) identified 25 Distinctive Views, defined as those views "that make a clear, unmistakable impression, and are distinguished as some of the best scenic views in the County." The Inventory also identified 30 Noteworthy Views, defined as "worthy of attracting attention, and are better than many of the scenic views in the County." Maps of the locations of Distinctive and Noteworthy Views can be found on the Tompkins County Department of Planning and Sustainability's website. Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of the viewsheds located in their communities. For information about ways to protect scenic resources, see *Tompkins County: Protecting Our Scenic Resources – Tools to Safeguard Important Scenic Resources* (2010).

Notes on Select Recommendations for Large-Scale Wind Energy Systems*

Setbacks
Setbacks for large-scale wind energy systems should be sized to address some potential impacts of these systems on adjoining properties, including noise, vibrations, shadow flicker, and ice throw. It is recommended that:

Setbacks for Large-Scale Wind Energy Systems from lot lines should be 1.5 times the total height of the installation.

Setbacks from neighboring residences, schools, churches, and libraries should be 2 times the total height of the installation, unless the affected adjoining property owner agrees otherwise in writing.

The total height of an installation means the height of the tower plus blade length. These setbacks should be measured from the center of the tower.

*For all recommendations, see the Summary at the beginning of this report.

Decommissioning

NYSERDA has prepared a fact sheet on the decommissioning of Large-Scale Solar Energy Systems that provides an overview of the process and a description of alternatives available to municipalities. Most of that Fact Sheet applies equally well to decommissioning of Large-Scale Wind Energy Systems. See https://training.ny-sun.ny.gov/images/PDFs/Decommissioning-Solar-Systems.pdf.

There is no specific recommendation concerning decommissioning. Refer to the NYSERDA Decommissioning Fact Sheet for guidance.

Stormwater Management

These systems will likely include changes to the landscape not just for the towers themselves, but for roads, utility lines, and appurtenant facilities as well. These will, in some cases, trigger the thresholds established by communities for the preparation of stormwater management plans, generally when a project will disturb more than one acre of land. It is recommended that:

When stormwater management plans are required by the community under existing stormwater management ordinances, the impacts of towers, roads, utility lines, and all appurtenant facilities should be considered.

Agricultural Resources

There is no inherent conflict between agricultural operations and Large-Scale Wind Energy Systems. The land in and around wind towers can be used to graze livestock or to grow crops. However, the location of the tower, roads, and utility lines can impact the efficiency of agricultural operations. It is recommended that:

Proposals for Large-Scale Wind Energy Systems should be reviewed for potential impacts on agricultural operations.

Natural Resources

It is recommended that:

Large-Scale Wind Energy Systems should avoid Critical Environmental Areas, Unique Natural Areas, slopes in excess of 15%, and clearing extensive areas of forest. Any systems located in these areas should be required to take appropriate mitigation measures.

Local and state agencies may designate Critical Environmental Areas (CEA) under the State's SEQR regulations. These areas must have an exceptional or unique character with respect to a benefit or threat to human health; a natural setting; agricultural, social, cultural, historic, archaeological, recreational or educational values; or an inherent ecological, geological, or hydrological sensitivity to change. As of this writing there is one CEA in Tompkins County – Coy Glen in the Town of Ithaca.

*For all recommendations, see the Summary at the beginning of this report.

Unique Natural Areas (UNA) in Tompkins County are designated by the Tompkins County Environmental Management Council. UNAs include important natural plant or animal communities, the best representative of a particular resource in the county, rare or scarce plants or animals, geological importance, or cultural significance. There are nearly 200 UNAs in Tompkins County.

Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of these areas.

Water Quality

Protecting surface water quality can best be accomplished by protecting the quality of water that enters streams and lakes. Along the edges of streams, maintaining naturally vegetated buffers can help remove many of the pollutants carried via runoff. Wetlands also play an important role in improving water quality. It is recommended that:

Large-Scale Wind Energy Systems should be prohibited within 100-foot buffers of perennial streams and 50-foot buffers of intermittent streams.

Large-Scale Wind Energy Systems should be prohibited in wetlands.

Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of wetlands and for recommended stream buffers.

Scenic Resources

It is recommended that:

Large-Scale Wind Energy Systems located in previously-identified distinctive or noteworthy viewsheds should be required to prepare a visual impact analysis.

Tompkins County has conducted a rigorous process to identify the most important scenic resources in the county. The *Tompkins County Scenic Resources Inventory* (2007) identified 25 Distinctive Views, defined as those views "that make a clear, unmistakable impression, and are distinguished as some of the best scenic views in the County." The Inventory also identified 30 Noteworthy Views, defined as "worthy of attracting attention, and are better than many of the scenic views in the County." Maps of the locations of Distinctive and Noteworthy Views can be found on the Tompkins County Department of Planning and Sustainability's website. Municipal officials can contact the Tompkins County Department of Planning and Sustainability for maps of the viewsheds located in their communities. For information about ways to protect scenic resources, see *Tompkins County: Protecting Our Scenic Resources – Tools to Safeguard Important Scenic Resources* (2010).

Wildlife

Large-Scale Wind Energy Systems could also impact important habitat areas. The potential impacts and appropriate mitigation strategies can vary widely. It is recommended that:

Habitat loss, habitat fragmentation, and impacts on migratory routes and Important Bird Areas should be assessed on a case-by-case basis for potential impacts when proposals are reviewed by municipal officials.

*For all recommendations, see the Summary at the beginning of this report.

Important Bird Areas (IBAs) are designated by the Audubon Society. These are areas that contain a concentration of birds in significant numbers when breeding, in winter, or during migration; support a population of a species that is endangered, threatened, or of special concern; contain assemblages of species characteristic of a representative rare, threatened, or unique habitat; or support long-term avian research or monitoring. There are four IBAs in Tompkins County: Cayuga Lake, Caswell Road Grassland Complex, Salmon Creek IBA, and the Connecticut Hill Wildlife Management Area.

Birds and Bats

The New York State Department of Conservation (NYSDEC) has developed: Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects. June 2016. New York State Department of Environmental Conservation. It is recommended that:

Large-Scale Wind Energy Systems should be the subject of bird and bat studies performed in accordance with NYSDEC guidelines.

Shadow Flicker

Rotating wind turbine blades cast moving shadows over the landscape. When those shadows pass over windows on a building, those shadows can appear to 'flick' on and off; this effect is called shadow flicker. Since it is known to a high degree of accuracy where shadows will fall (based on sun location and turbine location), the exact location and frequency of shadow flicker can be identified. Shadow flicker can be mitigated by changes in turbine siting. Turbines can also include automated control systems that shut down the turbines during times when shadow flicker is anticipated. While we recommend impacts be measured on an annual basis, some communities also adopt a daily limit of 30 minutes. It is recommended that:

Communities should require a preliminary (and, if indicated, a more comprehensive) shadow flicker analysis for all proposed Large-Scale Wind Energy Systems. If shadow flicker will occur for more than 30 hours per year on any one nearby residence or facility, mitigation steps should be required.

Ice Throw

The effects and amounts of ice throw produced by a wind turbine are predictable, depending on its location, height, blade length, and wind speed. In most cases, ice falls within a radius of the tower equal to the tower height, and rarely exceeds total height (tower height plus blade length). If needed, automated control systems are available that can sense ice formation on the blades and shut the turbine down.

No additional recommendations are provided for ice throw as the recommended setbacks are designed, in part, to minimize the impact of ice throw.

*For all recommendations, see the Summary at the beginning of this report.

Noise and Vibration

Noise and vibrations can be generated by wind turbines. The recommended setbacks are designed, in part, to minimize or eliminate impacts from vibration. Communities that establish the recommended noise standards should invest in equipment and staff training for enforcement. Noise standards should be established at neighboring buildings. It is recommended that:

Communities should <u>either</u> establish the following noise standards to be measured at neighboring residences, schools, churches, and libraries:[7]

►a design goal of 40 dBA;

►a long-term average sound limit of 45 dBA; and

►a short-term (10-20 minute) maximum sound limit of 50 dBA; <u>or</u>

If the community wishes to use setbacks <u>instead of</u> sound measurements to address noise impacts, require that wind turbines be set back from residences, schools, churches and libraries by at least 1,150 feet.

More on Noise

The most common concern voiced by the public with renewable energy installations was with noise impacts from Large-Scale Wind Energy Systems. Noise and its impacts are complicated subjects, so we provide the following additional information for municipal officials. The most scientifically rigorous paper we could find that both addresses the noise produced by wind turbines and recommends appropriate setbacks to address the impacts of that noise was the 2010 paper by Hessler and Hessler cited in the Reference Material at the end of this report.

<u>Source of Noise from Large-Scale Wind Energy Systems</u>

Wind turbines generate both mechanical noise, caused by a turbine's internal gears and controls, and aerodynamic noise, caused by the blades passing through the air – often described as 'whooshing' or 'swishing.' It is worth noting that the noise generated by wind turbines has changed significantly with more recent installations.

[7] Noise Level Chart (modified from www.noisehelp.com)

dBA	Examples
10	A pin dropping
20	Rustling leaves
30	Whisper
40	Babbling brook, computer
50	Light traffic, refrigerator
60	Conversational speech, air conditioner
70	Shower, dishwasher
75	Toilet flushing, vacuum cleaner
80	Alarm clock, garbage disposal
85	Passing diesel truck, snow blower
90	Squeeze toy, land mower, arc welder
95	Inside subway car, food processor, belt sander

*For all recommendations, see the Summary at the beginning of this report.

Mechanical noise from older turbines was often a significant cause of noise complaints. However, improvements in mechanical design of large wind turbines, including insulation, have resulted in significantly reduced mechanical sounds. Most of the noise from wind turbines now comes from aerodynamic sounds.

Modern large-scale wind turbines produce mostly mid-frequency aerodynamic noise and do not produce high levels of perceptible infrasound or low frequency sound.

Design and siting approaches for wind turbines have also changed over time, reducing the noise associated with large-scale wind energy facilities. For example, newer large-scale wind energy systems use upwind rotors (as opposed to downwind rotors which were more common in older installations). The lower rotational speeds and pitch control result in lower sound generation.

Establishing Noise Standards

Noise complaints and annoyance occurs most commonly when a new facility (of any kind) exceeds the prevailing background sound level. Because large-scale wind energy systems are usually sited in rural areas, the existing background sound level is often very low.

Wind turbine noise is most impactful at night on nights when the winds are fairly light. When it's windy, the background noise of the wind usually masks the sound of wind turbines. And during the day, atmospheric conditions and other background noises diminish the noise from turbines. Since the impact is greatest at night, noise standards should be focused on sound levels appropriate at night.

Recommendations For Communities Addressing Noise Impacts Using Noise Standards

Noise standards for Large-Scale Wind Energy Systems should take into account noise levels during the night and the relative quiet of the rural areas in which they are likely to be located. Various agencies that have considered these two factors in establishing noise standards have consistently established 45 dBA as the **long-term average noise level** to be measured outside of nearby residences.

In order to account for fluctuations in actual conditions, it is suggested that communities use a **design goal** of 40 dBA for planned Large-Scale Wind Energy Systems. The actual level of turbine-related noise is affected by a variety of factors:

- Size, make, and number of turbines,
- Maintenance condition of the turbines,
- Distance from turbines,
- Direction and speed of wind,
- Atmospheric conditions, and
- Topography

These factors should be considered when installations are planned and noise impact models should be used by the developer to prepare a design that achieves the design goal of 40 dBA for most, if not all, nearby residences.

In addition, while 45 dBA is a long-term average regulatory standard, communities should establish short-term maximum sound limits that anticipate short-term unexpected changes in conditions (like wind speed and direction and short-term equipment problems). We recommend that installations should not be allowed to exceed a **short-term** (10-20 minutes) **maximum sound limit** of 50 dBA.

*For all recommendations, see the Summary at the beginning of this report.

Recommendations For Communities Addressing Noise Impacts Using Setbacks

Not all communities will want to establish and enforce noise standards. They can use setback standards to approximate the noise-reduction goals on nearby residences, schools, churches, and libraries. Most modern industrial wind turbines are designed to keep noise levels at or below 45 dB at 350 meters (1,150 feet). Therefore communities that prefer to mitigate noise impacts through setback provisions should use 1,150 foot setbacks from nearby residences, schools, churches, and libraries.

NOTE: Communities should either establish noise standards or setback standards to address noise impacts, not both.

Potential Mitigation Measures

If the pre-construction design or post-construction noise standards cannot be met, there are mitigation measures available. The most useful, and least expensive, method for mitigating noise impacts is through noise modeling during the early stages of the design of a project. It often takes several iterations to find the optimal arrangement that minimizes noise and meets all other concerns.

Some turbines can be operated in 'low noise operating mode.' While not universally available on all models of turbines, noise reductions of up to 5 dB can be achieved through electronic manipulation of blade pitch. Since this measure adversely affects power production it would be appropriate to use this measure sparingly: under certain weather conditions or times of day.

There are times when it may be appropriate to shut down an individual unit for a temporary period (for example, overnight). Model simulations have shown that noise reductions of 2 to 8 dBA can be achieved by shutting down only the single nearest turbine to a particular house where noise is an issue.

Other Noise-Related Issues Raised by the Public

Low Frequency Noise. Members of the public raised concerns about the potential for health impacts from the low frequency noise/infrasound produced by wind turbines. Studies have shown that modern wind turbines do not produce high levels of perceptible infrasound or low frequency sound. Modern wind turbines produce mostly mid-frequency aerodynamic noise.

Measuring Noise. We have recommended establishing noise standards by measuring sound using "A" weighted sound levels (dBA). Members of the public have suggested using "C" weighted sound levels (dBC). Acoustical engineers organize the audio spectrum into sound octave bands. The "A" weighted sound level discriminates against low frequencies, in a manner similar to the response of the human ear. This approach primarily measures in the 500 to 10,000 Hz range. It is the weighting scale most commonly used for regulatory measurements.

The "C" weighted sound level does not discriminate against low frequencies and measures uniformly over a wider frequency range of 30 to 10,000 Hz. This weighting scale is useful for monitoring sources such as engines, explosions, and machinery.

*For all recommendations, see the Summary at the beginning of this report.

Because low frequency noise from wind turbines, essentially irrespective of distance, is well below the point where it might begin to be audible there is no actual need for a design goal or regulatory limit.

If a community wants to regulate noise from wind turbines, there is an additional problem with using "C" weighted sound levels. It is extremely difficult to accurately measure "C" weighted sound levels in the presence of any kind of wind. Low frequency noises generated by wind through windscreens and over microphones elevate the apparent "C" weighted sound levels, making it difficult to verify noise standards are being met by the wind energy system using this approach.

*For all recommendations, see the Summary at the beginning of this report.

APPENDIX A

REFERENCE MATERIAL

Publications

Assessing and Mitigating Noise Impacts. NYSDEC. 2001.

Assessing and Mitigating Visual Impacts. NYSDEC. 2000.

Decommissioning Solar Panel Systems. NY-Sun. undated.

Guidelines for Conducting Bird and Bat Studies at Commercial Wind Energy Projects. NYSDEC. 2016.

Implementation of Small Wind System Ordinances by California Counties. California Energy Commission. 2016.

Low Frequency Noise and Infrasound Associated with Wind Turbine Generator Systems: A Literature Review. Ontario Ministry of the Environment.

Model Municipal Wind Siting Ordinance. Center for Climate Change Law at Columbia Law School. 2012.

Model Small-Scale Solar Siting Ordinance. Center for Climate Change Law at Columbia Law School. 2012.

New York State Model Solar Energy Law. Sustainable CUNY of the City University of New York; supported by Pace Law School's Land Use Law Center and the NYSolar Smart Planning and Zoning Working Group. 2016.

NYSDOT Environmental Procedures Manual – Chapter 3 Noise. Environmental Analysis Bureau. 1998.

Noise Ordinances: Tools for Enactment, Modification and Enforcement of a Community Noise Ordinance. Robert C. Chanaud. 2014.

Overview of Opportunities for Co-Location of Solar Energy Technologies and Vegetation. National Renewable Energy Laboratory. 2013.

Planning for Solar Energy: Briefing Papers. American Planning Association and U.S. Department of Energy. 2013.

Planning for Wind Energy. American Planning Association Planning Advisory Service. 2011.

Recommended Noise Level Design Goals and Limits at Residential Receptors for Wind Turbine Developments in the United States. David M. Hessler and George F. Hessler Jr. 2010.

Report on Wind Turbines. Enfield Wind Farm Advisory Committee. 2016.

Rhode Island Land-Based Wind Siting Guidelines. Rhode Island Office of Energy Resources. 2016.

Tompkins County Energy Roadmap. Tompkins County Planning Department. 2016.

Tompkins County: Protecting Our Scenic Resources – Tools to Safeguard Important Scenic Resources. Tompkins County Planning Department. 2010.

Tompkins County Scenic Resources Inventory. peter j. smith & company, inc. 2007.

Wind Energy: Model Ordinance Options. N.Y. Planning Federation. Funded by NYSERDA. 2005.

Wind Farm Noise 2012: Science and Policy Overview. The Acoustic Ecology Institute. 2012.

Wind Turbine Acoustic Noise. Renewable Energy Research Laboratory. 2006.

Wind Turbine-Related Noise and Community Response. NYSERDA. 2013.

Wind Turbine-Related Noise: Current Knowledge and Research Needs. NYSERDA. 2013.

Working Paper on Developing Municipal Wind Energy Ordinances in New York State. Center of Climate Change Law at Columbia Law School. 2009.

Other Documents

Critique of the Noise Analysis of the Draft Supplemental Environmental Impact Statement for the Black Oak Wind Farm. Les Bloomberg, Noise Pollution Clearinghouse. 2016.

Ice Shedding and Ice Throw – Risk and Mitigation. GE Energy. Undated.

Large Scale Wind Projects FAQ. NYSERDA. 2005

Model Wind Energy Facility Law for St. Lawrence County Municipalities. Author unknown. Undated.

North Carolina Noise Ordinances with Sound level Limits. Noral D. Stewart. Undated.

Proposed Content for the Renewable Energy Approval Regulation under the Environmental Protection Act. Ontario Ministry of the Environment. 2009.

What is the Difference Between "A weighting" and "C weighting"? Vernier Tech Info Library. 2015.

Wind Power Frequently Asked Questions. Tompkins County Environmental Management Council. 2016.

Presentations

Planning for Solar Energy (presentation). Broome County Department of Planning and Economic Development. 2016.

Shadow Flicker Regulations and Guidance: New England and Beyond (presentation). Richard Lampeter, INCE. 2011

Wind Turbine Noise Regulation: Perspectives in New England (presentation). Kenneth Kaliski. 2010

Zoning for Solar Energy (presentation). NY-Sun PV Trainers Network. 2016.

Websites

American Wind Energy Association (website). http://www.awea.org/

Illustrated Guidelines on Sustainability for Rehabilitating Historic Buildings: Solar Technology (website). https://www.nps.gov/tps/standards/rehabilitation/guidelines/solar-technology.htm

Noise Enforcement Authority Has Been Transferred to Local Jurisdictions. Maryland Department of the Environment. http://mde.maryland.gov/programs/Marylander/PublicHealth/Pages/noise.aspx

Oregon Administrative Rules Chapter 340, Division 35. New Industrial and Commercial Noise Source Standards. State of Oregon. http://www.deq.state.or.us/aq/rules/div35/table78.pdf

Planning and Zoning for Solar Energy: Frequently Asked Questions (website). American Planning Association. https://www.planning.org/research/solar/faq.htm

Small Wind Turbine Case Studies (website). NYSERDA. https://www.nyserda.ny.gov/About/Publications/Case-Studies-and-Features/Renewable-Case-Studies

WINDExchange. Wind Energy Ordinances (website). U.S. Department of Energy. http://apps2.eere.energy.gov/wind/windexchange/policy/ordinances.asp?page=20&field=default&order=asc&#links

Wind Power (website). NY Department of Environmental Conservation. http://www.dec.ny.gov/energy/40966.html

Local Ordinances

Town of Dryden. Solar Energy Provisions. 2017
Town of Enfield. Wind Energy Facilities Local Law. 2009.
Town of Ithaca. Solar Energy Provisions. 2016.
Town of Newfield. Wind Energy Regulations. *Proposed*.
Town of Ulysses. Solar Energy Provisions. 2015.
Village of Freeville. Renewable Energy Facilities Law. 2017.

Ordinances from Other Locations

Solar

City of Calabasas, California
City of Boulder, Colorado
City of Aurora, Illinois
Village of Lincolnshire, Illinois
County of Montgomery, Maryland
Township of Dundee, Michigan
City of St. Cloud, Minnesota
City of Albany, New York
Town of Shoreham, Vermont

Wind

County of Navajo, Arizona
County of Kern, California
County of Jefferson, Idaho
County of LaPorte, Indiana
County of McLean, Illinois
County of Saline, Kansas
County of Gratiot, Michigan
County of Huron, Michigan
County of Cascade, Montana
County of Washoe, Nevada
Town of Clarkson, New York
Town of Clayton, New York
Town of Fenner, New York
County of Hyde, North Carolina
County of Rockingham, Virginia
County of Benton, Washington
County of Kittitas, Washington

Noise

County of San Diego, California

APPENDIX B: Public Comments and Responses

… on Renewable Energy Systems, in General

The following is a summary of comments received on renewable energy and related topics not specific to wind or solar energy systems. It is intended to capture the breadth of comments received. Often, similar comments were made by more than one person, but are only listed here once.

Geographic Information

- Has a geospatial analysis been prepared of where wind and solar could be located given the recommended restrictions?
- Has the County mapped the capacity of transmission lines for supporting larger-scale installations?
    - The County has evaluated the areas that would be suitable for development of large-scale wind and solar energy systems following the recommendations in this document. Much of this analysis was done as part of the preparation of the *Tompkins County Energy Roadmap*. There is insufficient information available now; more information on transmission line capacity for large-scale solar and wind energy systems is expected in the Fall of 2017.

Micro-Hydro

- Why isn't micro-hydro being emphasized?
    - Micro-hydro and other renewable energy systems were not included in this report as they likely would have fewer land use impacts, impacts will be very site specific, and these systems are not as likely to be developed at a significant scale in the immediate future.

Energy Conservation

- Supporting energy conservation is very important
- Continue to educate the public concerning conservation of energy.
    - Energy conservation is critical to achieving greenhouse gas emission goals, as is the development of renewable energy resources. The Energy Roadmap documented that both will be required to meet future energy needs.

Decommissioning

- Should decommissioning plans and guarantees be required? What about PILOT [payments in lieu of taxes] agreements?
    - The County makes no specific recommendations for decommissioning requirements – information provided by NYSERDA on decommissioning is provided in the report.
    - The Tompkins County IDA is working with local taxing authorities to identify appropriate PILOT standards.

Enforcement

- What happens if required landscaping isn't maintained?
    - Municipalities would have the same enforcement authority they would have when any permitted land use does not meet the conditions of approval. Local enforcement officials would notify the owner and, if not corrected, take enforcement proceedings.

Landowner Education

- Landowners should be educated about leases.
    - This is outside the scope of this report.

Climate Change and Greenhouse Gas Emissions

- The community is responsible for reducing greenhouse gas emissions, it's a serious issue.
- The community needs to remember the bigger issue here – climate change and impacts of extreme weather events.
- The scale of change in energy generation needs to reflect the scale of the potential impacts of climate change.
    - Tompkins County has been a leader in efforts to reduce greenhouse gas emissions, both as an individual entity and as a leader in moving the community forward. This project recognizes the important role that renewable energy resources need to play in reducing emissions.

Don't Call Installations Farms

- Energy generating installations are not 'farms' and shouldn't be called this.
    - We have followed this recommendation throughout this report.

Encourage Deployment

- County and towns should encourage deployment of renewable energy on a small-, medium- and large-scale – and need to balance the small number of people impacted by such vs. the positive impact to so many.
    - We hope that the recommendations included in this report will help provide local municipalities with the tools they need to enact appropriate land use regulations that protect the community as well as promote the deployment of wind and solar energy systems throughout the county.

Environmental Protection

- Noise, wildlife, rural character, and viewsheds are important to consider when locating wind and solar installations.
    - We have recommended that installation of solar and wind energy systems avoid our most important natural features and, when needed, that appropriate mitigation measures be taken to minimize the effect of any impacts.

Public Service Commission Important

- The location of large-scale systems (wind and solar) will be influenced by [New York State] PSC [Public Service Commission] rulings concerning locations that strengthen the grid and stabilize voltage fluctuations. This will affect the financial viability of some sites.
    - Agreed, but the recommendations in this report would still apply. Communities should keep abreast of new information in this area as it is made available.

APPENDIX B (cont.): Public Comments and Responses

… on Solar Energy Systems

The following is a summary of comments received on solar energy systems. It is intended to capture the breadth of comments received. Often, similar comments were made by more than one person, but are only listed once here. Brief responses from the Department of Planning and Sustainability are provided.

Communities Without Zoning

- How can communities without zoning regulate solar energy systems?
    - Communities can adopt a Site Plan Review Law or a "Renewable Energy System" stand-alone law. This will limit the community's ability to control where installations can be allowed.

Quality Control of Installations

- Loss of NYSERDA incentives for solar energy systems of all scales means loss of NYSERDA quality control. Municipalities should work together to create a unified inspection and quality control program.
    - A good idea, but not part of the scope of this report.

Rooftop Installations

- Rooftop installations are unobtrusive and blend in with building architecture.
    - We recommend allowing rooftop installations on all buildings.

Vegetative Cover beneath Panels

- Communities should require that vegetative cover under large-scale installations be maintained by sheep rather than by mechanical or herbicide application.
- Leave existing vegetation for beneficial insects – mow once per year and do not apply herbicides or pesticides.
    - We recommend that communities include a discussion of vegetative cover management as part of their review of proposals.

Fencing

- Include site plan standards that require fences not be constructed of chain link, vinyl, barbed wire, concertina or razor wire, electrically-charged wire, ugly split face concrete, or scrap metal.
- Do not use 8-foot steel fencing with barbed wire; use rows of native shrubs as a green fence.
    - Fencing is required by electrical codes. The type of fencing provided should be a community decision.

Development in Agricultural Areas

- Allow development of large-scale systems on prime agricultural soils using best practices.
- Is prime agricultural soils defined? Seems reasonable to allow large-scale solar on inactive farms.
- Most farmland has been hand-cleared, do we want to use this for solar?
- We need to carefully guard our agricultural land – large-scale solar installations should be located over parking lots.
- Prime agricultural soils are not the only important agricultural lands that should be protected. Communities need to do more to preserve the accessibility of good farmland for agricultural use, including limiting the installation of solar energy systems for non-farm use.
    - We recommend that Large Scale Solar Energy Systems avoid areas with over ten acres of prime agricultural soil that is actively farmed.

Amount of Land to Develop

- Caution communities about how much land to dedicate to large-scale solar.
    - The Tompkins County Energy Roadmap suggests that 1.5% of the County's land area will be needed for large-scale solar. This could increase if the amounts of wind or micro-hydro proposed in the Roadmap cannot be developed.

Most Likely Places for Development

- Where are the best places for connections to the grid, i.e., the most attractive places to develop large-scale solar.
    - In the Fall, information on the location of transmission lines suitable for the location of large-scale solar energy systems will be available.

Inverter Setbacks

- Setbacks for inverters is an issue the County's recommendations should address.
    - Inverters should be at least fifty feet from residences or places where people will gather. Most installations place inverters interior to the installation. The recommended setbacks should adequately address this.

Decommissioning Plans

- Include provisions for decommissioning that includes soil/vegetation remediation and some kind of surety bond.
    - We have provided a link to information prepared by NYSERDA on decommissioning requirements and financial guarantees.

Protect Residential and Scenic Areas

- I am not in favor of large-scale solar in residential or scenic areas.
    - We recommend communities require visual impact analyses for proposals located within distinctive viewsheds. This would allow municipal officials to establish appropriate mitigation measures when proposals are reviewed.
    - We also recommend that communities with zoning consider which of their zoning districts would be appropriate for the installation of Large-Scale Solar Energy Systems.

Limit Size of Solar Installations

- Solar installations should be limited in size to a few acres to prevent large wildlife habitat disruptions.
    - We recommend that communities review proposals for Large-Scale Solar Energy Systems for their impacts on habitat loss, habitat fragmentation, and wildlife corridors, establishing appropriate mitigation measures at the time of review.

Incentivize On-Site Installations, not Industrial Ones

- Tompkins County should incentivize and reward on-site renewable installations, not industrial installations from out-of-county business.
    - Tompkins County, in accordance with State Law, provides tax exemptions for solar and wind energy systems.
    - The IDA provides tax incentives for business. They have been working with communities to establish a PILOT (payment-in-lieu-of-taxes) agreement for Large-Scale Solar Installations.
    - The Energy Roadmap shows that large scale solar will be a critical component of our renewable energy future.

Use Local Companies and Equipment Made in USA

- Use local solar energy companies and use panels and equipment made in the USA.
    - This is outside the scope of local land use regulations.

Solar Vs. Fracking

- Fight over solar shouldn't be as big of a fight as over fracking or coal.
    - The impact of High-volume hydraulic fracturing for natural gas extraction would have a much larger potential impact on the environment and on our community than solar installations.

APPENDIX B (cont.): Public Comments and Responses

… on Wind Energy Systems

The following is a summary of comments received on wind energy systems. It is intended to capture the breadth of comments received. Often, similar comments were made by more than one person, but are only listed here once. Brief responses from the Department of Planning and Sustainability are provided.

Setback Requirements for Small-Scale Systems

- Can recommended setbacks for small-scale wind be waived with the adjoining landowners agreement?
    - We have recommended establishing setbacks of total tower height plus ten feet for Small-Scale Wind Energy Systems, unless a written waiver is provided by the affected landowner.
- How do you measure setbacks from small-scale turbines?
    - We also recommend that setback be measured from the center of the tower.
- For small-scale wind installations, why aren't setbacks from buildings on the property recommended?
    - We believe that is up to the individual landowner to decide the location of a tower on their property.
- How was the recommended setback chosen?
    - The setback was chosen to provide clearance of the 'fall zone' for the tower.

Setbacks for Medium- and Large-Scale Systems

- Setback distances should be defined from property lines.
    - We recommend that setbacks be measured from property lines and, in the case of Large- and Medium-Scale Wind Energy Systems, additional setbacks from nearby residences, schools, churches, and libraries.
- Setbacks of 1.5 times total height is not adequate to address ice throw and disintegrating blades – need 2000 feet. Nor is it sufficient for noise.
- Setbacks should be 1950 feet from property lines to protect from ice and blade throw.
- Ice throw is an issue, but the likelihood of impact is very low – coal plants are riskier.
    - Ice can build up on turbine blades, the resulting ice can be thrown from the turbine. Some physicists have tried to calculate the theoretical maximum distance ice could be thrown. One such calculation found the maximum distance to be 835 feet, but noted that this does not take into account several factors (such as surface tension of water and the slow rate of snow and ice melt) which would reduce the maximum range.

Height of Small-Scale Wind Towers

- How tall are typical small wind turbines?
    - Typically around 100 feet.

Forest Protection

- Why recommend that clearance of forest be avoided?
    - Forests provide a multitude of benefits to the community, including habitat, wildlife corridors, carbon sequestration, and water quality and stormwater benefits.

Viewshed Protection

- What guidance is there for protecting viewsheds?
    - The Department has published a report on protecting scenic resources (*Tompkins County: Protecting Our Scenic Resources*-2010) which is available on our website.

Footprint of Large-Scale Turbine

- What's the typical footprint of a large-scale wind turbine? Is there a building associated with each turbine?
    - A typical footprint is 2000-3000 square feet. There are not buildings associated with individual towers, but electrical substations need to be installed on the site.

Protect Residential and Scenic Areas

- I am opposed to large-scale wind turbines in residential and scenic areas. Small- and medium-scale are fine.
    - We recommend communities require visual impact analyses for proposals located within distinctive and noteworthy viewsheds. This would allow municipal officials to establish appropriate mitigation measures when proposals are reviewed.
    - We also recommend that communities with zoning consider which of their zoning districts would be appropriate for the installation of Large-Scale Wind Energy Systems.

Shadow Flicker

- What would a shadow flicker analysis entail?
    - Since the precise location of the sun, proposed turbines, and potentially affected buildings are all known, it is possible to predict with great accuracy the amount and time of shadow flicker.

      A shadow flicker analysis calculates for each point of interest:
        - *Number of hours per year that the flickering occurs,*
        - *Maximum length (in minutes) that flickering occurs on the worst day in the year, and*
        - *Number of days in the year that shadow flickering appears at all.*[1]

[1] http://www.greenrhinoenergy.com/renewable/wind/wind_flicker.php

- Shadow flicker should be limited not only annually but to no more than 15 minutes per day. Would prefer that shadow flicker not be allowed at all without resident permission.
- Regulations should limit shadow flicker to no more than 30 hours per year and 30 minutes per day.
    - We recommend that shadow flicker on any one building be limited to no more than 30 hours per year. Local communities may also decide whether to include a 30 minutes per day standard.

Noise

- Concern over noise pollution can be addressed with proper blade design.
- Noise limits should be established measured at or beyond lot lines to 40 dBA daytime, 35 dBA at night; and 50 dBC daytime, 45 dBC at night.
- Setbacks should be set at (1) 1-2 miles with nearby property owners allowed to waive this requirement. If not, (b) setback so noise at the property line is 40 dB daytime and 30 dB at night or 3 dB above ambient. If not (c) set to address risk of collapse, blade throw, ice throw (1500 to 2000 feet). If not (d) towns should guarantee property values, including relocation costs.
- There is evidence from around the world that infrasound from wind installations affect the health of people and animals – some are recommending setbacks of 2-3 km.
- Residents should be informed of the potential adverse health effects that have been reported around the world.
    - We conducted a review of studies and recommendations with regard to setting noise limits for Large-Scale Wind Energy Systems. There is an extensive discussion of the results of that research in the body of this report.
    - We have recommended that communities should <u>either</u> (a) establish the following noise standards to be measured at neighboring residences, schools, churches, and libraries:
        - a design goal of 40 dBA;
        - a long-term average regulatory standard of 45 dBA; and
        - a short-term (10-20 minute) maximum sound limit of 50 dBA; <u>or</u>

        (b) if the community wishes to use setbacks <u>instead of</u> sound measurements to address noise impacts, require that wind turbines be set back from residences, schools, churches and libraries by at least 1,150 feet.