City of Columbus – Bartholomew County
Planning Department

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MEMORANDUM

TO: Bartholomew County Plan Commission Members

FROM: Emilie Pinkston

DATE: August 3, 2022

RE: Commercial Solar Zoning Ordinance Amendments

The agenda for the August 10 Plan Commission meeting again includes the proposed resolution forwarding a favorable recommendation to the Board of County Commissioners on the CSES (Commercial Solar Energy System) zoning ordinance amendments. The proposed resolution incorporates the draft ordinance updates agreed upon by the Plan Commission at the July meeting. We have also applied changes to the draft resolution based on Plan Commission discussion at the July meeting and incorporated additional detail in some sections; these additional changes are identified by underlined text.

Attached for your reference are the following documents:

1. The proposed resolution with the proposed zoning ordinance language attached;
2. A second list of optional revisions to the proposed zoning ordinance language based on feedback received from the Plan Commission and the public just before and at the July Plan Commission meeting;
3. A table comparing required setbacks for industrial and similar uses in the City of Columbus-Bartholomew County Zoning Ordinance;
4. An abridged version of *The Comparison of Solar Regulations in Indiana Communities and State Model Ordinances* focusing on setbacks only; and
5. Copies of emails and letters received by the Planning Department since the July Plan Commission meeting from members of the public regarding the proposed zoning ordinance amendments.

Please contact me ahead of the meeting if you have any questions or concerns.

GENERAL RESOLUTION: #2022-01

of the Bartholomew County, Indiana Plan Commission

regarding
revision of the Columbus & Bartholomew County Zoning Ordinance for the jurisdiction of Bartholomew County

WHEREAS, on February 8, 2008 the Bartholomew County Board of Commissioners passed Ordinance No. 3, 2008 adopting a replacement zoning ordinance, including zoning maps, for the jurisdiction of Bartholomew County; and

WHEREAS, since that ordinance's effective date of April 1, 2008 its effectiveness has been monitored, reviewed, and evaluated by the Bartholomew County Plan Commission and its professional staff; and

WHEREAS, this on-going review of the zoning ordinance was both an expected and planned component of its long-term maintenance, and periodic revisions to ensure its relevance and appropriateness have been anticipated; and

WHEREAS, commercial solar energy systems (CSESs), large-scale developments that capture and convert solar energy into electricity for the purpose of wholesale sales and off-site use, have become a more common land use throughout the state of Indiana and, in the future, may be proposed in Bartholomew County; and

WHEREAS, the City of Columbus – Bartholomew County Planning Department completed extensive research on commercial solar developments, including conducting site visits, attending professional seminars on the topic, and reviewing existing commercial solar model ordinances for Midwestern states and regulations in 14 other Indiana counties; and

WHEREAS, the City of Columbus-Bartholomew County Planning Department prepared recommended zoning ordinance revisions intended to establish reasonable requirements for the development, operation, and decommissioning of commercial solar energy systems and to minimize conflict between these developments and surrounding land uses; and

WHEREAS, the proposed zoning ordinance revisions were prepared for the purposes described in Indiana Code Section 36-7-4-601(c) including (1) the securing of adequate light, air, convenience of access, and safety from fire flood, and other danger; (2) lessening or avoiding congestion in public ways; and (3) promoting the public health, safety, comfort, morals, convenience, and general welfare; and

WHEREAS, the Bartholomew County Comprehensive Plan, adopted in a series of elements from 1999 through 2012, provides the policy guidance appropriate for the creation and periodic revision of the zoning ordinance; and

WHEREAS, the Plan Commission did, on July 13, 2022, hold a public hearing consistent with the applicable requirements of Indiana law and the Plan Commission Rules of Procedure; and

WHEREAS, the Plan Commission did pay reasonable regard to the criteria listed by Indiana Code Section 36-7-4-603; including (1) the Comprehensive Plan, (2) the current conditions in each district, (3) the most desirable use for land in each district, (4) the conservation of property values, and (5) responsible growth and development; and

WHEREAS, the Plan Commission recognizes that its action represents a recommendation to the Board of Commissioners of Bartholomew County, Indiana, which will be responsible for final action on this matter.

NOW THEREFORE BE IT RESOLVED, by the Plan Commission of Bartholomew County, Indiana, as follows:

1) The proposed revisions to the Columbus & Bartholomew County Zoning Ordinance as documented by the attached Exhibit "A", which is hereby made a part of this resolution, are forwarded to the Bartholomew County Board of Commissioners with a favorable recommendation.

2) This resolution shall serve as the certification required by Indiana Code Section 36-7-4-605.

ADOPTED BY THE BARTHOLOMEW COUNTY, INDIANA PLAN COMMISSION THIS ____ DAY OF _____ 2022 BY A VOTE OF___ IN FAVOR AND ___ OPPOSED.

_____
Tom R. Finke, President

ATTEST:

_____
Arnold Haskell, Secretary

Exhibit "A"

Bartholomew County Zoning Ordinance Revisions for Commercial Solar Energy Systems (CSESs)

Zoning Ordinance Section 3.5(B): Agriculture: Preferred (AP)

Addition of Commercial Solar Energy System (CSES) to conditional use list under 'Industrial Uses.'

Zoning Ordinance Section 3.6(B): Agriculture: General Rural (AG)

Addition of Commercial Solar Energy System (CSES) to conditional use list under 'Industrial Uses.'

Zoning Ordinance Article 3: Zoning Districts

Table 3.1: Addition of Commercial Solar Energy System (CSES), listed as conditional in AP and AG zoning districts.

Zoning Ordinance Chapter 6.10: Commercial Solar Energy Systems

Intent: The purpose of the commercial solar energy system standards is to establish reasonable requirements for the development, operation, and decommissioning of commercial solar energy systems and to minimize conflict between these developments and surrounding land uses.

These General Commercial Solar Energy System (CSES) Standards apply to the AP (Agriculture: Preferred) and AG (Agriculture: General Rural) zoning districts:

A. *CSES Location and Design Standards:* Commercial Solar Energy Systems (CSESs) shall be located consistent with Article 3 of this (the Zoning) Ordinance. All such energy systems shall meet any and all applicable requirements of the federal, state, and local government in addition to the standards listed below.
    1. *Setback Distances:*
        a. *Minimum Front Yard (Right-of-Way) Setbacks:* All structures, equipment, storage areas, vehicle service drives, and fencing used in association with a CSES shall be setback a minimum of 50 feet from the actual or planned right-of-way, whichever is greater, for all adjacent streets and roads. Access drives that connect the CSES facility to the adjacent public street or road may encroach into the required setback area.
        b. *Minimum Side and Rear Yard Setbacks:* All structures, equipment, storage areas, vehicle service drives, and fencing used in association with a CSES shall be setback a minimum of 30 feet from all side and rear property lines, where adjacent to a non-participating property. No setback shall be required along shared property lines with other participating properties.
        c. *Exemption*: The minimum setback distances described above shall not apply to any cables buried underground or to the cable that connects the Commercial Solar Energy System (CSES) electrical substation to the transmission line (when located either above or below ground).

2. *Separation Distances*: All structures, equipment, storage areas, vehicle service drives, and fencing used in association with a CSES shall be separated from other properties and/or land uses as specified below:
    a. *Municipal Boundaries:* No CSES facility shall be located closer than ½ mile to any municipal boundary line. The separation shall be measured from the nearest structure, equipment, storage area, vehicle service drive, or fence associated with the CSES to the corporate limits.
    b. *Residential Properties:* No CSES electrical substation shall be located within 750 feet, and no other CSES component (including structures, equipment, storage areas, vehicle service drives, and fences) shall be located within 500 feet, of the residential properties listed below. Separation measurement for each shall be as specified for below.
        i. Residential Zoning Districts: Including Single-Family Residential and Multi-Family Residential zoning districts. The separation shall be measured from the boundary line of those zoning districts.
        ii. Residential Properties in Agricultural Zoning Districts: Including all properties of 5 acres or less in any agricultural zoning district, regardless of whether or not that property currently contains a residence. The separation shall be measured from the residential property lines.
        iii. Farm Dwellings in Agricultural Zoning Districts: Including any and all residences in any agricultural zoning district located on a property of greater than 5 acres. The separation shall be measured from the farm dwelling.
        iv. Exemptions: Any residential property or farm dwelling that is (1) on a property that is considered a participating property in the CSES facility or (2) in the same ownership as any participating property in the applicable CSES facility shall be exempt from the minimum separation distances described above.
    c. *Certain Community Facilities:* No CSES electrical substation shall be located within 750 feet, and no other CSES component (including structures, equipment, storage areas, vehicle service drives, and fences) shall be located closer than 500 feet to any (1) school (including a trade or business school, college or university, and day-care center); (2) health care facility (including a hospital, clinic, retirement facility, and nursing home / assisted living facility); (3) worship facility; (4) recreational facility (including all park uses and all outdoor recreational uses); or (5) cemetery. In the case of nature preserves (which are considered a park use) the specified separation shall only be required if the nature preserve is dedicated by the State of Indiana. The separation shall be measured from the nearest CSES component to the property line of the other use. <u>For cemeteries on parcels greater than 5 acres, the separation shall be measured from the nearest CSES component to the visible boundary of the cemetery, rather than the property line.</u>
    d. *Exemption*: The minimum separation distances described above shall not apply to any cables buried underground or to the cable that connects the Commercial Solar Energy System (CSES) electrical substation to the transmission line (when located either above or below ground).
    e. *Waivers*: <u>Waivers from the required separation distances specified above in Sections A(2)(a) and A(2)(b)(ii) and (iii) may be granted by the municipality or individual residential property or farm dwelling owner(s) from which they are required. All such waivers shall exempt the CSES from providing the otherwise required separation distance in its entirety. Any alternate separation, buffering, and/or other mitigation of the presence of the CSES shall be established as a</u>

private agreement between the involved municipality or residential property or farm dwelling owner(s) and the CSES developer/owner/property owner(s). These private agreements shall not be subject to enforcement by Bartholomew County or any other unit or entity of local government.

3. *Vehicular Access:* Vehicle access drives serving the CSES facility shall be paved with asphalt or concrete for the first 50 feet from the edge of road or street pavement; the remaining portion of the access drive may be gravel. Any portion of a drive located in a public right-of-way shall meet the applicable requirements of the County Engineer.
4. *Equipment Height:* CSES solar arrays shall not exceed 20 feet in height when oriented at maximum tilt. All other structures in the CSES shall conform with the maximum height standards for accessory structures in the underlying zoning district.
5. *Vegetative Groundcover:* For the life of the CSES, perennial vegetated groundcover shall be established and maintained on the ground around and under solar arrays. Vegetative groundcover shall consist only of plants native to Indiana. The use of pollinator specific seed mixes is encouraged but not required. A Groundcover Plan demonstrating compliance with this requirement shall be submitted. For a guide to best management practices, refer to *Technical Guide: Establishment and Maintenance of Pollinator-Friendly Solar Projects (Northern Indiana 2020*) developed by the Michiana Area Council of Governments (MACOG).
    a. Perennial vegetated groundcover shall be based on a diverse seed mix of at least 12 species, selected based on guidance from Purdue Extension – Bartholomew County. No plants included on the Indiana Department of Natural Resources Terrestrial Plant Rule list, which identifies invasive species, shall be included in the seed mix.
    b. The Groundcover Plan shall include planting details for all setback areas. Setback areas must be planted with some form of groundcover, which could include agricultural crops. The Groundcover Plan shall also include the details for site preparation and maintenance practices designed to control invasive species and noxious vegetation. The strategy for site preparation and maintenance practices shall be based on guidance from Purdue Extension – Bartholomew County.
    c. Consistent with Section F, the requirement for vegetative groundcover is not intended to restrict the practice of agrivoltaics, the concurrent use of land for solar power generation and agricultural production.
6. *Lighting:* Exterior lighting for any CSES shall be limited to that required for safety and operational purposes. All lighting shall be oriented so as not to project onto surrounding properties and shall have shielded 90-degree cut-off fixtures.
7. *Cables*: All power and communication cables running between solar arrays, inverters, CSES electrical substations, and operation and maintenance buildings shall be buried underground to a depth of at least 36 inches below grade. This requirement shall not be interpreted as prohibiting above ground cables that are integrated with solar arrays, their mounting systems, or other equipment, provided that equipment, including the cabling, does not exceed the maximum height specified by Section A(4). Cables connecting the CSES electrical substation to the transmission line may be under or above ground.

B. *Outdoor Storage*: Outdoor storage areas, used to store materials, supplies, Battery Energy Storage Systems (BESS), and other equipment, that are within 200 feet of an existing right-of-way of a public road shall be screened from view by a Buffer Yard Type A, as described in Chapter 8 of this Ordinance. For the purposes of this screening, only the Opaque Tree Screen option of the Buffer Yard Type A shall be used. The buffer may encroach into the required setback described in Section A(1)(a). The buffer requirement does not apply to areas temporarily used for materials and equipment storage during the construction of a CSES.

C. *Safety and Security Standards:* All Commercial Solar Energy Systems (CSESs) shall meet the following safety and security requirements:
    1. *Fencing:* Any fencing used to enclose the CSES shall not exceed a height of 8 feet. The use of barbed wire is prohibited except around a CSES electrical substation or otherwise as required by the National Electric Code (NEC). Fencing that provides clearance at the bottom, to allow for the passage of wildlife, is encouraged but not required.
    2. *Posted Warnings and Information*: At all driveway entrances to the CSES, a sign containing the emergency contact information for the site operator and the facility's 911 address shall be posted.

D. *Decommissioning and Site Restoration Plan:* Any CSES which has ceased electrical power generation or transmission for twelve (12) consecutive months shall be removed in compliance with a Decommissioning and Site Restoration Plan submitted to the Chief Code Enforcement Officer and approved by the Board of County Commissioners. The following standards apply.
    1. *Decommissioning and Site Restoration Plan:* At a minimum, the Decommissioning and Site Restoration Plan shall include:
        a. A description of the decommissioning activities, which shall include but not be limited to:
            i. Removal of all surface and subsurface physical improvements including but not limited to all solar arrays, electric systems and components, buildings, cabling, security barriers, interior drives, gravel areas, foundations, pilings, and fences.
            ii. Restoration of surface grade and soil to pre-construction conditions.
            iii. Establishment of groundcover for erosion control purposes.
        b. Acknowledgement, by the notarized signature, of every participating property owner of the decommissioning requirement as well as their authorization for the County to enter their properties to accomplish decommissioning. Both the acknowledgement and authorization shall run with the land and extend to all successors in ownership.
        c. Decommissioning Cost Estimate: The applicant shall submit a cost estimate for the total estimated cost of decommissioning the CSES in accordance with the Decommissioning and Site Restoration Plan.
            i. The decommissioning cost estimate shall be calculated by a third party Indiana licensed engineer selected by the applicant and agreed upon by the County Commissioners.
            ii. The decommissioning cost estimate shall not include any estimates or offsets for the resale or salvage values of the CSES equipment and materials.
        d. Financial Guarantee for Decommissioning*:*
            i. The applicant shall provide a financial guarantee in the form of an irrevocable letter of credit, performance bond, or surety bond for 125% of the total estimated cost of decommissioning, as described in Section D(1)(a), posted with Bartholomew County.
            ii. The letter of credit or bond shall be in place prior to the issuance of an Improvement Location Permit.
    2. Updates Required:
        a. The decommissioning cost estimate shall be reevaluated and updated every five years by a third party Indiana licensed engineer selected by the applicant or its successor and agreed upon by the County Commissioners. Each reevaluation and update shall be completed within 5 years of the acceptance, by the County Commissioners, of the preceding estimate.

b. The applicant or its successor shall submit an updated financial guarantee per Section D(1)(d)(i) to the County as part of each decommissioning cost estimate update.

3. *Timeline for Decommissioning:* If the applicant or its successor fails to remove all CSES project assets within eighteen (18) months of the start date of decommissioning, a date beginning immediately after the CSES has ceased electrical power generation or transmission for twelve (12) consecutive months or an alternative date agreed upon by the Chief Code Enforcement Officer, the County may engage qualified contractors to enter the site, remove the CSES project assets, sell any assets removed, and remediate the site. The County may also initiate proceedings to recover, from the provided financial guarantee, any costs incurred. If decommissioning is triggered for a portion, but not the entire CSES, then decommissioning shall commence in accordance with the approved Decommissioning and Site Restoration Plan for the applicable portion of the CSES. The remaining portion of the CSES would continue to be subject to the approved Decommissioning and Site Restoration Plan.

E. *Road Use and Maintenance Agreement:* The agreement is subject to the requirements and procedures of the Board of County Commissioners and County Engineer and may include, but not be limited to, the following information:
    1. Identification of roads to be used for the transport of CSES construction materials.
    2. Road closure plans and procedures and temporary road modifications related to CSES construction activity.
    3. Roadway time of day use restrictions for CSES construction activity.
    4. A pre-construction, existing conditions survey of all roads identified for use in transport of CSES construction materials, to be used in an assessment of road damage caused by CSES construction activity.
    5. A compensation agreement and/or financial guarantee for road repairs needed as a result of construction activity related to the CSES.

F. *Agrivoltaic*s: This Ordinance does not restrict the practice of agrivoltaics, the concurrent use of land for solar power generation and agricultural production.

G. *Required Documentation for Commercial Solar Energy System (CSES) Facilities:* In addition to the requirements provided in Article 12 for the receipt of conditional use approval and an Improvement Location Permit, applications for new or modified CSESs shall include the following documentation.
    1. The following documentation shall be submitted with the conditional use application materials:
        a. *Project Description:* A project description including project developer and operator, approximate number of solar panels, total acreage occupied by solar arrays, generating capacity, means of connecting to the electrical grid, a list and/or map of participating properties and their owners, and a list and map of all property owners within 750 feet of the CSES facility.
        b. *Conceptual Site Plan:* The conceptual site plan including areas of solar arrays, the location of inverters, the CSES electrical substation, the location and route of the connection between the CSES electrical substation and the transmission line, the location of any permanent outdoor storage areas, the location of any battery storage areas, service drive access points to public streets or roads, and the location of all perimeter fencing.
        c. *Preliminary Drainage Plan:* A preliminary drainage plan describing the applicant's overall approach to managing stormwater runoff on the project site, including pre- and post- construction run-off calculations.

d. *Conceptual Groundcover Plan:* A conceptual groundcover plan, including the location of all proposed perennial vegetated groundcover, preliminary species selection, and the groundcover strategy for all setback and separation areas. The conceptual plan shall also describe the preliminary groundcover maintenance strategy.
e. *Glare Analysis (if applicable):* For any CSES project proposed within 500 feet or within an approach zone of the Columbus Municipal Airport, a glare analysis must be submitted for review and approval by the Columbus Board of Aviation Commissioners.
f. *Residential Property Separation Distance Waiver(s):* For any property from which a waiver of the minimum separation distance required by Section A(2)(b)(ii) and (iii) is to be granted by that property's owner(s), a written statement of that waiver, specifying the property for which the waiver is to be granted by legal description and parcel number, signed by the property owner(s).
g. *Municipal Boundary Separation Distance Waiver(s):* For any municipality from which a waiver of the minimum separation distance required by Section A(2)(a) is granted, a written statement of that waiver signed by the Mayor or Town Council President, as applicable.
h. Any other information or documentation requested by the Planning Director, Chief Code Enforcement Officer, City/County Engineer of jurisdiction, or Board of Zoning Appeals to demonstrate compliance with the requirements and review criteria of this Ordinance and to support a thorough review of the project.

2. The following documentation shall be submitted to the Planning Director prior to the issuance of an Improvement Location Permit but shall not be required as part of the conditional use application:
    a. *Site Plan:* The site plan required by Section 12.9(D) shall describe all aspects of the new or modified CSES facility including solar arrays and their configuration, CSES electrical substations, access and service drives, inverters, battery storage, cabling, storage yards, fencing, and other ground-based equipment.
    b. *Drainage Plan:* A detailed drainage plan meeting the requirements of the County Engineer. All existing waterways and/or other drainage ways on the subject property shall be identified on the plan. The drainage plan shall also include the location of existing field tiles on the CSES project site, based on best available information, and a statement signed by the applicant accepting responsibility for the repair and/or relocation of field tiles that are damaged as a result of construction, maintenance, and/or operation of the CSES.
    c. *Groundcover Plan:* A Groundcover Plan in accordance with Section A(5) of this Chapter.
    d. *Residential Property Separation Distance Waiver(s):* For any property from which a waiver of the minimum separation required by Section A(2)(b)(ii) and (iii) is granted by that property's owner(s), a copy of the waiver document which identifies the property by legal description and parcel number, has been approved as to form and content by the Planning Director, includes the notarized signature(s) of the property owner(s), and has been recorded in the Office of the Bartholomew County Recorder.
    e. *Municipal Boundary Separation Distance Waiver(s):* For any municipality from which a waiver of the minimum separation distance required by Section A(2)(a) is granted, a copy of the waiver document which has been approved as to form and content by the Planning Director, has been approved by resolution of the city or town council, as applicable, and has been recorded in the Office of the Bartholomew County Recorder.

f. *Structural Certification:* Certification from a professional engineer licensed in the State of Indiana that the foundation, anchoring, and design of the solar panel racking and support is within accepted professional standards, given local soil and climate conditions.
g. *Decommissioning and Site Restoration Plan:* A copy of the Decommissioning and Site Restoration Plan in accordance with Section D of this Chapter as approved by the Board of County Commissioners and recorded in the Office of the Bartholomew County Recorder, including a copy of the financial guarantee.
h. *Road Use and Maintenance Agreement:* A copy of the fully executed Road Use and Maintenance Agreement as approved by the Board of County Commissioners in accordance with Section E of this Chapter.

Zoning Ordinance Chapter 12.9: Improvement Location Permits

Section 12.9(B)(1)(l): *Commercial Solar Energy System (CSES) Facilities:* the construction, additions to, installation, or placement of any CSES structure(s), storage area, equipment, or access drives.

Zoning Ordinance Chapter 14.2: Definitions

Power Generation Facility: A commercial facility that produces usable electricity by harnessing any array of resources including fossil fuels, water, and wind sources. This definition does not include solar sources. See also *Commercial Solar Energy System (CSES).*

Commercial Solar Energy System (CSES): A system that captures and converts solar energy into electricity for the primary purpose of wholesale sales of generated electricity and for use in locations other than where it is generated. The term includes, but is not limited to, solar arrays, collection and feeder lines, substations, ancillary buildings, solar monitoring stations, battery storage facilities, outdoor storage areas, and other accessory equipment or structures. This definition does not include residential or other uses with solar arrays capturing solar energy for primarily on-site use, with any excess amounts supplied to the electrical grid.

Commercial Solar Energy System (CSES) Electrical Substation: A facility, operated as part of a CSES facility and located on the CSES project site, generally consisting of a main power transformer, breakers, control building, metering and other power conditioning equipment in which electricity produced by the CSES is aggregated at a centralized location and the voltage is transformed from medium voltage to grid voltage for final conveyance to the electrical grid.

Inverter: Regarding a Commercial Solar Energy System (CSES), a device that converts direct current (DC) electricity, which is what solar panels generate, to alternating current (AC) electricity, which the electrical grid uses.

Non-Participating Property: A lot or parcel of real property that is not owned, leased, or otherwise controlled or used by a Commercial Solar Energy System (CSES) project owner and with respect to which the CSES project owner does not seek to install or locate one or more CSESs or other facilities related to a CSES project (including power lines, temporary or permanent access roads, or other temporary or permanent infrastructure).

Participating Property: A lot or parcel of real property all or part of which is included in a Commercial Solar Energy System (CSES) project.

Solar Array: Two or more solar panels connected together in a series for the purpose of generating electricity.

Solar Panel: A bank of interconnected solar cells combined into the form of a panel normally contained by a metal or plastic perimeter frame.

Optional Revisions to the Proposed Zoning Ordinance Amendments for Commercial Solar Energy Systems (CSESs) - Update

City of Columbus – Bartholomew County Planning Department
Updated: August 3, 2022 (for the August 10, 2022 Bartholomew County Plan Commission Meeting)

Below is a list of possible revisions to the proposed commercial solar zoning ordinance amendments for Plan Commission consideration, based on feedback from Plan Commission members and the public just before and at the July 13, 2022 Plan Commission meeting and needed clarifications identified by the Planning Department.

Deletions: ~~strikethrough~~ Additions: underline

1. **Change to Separation Distance for Residential Properties in Agricultural Zoning Districts** [Planning Department Clarification]

   Section A(2)(b)(ii): Residential Properties in Agricultural Zoning Districts: Including all properties of 5 acres or less in any agricultural zoning district on which home construction is allowed per the Bartholomew County Subdivision Control Ordinance, regardless of whether or not that property currently contains a residence. The separation shall be measured from the residential property lines.

2. **Required Improvement Location Permit Documentation** [Public Input]

   Section G(2)(b): *Drainage Plan:* A detailed drainage plan meeting the requirements of the County Engineer. All existing waterways and/or other drainage ways on the subject property shall be identified on the plan. The drainage plan shall also include the location of existing field tiles on the CSES project site, based on best available information, and a statement signed by the applicant accepting responsibility for the repair and/or relocation of field tiles that are damaged as a result of construction, maintenance, ~~and/or~~ operation, and/or decommissioning of the CSES.

3. **Vegetative Groundcover Clearance** [Plan Commission Suggestion]

   Section A(4): *Equipment Height:* CSES solar arrays shall not exceed 20 feet in height when oriented at maximum tilt and shall provide a minimum clearance of 3 feet between the ground and the solar array, at maximum tilt, for the purpose of vegetative groundcover. All other structures in the CSES shall conform with the maximum height standards for accessory structures in the underlying zoning district.

4. **Decommissioning Documentation** [Public Input]

   Section D(1)(a)(ii): Restoration of surface grade and soil to pre-construction conditions, documented by pre-construction and post-decommissioning as-built topographic maps.

5. **Decommissioning Waiver for Subsurface Infrastructure and Vehicle Access Drives** [Public Input]

   Section D(4): Waivers: The decommissioning requirement described above in Section D(1)(a)(i) may be waived by individual property owners for only subsurface improvements, such as cabling, and/or vehicle access drives. All such waivers shall exempt the CSES operator and/or owner from removing subsurface improvements and/or vehicle access drives on individual properties during the decommissioning process. A notarized waiver document signed by the individual property owner(s), subject to review and approval by the County Attorney, shall be recorded in the Office of the Bartholomew County Recorder. Waivers may be granted any time prior to the start of CSES decommissioning and shall remain with the property and apply to all subsequent property owners.

6. **Complete Decommissioning Required** [Public Input and Planning Department Clarification]

   Section D(5): Complete decommissioning of the CSES is required regardless of the presence of the financial guarantee and including any instance where that financial guarantee is insufficient for complete decommissioning to be carried out by the County. Incomplete decommissioning for any cause and/or circumstances, other than in the case of waivers granted per Section D(4), shall constitute a violation of this ordinance subject to the provisions of Article 13, including the responsibility of the property owner specified by Section 13.1(D).

7. **Separation Distances for Residential Properties and Certain Community Facilities** [Public Input]

   Section A(2)(b): *Residential Properties:* No CSES electrical substation shall be located within ~~750~~ 500 feet, and no other CSES component (including structures, equipment, storage areas, vehicle service drives, and fences) shall be located within ~~500~~ 250 feet, of the residential properties listed below. Separation measurement for each shall be as specified for below.

   Section A(2)(c): *Certain Community Facilities:* No CSES electrical substation shall be located within ~~750~~ 500 feet, and no other CSES component (including structures, equipment, storage areas, vehicle service drives, and fences) shall be located closer than ~~500~~ 250 feet to any (1) school (including a trade or business school, college or university, and day-care center); (2) health care facility (including a hospital, clinic, retirement facility, and nursing home / assisted living facility); (3) worship facility; (4) recreational facility (including all park uses and all outdoor recreational uses); or (5) cemetery. In the case of nature preserves (which are considered a park use) the specified separation shall only be required if the nature preserve is dedicated by the State of Indiana. The separation shall be measured from the nearest CSES component to the property line of the other use. For cemeteries on parcels greater than 5 acres, the separation shall be measured from the nearest CSES component to the visible boundary of the cemetery, rather than the property line.

   Section G(1)(a): *Project Description*: A project description including project developer and operator, approximate number of solar panels, total acreage occupied by solar arrays, generating capacity, means of connecting to the electrical grid, a list and/or map of participating properties and their owners, and a list and map of all property owners within ~~750~~ 500 feet of the CSES facility.

City of Columbus - Bartholomew County Planning Department

Zoning Ordinance Setback Examples

8.3.2022

Land Use	Minimum Front Setback	Minimum Side and Rear Setback	Minimum Setback from Municipal Boundary	Minimum Setback from Residential Zoning Districts	Minimum Setback from Residential Properties in Agriculture Zoning Districts (any property of 5 acres of less, regardless of whether or not it currently contains a residence)	Minimum Setback from Farm Dwellings in Agriculture Zoning Districts (a residence located on a property of greater than 5 acres)	Minimum Setback from Community Facilities (schools, health care facilities, worship facilities, and recreational facilities)	Minimum Setback from Private Wells for Household Use
Confined Feeding Operations (CFOs)	100 Feet	100 Feet	1/2 Mile (2,640 Feet)	1/2 Mile (2,640 Feet)	500 Feet measured from residential property line	500 Feet measured from the farm dwelling	1/4 Mile (1,320 Feet) measured from the property line	500 feet meausured from the well water withdral location
Telecommunications Facilities (Cell Towers)	As specified for the zoning district in which the facility is located (Ranges from 10 - 50 Feet)	50 Feet	N/A	250 Feet	N/A	N/A	N/A	N/A
Mineral Extraction	100 Feet	200 Feet	N/A	N/A	N/A	N/A	N/A	N/A
Industrial Uses (in I3 zoning district) (including concrete/asphalt production, truck freight terminal, general industrial production, etc.)	Arterial Street or Road: 50 Feet Collector Street or Road: 35 Feet Local Street or Road: 25 Feet	20 Feet	N/A	45 Feet (20' setback + 25' buffer)	35 - 45 Feet (20' setback + 25' buffer in AG zoning district*) *15' buffer in AP zoning district	35 - 45 Feet measured from property line (20' setback + 25' buffer in AG zoning district*) *15' buffer in AP zoning district	45 Feet (20' setback + 25' buffer)	N/A
Proposed Commecial Solar Energy System (CSES) Ordinance	50 Feet	30 Feet	1/2 Mile (2,640 Feet)	500 Feet (750 Feet for CSES Electrical Substations)	500 Feet (750 Feet for CSES Electrical Substations) measured from the property line	500 Feet (750 Feet for CSES Electrical Substations) measured from the farm dwelling	500 Feet (750 Feet for CSES Electrical Substations) measured from the property line	N/A

City of Columbus - Bartholomew County Planning Department

CSES Setback and Separation Requirement Examples

8.3.2022

STANDARD	SB 411 (Passed March 11, 2022)	INDIANA MODEL SOLAR ORDINANCE (IU Environmental Resilience Institute / Great Plains Institute)	ST. JOSEPH COUNTY ORDINANCE	MONTGOMERY COUNTY ORDINANCE	SHELBY COUNTY ORDINANCE	BLACKFORD COUNTY ORDINANACE	WHITE COUNTY ORDINANCE	STARKE COUNTY ORDINANCE
Minimum Setback from Nonparticipating Property Line	50 feet	Meet the established setback for structures in the district in which the project is located. (Setback can be reduced by 50% if a landscape buffer is present)	As Required for Accessory Structures in the Applicable Zoning District	30 feet (200 feet if adjoining property is zoned residential)	150 feet	50 feet	50 feet	50 feet
Setback may be waived by non-participating property owner	No	No	No	No	No	No	Yes	Yes
Minimum Setback from Non-participating Dwelling	150 feet	150 feet (Setback can be reduced by 50% if landscape buffer is present)	No	No	660 feet	300 feet	150 feet	200 feet
Setback may be waived by non-participating property owner	Yes	No	N/A	N/A	No	No	No	Yes
Screening/Landscape Buffer Required for Non-participating Dwellings	Yes (if CSE is within 250 feet)	Yes	No	No	Yes (whenever the subject property abuts a parcel with an equal or less intensive zoning category)	Yes (where there is a house within 500 feet)	Yes (for all dwellings and residential zoning districts 250 feet or closer to project)	Yes (along the perimeter of project)
Screening may be waived by non-participating property owner	Yes	No	N/A	N/A	No	No	Yes	Yes

STANDARD	RANDOLPH COUNTY ORDINANCE	PULASKI COUNTY ORDINANCE	CASS COUNTY ORDINANCE	BENTON COUNTY ORDINANCE	KNOX COUNTY ORDINANCE	POSEY COUNTY ORDINANCE	FULTON COUNTY ORDINANCE	KOSCIUSKO COUNTY ORDINANCE
Minimum Setback from Nonparticipating Property Line	20 - 500 feet (varies by land use/zoning) (Driveways setback minimum of 50 feet to adjoining landowner property line)	75 feet (100 feet setback from an inverter or converter)	50 feet (150 feet for adjoining land with residential units)	Meet the minimum setback for the zoning district in which located	50 feet	100 feet	Meet the minimum setback for the zoning district in which located	200 feet
Setback may be waived by non-participating property owner	Yes	No	Yes	No	No	No	No	No
Minimum Setback from Non-participating Dwelling	20 - 500 feet (varies by land use/zoning; inverters must be setback from dwelling at least 250 feet)	100 feet from an inverter (otherwise no setback from dwelling identified)	No	200 feet	200 feet	No	No	No
Setback may be waived by non-participating property owner	Setbacks from inverters cannot be waived.	No	No	Yes	No	No	No	No
Screening/Landscape Buffer Required for Non-participating Dwellings	Yes (for dwellings and public use buildings within 400 feet and parcels platted for intent of future residential use)	Yes	Yes	Yes (any nonparticipating property owner, not just dwelling)	Yes	No	No	As deemed necessary by the BZA
Screening may be waived by non-participating property owner	Yes	Yes	No	Yes	No	No	No	No

Pinkston, Emilie

From: Colin & Yas <colinandyas@gmail.com>
Sent: Wednesday, July 13, 2022 10:15 AM
To: Bergman, Jeffrey; Pinkston, Emilie
Subject: External Message: Re: Contact Us [#6845]

Follow Up Flag: Follow up
Flag Status: Flagged

Jeffrey, Emilie

After re-reading the proposed ordinance I see another concerning restriction...

Minimum Separation Distances: All structures, equipment, storage areas, and fencing used in association with a CSES shall be separated from other properties and/or land uses as specified below:
Municipal Boundaries: No CSES facility shall be located closer than ½mile to any municipal boundary line. The separation shall be measured from the nearest structure, equipment, storage area, or fence associated with the CSES to the corporate limits

Residential properties: No CSES electrical substation shall be located within 750 feet, and no other CSES component (including structures, equipment, storage areas, and fences) shall be located within 500 feet, of the residential properties listed below. Separation measurement for each shall be as specified below.
a. Residential Zoning Districts: Including Single-Family Residential and Multi-Family Residential zoning districts. The separation shall be measured from the boundary line of those zoning districts.
b. Residential Properties in agricultural Zoning Districts: Including all properties of 5 acres or less in any agricultural zoning district, regardless of whether or not that property currently contains a residence. The separation shall be measured from the residential property lines.
c. Farm Dwellings in Agricultural Zoning Districts: Including any and all residences in any agricultural zoning district located on a property of greater than 5 acres. The separation shall be measured from the farm dwelling.
d. Exemptions: Any residential property or farm dwelling that is (1)on a property that is considered a participating property in the CSES facility or (2) in the same ownership as any participating property in the applicable CSES facility shall be exempt from the minimum separation distances described above

The minimum distances are over restrictive and would greatly reduce the available land for solar generation.

The Indiana University model solar ordinance suggests a 150ft setback from existing dwellings (https://eri.iu.edu/documents/in-solar-ordinance-2020-december.pdf)

Similar ordinances from nearby counties have a 200ft setback from residential (https://www.montgomerycounty.in.gov/egov/documents/1591987523_97548.pdf)

The impact of having excess setback is the resultant need for more land to generate the same amount of energy. While I understand the desire to minimize the impact on neighbors' properties may I suggest a lower maximum height (say 8-10ft) allowing solar closer to neighboring properties and/or as proposed in the above IU ordinance….

"All setbacks can be reduced by 50%, except that unwaived setbacks cannot be less than 30 feet if the array has a landscape buffer that screens the array at the setback point of measurement."

I understand this feedback may be too late for inclusion in this evening's meeting but I do hope that this consideration is included before voting on the ordinance.

Thanks

Colin Norris

812 391 2081

On Mon, Jul 11, 2022 at 11:25 AM Bergman, Jeffrey <jbergman@columbus.in.gov> wrote:

> Hi Colin,
>
> Thank you for providing this comment. I will be sure that it is included with the Plan Commission's materials for their discussion on this topic later this week.
>
> I will also note that others have offered this same clarification. The Planning Department staff has included language similar to what you have suggested as a possible revision/clarification to the initially proposed ordinance text for the Commission to consider.
>
> Please feel free to follow-up with me or Emilie Pinkston in our office (epinkston@columbus.in.gov) if you have any questions.

BARTHOLOMEW COUNTY SURVEYOR'S OFFICE

E. R. GRAY III, *County Surveyor*

Governmental Office Building
440 Third Street, Room 400
Columbus, Indiana 47201
ph: 812.379.1525 - *fax:* 812.379.1526
email: surveyor@bartholomew.in.gov
website: www.bartholomew.in.gov

Bartholomew County Plan Commission members:

July 20, 2022

I support the inclusion of cemeteries in the Community Facilities section of the proposed Commercial Solar Ordinance as it was presented at the public hearing on July 13 for the following reasons:

- I believe cemeteries serve a sacred purpose and warrant protection.
- Pioneer cemeteries are part of our cultural heritage. Many of the first pioneers to this county died here and are buried in these cemeteries.
- The proposed buffer would help preserve the rural character of many of the existing cemeteries located in agricultural areas.
- I have documented dozens of unmarked cemeteries in the county.
- Nearly a third of all cemeteries in the county (marked and unmarked) have no defined boundary.
- A buffer will decrease the likelihood of future conflicts and allow continued access for upkeep, burials and visitation.
- A buffer falls in line with current plan department procedures concerning cemeteries.

Thank you,

Cris L E West

Cris L.E. West
Administrative Assistant / Cemetery Historian
Bartholomew County Surveyor's Office

Bartholomew County Plan Commission
123 Washington St., Suite 8123
Columbus, IN 47201

July 21, 2022

Dear Bartholomew County Plan Commission,

EDP Renewables (EDPR) is Indiana's largest owner-operator of renewable energy generation assets and has developed over 1,400 megawatts (MW) of clean energy generation. This represents more than $2.4 billion in capital investments across the state. EDPR has fostered strong relationships with local and county governments, as well as neighboring landowners and community stakeholders, in order to develop renewable energy projects that create economic development opportunities for communities and local businesses while meeting the demands of a robust and growing commercial market for clean energy.

We greatly appreciate the opportunity to review and assess the proposed draft solar ordinance and appreciate the commission and planning staff for its thorough and considerate review of county ordinances and state guidance in preparing the proposed Bartholomew County solar ordinance. In reviewing local regulations and best practices developed across our nine operational Indiana project sites, EDP Renewables respectfully requests the following proposals be taken under consideration.

The setback requirements currently proposed in the draft solar ordinance create major challenges to development. Bartholomew County's proposed residential property line setbacks would be the most restrictive setback requirements in the state, by far. In addition, they are substantially higher than almost all other counties that measure setback distances from the actual dwelling on the property (rather than the property line). The proposed setback distances are also significantly higher than the voluntary renewable energy project siting standards enacted in Senate Enrolled Act 411 and signed into law by Gov. Holcomb earlier this year.

We respectfully request the setbacks be reduced to **250 feet** from the solar panel to the outer wall of a non-participating dwelling for parcels. Excessive setbacks infringe on participating landowners' individual property rights to utilize their land as they see fit, particularly with revenue-generating property. We believe landowners have the right to determine what they can do on their own private property, and that those rights should be respected when considering renewable energy development regulations. Reasonable setbacks enable responsible project development while protecting the property rights of Bartholomew County landowners.

EDP Renewables also encourages the Bartholomew County Plan Commission to modify setback requirements as measured from property lines on parcels with no residences or dwellings to reduce unintended restrictions on land use and project development. Measuring setbacks from property lines, rather than residences, is an atypical development requirement that creates additional development constraints and further restricts an individual landowner's use of their land. Using a property line-based setback can double or triple the required setback distance from a residence, depending on the shape of the parcel and the location of the dwelling on that parcel.

For example, please see Exhibit A, which illustrates a 5-acre parcel with a dwelling adjacent to the road near the front of the property. This parcel has a rear property line that extends more than 1,260 feet from the actual home. The proposed ordinance would require solar panels to be set back an additional 500 feet from the back of the property line, which would be equivalent to a 1,760-foot setback from the home. This is an unintended consequence of the ordinance as drafted, resulting in excessive setbacks impeding the neighboring landowners' use of their property, to no real benefit to the nearby homeowners. Additionally, in this example, the homes are already buffered by hundreds of feet of thickly wooded forestland, and will most likely never be able to see the solar panels even if they were directly adjacent to their property line.

When looking at a roughly 8,500-acre section of Bartholomew County suitable for a solar park and applying a 500-foot property line setback to parcels 5 acres or smaller, approximately 2,625 acres or 30.8% of the land is removed from development. With a 250-foot residence setback, 582 acres, or 6.8% of the land is removed from development. Maintaining a 500-foot setback requirement instead of 250 feet represents a 451% increase in the amount of land removed from potential development. We believe that blocking nearly a third of the land from development infringes on participating landowners' ability to site infrastructure and would result in more sprawling solar layouts. Requiring 500-foot setbacks from property lines would make it very difficult to build a solar park in Bartholomew County.

Additionally, land parcels that are 5 acres or smaller without a dwelling should not have excessive 500 ft property-line setbacks. Exhibit B shows an example of a parcel smaller than 5 acres. This parcel is adjacent to a railroad and is unlikely to be developed for residential use. A 500-foot set-back from these property lines unnecessarily restricts approximately 52 acres of neighboring land from being used for solar development. These smaller parcels, many of which are not suited for residential development, should be treated similarly to other property line setbacks in the ordinance (30 feet from the property line). This proposal aligns similarly with other counties' setbacks in Indiana.

We also request the commission modify the proposed ordinance to allow landowners the opportunity to waive provisions of the ordinance that apply directly to their property, specifically regarding decommissioning requirements and standards. For example, with respect to the removal of infrastructure, EDPR has worked with landowner participants on other projects to keep access roads developed to service solar infrastructure on a landowner's property at the landowner's request, as those roads have proven useful for harvesting crops and moving farm equipment between parcels. Additionally, removing underground cabling below certain depths would disturb land that has been allowed to rest for decades, to the detriment of future farming operations. Landowners should have the ability to waive these decommissioning requirements that impact their property.

We similarly request that municipalities be afforded the same opportunities to waive setback restrictions, to give greater local control to local officials. Allowing municipalities to waive certain requirements creates additional opportunities for local officials and developers to negotiate project site design that best fits a community's intended growth plans and may create additional economic opportunities to further invest in a community. We additionally request the municipality setback be amended to only apply to above-ground infrastructure as below-ground infrastructure will have little to no impact on the municipality.

EDP Renewables thanks the Bartholomew County Plan Commission for the considerable work undertaken to draft this proposed ordinance. We appreciate your consideration of our proposed recommendations.

Sincerely,

Andrew Magner

Project Manager, EDP Renewables
129 E. Market Street, Suite 600
Indianapolis, IN 46204
Andrew.Magner@edp.com

Exhibit A

Bartholomew County Parcels
500 Foot Setback from Property Line
250 Foot Setback from Residence

-Distance from the residence (yellow point) to the northern property line 1263 feet (blue line)
-Distance from the residence (yellow point) to the northern edge of the property line setback 1763 feet (white line)

Exhibit B

Bartholomew County Parcels
500 Foot Setback from Property Line

This illustration represents a residential parcel unlikely to include a dwelling, given its proximity to a railroad line.

August 4, 2022

Bartholomew County Plan Commission
ATTN: Emilie Pinkston
123 Washington St., Suite 8123
Columbus, IN 47201

Dear Ms. Pinkston:

As a follow-up to the written comments we submitted on July 21 and in response to questions received regarding the impact of factoring salvage value for CSES infrastructure into the net financial value of a decommissioning bond, EDP Renewables (EDPR) is pleased to share a brief analysis demonstrating the impact salvage value has on the total value of a decommissioning bond.

In summary, disregarding the salvage value of solar parks adds almost $1 million in additional financial costs for solar developers to secure a bond for a standard 100 MW CSES facility.

As such, EDPR respectfully requests that Bartholomew County's forthcoming solar ordinance permits salvage value for CSES infrastructure be factored into a project decommissioning bond cost.

Background

EDPR is Indiana's largest owner-operator of renewable energy generation assets and has developed over 1,400 megawatts (MW) of clean energy generation in the state. This represents more than $2.4 billion in capital investments in White, Benton and Randolph Counties where EDPR operates its Indiana project portfolio. EDPR has fostered strong relationships with local and county governments, as well as neighboring landowners and community stakeholders, in order to develop renewable energy projects that create economic development opportunities for communities and local businesses while meeting the demands of a robust and growing market for clean energy.

As part of our permitting requirements in White, Benton and Randolph Counties, EDPR is obligated to secure a decommissioning bond to be held by the county for the net value of decommissioning costs, assessed periodically by a third-party engineer mutually confirmed by both the county and EDPR. Importantly, **all three counties in which EDPR has developed projects allow the salvage value of project infrastructure to be subtracted from the assessed decommissioning costs** to establish the net value for the decommissioning bond.

Calculating Salvage Value Impact

EDP Renewables North America LLC
129 E. Market Street, Suite 600
Indianapolis, IN 46204
T: 317.636.0866 | F: 317.636.1418
www.edpr.com/north-america

To demonstrate the impact salvage value has on a decommissioning bond assessment, we have calculated a comparison demonstrating the annual costs of holding a decommissioning bond for a 100 MW CSES project that allows salvage value to be netted out versus a bond for the total amount of decommissioning that does not account for salvage value. We calculated these costs by adjusting the per-year decommissioning bond costs for our 200 MW Indiana Crossroads Solar Park, which is currently under construction in White County, to assess a smaller CSES facility with less infrastructure utilized over an estimated 35-year operational life cycle for project.

Table 1: 100 MW Solar Project Decommissioning Bond Cost Comparison

Year	Annual Bond Cost based on Net Decommission Value (Salvage Value Removed)	Annual Bond Cost based on Gross Decommissioning Value (Does Not Account for Salvage)	Difference
1	$ 25,000	$ 45,000	$ 20,000
2	$ 25,000	$ 45,000	$ 20,000
3	$ 25,000	$ 45,000	$ 20,000
4	$ 25,000	$ 45,000	$ 20,000
5	$ 25,000	$ 45,000	$ 20,000
6	$ 27,738	$ 49,928	$ 22,190
7	$ 27,738	$ 49,928	$ 22,190
8	$ 27,738	$ 49,928	$ 22,190
9	$ 27,738	$ 49,928	$ 22,190
10	$ 27,738	$ 49,928	$ 22,190
11	$ 30,775	$ 55,395	$ 24,620
12	$ 30,775	$ 55,395	$ 24,620
13	$ 30,775	$ 55,395	$ 24,620
14	$ 30,775	$ 55,395	$ 24,620
15	$ 30,775	$ 55,395	$ 24,620
16	$ 34,145	$ 61,461	$ 27,316
17	$ 34,145	$ 61,461	$ 27,316
18	$ 34,145	$ 61,461	$ 27,316
19	$ 34,145	$ 61,461	$ 27,316
20	$ 34,145	$ 61,461	$ 27,316
21	$ 37,884	$ 68,191	$ 30,307
22	$ 37,884	$ 68,191	$ 30,307
23	$ 37,884	$ 68,191	$ 30,307
24	$ 37,884	$ 68,191	$ 30,307
25	$ 37,884	$ 68,191	$ 30,307
26	$ 42,032	$ 75,658	$ 33,626
27	$ 42,032	$ 75,658	$ 33,626
28	$ 42,032	$ 75,658	$ 33,626
29	$ 42,032	$ 75,658	$ 33,626
30	$ 42,032	$ 75,658	$ 33,626
31	$ 46,635	$ 83,943	$ 37,308
32	$ 46,635	$ 83,943	$ 37,308
33	$ 46,635	$ 83,943	$ 37,308
34	$ 46,635	$ 83,943	$ 37,308
35	$ 46,635	$ 83,943	$ 37,308
		Total:	**$ 976,835.013**

As shown above, the gap between decommissioning bond costs for projects factoring in salvage value (net decommissioning costs) versus bonds that do not account for salvage value (gross decommissioning costs) widens significantly towards the end of the project life cycle. Decommissioning bonds are negotiated and issued to create assurances for communities that projects will be properly removed from landowner parcels in emergency circumstances if the operator cannot financially support decommissioning themselves. Ignoring the high salvage value of a solar park is not only unrealistic, but also adds unnecessary financing costs to a projects that ultimately increase the cost of the clean energy that is provided.

Conclusion

EDPR again thanks the Bartholomew County Planning Commission for their considerate and thorough solar ordinance development process and respectfully requests that Bartholomew County allow the salvage value for CSES infrastructure to be removed from the total decommissioning cost when determining the amount of the decommissioning bond. Using the net decommissioning costs creates hundreds of thousands, if not millions of dollars in savings for developers while the County's interests in project decommissioning are sufficiently addressed. We encourage Bartholomew County and the APC to promote thoughtful, community-focused renewable energy development while safeguarding the interests of its communities and citizens through this ordinance revision.

Thank you,

Andrew Magner
Project Manager
EDP Renewables

EDP Renewables North America LLC
129 E. Market Street, Suite 600
Indianapolis, IN 46204
T: 317.636.0866 | F: 317.636.1418

www.edpr.com/north-america

Pinkston, Emilie

From: Kathy Bush <bushk63501@yahoo.com>
Sent: Monday, July 25, 2022 11:34 PM
To: Bergman, Jeffrey; Pinkston, Emilie
Subject: External Message: Thank You

Thank you for taking the time to listen to our concerns about the set back and other issues concerning the solar farm ordinances. Too large of set back will only reduce the number of usable acres and cause a different issue with what to do with that land so it doesn't become an eye sore. Whether there is a large set back or a small one, there will be no way to totally hide a solar field.

I was so impressed that you chose to table the recommendation until you looked into the stipulations for other building project set backs. It is quite apparent that you do your research and we appreciate that very much.

This was the first building and planning meeting that I have ever attended and want to thank you for serving our county in this capacity. It is apparent the whole board works hard on behalf of the county.

The opposition stated that Columbus is different by design ...but we aren't the city of Columbus. This is a county issue. We do identify with the city in the fact that we are all looking forward to ways to make progress for the future of our area. And the need for additional clean energy is of major importance.

Please share with the other board members.

Sincerely, Kathy Bush

大成 DENTONS BINGHAM GREENEBAUM

MEMORANDUM

To: Jeff Bergman, AICP, Planning Director
jbergman@columbus.in.gov
Emilie Pinkston, AICP, Senior Planner
epinkston@columbus.in.gov

cc: James A. Shoaf
jamesashoaf@outlook.com
Jarrod Pitts
Timberly Ross
Jemma King

From: Mary Solada

Date: July 29, 2022

Re: Proposed Solar ordinance under consideration by the Bartholomew County Plan Commission

---

Jeff, Emilie and Jim—thank you for the opportunity to further comment regarding the proposed ordinance draft in response to the testimony received at the Plan Commission's ("PC") public hearing on July 13.

Given the discussion and apparent concurrence on the "alternate items" by the PC (subject of course to a final vote on August 10 or after), we would like to focus on 2 remaining important topics: Setbacks from non-participating residences and Decommissioning (content and proposed draft), including our request for the inclusion of salvage value credit against decommissioning security.

We ask that you provide this Memo and supporting information to the PC.

SETBACKS FROM NON-PARTICIPATING RESIDENCES

Again, by way of reminder, please recall the setback table previously provided which is based on a wide sample survey. You will recall testimony on July 13 from farmer land participants regarding their view that larger setbacks result in not only un-useable strips of land but further result in projects that are larger and more diffuse. In short, these setbacks result in unnecessary farm land being removed from production.

Additionally, see the Chart below which compares the County proposed setbacks with other credible sources (Purdue, IU Model and SEA 411).

We will provide to the PC members at the August 10 public hearing visual simulations which show the impact of a 500 foot setback as compared to a 250 foot setback.

Lastly, as suggested by the PC, we concur that it is important to provide the members context by comparing setbacks set out in the current Ordinance for uses far less intensive (e.g. Heavy Industrial – range of 20 to 40 feet depending on yard placement).

SAMPLE DECOMMISSIONING AGREEMENT AND SALVAGE VALUE CREDIT AGAINST FUTURE DECOMMISSIONING COSTS

Please find an attached summary of the decommissioning provisions set out in the form of Decommissioning Agreement approved by the County Commissioners and attorneys for the Elliott Solar project in Gibson County, Indiana.

Counties in which Salvage Value is referenced in their solar ordinances include:

1. Pulaski County (see page 217 of the attached): If abandoned, access is required for salvage value.

2. Cass County (see the 155th page of the attached): Salvage value can be considered when determining decommissioning costs.

3. Knox County (see page 6 of the attached): Salvage value can be considered when determining decommissioning costs.

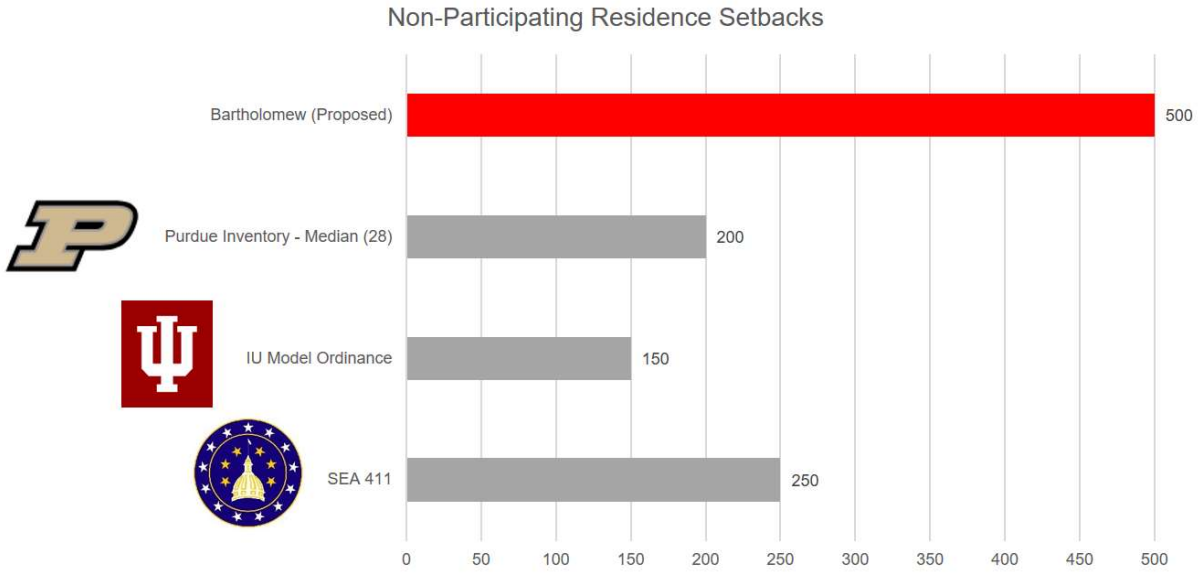
4. Posey County (see page 17 of the attached): Up to 65% of the net salvage value may be used to determine the estimated cost of decommissioning.

We found no references to salvage value in any of the other ordinances (St. Joseph, Montgomery, Shelby, Blackford, White, Starke, Randolph, Benton, Fulton, Kosciusko) cited in your County ordinance survey. In our view, this leaves the application of salvage value to the discretion of the planning director and County Commissioners in these Counties.

Furthermore, SEA 411 provides that the estimated costs of decommissioning shall be NET of any salvage value at the time of decommissioning – see Section 18(b).

The IU Model ordinance provides in Section 7(e) that: "The value of the decommission bond or letter of credit should consider the salvage value of the solar equipment."

In sum, the benefit of salvage value is a major fiscal matter to a project that can materially impact project economics and viability.



Sources:
1) Purdue Inventory Link: https://cdext.purdue.edu/wp-content/uploads/2022/03/Renewable-Energy-Report.pdf
2) IU Model Ordinance Link: https://eri.iu.edu/documents/in-solar-ordinance-2020-december.pdf
3) SEA 411 Link: http://iga.in.gov/legislative/2022/bills/senate/411#document-d840c47e

Summary of Representative Terms Contained in a
Decommissioning Agreement approved by Gibson County, Indiana[1]

- The Decommissioning Agreement requires the Company to provide the County with a decommissioning security before building the Company's solar project.
- The decommissioning security will either be a surety bond or letter of credit, with the County named as the beneficiary. It serves as a reserve of funds to eventually decommission the project and restore the project site.
- The decommissioning security will cover the cost of decommissioning the solar project. The amount required in the reserve depends on the age of the project, outlined in the following timeline:
    - 0 – 5 years: 25% of the cost to decommission the project
    - 5 – 10 years: 50% of the cost to decommission the project
    - 10 years – Project Expiration: 100% of the cost to decommission the project
- The Company, with the consent of the County, will hire a professional engineer to estimate the cost of decommissioning the project. If the Company and the County cannot agree on the engineer, each party will hire an engineer. The average of each engineer's estimate will be the cost to decommission the project.
- Every five years after the start of the project, the Company must notify the County before the expiration date of the decommissioning security and provide a certificate of continuation that includes an updated cost to decommission the project. The Company must deliver the certificate at least 60 days before the existing decommissioning security expires.
- In the event the Company does not provide the County with the proper decommissioning security or notice, the County may use the existing decommissioning security to pay the cost of decommissioning the project.
- Decommissioning the solar project includes removing all project equipment, including the solar panels, solar trackers, transformers, equipment pads and foundation, access roads, security fences, drainage structures, and collector substations; decommissioning returns the project site to agricultural use or its pre-construction condition.
- There are individual units generating electricity within the larger project. For a unit that does not produce electricity for 12 consecutive months, the Company must decommission the non-producing unit or provide the County with a plan to return the unit to work within the non-producing 12-month period.
- If a catastrophic event occurs and prevents a unit from producing electricity, the Company must provide the County with evidence that the non-producing unit can return to work within 24 months of the catastrophic event. If the County disagrees, the Company must begin decommissioning the non-producing unit within 18 months of the catastrophic event.
- The County may salvage the project equipment and use the value of the salvaged equipment to offset the cost of decommissioning the project if the Company does not properly decommission the project.

[1] This summary is based on the Decommissioning Agreement for Elliot Solar LLC in Gibson County.

d. A description of the means by which decommissioning/demolition will occur and the timeline for such work.

D. Discontinuation and Abandonment.

1. All WECS and SES shall be considered a discontinued use after one (1) year without energy production, unless a plan is developed and submitted to the Pulaski County Building Department outlining the steps and schedule for returning the WECS or SES to service within 24 months of the initial cessation of operations. If such a plan for renewal of operations is not made to Pulaski County's satisfaction, then the decommissioning must be initiated within eighteen months of the cessation of operations.

2. In the event of abandonment by the owner or operator, the applicant will provide an affidavit to the Pulaski County Building Department representing that all easements for wind turbines or solar arrays shall contain terms that provide financial assurance, including access to the salvage value of the equipment, for the property owners to ensure that facilities are properly decommissioned within one (1) year of expiration or earlier termination of the project.

E. Removal.

1. An applicant's obligations shall include removal of all physical material pertaining to the project improvements on the ground and to no less than a depth of four (4) feet below ground level within three hundred sixty-five (365) days of the discontinuation or abandonment of the facility, and restoration of the project area to as near as practicable the condition of the site immediately before construction of such improvements by the owner, or by Pulaski County at the owner's expense. Any hazardous materials shall be removed in accordance with federal and state law.

F. Written Notices.

1. Prior to implementation of the existing procedures for the resolution of such default(s), the appropriate County body shall first provide written notice to the owner and/or operator, setting forth the alleged default(s). Such written notice shall provide the owner and/or operator a reasonable time period not to exceed sixty (60) days, for good faith negotiations to resolve the alleged default(s).

G. Costs Incurred by the County.

1. If the County removes a tower or solary array and appurtenant facilities, it may sell the salvage to defray the costs of removal. By approval, the permitted or grantor grants a license to Pulaski County to enter the property to remove a tower or solary array pursuant to the terms of an approved decommissioning plan.

H. Continuity of Decommissioning Plan

1. The terms of the decommissioning plan shall be binding upon the owner/operator and any of their successors, assignees, or heirs, and the plan's language shall reflect this.

7.5 Application Procedures

A. Permits and variances shall be applied for and reviewed under the procedures established by this UDO and the application procedures application for a WECS or SES Improvement Location Permit.

1. See section 2.3.Q, 'Applications for Micro/Non-commercial Energy Conversion Systems (WECS)', for application procedures.

2. See section 2.3.R, 'Applications for All Solar Energy Systems (SES)', for application procedures.

Planning Department for their file. The CSES owner and/or operator shall make reasonable efforts to respond to the public's inquires and complaints.

J. An Economic Development Agreement, a Drainage Agreement, and Maintenance Agreement must be approved by the County Commissioners. The agreements shall be developed in conjunction with the Cass County Economic Development, Surveyor and Highway Department Offices and copies provided to the Planning Department. These agreements must be signed before any Building Permit is issued. The Drainage Agreement must prescribe or reference provisions to address crop and field tile damages up to five (5) years after construction.

K. Decommissioning. In order to facilitate and ensure appropriate removal of the energy generation equipment of a CSES a decommissioning agreement must be approved and signed by the County Commissioners before a building permit is issued. This agreement must include a description of implementing the decommissioning, a description of the work required, a cost estimate for decommissioning, a schedule for contributions to the decommissioning fund, and a demonstration of financial assurance. Salvage value can be considered in determining decommissioning cost. In the event of a fire, flood, tornado or other unforeseen events that results in the absence of electrical generation for twelve months, the applicant must demonstrate that the project will be substantially operational producing electricity with-in twelve months of the event after such time it will be considered abandoned and need to follow decommissioning as such.

1. Applicant will provide financial assurance in an amount at least equal to said demolition and removal contractor cost estimate, through the use of a bond, letter of credit or other security acceptable to the County, for the cost of decommissioning CSES and related improvements constructed under the permit. Said security will be released when CSES is properly decommissioned as determined by Cass County Commissioners. Review of estimated cost shall be done every five (5) years and the financial assurance reflect the changes.

2. The CSES owner is required to notify the Planning Department immediately upon cessation or abandonment of the operation. The CSES shall be presumed to be discontinued or abandoned if no electricity is generated by such system for a period of twelve (12) continuous months.

3. The CSES owner shall have ninety (90) days to start decommissioning and one hundred and eighty (180) days to totally dismantle and remove the CSES including all solar related equipment or appurtenances related thereto, including but not limited to buildings, electrical components, roads, foundations, and other associated facilities from the property. If the owner fails to dismantle and/or remove the CSES within the established timeframes, the municipality may complete the decommissioning at the owner's expense.

g. Battery Storage if any

(2) Boundary Survey, or a reference to a previously recorded survey, conducted in accordance with the Minimum Standards for Competent Practice of Land Surveying as outlined in 865 IAC-1-12

(3) Location of fencing, screening, and buffer areas

(4) Location of all access roads and access points

(5) Location of all above ground and underground utility lines associated with the site

(6) Floodplain location and elevation, and wetlands if any

(7) Location of all residences and other Principal Structures within 200 feet of the nearest SES structure

(8) Location of all easements

(9) Location of all security lights

(F) Decommissioning Plan:

(1) A Decommissioning Plan shall be submitted with the Development Plan to assure the project will be properly decommissioned by the Applicant or any subsequent Owner upon the end of the project life or abandonment. The plan shall demonstrate how the removal of all infrastructure and remediation of soil and vegetation will be conducted, and the expected timeline for execution of the decommissioning. A cost estimate for decommissioning, determined by a third-party professional engineering firm, shall be included. Salvage value may be considered in determining decommissioning cost.

(2) The Applicant shall secure and provide to the Board of Commissioners of Knox County a financial assurance in the form of a performance bond, surety bond, or other form of financial assurance that is acceptable to the Board of Commissioners of Knox County before the issuance of an Improvement Location Permit.

(3) The obligations with respect to decommissioning shall include removal and proper disposal of all physical material pertaining to the project improvements beneath the soil surface, and restoration of the area occupied by the project improvements such that it is suitable for an equivalent land use to what existed immediately before construction of such improvements.

(4) In the event of a force majeure or other event that results in the absence of electrical generation for twelve (12) consecutive months, by the end of the twelfth month of non-operation the Applicant must demonstrate to Area Plan Commission that the project will be substantially operational and producing electricity within twenty-four (24) months of the force majeure or other event. If such demonstration is not made to the Area Plan Commission's satisfaction, the decommissioning must be initiated eighteen (18) months after the force majeure or other event. A force majeure event means fire, earthquake, flood, tornado, or other acts of God and natural disasters, and war, civil strife, or other similar violence.

(5) The Decommissioning Plan shall include the full written legal description(s) of all Participating properties from the last recorded deed(s) or subsequently recorded project legal description. It shall also include the record owner name(s) of the property(ies) from the last recorded deed(s), and a cross-

C. Any SECS project proposed shall not have a boundary closer than one mile to any municipal boundary line.

D. No solar panel may exceed 25' in height at its highest extended rotation.

E. No Tier 3 SECS solar panel may exceed the height restriction in the underlying zoning district.

F. Applicant shall give notice to the owner of any private certified landing strip. Setbacks will be determined based upon the agreement of the landing strip owner, Applicant, and the Area Plan Commission which shall take into consideration the guidelines provided in a U.S. Department of Transportation FAA Advisory Circular dated February 26, 2014, as may be updated. Proof of notice must be included with the Preliminary Development Plan.

G. Allowed Variances. Variances may only be granted for relief from 153.126.03 (B). However, the variance application must include an executed agreement between the applicant and all participating and non-participating landowners affected by the requested variance prior to consideration of the variance request by the Board of Zoning Appeals.

153.127.01 POST-CONSTRUCTION AND CONTINUED MAINTENANCE

A. DECOMMISSIONING SECURITY. At the completion of construction but before any commercial operations begins, the Applicant shall secure and provide to the Area Plan Commission a performance bond, surety bond, letter of credit, or other form of financial assurance that is acceptable to the Area Plan Commission (the "Decommissioning Security") equal to 125% of the estimated cost of decommissioning the project pursuant to the Decommissioning Plan. The Decommissioning Security, in computing the estimated cost of decommissioning, shall consider and deduct up to 65% of the Net Salvage Value (as defined) of the project. The amount of the Decommissioning Security shall be adjusted annually by January 31 by an amount equal to the increase in the CPI Index. "CPI Index" shall mean the Consumer Price Index for "All Urban Consumers, U.S. City Average, All items," issued by the Bureau of Labor Statistics of the United States Department of Labor, or, if discontinued or no longer published, such other governmental index that most closely matches the manner in which inflation had been previously tracked as selected by the Area Plan Commission. The Decommissioning Plan and Decommissioning Surety shall be re-evaluated every five (5) years commencing with the operation of the project by a licensed engineer approved by the Area Plan Commission and qualified to provide an estimate of the cost of decommissioning of the project and the Net Salvage Value of the project (the "Decommissioning Engineer"). A new Decommissioning Security in the revised amount, if any, shall be provided within sixty (60) days of the approval of the updated Decommissioning Plan.

Second Regular Session of the 122nd General Assembly (2022)

SENATE ENROLLED ACT No. 411

AN ACT to amend the Indiana Code concerning utilities.

Be it enacted by the General Assembly of the State of Indiana:

SECTION 1. IC 8-1-41 IS ADDED TO THE INDIANA CODE AS A **NEW** CHAPTER TO READ AS FOLLOWS [EFFECTIVE JULY 1, 2022]:

Chapter 41. Default Standards for Wind Power Devices

Sec. 1. (a) Except as provided in subsections (b) and (c), and subject to IC 36-7-4-1109 and section 9 of this chapter, the standards set forth in sections 10 through 16 of this chapter, or standards less restrictive than the standards set forth in sections 10 through 16 of this chapter, apply to a project owner that, after June 30, 2022, files an initial application for a project to install or locate one (1) or more wind power devices in a unit that qualifies as a wind energy ready community under subsection (d).

(b) Subject to a unit's planning and zoning powers under IC 36-7, this chapter does not apply to a property owner that seeks to install a wind power device on the property owner's premises for the purpose of generating electricity to meet or offset all or part of the need for electricity on the premises, whether through distributed generation, participation in a net metering program offered by an electricity supplier (as defined in IC 8-1-40-4), or otherwise.

(c) Unless a standard set forth in sections 10 through 16 of this chapter is already agreed to before July 1, 2022, by the parties involved, the standard does not:

(1) apply to any proposal, request, or application that:

(A) concerns the permitting, construction, installation, siting, modification, operation, or decommissioning of one (1) or more wind power devices in a unit;

(B) is submitted by a project owner to a unit before July 1, 2022; and

(C) is pending approval or has been approved as of July 1, 2022;

as set forth in IC 36-7-4-1109;

(2) affect the:

(A) permitting;

(B) construction;

(C) installation;

(D) siting;

(E) modification;

(F) operation; or

(G) decommissioning;

of one (1) or more wind power devices in a unit that before July 1, 2022, has approved such permitting, construction, installation, siting, modification, operation, or decommissioning; or

(3) affect any:

(A) economic development agreement; or

(B) other agreement;

entered into before July 1, 2022, with respect to the permitting, construction, installation, siting, modification, operation, or decommissioning of one (1) or more wind power devices in one (1) or more units.

(d) As used in this section, "wind energy ready community" means a unit that has voluntarily adopted:

(1) the standards set forth in sections 10 through 16 of this chapter; or

(2) standards less restrictive than the standards set forth in sections 10 through 16 of this chapter.

Sec. 2. As used in this chapter, "dwelling" means any building, structure, or part of a building or structure that is occupied as, or is designed or intended for occupancy as, a residence by one (1) or more families or individuals.

Sec. 3. (a) As used in this chapter, "nonparticipating property" means a lot or parcel of real property:

(1) that is not owned by a project owner; and

(2) with respect to which:

(A) the project owner does not seek:

(i) to install or locate one (1) or more wind power devices or other facilities related to a wind power project

(including power lines, temporary or permanent access roads, or other temporary or permanent infrastructure); or

(ii) to otherwise enter into a lease or any other agreement with the owner of the property for use of all or part of the property in connection with a wind power project; or

(B) the owner of the property does not consent:

(i) to having one (1) or more wind power devices or other facilities related to a wind power project (including power lines, temporary or permanent access roads, or other temporary or permanent infrastructure) installed or located; or

(ii) to otherwise enter into a lease or any other agreement with the project owner for use of all or part of the property in connection with a wind power project.

(b) The term does not include a lot or parcel of real property otherwise described in subsection (a) if the owner of the lot or parcel consents to participate in a wind power project through a neighbor agreement, a participation agreement, or another similar arrangement or agreement with a project owner.

Sec. 4. (a) As used in this chapter, "permit authority" means:

(1) a unit; or

(2) a board, a commission, or any other governing body of a unit;

that makes legislative or administrative decisions concerning the permitting, construction, installation, siting, modification, operation, or decommissioning of wind power devices in the unit.

(b) The term does not include:

(1) the state or any of its agencies, departments, boards, commissions, authorities, or instrumentalities; or

(2) a court or other judicial body that reviews decisions or rulings made by a permit authority.

Sec. 5. (a) As used in this chapter, "project owner" means a person that:

(1) will own one (1) or more wind power devices proposed to be located in a unit; or

(2) owns one (1) or more wind power devices located in a unit.

(b) The term includes an agent or a representative of a person described in subsection (a).

(c) The term does not include an electricity supplier (as defined in IC 8-1-2.3-2).

Sec. 6. (a) As used in this chapter, "unit" refers to:

(1) a county, if a project owner, as part of a single wind power project or development, seeks to locate one (1) or more wind

power devices:

(A) entirely within unincorporated areas of the county;

(B) within both unincorporated areas of the county and one (1) or more municipalities within the county; or

(C) entirely within two (2) or more municipalities within the county; or

(2) a municipality, if:

(A) a project owner, as part of a single wind power project or development, seeks to locate one (1) or more wind power devices entirely within the boundaries of the municipality; and

(B) subdivision (1)(B) or (1)(C) does not apply.

(b) The term refers to:

(1) each county described in subsection (a)(1) in which a project owner seeks to locate one (1) or more wind power devices, if the project owner seeks to locate wind power devices in more than one (1) county as part of a single wind power project or development; and

(2) each municipality described in subsection (a)(2) in which a project owner seeks to locate one (1) or more wind power devices, if the project owner seeks to locate wind power devices in two (2) or more municipalities, each of which is located in a different county.

Sec. 7. As used in this chapter, "wind power device" means a device, including a windmill or a wind turbine, that is designed to use the kinetic energy of moving air to provide mechanical energy or to produce electricity.

Sec. 8. As used in this chapter, "wind power regulation" refers to any ordinance or regulation, including any:

(1) zoning or land use ordinance or regulation; or

(2) general or specific planning ordinance or regulation;

that is adopted by a unit and that concerns the permitting, construction, installation, siting, modification, operation, or decommissioning of wind power devices in the unit.

Sec. 9. (a) A permit authority for a unit described in section 1(a) of this chapter is responsible for enforcing compliance with any standards set forth in sections 10 through 16 of this chapter that apply in the unit under section 1(a) of this chapter.

(b) A unit may:

(1) adopt and enforce a wind power regulation that includes standards that:

(A) concern the permitting, construction, installation, siting, modification, operation, or decommissioning of wind power devices in the unit; and

(B) are less restrictive than the standards set forth in this

chapter;

(2) waive or make less restrictive any standard set forth in this chapter with respect to any particular:

(A) wind power device; or

(B) project to install one (1) or more wind power devices in the unit; or

(3) waive or make less restrictive any standard that is not set forth in this chapter but that is included in a wind power regulation adopted by the unit with respect to any particular:

(A) wind power device; or

(B) project to install one (1) or more wind power devices in the unit.

(c) This chapter does not affect a unit's planning and zoning powers under IC 36-7 with respect to the permitting, construction, installation, or siting of one (1) or more wind power devices in the unit.

Sec. 10. (a) Subject to subsection (h), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device on property in a unit unless the distance, measured as a straight line, from the vertical centerline of the base of the wind power device to:

(1) the centerline of any:

(A) runway located on a public use airport, private use airport, or municipal airport;

(B) public use highway, street, or road; or

(C) railroad easement or right-of-way; or

(2) the property line of any nonparticipating property;

is equal to a distance that is at least one and one-tenth (1.1) times the wind power device's blade tip height, as measured from the ground to the tip of the blade.

(b) Subject to subsection (h), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device on property in a unit unless the distance, measured as a straight line, from the vertical centerline of the base of the wind power device to the nearest point on the outer wall of a dwelling located on a nonparticipating property is equal to a distance that is at least three (3) times the wind power device's blade tip height, as measured from the ground to the tip of the blade.

(c) Except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device on property in a unit unless the distance, measured as a straight line, from the vertical centerline of the base of the wind power device to the nearest edge of the right-of-way for any utility transmission or distribution line is equal to a distance that is at least one and

two-tenths (1.2) times the wind power device's blade tip height, as measured from the ground to the tip of the blade.

(d) Except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device on property in a unit unless the distance, measured as a straight line, from the vertical centerline of the base of the wind power device to the property line of any undeveloped land within the unit that is zoned or platted for residential use is equal to a distance that is at least two (2) times the wind power device's blade tip height, as measured from the ground to the tip of the blade.

(e) Except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device on property in a unit unless the distance, measured as a straight line, from the vertical centerline of the base of the wind power device to the property line of a state park is equal to a distance of at least one (1) mile.

(f) A project owner may not install or locate a wind power device within a county unless the distance, measured as a straight line, from the vertical centerline of the base of the wind power device to the corporate boundaries of any municipality within the county is equal to a distance of at least one (1) mile. However, a municipality may waive or reduce the minimum distance prescribed by this subsection with respect to the installation of one (1) or more wind power devices.

(g) Except as otherwise allowed by IC 36-7-4-1109, a permit authority, with respect to the permitting, construction, installation, or siting of any wind power device within the unit, may not set a blade tip height limitation, through a wind power regulation or otherwise, that is more restrictive than the standards of the Federal Aviation Administration under 14 CFR Part 77 concerning the safe, efficient use and preservation of the navigable airspace.

(h) The distance requirements set forth in subsections (a)(2) and (b) may be waived with respect to the siting of any one (1) wind power device, subject to the written consent of the owner of each affected nonparticipating property.

Sec. 11. (a) Subject to subsection (c), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate one (1) or more wind power devices in a unit unless the project owner demonstrates to the permit authority that with respect to each wind power device that the project owner seeks to install or locate in the unit:

(1) the project owner has used shadow flicker computer modeling to estimate the amount of shadow flicker anticipated to be caused by the wind power device; and

(2) the wind power device has been designed such that

industry standard computer modeling indicates that any dwelling on a nonparticipating property within the unit will not experience more than thirty (30) hours per year of shadow flicker under planned operating conditions for the wind power device.

(b) After a project owner installs or locates a wind power device in a unit, the project owner shall work with the owner of any affected dwelling on a nonparticipating property to mitigate the effects of shadow flicker to the extent reasonably practicable.

(c) The requirement set forth in subsection (a)(2) may be waived with respect to any one (1) wind power device, subject to the written consent of the owner of each affected nonparticipating property.

Sec. 12. Except as otherwise allowed by IC 36-7-4-1109, a wind power device installed in a unit must be installed in a manner so as to minimize and mitigate impacts to:

(1) television signals;

(2) microwave signals;

(3) agricultural global positioning systems;

(4) military defense radar;

(5) radio reception; or

(6) weather and doppler radar.

Sec. 13. (a) Subject to subsection (b), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device in a unit unless the project owner demonstrates to the permit authority that the wind power device will operate in a manner such that the sound attributable to the wind power device will not exceed an hourly average sound level of fifty (50) A-weighted decibels, as modeled at the outer wall of an affected dwelling.

(b) The requirement set forth in subsection (a) may be waived with respect to any one (1) wind power device, subject to the written consent of the owner of each affected property.

Sec. 14. (a) As used in this section, "wind turbine light mitigation technology" means any technology used in connection with a wind power device to shield, limit, or otherwise mitigate the amount, intensity, character, or visibility of light emitted from the wind power device.

(b) Except as otherwise allowed by IC 36-7-4-1109, after January 1, 2023, and to the extent permissible under federal law or regulations, a wind power device on property in a unit must be equipped with a wind turbine light mitigation technology, unless:

(1) the Federal Aviation Administration denies the project owner's application to use a wind turbine light mitigation technology;

(2) the wind turbine light mitigation technology application is pending review by the appropriate federal agencies; or

(3) the project owner determines that the use of a wind turbine light mitigation technology is not economically feasible.

Sec. 15. This section applies with respect to a wind power device that is constructed or installed in a unit after June 30, 2022. Except as otherwise allowed by IC 36-7-4-1109, all damages to waterways, drainage ditches, field tiles, or other drainage related infrastructure caused by the construction, installation, or maintenance of a wind power device must be completely repaired by the project owner or remedied with the installation of new drainage infrastructure so as to not impede the natural flow of water. All repairs must be completed within a reasonable period of time and:

(1) to the satisfaction of the unit; and

(2) as stated in an applicable lease or another agreement with the landowner;

subject to applicable federal, state, and local drainage laws and regulations.

Sec. 16. (a) Subject to subsection (b), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a wind power device in a unit unless the project owner submits to the permit authority a decommissioning and site restoration plan, and posts a surety bond, or an equivalent means of security acceptable to the permit authority, including a parent company guarantee or an irrevocable letter of credit, but excluding cash, in an amount equal to the estimated cost of decommissioning the wind power device, as calculated by a third party licensed or registered engineer, or by another person with suitable experience in the decommissioning of wind power devices, as agreed upon by the project owner and the permit authority. The required bond or other security shall be posted in increments such that the total amount of the bond or security posted is as follows:

(1) An amount equal to twenty-five percent (25%) of the total estimated decommissioning costs not later than the start date of the wind power device's full commercial operation. For purposes of this subdivision, the total estimated decommissioning costs shall be reevaluated by a third party licensed or registered engineer (or by another person with suitable experience in the decommissioning of wind power devices, as agreed upon by the project owner and the permit authority) in connection with the:

(A) fifth anniversary; and

(B) tenth anniversary;

of the start date of the wind power device's full commercial operation, and the total amount of the bond or security posted under this subdivision shall be adjusted as necessary after each reevaluation.

(2) An amount equal to fifty percent (50%) of the total estimated decommissioning costs not later than the fifteenth anniversary of the start date of the wind power device's full commercial operation. For purposes of this subdivision, the total estimated decommissioning costs shall be reevaluated by a third party licensed or registered engineer (or by another person with suitable experience in the decommissioning of wind power devices, as agreed upon by the project owner and the permit authority) in connection with the fifteenth anniversary of the start date of the wind power device's full commercial operation, and the total amount of the bond or security posted under this subdivision shall be adjusted as necessary after the reevaluation.

(3) An amount equal to one hundred percent (100%) of the total estimated decommissioning costs not later than the twentieth anniversary of the start date of the wind power device's full commercial operation. For purposes of this subdivision, the total estimated decommissioning costs shall be reevaluated by a third party licensed or registered engineer (or by another person with suitable experience in the decommissioning of wind power devices, as agreed upon by the project owner and the permit authority):

(A) in connection with the twentieth anniversary of the start date of the wind power device's full commercial operation; and

(B) at least once every succeeding five (5) year period after the twentieth anniversary of the start date of the wind power device's full commercial operation;

and the total amount of the bond or security posted under this subdivision shall be adjusted as necessary after each reevaluation.

(b) For purposes of this section, the estimated cost of decommissioning a wind power device, as calculated by a licensed or registered professional engineer (or by another person with suitable experience in the decommissioning of wind power devices, as agreed upon by the project owner and the permit authority), shall be net of any estimated salvage value attributable to the wind power device at the time of decommissioning, unless the unit and the project owner agree to include any such value in the estimated cost.

SECTION 2. IC 8-1-42 IS ADDED TO THE INDIANA CODE AS

A **NEW** CHAPTER TO READ AS FOLLOWS [EFFECTIVE JULY 1, 2022]:

Chapter 42. Default Standards for Commercial Solar Energy Systems

Sec. 1. (a) Except as provided in subsections (b) and (c), and subject to IC 36-7-4-1109 and section 9 of this chapter, the standards set forth in sections 10 through 20 of this chapter, or standards less restrictive than the standards set forth in sections 10 through 20 of this chapter, apply to a project owner that, after June 30, 2022, files an initial application for a project to install or locate one (1) or more CSE systems in a unit that qualifies as a solar energy ready community under subsection (d).

(b) Subject to a unit's planning and zoning powers under IC 36-7, this chapter does not apply to a property owner who seeks to install a solar energy device (as defined in IC 32-23-4-3) on the property owner's premises for the purpose of generating electricity to meet or offset all or part of the need for electricity on the premises, whether through distributed generation, participation in a net metering program offered by an electricity supplier (as defined in IC 8-1-40-4), or otherwise.

(c) Unless a standard set forth in sections 10 through 20 of this chapter is already agreed to before July 1, 2022, by the parties involved, the standard does not:

(1) apply to any proposal, request, or application that:

(A) concerns the permitting, construction, installation, siting, modification, operation, or decommissioning of one (1) or more CSE systems in a unit;

(B) is submitted by a project owner to a unit before July 1, 2022; and

(C) is pending approval or has been approved as of July 1, 2022;

as set forth in IC 36-7-4-1109;

(2) affect the:

(A) permitting;

(B) construction;

(C) installation;

(D) siting;

(E) modification;

(F) operation; or

(G) decommissioning;

of one (1) or more CSE systems in a unit that before July 1, 2022, has approved such permitting, construction, installation, siting, modification, operation, or decommissioning; or

(3) affect any:

(A) economic development agreement; or

(B) other agreement;

entered into before July 1, 2022, with respect to the permitting, construction, installation, siting, modification, operation, or decommissioning of one (1) or more CSE systems in one (1) or more units.

(d) As used in this section, "solar energy ready community" means a unit that has voluntarily adopted:

(1) the standards set forth in sections 10 through 20 of this chapter; or

(2) standards less restrictive than the standards set forth in sections 10 through 20 of this chapter.

Sec. 2. (a) As used in this chapter, "commercial solar energy system", or "CSE system", means a system that:

(1) has a nameplate capacity of at least ten (10) megawatts; and

(2) captures and converts solar energy into electricity:

(A) for the purpose of selling the electricity at wholesale; and

(B) for use in locations other than where it is generated.

(b) The term includes solar panels, collection and feeder lines, generation tie lines, substations, ancillary buildings, solar monitoring stations, and accessory equipment or structures.

Sec. 3. As used in this chapter, "commercial solar regulation" refers to any ordinance or regulation, including any:

(1) zoning or land use ordinance or regulation; or

(2) general or specific planning ordinance or regulation;

that is adopted by a unit and that concerns the permitting, construction, installation, siting, modification, operation, or decommissioning of CSE systems in the unit.

Sec. 4. As used in this chapter, "dwelling" means any building, structure, or part of a building or structure that is occupied as, or is designed or intended for occupancy as, a residence by one (1) or more families or individuals.

Sec. 5. (a) As used in this chapter, "nonparticipating property" means a lot or parcel of real property:

(1) that is not owned by a project owner; and

(2) with respect to which:

(A) the project owner does not seek:

(i) to install or locate one (1) or more CSE systems or other facilities related to a CSE system project (including power lines, temporary or permanent access roads, or other temporary or permanent infrastructure); or

(ii) to otherwise enter into a lease or any other agreement with the owner of the property for use of all

or part of the property in connection with a CSE system project; or

(B) the owner of the property does not consent:

(i) to having one (1) or more CSE systems or other facilities related to a CSE system project (including power lines, temporary or permanent access roads, or other temporary or permanent infrastructure) installed or located; or

(ii) to otherwise enter into a lease or any other agreement with the project owner for use of all or part of the property in connection with a CSE system project.

(b) The term does not include a lot or parcel of real property otherwise described in subsection (a) if the owner of the lot or parcel consents to participate in a CSE system project through a neighbor agreement, a participation agreement, or another similar arrangement or agreement with a project owner.

Sec. 6. (a) As used in this chapter, "permit authority" means:

(1) a unit; or

(2) a board, a commission, or any other governing body of a unit;

that makes legislative or administrative decisions concerning the permitting, construction, installation, siting, modification, operation, or decommissioning of CSE systems in the unit.

(b) The term does not include:

(1) the state or any of its agencies, departments, boards, commissions, authorities, or instrumentalities; or

(2) a court or other judicial body that reviews decisions or rulings made by a permit authority.

Sec. 7. (a) As used in this chapter, "project owner" means a person that:

(1) will own one (1) or more CSE systems proposed to be located in a unit; or

(2) owns one (1) or more CSE systems located in a unit.

(b) The term includes an agent or a representative of a person described in subsection (a).

(c) The term does not include an electricity supplier (as defined in IC 8-1-2.3-2).

Sec. 8. (a) As used in this chapter, "unit" refers to:

(1) a county, if a project owner, as part of a single CSE system project or development, seeks to locate one (1) or more CSE systems:

(A) entirely within unincorporated areas of the county;

(B) within both unincorporated areas of the county and one (1) or more municipalities within the county; or

(C) entirely within two (2) or more municipalities within

the county; or

(2) a municipality, if:

(A) a project owner, as part of a single CSE system project or development, seeks to locate one (1) or more CSE systems entirely within the boundaries of the municipality; and

(B) subdivision (1)(B) or (1)(C) does not apply.

(b) The term refers to:

(1) each county described in subsection (a)(1) in which a project owner seeks to locate one (1) or more CSE systems, if the project owner seeks to locate CSE systems in more than one (1) county as part of a single CSE system project or development; and

(2) each municipality described in subsection (a)(2) in which a project owner seeks to locate one (1) or more CSE systems, if the project owner seeks to locate CSE systems in two (2) or more municipalities, each of which is located in a different county.

Sec. 9. (a) A permit authority for a unit described in section 1(a) of this chapter is responsible for enforcing compliance with any standards set forth in sections 10 through 20 of this chapter that apply in the unit under section 1(a) of this chapter.

(b) A unit may:

(1) adopt and enforce a commercial solar regulation that includes standards that:

(A) concern the permitting, construction, installation, siting, modification, operation, or decommissioning of CSE systems in the unit; and

(B) are less restrictive than the standards set forth in this chapter;

(2) waive or make less restrictive any standard set forth in this chapter with respect to any particular:

(A) CSE system; or

(B) project to install one (1) or more CSE systems in the unit; or

(3) waive or make less restrictive any standard that is not set forth in this chapter but that is included in a commercial solar regulation adopted by the unit with respect to any particular:

(A) CSE system; or

(B) project to install one (1) or more CSE systems in the unit.

(c) This chapter does not affect a unit's planning and zoning powers under IC 36-7 with respect to the permitting, construction, installation, or siting of one (1) or more CSE systems in the unit.

Sec. 10. (a) Subject to subsection (e), and except as otherwise

allowed by IC 36-7-4-1109, a project owner may not install or locate a CSE system on property in a unit unless the distance, measured as a straight line, from the nearest outer edge of the CSE system's solar panels to:

(1) the nearest edge of the right-of-way for any:

(A) federal interstate highway, federal highway, state highway, or county highway is at least forty (40) feet;

(B) collector road is at least thirty (30) feet; or

(C) local road is at least ten (10) feet; or

(2) the property line of any nonparticipating property is at least fifty (50) feet.

(b) Subject to subsection (e), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a CSE system on property in a unit unless the distance, measured as a straight line, from the nearest outer edge of the CSE system's solar panels to the nearest point on the outer wall of a dwelling located on a nonparticipating property is at least two hundred fifty (250) feet.

(c) Subject to subsection (e), and except as otherwise allowed by IC 36-7-4-1109, if a project owner installs a CSE system within a distance of two hundred fifty (250) feet, measured as a straight line, from the nearest outer edge of the CSE system's solar panels to the nearest point on the outer wall of a dwelling located on a nonparticipating property, the project owner shall install a landscape buffer in the area between the nearest outer edge of the CSE system's solar panels and the nonparticipating property owner's property line that faces the CSE system's solar panels. The landscape buffer must be:

(1) in a location that is not on the property of the nonparticipating property owner; and

(2) constructed from such materials;

as set forth in a plan submitted to the unit during the permitting and approval process for the CSE system.

(d) Except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a CSE system on property in a unit unless the height of the CSE system solar panels are not more than twenty-five (25) feet above ground level when the CSE system's arrays are at full tilt. However, a permit authority or a unit may not impose a clearance requirement between the ground and the bottom edge of a CSE system's solar panels.

(e) The:

(1) distance requirements set forth in subsection (a)(2) and subsection (b); and

(2) requirement for the installation of a landscape buffer set forth in subsection (c);

may be waived with respect to the siting of any one (1) CSE system, subject to the written consent of the owner of each affected nonparticipating property.

Sec. 11. Except as otherwise allowed by IC 36-7-4-1109, if a project owner installs a CSE system in a unit, the project owner shall plant, establish, and maintain for the life of the CSE system perennial vegetated ground cover on the ground around and under solar panels, and in project site buffer areas. The use of pollinator seed mixes in the planting of ground cover required by this section is encouraged. A unit or permit authority may require a project owner to prepare for a project site a vegetation plan that:

(1) is compatible with each CSE system on the project site;

(2) provides for the planting of noninvasive species and the use of native or naturalized species if the planting and use of noninvasive and native or naturalized species are:

(A) appropriate to the region;

(B) economically feasible; and

(C) agreed to by the landowner;

in order to reduce storm water runoff and erosion at the site and to provide habitat for wildlife and insects; and

(3) provides for site preparation and maintenance practices designed to control invasive species and noxious weeds (as defined in IC 15-16-7-2).

Sec. 12. Except as otherwise allowed by IC 36-7-4-1109, if a project owner installs a CSE system in a unit, the project owner shall completely enclose the CSE system with fencing that is at least six (6) feet high.

Sec. 13. Except as otherwise allowed by IC 36-7-4-1109, if a project owner installs a CSE system in a unit, all cables of up to thirty-four and one-half (34.5) kilovolts that are located between inverter locations and project substations shall be located and maintained underground, as feasible. Other solar infrastructure, such as module-to-module collection cables, transmission lines, substations, junction boxes, and other typical aboveground infrastructure may be located and maintained above ground. Buried cables shall be at a depth of at least thirty-six (36) inches below grade or, if necessitated by onsite conditions, at a greater depth. Cables and lines located outside of the CSE system project site may:

(1) be located above ground; or

(2) in the case of cables or lines of up to thirty-four and one-half (34.5) kilovolts, be buried underground at:

(A) a depth of at least forty-eight (48) inches below grade, so as to not interfere with drainage tile or ditch repairs; or

(B) another depth, as necessitated by conditions;

as determined in consultation with the landowner.

Sec. 14. Except as otherwise allowed by IC 36-7-4-1109, a CSE system installed by a project owner must be designed and constructed to:

(1) minimize glare on adjacent properties and roadways; and

(2) not interfere with vehicular traffic, including air traffic.

Sec. 15. Except as otherwise allowed by IC 36-7-4-1109, a CSE system installed in a unit must be installed in a manner so as to minimize and mitigate impacts to:

(1) television signals;

(2) microwave signals;

(3) agricultural global positioning systems;

(4) military defense radar;

(5) radio reception; or

(6) weather and doppler radar.

Sec. 16. (a) Subject to subsection (b), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a CSE system in a unit unless the project owner demonstrates to the permit authority that the CSE system will operate in a manner such that the sound attributable to the CSE system will not exceed an hourly average sound level of fifty (50) A-weighted decibels, as modeled at the outer wall of a dwelling located on an adjacent nonparticipating property.

(b) The requirement set forth in subsection (a) may be waived with respect to any one (1) CSE system, subject to the written consent of the owner of each adjacent nonparticipating property.

Sec. 17. This section applies with respect to a CSE system that is constructed or installed in a unit after June 30, 2022. Except as otherwise allowed by IC 36-7-4-1109, all damages to waterways, drainage ditches, field tiles, or other drainage related infrastructure caused by the construction, installation, or maintenance of a CSE system must be completely repaired by the project owner or remedied with the installation of new drainage infrastructure so as to not impede the natural flow of water. All repairs must be completed within a reasonable period of time and:

(1) to the satisfaction of the unit; and

(2) as stated in an applicable lease or another agreement with the landowner;

subject to applicable federal, state, and local drainage laws and regulations.

Sec. 18. (a) Subject to subsection (b), and except as otherwise allowed by IC 36-7-4-1109, a project owner may not install or locate a CSE system in a unit unless the project owner submits to the permit authority a decommissioning and site restoration plan, and posts a surety bond, or an equivalent means of security

acceptable to the permit authority, including a parent company guarantee or an irrevocable letter of credit, but excluding cash, in an amount equal to the estimated cost of decommissioning the CSE system, as calculated by a third party licensed or registered engineer or by another person with suitable experience in the decommissioning of CSE systems, as agreed upon by the project owner and the permit authority. The required bond or other security shall be posted in increments such that the total amount of the bond or security posted is as follows:

(1) An amount equal to twenty-five percent (25%) of the total estimated decommissioning costs not later than the start date of the CSE system's full commercial operation.

(2) An amount equal to fifty percent (50%) of the total estimated decommissioning costs not later than the fifth anniversary of the start date of the CSE system's full commercial operation.

(3) An amount equal to one hundred percent (100%) of the total estimated decommissioning costs not later than the tenth anniversary of the start date of the CSE system's full commercial operation. For purposes of this subdivision, the total estimated decommissioning costs shall be reevaluated by a third party licensed or registered engineer (or by another person with suitable experience in the decommissioning of CSE systems, as agreed upon by the project owner and the permit authority):

(A) in connection with the tenth anniversary of the start date of the CSE system's full commercial operation; and

(B) at least once every succeeding five (5) year period after the tenth anniversary of the start date of the CSE system's full commercial operation;

and the total amount of the bond or security posted under this subdivision shall be adjusted as necessary after each reevaluation.

(b) For purposes of this section, the estimated cost of decommissioning a CSE system, as calculated by a licensed or registered professional engineer (or by another person with suitable experience in the decommissioning of CSE systems, as agreed upon by the project owner and the permit authority), shall be net of any estimated salvage value attributable to the CSE system at the time of decommissioning, unless the unit and the project owner agree to include any such value in the estimated cost.

(c) A project owner shall provide to the permit authority written notice of the project owner's intent to decommission a CSE system not later than sixty (60) days before the discontinuation of commercial operation by the CSE system. Except as provided in

subsection (e), after the discontinuation of commercial operation by the CSE system, and as part of the decommissioning process:

(1) all structures, foundations, roads, gravel areas, and cables associated with the project shall be removed to a depth of at least thirty-six (36) inches below grade; and

(2) the ground shall be restored to a condition reasonably similar to its condition before the start of construction activities in connection with the CSE system project.

(d) Except as provided in subsection (e), if the project owner fails to remove all CSE system project assets not later than one (1) year after the proposed date of final decommissioning, as set forth in the notice to the permit authority under subsection (c), the permit authority may engage qualified contractors to:

(1) enter the project site;

(2) remove the CSE system project assets;

(3) sell any assets removed; and

(4) remediate the site;

and may initiate proceedings to recover any costs incurred.

(e) Project assets may remain in place after decommissioning is complete if:

(1) the location and condition of the assets conform with local regulations at the time of decommissioning; and

(2) the written consent of the landowner is obtained.

Sec. 19. (a) If a CSE system installed in a unit does not generate electricity for eighteen (18) consecutive months:

(1) the CSE system is considered abandoned as of the date that is five hundred forty (540) days after the date on which the CSE system last generated electricity; and

(2) all CSE system project assets shall be removed in accordance with section 18(c) of this chapter not later than one (1) year after the date of abandonment specified in subdivision (1).

(b) In the case of abandonment, as described in subsection (a), if the project owner fails to remove the CSE system project assets not later than one (1) year after the date of abandonment, as required by subsection (a)(2), the permit authority may engage qualified contractors to:

(1) enter the project site;

(2) remove the CSE system project assets;

(3) sell any assets removed; and

(4) remediate the site;

and may initiate proceedings to recover any costs incurred.

Sec. 20. (a) As used in this section, "force majeure event" includes the following:

(1) Fire, flood, tornado, or other natural disasters or acts of

God.

(2) War, civil strife, a terrorist attack, or other similar acts of violence.

(3) Other unforeseen events or events over which a project owner has no control.

(b) If a force majeure event results in a CSE system not generating electricity, the project owner shall:

(1) as soon as practicable after the occurrence of the force majeure event, provide notice to the permit authority of the event and of the resulting cessation of generating operations; and

(2) demonstrate to the permit authority that the CSE system will be substantially operational and generating electricity not later than twelve (12) months after the occurrence of the force majeure event.

(c) If the CSE system does not become substantially operational and resume generating electricity within the time set forth in subsection (b)(2):

(1) the CSE system is considered abandoned as of the date that is three hundred sixty-five (365) days after the date on which the CSE system last generated electricity, unless the project owner demonstrates to the permit authority that the project owner is using all commercially reasonable efforts to resume generation; and

(2) all CSE system project assets shall be removed in accordance with section 18(c) of this chapter not later than one (1) year after the date of abandonment specified in subdivision (1).

(d) In the case of presumed abandonment, as described in subsection (c), if the project owner fails to remove the CSE system project assets not later than one (1) year after the date of abandonment, as required by subsection (c)(2), the permit authority may engage qualified contractors to:

(1) enter the project site;

(2) remove the CSE system project assets;

(3) sell any assets removed; and

(4) remediate the site;

and may initiate proceedings to recover any costs incurred.

President of the Senate

President Pro Tempore

Speaker of the House of Representatives

Governor of the State of Indiana

Date: _____ Time: _____

Model Solar Ordinance

for Indiana local governments

Photo credit: Great Plains Institute

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ENVIRONMENTAL RESILIENCE INSTITUTE

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Better Energy. Better World.

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Model Solar Ordinance – Indiana

Introduction

Indiana has high-quality and cost-effective solar energy resources – as good as many states to the south and consistently available across the entire state. As solar energy system components have become more efficient and less costly, an increasing number of solar energy systems have been installed in Indiana. Market opportunities for solar development have dramatically increased in Indiana over the last five years, such that communities must now address solar installations as land use and development issues. Solar energy components continue to improve in efficiency and decline in price; large-scale solar energy is expected to become the least expensive form of electric energy generation within a few years, surpassing wind energy and natural gas in the levelized cost of energy.

Model Solar Energy Standards

This ordinance is based on the model solar energy ordinance originally created for the Department of Energy's Phase I Rooftop Solar Challenge program in Minnesota, and updated for the three- state Grow Solar initiative, funded by Rooftop Solar Challenge Phase 2.

However, solar energy is much more than just low-cost energy generation. Households and businesses seeking to reduce their carbon footprint see solar energy as a strong complement to energy efficiency. Agricultural producers see solar energy as an economic hedge against price volatility in commodity crops. Utilities see solar's declining cost, high reliability, and free fuel as a means to put downward pressure on electric rates. Corporate, institutional, and municipal buyers are actively acquiring carbon-free solar generation to meet climate and clean energy goals. And innovative solar site designs are creating and capturing habitat and water quality co-benefits by using solar with habitat-friendly ground cover to restore ecosystem functions. Innovative solar site designs can also create and capture biodiversity and water quality benefit with vegetation plans that include perennial ground cover to enhance ecosystem functions that have been lost over the decades.

Solar Energy Issues

Local governments in Indiana are seeing increasing interest from property owners in solar energy installations and are having to address a variety of solar land uses in their development regulations. Given the continuing cost reductions and growing value of clean energy, solar development will increasingly be a local development opportunity, from the rooftop to the large-scale solar farm. Three primary issues tie solar energy to development regulations:

1. *Land use conflicts and synergies.* Solar energy systems have few nuisances. Nevertheless, solar development can compete for land with other development options, and visual impacts and perceived safety concerns sometimes create opposition to solar installations. Good design and attention to aesthetics can address most concerns for rooftop or accessory use systems, including historic and design standards. Good site placement and design standards for large- and community-scale solar can similarly resolve conflicts and create co-benefits from solar development such as restoring habitat, diversifying agricultural businesses, and improving surface and ground waters.

2. *Protecting access to solar resources.* Solar resources are a valuable component of property ownership. Development regulations can inadvertently limit a property owner's ability to access their solar resource. Communities should consider how to protect and develop solar resources in zoning, subdivision, and other development regulations or standards.

3. *Encouraging appropriate solar development.* Local governments can go beyond simply removing regulatory barriers and encourage solar development that provides economic development, climate protection, and natural resources co-benefits. Local governments have a variety of tools to encourage appropriately sited and designed solar development to meet local goals.

Components of a Solar Standards Ordinance

Solar energy standards should:

1. *Enable solar installations by-right for property-owners*. Create a clear regulatory path (an as-of-right installation) to solar development for accessory uses and – if appropriate – for principal uses such as large-scale solar and ground-mounted community shared solar installations.

2. *Create a clear pathway for principal solar uses*. Define where community- and large-solar energy land uses are appropriate as a principal or primary use, set development standards and procedures to guide development, and capture co-benefit opportunities for water quality, habitat, and agriculture.

3. *Limit regulatory barriers to developing solar resources*. Ensure that access to solar resources is not unduly limited by height, setback, or coverage standards, recognizing the distinct design and function of solar technologies and land uses for both accessory and principal uses.

4. *Define appropriate aesthetic standards*. Retain an as-of-right installation pathway for accessory uses while balancing design concerns in urban neighborhoods and historic districts. Set reasonable aesthetic standards for solar principal uses that are consistent with other principal uses that have visual impacts.

5. *Address cross-property solar access issues*. Consider options for protecting access across property lines in the subdivision process and in zoning districts that allow taller buildings on smaller (urban density) lots.

6. *Promote "solar-ready" design.* Every building that has a solar resource should be built to seamlessly use it. Encourage builders to use solar-ready subdivision and building design.

7. *Include solar in regulatory incentives.* Encourage desired solar development by including it in regulatory incentives: density bonuses, parking standards, flexible zoning standards, financing/ grant programs, and promotional efforts.

Different Community Types and Settings

The model ordinance language addresses land use concerns for both urban and rural areas, and thus not all the provisions may be appropriate for every community. Issues of solar access and nuisances associated with small or accessory use solar energy systems are of less consequence in rural areas, where lot sizes are almost always greater than one acre. Large-scale and community-scale solar (principal solar land uses) are much more likely to be proposed in rural areas rather than developed cities. However, urban areas should consider where community-or large-scale solar can add value to the community and enable economic development of a valuable local resource. Rural communities should address rooftop and accessory ground-mounted development, although the standards used in this model are designed more for the urban circumstances.

This ordinance includes language addressing solar energy as an accessory use to the principal residential or commercial use in an urban area, and language for principal solar uses more typically seen in rural communities. Communities should address both types of solar development.

Solar development is not one thing

Communities would not apply the same development and land use standards to an industrial facility and a single-family home, merely because both are buildings. Community and large-scale solar development is a completely different land use than rooftop or backyard solar. Standards that are appropriate for large-scale solar may well be wholly inappropriate for rooftop solar and may unnecessarily restrict or stymie solar development opportunities of homes and business owners.

How to Use this Model Ordinance

This Model Ordinance is based on research and best practices identified through working with over 100 Midwestern communities over the last ten years as solar energy markets evolved and expanded. The standards included in this model reflect the real-world controversies and opportunities the communities faced as the solar energy market grew. The portfolio of standards included in the model is intended to provide a reference for how communities can address those controversies and opportunities to make solar development more predictable, solar land use regulation more transparent, and regulatory standards more consistent across jurisdictions within the same solar market.

The model has been tailored to reflect Indiana-specific enabling statutes, ordinance practices, and community priorities currently seen in the state, with input from local planning, solar industry, and other experts. Because Indiana communities' ordinances, comprehensive plans and other local planning documents naturally vary, not all provisions included in the Model Ordinance will be suitable for each individual community. Moreover, as this is a "best practices" document, communities may decide not to include one or more suggested provisions. A community may also be aware of elements not included in this Model Ordinance that they wish to include. These sorts of adjustments are to be expected.

Appendix A includes links to solar ordinances already adopted by Indiana communities. The authors have not reviewed these existing ordinances against the language provided in this Model Ordinance, but provide them for users' convenience.

Model Ordinance

I. Scope – This article applies to all solar energy installations in Model Community.

II. Purpose – Model Community has adopted this regulation for the following purposes:

A. Comprehensive Plan Goals – Model Community has goals in its Comprehensive Plan, including preserving the health, safety, and welfare of the community by promoting the safe, effective, and efficient use of solar energy systems. The solar energy standards specifically implement the following goals from the Comprehensive Plan:

1. **Goal** – Encourage the use of local renewable energy resources, including appropriate applications for wind, solar, and biomass energy and energy storage.
2. **Goal** – Promote sustainable building design and management practices to serve current and future generations.
3. **Goal** – Assist local businesses to lower financial and regulatory risks and improve their economic, community, and environmental sustainability.
4. **Goal** – Efficiently invest in and manage public infrastructure systems to support development and growth.

B. Infrastructure – Distributed solar photovoltaic systems will enhance the reliability and power quality of the power grid and make more efficient use of Model Community's electric distribution infrastructure.

C. Local Resource – Solar energy is an underused local energy resource and encouraging its use will diversify the community's energy supply portfolio and reduce exposure to fiscal risks associated with fossil fuels.

D. Consistency with Greenhouse Gas Reduction Plans – Model Community has developed recommendations for greenhouse gas reductions, a purpose served by encouraging local solar development.

E. Improve Competitive Markets – Solar energy systems offer additional energy choices to consumers and will improve competition in the electricity and natural gas supply markets.

Comprehensive Plan Goals

Tying the solar energy ordinance to Comprehensive Plan goals is particularly important for helping users (both Planning Commission and community members) understand why the community is developing and administering regulation.

The language here provides examples of different types of Comprehensive Plan goals, and other policy goals that the community may have that are served by enabling and encouraging solar development. The community should substitute its policy goals for these examples.

The Comprehensive Plan may not include goals that specifically address or would be enhanced by solar development (such as climate protection or local resource economic goals). While lack of a policy goal should not delay adoption of a solar ordinance, the community may wish to consider creating a local energy plan or similar policy document that provides guidance regarding solar development.

Climate Protection Strategies

Some local governments in Indiana have adopted climate resolutions, committed to national climate goals, or have otherwise identified greenhouse gas reduction or energy independence targets. Introductory language in solar ordinances can list those commitments. An increasing number of Hoosier local governments are using and promoting solar installations to meet their energy and greenhouse gas reduction goals, but there are many reasons other than climate-related goals for a community to prepare for solar developments.

III. Definitions

Agrivoltaics – A solar energy system co-located on the same parcel of land as agricultural production, including crop production, grazing, apiaries, or other agricultural products or services.

Building-integrated Solar Energy Systems – A solar energy system that is an integral part of a principal or accessory building, rather than a separate mechanical device, replacing or substituting for an architectural or structural component of the building. Building-integrated systems include, but are not limited to, photovoltaic or hot water solar energy systems that are contained within roofing materials, windows, skylights, and awnings.

Community-Scale Solar Energy System – A commercial solar energy system that converts sunlight into electricity for the primary purpose of serving electric demands off-site from the facility, either retail or wholesale. Community-scale systems are principal uses and projects typically cover less than 10 acres.

Community Shared Solar – A solar energy system that provides retail electric power (or a financial proxy for retail power) to multiple community members or businesses residing or located off-site from the location of the solar energy system.

Grid-tied Solar Energy System– A photovoltaic solar energy system that is connected to an electric circuit served by an electric utility company.

Ground-Mounted – A solar energy system mounted on a rack or pole that rests or is attached to the ground. Ground-mounted systems can be either accessory or principal uses.

Large-Scale Solar Energy System – A commercial solar energy system that converts sunlight into electricity for the primary purpose of wholesale sales of generated electricity. A large-scale solar energy system will have a project size greater than 10 acres and is the principal land use for the parcel(s) on which it is located. It can include collection and feeder lines, substations, ancillary buildings, solar monitoring stations and accessory equipment or structures thereto, that capture and convert solar energy into electrical energy, primarily for use in locations other than where it is generated.

Off-grid Solar Energy System – A photovoltaic solar energy system in which the circuits energized by the solar energy system are not electrically connected in any way to electric circuits that are served by an electric utility company.

Passive Solar Energy System – A solar energy system that captures solar light or heat without transforming it to another form of energy or transferring the energy via a heat exchanger.

Photovoltaic System – A solar energy system that converts solar energy directly into electricity.

Pollinator-Friendly Solar Energy – A community- or large-scale solar energy system that meets the requirements of the 2020 Indiana

Solar Definitions

Not all of these terms are used in this model ordinance, nor is this a complete list of solar definitions. As a community develops its own development standards for solar technology, many of the concepts defined here may be helpful in meeting local goals. For instance, solar daylighting devices may change the exterior appearance of the building, and the community may choose to distinguish between these devices and other architectural changes.

Differentiating Solar Uses by Size

Community-scale and large-scale systems are defined here as occupying less than 10 acres and greater than 10 acres, respectively. Some communities use a lower number (five acres) and some a higher number (up to 50 acres). An ex-urban city would likely use a lower number and a rural county could use a higher number. Community-scale is generally a size that can fit into the land use fabric of the community without assembly of separate parcels. Some communities have chosen not to distinguish between community- and large-scale, and instead use a single large-scale designation.

Pollinator Friendly Standards

As pollinator-friendly landscaping becomes more common for solar energy systems, organizations are publishing standards, checklists, and scorecards to help developers and local governments so they will not have to independently research the kinds of plants that are appropriate and so that landscaping described as "pollinator-friendly" can be assured to meet an independently established standard. In Indiana, examples include Purdue University's 2020 Indiana Solar Site Pollinator Habitat Planning Scorecard and the Michiana Area Council of Governments' (MACOG) Technical Guide: Establishment and Maintenance of Pollinator-Friendly Solar Projects. Porter County, Indiana has adopted pollinator-friendly language in its solar ordinance that also provides a useful guide. Using a standard establishes a common foundation for what constitutes a pollinator-friendly installation and saves the local government the dilemma of devising and policing a habitat standard.

Solar Site Pollinator Habitat Planning Scorecard developed by Purdue University or another pollinator-friendly checklist developed by a third-party as a solar-pollinator standard designed for Midwestern eco-systems, soils, and habitat.

Renewable Energy Easement, Solar Energy Easement – An easement that limits the height or location, or both, of permissible development on the burdened land in terms of a structure or vegetation, or both, for the purpose of providing access for the benefited land to wind or sunlight passing over the burdened land.

Roof-Mounted – A solar energy system mounted on a rack that is fastened to or ballasted on a structure roof. Roof-mounted systems are accessory to the principal use.

Roof Pitch – The final exterior slope of a roof calculated by the rise over the run, typically but not exclusively expressed in twelfths such as 3/12, 9/12, 12/12.

Solar Access – Unobstructed access to direct sunlight on a lot or building through the entire year, including access across adjacent parcel air rights, for the purpose of capturing direct sunlight to operate a solar energy system.

Solar Carport – A solar energy system of any size that is installed on a carport structure that is accessory to a parking area, and which may include electric vehicle supply equipment or energy storage facilities.

Solar Collector – A device, structure or a part of a device or structure for which the primary purpose is to transform solar radiant energy into thermal, mechanical, chemical, or electrical energy. The collector does not include frames, supports, or mounting hardware.

Solar Daylighting – Capturing and directing the visible light spectrum for use in illuminating interior building spaces in lieu of artificial lighting, usually by adding a device or design element to the building envelope.

Solar Energy – Radiant energy received from the sun that can be collected in the form of heat or light by a solar collector.

Solar Energy System – A device, array of devices, or structural design feature, the purpose of which is to provide for generation or storage of electricity from sunlight, or the collection, storage, and distribution of solar energy for space heating or cooling, daylight for interior lighting, or water heating.

Solar Hot Air System – (also referred to as Solar Air Heat or Solar Furnace) A solar energy system that includes a solar collector to provide direct supplemental space heating by heating and re-circulating conditioned building air. The most efficient performance includes a solar collector to preheat air or supplement building space heating, typically using a vertically mounted collector on a south-facing wall.

Solar Hot Water System (also referred to as Solar Thermal)– A system that includes a solar collector and a heat exchanger that heats or preheats water for building heating systems or other hot water needs, including residential domestic hot water and hot water for commercial processes.

Solar Mounting Devices – Racking, frames, or other devices that allow the mounting of a solar collector onto a roof surface or the ground.

Solar Resource – A view of the sun from a specific point on a lot or building that is not obscured by any vegetation, building, or object for a minimum of four hours between the hours of 9:00 AM and 3:00 PM Standard time on all days of the year, and can be measured in annual watts per square meter.

Solar-Ready Design – The design and construction of a building that facilitates and makes feasible the installation of rooftop solar.

Solar Resource

Understanding what defines a "solar resource" is foundational to how land use regulation affects solar development. Solar energy resources are not simply where sunlight falls. A solar resource has minimum spatial and temporal characteristics, and needs to be considered not only today but also into the future. Solar energy equipment cannot function as designed if installed in partial shade, with too few hours of daily or annual direct sunlight, or without southern or near-southern exposure. Many provisions of the model ordinance are predicated on the concept that a solar resource has definable characteristics that are affected by local land use decisions and regulation.

IV. Permitted Accessory Use. Solar energy systems are a permitted accessory use in all zoning districts where structures of any sort are allowed, subject to certain requirements as set forth below. Solar carports and associated electric vehicle charging equipment are a permitted accessory use on surface parking lots in all districts regardless of the existence of another building. Solar energy systems that do not meet the following design standards will require a conditional use permit.

A. Height – Solar energy systems must meet the following height requirements:

1. Building or roof-mounted solar energy systems shall not exceed the maximum allowed height in any zoning district. For purposes of height measurement, solar energy systems other than building-integrated systems shall be given an equivalent exception to height standards as building-mounted mechanical devices or equipment.

2. Ground or pole-mounted solar energy systems shall not exceed 15 feet in height when oriented at maximum tilt.

3. Solar carports in non-residential districts shall not exceed 20 feet in height.

B. Setback – Solar energy systems must meet the accessory structure setback for the zoning district and principal land use associated with the lot on which the system is located, as allowed below.

1. **Roof or Building-mounted Solar Energy Systems** – The collector surface and mounting devices for roof-mounted solar energy systems shall not extend beyond the exterior perimeter of the building on which the system is mounted or built, unless the collector and mounting system has been explicitly engineered to safely extend beyond the edge, and setback standards are not violated. Exterior piping for solar hot water systems shall be allowed to extend beyond the perimeter of the building on a side yard exposure. Solar collectors mounted on the sides of buildings and serving as awnings are considered to be building-integrated systems and are regulated as awnings.

2. **Ground-mounted Solar Energy Systems** – Ground-mounted solar energy systems may not extend into the side-yard or rear setback when oriented at minimum design tilt, except as otherwise allowed for building mechanical systems.

C. Visibility – Solar energy systems in residential districts shall be designed to minimize visual impacts from the public right-of-way, as described in C.1-3, to the extent that doing so does not affect the cost or efficacy of the system, consistent with Indiana Code 36-7-2-8. Visibility standards do not apply to systems in non-residential districts, except for historic building or district review as described in E. below.

1. **Building-integrated Photovoltaic Systems –** Building integrated photovoltaic solar energy systems shall be allowed regardless of whether the system is visible from the public right-of-way, provided the building component in which the system is integrated meets all required setback, land use or performance standards for the district in which the building is located.

Indiana Code Title 36. Local Government § 36-7-2-1

Sec. 8 . . . (b) A unit may not adopt any ordinance which has the effect of prohibiting or of unreasonably restricting the use of solar energy systems other than for the preservation or protection of the public health and safety.

(c) This section does not apply to ordinances which impose reasonable restrictions on solar energy systems. However, it is the policy of this state to promote and encourage the use of solar energy systems and to remove obstacles to their use. Reasonable restrictions on solar energy systems are those restrictions which:

(1) do not significantly increase the cost of the system or significantly decrease its efficiency; or (2) allow for an alternative system of comparable cost and efficiency.

Height - Rooftop System

This ordinance notes exceptions to the height standard when other exceptions are granted in the ordinance. Communities should directly reference the exception language, rather than use the placeholder language here.

Height - Ground or Pole Mounted System

This ordinance sets a 15-foot height limit, which is typical for residential accessory uses. Some communities allow solar to be higher than other accessory uses in order to enable capture of the lot's solar resource when lots and buildings are closer together. An alternative is to balance height with setback, allowing taller systems if set back farther – for instance, an extra foot of height for every extra two feet of setback. In rural (or large lot) areas, solar resources are unlikely to be constrained by trees or buildings on adjacent lots and the lot is likely to have adequate solar resource for a lower (10-15 foot) ground- mounted application.

2. **Aesthetic restrictions** – Roof-mounted or ground-mounted solar energy systems shall not be restricted for aesthetic reasons if the system is not visible from the closest edge of any public right-of-way other than an alley or if the system meets the following standards.

   a. Roof-mounted systems on pitched roofs that are visible from the nearest edge of the front right-of-way shall have the same finished pitch as the roof and be no more than ten inches above the roof.

   b. Roof-mounted systems on flat roofs that are visible from the nearest edge of the front right-of-way shall not be more than five feet above the finished roof and are exempt from any rooftop equipment or mechanical system screening.

3. **Reflectors** – All solar energy systems using a reflector to enhance solar production shall minimize glare from the reflector affecting adjacent or nearby properties.

D. Lot Coverage – Ground-mounted systems shall meet the existing lot coverage restrictions for the zoning district except as defined below.

1. Ground-mounted systems shall be exempt from lot coverage or impervious surface standards if the soil under the collector is maintained in vegetation and not compacted.

2. Ground-mounted systems shall not count toward the maximum number of accessory structures permitted.

3. Solar carports in non-residential districts are exempt from lot coverage limitations.

E. Historic Buildings – Solar energy systems on buildings within designated historic districts or on locally designated historic buildings (exclusive of State or Federal historic designation) must receive approval of the local Historic Preservation Commission, or equivalent, consistent with the standards for solar energy systems on historically designated buildings published by the U.S. Department of the Interior.

F. Plan Approval Required – All solar energy systems requiring a building permit or other permit from Model Community shall provide a site plan for review.

1. **Plan Applications.** Plan applications for solar energy systems shall be accompanied by to-scale horizontal and vertical (elevation) drawings. The drawings must show the location of the system on the building or on the property for a ground-mounted system, including the property lines.

2. **Plan Approvals.** Applications that meet the design requirements of this ordinance shall be granted administrative approval by the zoning official and shall not require Planning Commission review. Plan approval does not indicate compliance with Building Code or Electric Code.

Visibility and Aesthetics

Aesthetic regulation should be tied to design principles rather than targeted at a specific land use. If the community already regulates aesthetics in residential districts, this model language provides guidance for balancing between interests of property owners who want to use their on-site solar resources and neighbors concerned with neighborhood character. Substantial evidence demonstrates that solar installations have no effect on property values of adjacent properties. But where aesthetic regulation is used to protect community character, these standards provide balance between competing goals.

Building-integrated PV

Building-integrated solar energy systems can include solar energy systems built into roofing (existing technology includes both solar shingles and solar roofing tiles), into awnings, skylights, and walls.

Roof-Mounted Solar Energy Systems

This ordinance sets a threshold for pitched roof installations that they not be steeper than the finished roof pitch. Mounted systems steeper than the finished roof pitch change the appearance of the roof, and create additional considerations in regard to the wind and drift load on structural roof components. If the aesthetic impacts are not a concern to the community, the structural issues can be addressed in the building permit.

Roof Coverage and Fire Code

Roof coverage limitations are generally not necessary, as some of the roof is likely to be shaded or otherwise not suitable for solar energy. Coverage is an issue of concern in order to ensure ready roof access in the event of a fire. The new 2018 IRC adopted by Indiana provides guidance for consistency with fire code and roof access. The permitting best practice is to allow for fire marshal variances where appropriate on access pathways.

G. **Approved Solar Components** – Electric solar energy system components must have an Underwriters Laboratory (UL) or equivalent listing and solar hot water systems must have an Solar Rating & Certification Corporation (SRCC) or equivalent rating.

H. **Compliance with Building Code** – All solar energy systems shall meet approval of local building code officials, consistent with the State of Indiana Building Code, and solar thermal systems shall comply with HVAC-related requirements of the Energy Code.

I. **Compliance with State Electric Code** – All photovoltaic systems shall comply with the Indiana State Electric Code.

J. **Compliance with State Plumbing Code** – Solar thermal systems shall comply with applicable Indiana State Plumbing Code requirements.

K. **Utility Notification** – It is recommended that the interconnection application be submitted to the utility prior to applying for required permits. Grid-tied solar energy systems shall comply with interconnection requirements of the electric utility. Off-grid systems are exempt from this requirement.

V. Principal Uses. Model Community encourages the development of commercial or utility scale solar energy systems where such systems present few land use conflicts with current and future development patterns. Community and large-scale systems are either conditional or permitted with site plan review, and are excluded elsewhere.

A. **Principal Use General Standards**

1. Site Design

a. Setbacks – Community- and large-scale solar arrays must meet the following setbacks:

1. Property line setback from a non-participating landowner's property line must meet the established setback for buildings or structures in the district in which the system is located, except as otherwise determined in 1.a.6 below.

2. Property line setbacks between separate parcels both of which are participating in the project may be waived upon agreement of the landowner(s).

3. Roadway setback of 50 feet from the ROW of State highways and County and State Aid Highways (CSAHs), and 40 feet for other roads, except as otherwise determined in 1.a.6 below.

4. Housing unit setback of 150 feet from any existing dwelling unit of a non-participating landowner, except as otherwise determined in 1.a.6 below. Participating landowner housing must meet building setbacks or required yards for the district in which the project is located.

Impervious Surface Coverage

Rather than consider the solar panel for a ground-mounted system as a roof, this provision recognizes that the ground under the panel can mitigate stormwater risks if it is kept in vegetation so that rainwater can infiltrate. Any effects are de minimis for a small array if the lot is otherwise within coverage ratios.

Historic Buildings

The standards set forth by the local historic preservation commission should be consistent with the standards for solar energy systems on historically designated buildings published by the U.S. Department of the Interior. If the local historic preservation commission does not have standards, local commissions should refer to the U.S. Department of Interior Standards and guidelines outlined at https://www.nps.gov/tps/sustainability/new-technology/solar-on-historic.htm

Plan Approval

This process is generally part of the process for obtaining a building permit. The standard that the model community typically uses for submittal requirements should be included here. If the community does not issue building permits, it can be tied to a land use permit instead. For rural areas or cities without zoning or building code standards, the plan approval section may be eliminated.

Use Standards

Most communities require a conditional use permit for large-scale solar development. The large size of such developments usually means that site-specific standards and design issues need to be considered. However, some communities have decided that sufficient oversight is provided by the Planning Commission in review of standards, and have chosen to list the use as permitted in appropriate districts. This is a decision to be made by each community in light of its oversight and review standards. To encourage large-scale solar development, list it as a permitted use.

5. Setback distance should be measured from the edge of the solar energy system array, excluding security fencing, screening, or berm.

6. All setbacks can be reduced by 50%, except that unwaived setbacks cannot be less than 30 feet, if the array has a landscape buffer that screens the array at the setback point of measurement.

b. Screening – Community- and large-scale solar energy systems shall be screened from existing residential dwellings.

1. A landscape plan shall be submitted that identifies the type and extent of proposed buffer and screening. Vegetation or another type of buffer can be proposed.

2. Screening shall be consistent with Model Community's screening ordinance or standards typically applied for other land uses requiring screening.

3. Screening shall not be required along highways or roadways, except as provided in 4. below, or along property lines within the same zoning district, except where the adjoining lot has an existing residential use.

4. Model Community may require screening where it determines there is a clear community interest in maintaining a viewshed.

c. Height – Large- and community-scale solar energy systems shall not exceed 20 feet.

Appropriate Setbacks

The community should consider balancing set-back requirements and screening requirements for principal use solar. Since the primary impact to neighbors of large-scale solar is visual, screening becomes less useful as the setbacks get larger (and vice versa).

The setback distances provided here are general examples that should be modified to be consistent with other setbacks already in the ordinance. Property line setbacks are typically not in excess of 50 feet, special setbacks for housing or existing sensitive land uses may be larger. Excessive setbacks that are unique to solar land uses, or that are designed for land uses with health and safety or significant nuisance risks such as industrial uses or animal agriculture, are unjustified given the low level of risk or nuisance posed by the solar array. It is common for a participating landowner to agree to a setback shorter than stated in the established ordinance. In that case, a waiver of the setback should be allowed.

Screening

The community should consider limiting screening of community- or large-scale solar to where there is a visual impact from an existing use, such as adjacent residential districts or uses. Screening standards should be consistent for solar with other land uses that have screening requirements. Solar energy systems may not need to be screened from adjacent lots if those lots are in agricultural use, are non-residential, or have low-intensity commercial use.

d. Ground cover and buffer areas (alternative A) – Community- or large-scale ground-mounted solar energy systems are required to adhere to the following standards. Additional site-specific conditions may apply as required by Model Community.

1. Ground around and under solar panels and in project site buffer areas shall be planted, established, and maintained for the life of the solar project in perennial vegetated ground cover meeting the definition of Pollinator-Friendly Solar Energy in Section III above.

a) All applicants shall submit a completed pollinator-friendly solar scorecard such as the 2020 Indiana Solar Site Pollinator Habitat Planning Scorecard developed by Purdue University, or a similar third-party solar pollinator standard designed for Midwest eco-systems and conditions.

b) When the scorecard results demonstrate the project does not qualify as pollinator-friendly, the applicant shall submit a landscaping plan detailing site conditions that prevent the site from being qualified and alternative means of meeting the water quality and habitat goals of the pollinator-friendly standard.

2. The site shall be planted and maintained to be free of invasive or noxious species, as listed by the Indiana Invasive Species Council. No insecticide use is permitted on the site. This provision does not apply to insecticide use in on-site buildings, in and around electrical boxes, spot control of noxious weeds, or as otherwise may be deemed necessary to protect public health and safety.

3. Projects maintained as pollinator-friendly compliant are exempt from landscaping requirements and post-construction stormwater management controls (as stated in Section V. A.2. below) that may be otherwise required under Model Community's development regulations, unless required due to special conditions by the plan commission or the Board of Zoning Appeals.

Importance of Ground Cover

Establishing and maintaining regionally appropriate ground cover creates important co-benefits for the community and the property owner. Grasses can be harvested for forage and wildflowers and blooming plants can create pollinator and bird habitat. Maintaining the site in vegetation will build soils that can be turned back into agriculture at the end of the solar farm's life.

If appropriately established, these ground cover standards also likely reduce maintenance costs and limit the need for chemical weed management, which also improves water quality outcomes.

Options for Ground Cover Standards

Two options are offered for ground cover standards. Alternative A requires perennial vegetation consistent with local eco-systems that meets the definition of "pollinator-friendly habitat," demonstrated through completion of the Purdue University pollinator scorecard or a similar third-party Midwest relevant checklist. Pollinator-friendly or habitat-friendly ground cover is a solar best practice encouraged or required by communities and some states for solar development throughout the Midwest. The inherent visual and water quality benefits of pollinator habitat can provide a basis to exempt the project from other landscaping and water quality requirements.

Alternative B requires regionally appropriate perennial ground cover. If the developer elects to use pollinator-friendly ground cover and wants to label it as such, the Purdue (or other) scorecard must be used, and other landscaping and water quality requirements are waived.

Other alternatives are also available and can be considered. Some communities may choose to apply a pollinator standard only under certain conditions, such as for mitigating taking farmland out of production. Another alternative is to encourage compliance with a habitat standard but make requirement decisions on a case by case basis in the permit review process.

e. Ground cover and buffer areas (alternative B) – Community- or large-scale ground-mounted solar energy systems are required to adhere to the following standards. Additional site-specific conditions may apply as required by Model Community.

1. Ground around and under solar panels and in project site buffer areas shall be planted, established, and maintained for the life of the solar project in perennial vegetated ground cover.

2. To the maximum extent feasible for site conditions, perennial vegetation ground cover shall be based on a diverse seed mix of native species consistent with guidance specific to the local area provided by

the Soil and Water Conservation District office or the Indiana Native Plant Society.

3. The owner/operator shall demonstrate site maintenance that is intended to remove invasive or noxious species, as listed by the Indiana Invasive Species Council, without harming perennial vegetation.

4. No insecticide use is permitted on the site. This provision does not apply to insecticide use in on-site buildings, in and around electrical boxes, spot control of noxious weeds, or as otherwise may be deemed necessary to protect public health and safety.

5. Plant material must not have been treated with systemic insecticides, particularly neonicontinoids.

6. Community- or large-scale ground-mounted solar energy systems that propose to install, establish, and maintain pollinator-friendly vegetative cover are to demonstrate the quality of their habitat by using guides such as Purdue University 2020 Indiana Solar Site Pollinator Habitat Planning Scorecard, or other third party solar-pollinator scorecards designed for Midwestern eco-systems, soils, and habitat.

7. Projects certified and maintained as pollinator-friendly compliant are exempt from landscaping requirements and post-construction stormwater management controls (as stated in Section V. A.2. below) that may be otherwise required under Model Community's development regulations, unless required due to special conditions by the plan commission or the Board of Zoning Appeals.

f. Foundations – A qualified engineer shall certify, prior to application for building permits, that the foundation and design of the solar panel racking and support is within accepted professional standards, given local soil and climate conditions.

g. Power and communication lines –

1. Power and communication lines running between banks of solar panels and to nearby electric substations or interconnections with buildings shall be buried underground. Exemptions may be granted by Model Community in instances where shallow bedrock, water courses, or other elements of the natural landscape interfere with the ability to bury lines, or distance makes undergrounding infeasible, at the discretion of the zoning administrator.

2. Power and communication lines between the project and the point of interconnection with the transmission system can be overhead.

h. Fencing – Perimeter fencing for the site shall not include barbed wire or woven wire designs and shall preferably use wildlife-friendly fencing standards that include clearance at the bottom. Alternative fencing can be used if the site is incorporating agrivoltaics.

2. **Stormwater and NPDES** – Large- and community-scale solar projects are subject to Model Community's stormwater management and erosion and sediment control provisions and Nonpoint Pollution Discharge Elimination System (NPDES) permit requirements. Solar collectors shall not be considered impervious surfaces if the project complies with ground cover standards, as described in A.1.d and e of this ordinance.

3. **Other standards and codes** – All large- and community-scale solar projects shall be in compliance with all applicable local, state and federal regulatory codes, including the State of Indiana Uniform Building Code, as amended; and the National Electric Code, as amended.

Site Plan

Solar farm developers should provide a site plan similar to that required by the community for any other development. Refer to your existing ordinance to guide site plan submittal requirements.

4. **Site Plan Required** – The applicant shall submit a detailed site plan for both existing and proposed conditions, showing locations of all solar arrays, other structures, property lines, rights-of-way, service roads, floodplains, wetlands, and other protected natural resources, topography, electric equipment, and all other characteristics requested by Model Community. The site plan should show all zoning districts and overlay districts.

5. **Aviation Protection** – For large- and community-scale solar projects located within 500 feet of an airport or within approach zones of an airport, the applicant must complete and provide the results of a glare analysis through a qualitative analysis of potential impact, field test demonstration, or geometric analysis of ocular impact in consultation with the Federal Aviation Administration (FAA) Office of Airports, consistent with the Interim Policy, FAA Review of Solar Energy Projects on Federally Obligated Airports, or most recent version adopted by the FAA.

6. **Agricultural Protection** – Large- and community-scale solar projects must comply with model community's site assessment standards for identifying agricultural soils. Model Community may require mitigation for use of prime soils for solar array placement, including the following:

   a. Demonstrating co-location of agricultural uses (agrivoltaics) on the project site.

   b. Using an interim use or time-limited Conditional Use Permit (CUP) that allows the site to be returned to agriculture at the end of life of the solar installation.

   c. Locating the project in a wellhead protection area for the purpose of removing agricultural uses from high risk recharge areas.

   d. Using pollinator-friendly ground cover, as defined in Section III.

7. **Decommissioning** – A decommissioning plan shall be required to ensure that facilities are properly removed after their useful life.

   a. Decommissioning of the system must occur in the event the project does not produce power for 12 consecutive months. An owner may petition for an extension of this period upon showing of reasonable circumstances that have caused the delay in the start of decommissioning.

   b. The plan shall include provisions for removal of all structures and foundations to a depth of 48", restoration of soil and vegetation and assurances that financial resources will be available to fully decommission the site.

   c. Disposal of structures and/or foundations shall meet the provisions of the Model Community Solid Waste Ordinance.

   d. Model Community may require the posting of a bond, letter of credit, a parent guarantee, or other financial surety to ensure proper decommissioning.

   e. The value of the decommission bond or letter of credit should consider the salvage value of the solar equipment.

Aviation Standards, Glare

This standard was developed for the FAA for solar installations on airport grounds. It can also be used for solar farm and garden development in areas adjacent to airports. This standard is not appropriate for areas where reflected light is not a safety concern.

Agricultural Protection

The agricultural protection section applies only to those communities that have adopted agricultural protection standards in their development regulations that apply to multiple types of development. In those instances, this provision applies those same standards to solar development. The ordinance language is written for a community that requires assessment of soils, but not necessarily protection of those soils. Communities should carefully evaluate to what degree solar development should be subject to the community's agricultural protection standards.

Solar and Prime Soils

Solar farms do not pose the same level or type of risk to agricultural practices or prime farm soil, as does housing or commercial development.

• State stormwater standards require, in most cases, establishment of perennial vegetation over the solar project site by the end of construction. The groundcover at solar farms will protect agricultural soil, build nutrients, prevent erosion, and improve topsoil quality at the site.

• Some forms of agriculture can be co-located with solar development, including grazing, small crop production, and apiaries.

• Solar farms can be easily turned back to agriculture at the end of the solar farm's life (now being estimated to be 35 years).

B. Community-Scale Solar – Model Community permits the development of community-scale solar, subject to the following standards and requirements:

1. **Rooftop shared solar systems permitted** – Rooftop systems are permitted in all districts where buildings are permitted.

2. **Community-scale uses** – Ground-mounted community-scale solar energy systems must cover no more than ten acres (project boundaries), and are a permitted use in industrial and agricultural districts, and permitted with standards or conditional in all other non-residential districts. Ground-mounted solar developments covering more than ten acres shall be considered large-scale solar.

3. **Dimensional standards** - All structures must comply with setback and height standards for the district in which the system is located.

4. **Other standards** - Ground-mounted systems must comply with all required standards for structures in the district in which the system is located.

Drinking Water Protection

In identifying preferred areas or districts for solar principal uses, the community should consider co-benefits of solar energy development. One such potential co-benefit is protection of drinking water supplies. Solar energy development may be intentionally sited within vulnerable portions of public water supply systems as a best management practice to restore and protect perennial groundcover that reduces nitrate contamination of ground water supplies.

Defining Community-Scale Solar

The acreage size for community-scale solar garden written here (10 acres) is the high end of project size for a one-megawatt system, but community-scale could be defined as high as 10 megawatts (100-acre project size). Community-scale solar is the size that can fit in to the landscape.

Community-Scale Solar or Solar Gardens

Community solar systems differ from rooftop or solar farm installations primarily in regards to system ownership and disposition of the electricity generated, rather than land use considerations. There is, however, a somewhat greater community interest in community solar, and thus communities should consider creating a separate land use category.

This language limits the size of the garden to ten acres, which is an installation of no more than one MW of solar capacity. Communities should tailor this size limit to community standards, which may be smaller or larger.

C. Large-Scale Solar – Ground-mounted solar energy arrays that are the principal use on the lot are permitted under the following standards:

1. **Conditional use permit** – Large- and community-scale solar projects are conditional uses in agricultural districts, industrial districts, shoreland and floodplain overlay districts, airport safety zones subject to V.A.5. of this ordinance, and in the landfill/brownfield overlay district for sites that have completed remediation.

Large-Scale Solar Conditional Uses

Communities can determine if large -scale solar should require a conditional use or permitted-use permit for the community to consider the site-specific conditions. The districts listed here are examples. Each community needs to consider where large scale solar is suitable in the context of its zoning districts and priorities.

Example Use Table

Use Type	Residential	Mixed Use	Business	Industrial	Agricultural, Rural, Landfill	Shoreland	Floodplain	Special (Conservation, Historic Districts)
Large-scale solar	X	X	X	C/PS	C/PS	C	C	C
Community-scale solar	C	C	C	P	P	PS	PS	PS
Accessory use ground-mounted solar	P	P	P	P	P	P	C	C
Rooftop solar	P	P	P	P	P	P	P	PS

P = Permitted

PS = Permitted Special (additional separate permit or review)

C = Conditional

X = Prohibited

Solar as a Land Use

The above use table shows four types of solar development that are distinct types of land uses (two kinds of accessory uses, two principal uses), and a group of districts or overlays that are commonly used in Indiana.

• Rooftop system are permitted in all districts where buildings are permitted, with recognition that historic districts will have special standards or permits separate from the zoning permits.

• Accessory use ground-mounted systems are conditional where potentially in conflict with the primary district or overlay goal.

• Community-scale solar principal uses are either conditional uses or permitted uses, depending on the community decisions. Permitted uses are where a 10-acre development can be integrated into the landscape, and require special consideration in shoreland and floodplain overlay districts.

• Large-scale solar is prohibited in higher density districts and conditional or permitted with separate permit review in all other districts.

Both community- and large-scale solar is allowed in shoreland and floodplain overlay districts, because the site design standards requiring beneficial habitat ground cover not only ensure a low-impact development but in most cases result in a restoration of eco-system services from the previous (usually agricultural) use.

VI. Renewable Energy Condition for Certain Permits

A. Condition for Planned Unit Development (PUD) Approval - Model Community may require on-site renewable energy systems, zero-net-energy (ZNE) or zero-net-carbon (ZNC) building designs, solar-synchronized electric vehicle charging or other clean energy systems as a condition for approval of a PUD permit to mitigate for:

1. Impacts on the performance of the electric distribution system,
2. Increased local emissions of greenhouse gases associated with the proposal,
3. Need for electric vehicle charging infrastructure to offset transportation-related emissions for trips generated by the new development, and
4. Other impacts of the proposed development that are inconsistent with the Model Community Comprehensive Plan.

B. Condition for Conditional Use Permit - Model Community may require on-site renewable energy systems or zero net energy construction as a condition for a rezoning or a conditional use permit.

VII. Solar Roof Incentives. Model Community encourages incorporating on-site renewable energy system or zero net energy construction for new construction and redevelopment. Model Community may require on-site renewable energy or zero-net- energy construction when issuing a conditional use permit where the project has access to local energy resources, in order to ensure consistency with Model Community's plan to reduce greenhouse gas emissions.

A. Density Bonus - Any application for subdivision of land in the Districts that will allow the development of at least four (4) new lots of record shall be allowed to increase the maximum number of lots by 10% or one lot, whichever is greater, provided all building and wastewater setbacks can be met with the increased density, if the applicant enters into a development agreement guaranteeing at least three (3) kilowatts of PV for each new residence that has a solar resource.

B. Solar-Ready Buildings – Model Community encourages builders to use a solar-ready design in buildings. Buildings that submit a completed U.S. EPA Renewable Energy Ready Home Solar Photovoltaic Checklist (or other approved solar- ready standard) and associated documentation will be certified as a Model Community solar ready home, and be eligible for low-cost financing through Model Community's Economic Development Authority. The designation will be included in the home's permit history.

Renewable Energy Conditions, Incentives

The community can use traditional development tools such as conditional use permits, PUDs, or other discretionary permits to encourage private investment in solar energy systems as part of new development or redevelopment. This model ordinance notes these opportunities for consideration by local governments. In most cases, additional ordinance language would need to be tailored to the community's ordinances.

For instance, a provision that PUDs (or other special district or flexible design standard) incorporate solar energy should be incorporated into the community's PUD ordinance rather than being a provision of the solar standards.

Conditional use permits generally include conditions, and those conditions can include renewable energy or zero net energy design, but only if the conditions are clearly given preference in adopted policy or plans providing the Board of Zoning Appeals with clear guidance for approving the conditions. Explicit reference to climate or energy independence goals in the ordinance and explicit preference for such conditions will set a foundation for including such conditions in the permit.

Solar Roof Incentives

This section of the model ordinance includes a series of incentives that can be incorporated into development regulation. Most cities and many counties use incentives to encourage public amenities or preferred design. These same tools and incentives can be used to encourage private investment in solar energy. Communities should use incentives that are already offered, and simply extend that incentive to appropriate solar development.

Some of the incentives noted here are not zoning incentives, but fit more readily into incentive programs offered by the community (such as financing or incentive-based design standards).

C. Solar Access Variance – When a developer requests a variance from Model Community's subdivision solar access standards, the zoning administrator may grant an administrative exception from the solar access standards provided the applicant meets the conditions of 1. and 2. below:

1. **Solar Access Lots Identified** - At least 20% of the lots, or a minimum number of lots to be determined by Model Community.
2. **Covenant Assigned** - Solar access lots are assigned a covenant that homes built upon these lots must include a solar energy system. Photovoltaic systems must be at least three (3) KW in capacity.
3. **Additional Fees Waived** - Model Community may waive any additional fees for filing of the covenant.

Solar-Ready Buildings

New buildings can be built "solar-ready" at very low cost (in some cases the marginal cost is zero). Solar energy installation costs continue to decline in both real and absolute terms, and are already competitive with retail electric costs in many areas. If new buildings have a rooftop solar resource, it is likely that someone will want to put a solar energy system on the building in the future. A solar ready building greatly reduces the installation cost, both in terms of reducing labor costs of retrofits and by "pre-approving" most of the installation relative to building codes.

A community's housing and building stock is a form of infrastructure that, although built by the private sector, remains in the community when the homeowner or business leaves the community. Encouraging solar-ready construction ensures that current and future owners can take economic advantage of their solar resource when doing so makes the most sense for them.

Solar Access Subdivision Design

Some communities will require solar orientation in the subdivision ordinance, such as requiring an east-west street orientation within 20 degrees in order to maximize lot exposure to solar resources. However, many such requirements are difficult to meet due to site constraints or inconsistency with other requirements (such as connectivity with surrounding street networks). Rather than simply grant a variance, the community can add a condition that lots with good solar access actually be developed as solar homes.

Appendix A

The following list contains solar ordinances proposed and adopted in Indiana. This list has not been vetted by the authors of Indiana's Model Solar Ordinance; instead, this list is intended to provide examples of what has already been adopted.

List of Solar Ordinances Adopted by Local Governments in Indiana *Last Updated October 2020*		
Local Government	**Adoption Date**	**Ordinance Link**
City of Goshen	2012; Amended in 2017	Goshen Zoning Ordinance > Solar Energy System Regulations
City of Plymouth	2017; Amended in 2019	City of Plymouth Zoning Ordinance Solar Energy Standards
City of South Bend	2019	South Bend Zoning Ordinance > Solar
Elkhart County	Dec 2014, Effective Feb 2015; Amended Jan 2020	Elkhart County Zoning Ordinance > Solar Panel Array
Fulton County	Unknown	Fulton County Zoning Ordinance > Solar Energy Systems Standard
Henry County	(proposed)	Draft Ordinance as of Oct 2020
Lake County	Sep 2020	Lake County Zoning Ordinance
Marshall County	2017; Amended Jan 2020*	Marshall County Zoning Ordinance > Solar Energy Systems
Porter County	Apr 2020	Porter County Unified Development Ordinance Amendment > Solar Ordinance Chaps. 2, 5 and 10
Posey County	Mar 2020	Posey County Zoning Ordinance > Renewable Energy Generation Systems for Cynthiana, Poseyville, and Mount Vernon
Posey County	Mar 2020	Posey County Zoning Ordinance > Renewable Energy Generation Systems for Unincorporated Areas
Pulaski County	Dec 2019, Effective Jan 2020	Pulaski County Unified Development Ordinance > Wind Energy Convergence and Solar Energy Systems
Randolph County	Jul 2020	Randolph County Solar Energy Systems Siting Regulations
Shelby County	Jul 2018	Shelby County Unified Development Ordinance > Commercial Solar Energy Systems Standards
St. Joseph County	Feb 2020	St. Joseph County Zoning Ordinance > Special Regulations for Renewable Energy Systems
Starke County	Jun 2019	Starke County Solar Energy Ordinance
White County	Jan 2019	White County Zoning Ordinance > Solar Farms and Solar Energy Systems

*under moratorium until 2021 to address decommissioning in the ordinance

Dear Bartholomew County Planning Commission:

I respectfully disagree with the 500-ft setback. but I think it is excessive and unreasonable. 500 feet subtracted from two sides of a 100-acre square is 50% of the land. That could be a deal-breaker for many solar-farm projects.

I missed the earlier meetings, so I can only speculate on the reasons given.

Solar systems are not “Heavy Industry”, which is defined as having external effects that are more obnoxious and less safe. But solar farms make no noise, no vibration, no smoke, no odor, no dust, no toxic gases, and no glare. They have no traffic, no trucks, no big and long working shifts, or no tall installations that are visually disruptive. IOW, they have no obnoxious or unsafe effects. Even standard farming is louder, more toxic, more dusty, more polluting, more visually disruptive, harder on wildlife, and has more trucks and big machinery going in and out.

Solar farms are not like Confined Feeding Operations. They have no buildings, no animals, no noise, no manure, no retention ponds, no smell, no truck traffic.

Solar farms are not like Wind Farms. They have no tall towers, no noise, no dangerous propellers.

Solar farms on average do not reduce property values. Granted, some appraisal studies claim otherwise, but just as many or more disagree. (4 studies are attached.) So it depends on what you read. Besides, if a nearby property sells for less, it’s more likely due to solar-farm myths than solar-farm facts.

Solar farms are not fire hazards. There is no data showing that they catch fire any more often.

Solar farms are not like landfills, in any way. Enough said.

Solar farms planned for this area are not like heavy industry or CAFOs or Wind Farms or landfills, and do not present a fire hazard, and do not ON AVERAGE reduce property values, etc. Solar farms are quiet, low-profile, inconspicuous, and have no moving parts. There is no factual justification for a large setback.

A previous commenter said a large setback is necessary for our county because of its larger population. If I understood that logic, I could refute it – but there doesn’t appear to be any. If no adverse elements warrant a large setback, population density is irrelevant.

Or maybe a large setback is Indiana law. No. In fact, Indiana Code IC 36-7-2-8 says the opposite. It says that solar energy system ordinances and restrictions should be REASONABLE. Part B says

that an Indiana county “may not adopt any ordinance which has the effect of prohibiting or of unreasonably restricting the use of solar energy systems other than for the preservation or protection of the public health and safety.” A 500-ft separation is most certainly NOT required to protect public health and safety, but it would most certainly have the effect of prohibiting or unreasonably restricting solar energy systems. The State of Indiana does not want county governments to do that. In fact, part C says: “it is the policy of this state to promote and encourage the use of solar energy systems and to remove obstacles to their use.”

Furthermore, the 500 ft setback does not appear to be related to any of the Commission’s own standards for revisions, which are to solve problems related to:
1. “securing adequate light, air, convenience of access, and safety from fire or flood or other danger”
2. “congestion in public ways”
3. “the public health, safety, comfort, morals, convenience, or general welfare”.
4. “the conservation of property values”
5. “responsible growth and development”.

Solar farms planned for this area present no such problems.

I could further speculate on the basis for a large setback, but hopefully the Commission will see through the emotional opposition whipped up by yard signs and social media, and instead base their decision on the facts and the law; which show that a 500-ft residential setback is an overly-restrictive obstacle for solar-energy-system installations.

For a more reasonable separation, the Commission could refer to the attached publication, “Model Solar Ordinance for Indiana local governments”. Page 10 suggests a maximum setback of “150 feet from any existing dwelling unit” – not property line.

Thank you,

Mark Niemoeller
1625 S Gladstone Ave

Indiana Code:

IC 36-7-2-8	Solar energy systems; ordinances; reasonable restrictions

Sec. 8. (a) As used in this section, "solar energy system" means either of the following:

(1) any solar collector or other solar energy device whose primary purpose is to provide for the collection, storage, and distribution of solar energy for space heating or cooling, or for water heating; or

(2) any structural design feature of a building, whose primary purpose is to provide for the collection, storage, and distribution of energy for space heating or cooling, or for water heating.

(b) A unit may not adopt any ordinance which has the effect of ***prohibiting or of unreasonably restricting*** the use of solar energy systems other than for the preservation or protection of the public health and safety.

(c) This section does not apply to ordinances which impose ***reasonable*** restrictions on solar energy systems. However, it is the policy of this state to promote and encourage the use of solar energy systems and to remove obstacles to their use. Reasonable restrictions on solar energy systems are those restrictions which:

(1) do not significantly increase the cost of the system or significantly decrease its efficiency; or

(2) allow for an alternative system of comparable cost and efficiency.

As added by Acts 1981, P.L.311, SEC.2.

IC 36-7-2-2	Planning and regulation of real property; access to solar energy

Sec. 2. A unit may plan for and regulate the use, improvement, and maintenance of real property and the location, condition, and maintenance of structures and other improvements. A unit may also regulate the platting and subdividing of real property and number the structures abutting public ways. In planning for and regulating the use of land or in regulating the platting or subdividing of real property, a unit may also regulate access to incident solar energy for all categories of land use.

[Pre-Local Government Recodification Citations: 18-1-1.5-6(d); 18-1-1.5-10 (Intro.); 18-1-1.5-10(b); 18-1-1.5-10(c); 18-1-1.5-10(d); 18-1-1.5-10(e); 18-1-1.5-10(f); 18-1-1.5-10(i); 18-1-1.5-11 part; 18-3-1-51 part; 18-4-2-18 part; 18-4-2-25 part; 18-5-10-7 part.]

As added by Acts 1980, P.L.211, SEC.2. Amended by Acts 1981, P.L.311, SEC.1.

Solar and Property Value

Correcting the Myth that Solar Harms Property Value

It is a common misconception that ground mounted solar farms decrease nearby property values.

- Examining property value in states across the United States demonstrates that large-scale solar arrays often have no measurable impact on the value of adjacent properties, and in some cases may even have positive effects.
- Proximity to solar farms does not deter the sales of agricultural or residential land.
- Large solar projects have similar characteristics to a greenhouse or single-story residence. Usually no more than 10 feet high, solar farms are often enclosed by fencing and/or landscaping to minimize visual impacts.

Vegetative screening will grow to obscure panels from the road and nearby homes, when desired.
Photo Credit: Borrego Solar

The Numbers

- A study conducted across Illinois determined that the value of properties within one mile *increased* by an average of 2 percent after the installation of a solar farm.[1]
- An examination of 5 counties in Indiana indicated that upon completion of a solar farm, properties within 2 miles were an average of 2 percent *more* valuable compared to their value prior to installation.[2]
- An appraisal study spanning from North Carolina to Tennessee shows that properties adjoining solar farms match the value of similar properties that do not adjoin solar farms within 1 percent.[3]

Paired Sale Analysis: Solar Farms and Adjoining Land		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Control Area Sales (5)	No: Not adjoining solar farm	$79.95
Adjoining Property 10 (Test Area)	Yes: Solar Farm was completed by the sale date	$82.42
Difference		3.09%

Various studies have shown that solar can potentially have a positive impact on adjoining property value. The above table references one of many in a report written by CohnReznick.[4]

[1] Kirkland, Richard C. *Grandy Solar Impact Study*. Kirkland Appraisals, 25 Feb. 2016, kirdlandapprasials.com.
[2] Lines, Andrew. "Property Impact Study: Solar Farms in Illinois." *Mcleancounty.gov*, Nexia International, 7 Aug. 2018.
[3] McGarr, Patricia. Property Value Impact Study. Cohn Reznick LLP Valuation Advisory Services, 2 May 2018.

Solar and Property Value

Harmony with Nearby Residential and Agricultural Property

1. **Appearance**: Large solar projects have similar characteristics to a greenhouse or single-story residence. Usually no more than 10 feet high, solar farms are often enclosed by fencing and/or landscaping to minimize visual impacts.

2. **Noise**: Solar projects are effectively silent. Tracking motors and inverters may produce an ambient hum that is not typically audible from outside the enclosure.

3. **Odor**: Solar projects do not produce any byproduct or odor.

4. **Traffic**: Solar projects do not attract high volumes of additional traffic as they do not require frequent maintenance after installation.

A ground-mounted solar system sited in a rural area.

Credit: Blattner

5. **Hazardous Material**: PV modules are constructed with the solar cells laminated into polymers and the minute amounts of heavy metals used in some panels cannot mix with water or vaporize into the air. Even in the case of module breakage, there is little to no risk of chemicals releasing into the environment.[5]

[5] "Clean Energy Results, Questions and Answers, Ground Mounted Solar Photovoltaic Systems." Energy Center, June 2015. http://www.mass.gov/eea/docs/doer/renewables/solar/solar-pv-guide.pdf


CohnReznick
ADVISORY • ASSURANCE • TAX
PROPERTY VALUE IMPACT STUDY
PROPOSED SOLAR FARM
MCLEAN COUNTY, IL
Patricia L. McGarr, MAI, CRE, FRICS
Andrew Lines, MAI
August 7, 2018
CohnReznick LLP
A member of Nexia International
CohnReznick is an independent member of Nexia International

Patricia L. McGarr, MAI, CRE, FRICS, CRA

Principal,
National Director, Valuation Advisory Services

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Licenses and Accreditations

- Member of the Appraisal Institute (MAI)
- Counselors of Real Estate, designated CRE
- Fellow of Royal Institution of Chartered Surveyors (FRICS)
- Certified Review Appraiser (CRA)
- California State Certified General Real Estate Appraiser
- District of Columbia Certified General Real Estate Appraiser
- Illinois State Certified General Real Estate Appraiser
- Indiana State Certified General Real Estate Appraiser
- New Jersey State Certified General Real Estate Appraiser
- Texas State Certified General Real Estate Appraiser
- Wisconsin State Certified General Real Estate Appraiser
- New York State Certified General Real Estate Appraiser
- Michigan State Certified General Real Estate Appraiser
- Virginia State Certified General Real Estate Appraiser
- Nevada State Certified General Real Estate Appraiser
- Maryland State Certified General Real Estate Appraiser
- Pennsylvania State Certified General Real Estate Appraiser
- Connecticut State Certified General Real Estate Appraiser

Professional Affiliations

- National Association of Realtors
- International Right Of Way Association
- Elkhart County Board of Realtors (MLS of Indiana)
- CREW (Commercial Real Estate Women)

Appointments

- Appointed by the Governor in 2017
  to the State of Illinois to the Department of Financial & Professional Regulation's Real Estate Appraisal Board
  Vice-Chairman - 2018

Property Value Impact Study - Overview

The purpose of this real estate impact study is to determine whether the existing solar farm uses under study have had any consistent and measurable impact on the value of adjacent properties.

According to the Solar Energy Industries Association (SEIA) 2017 statistics, Illinois had 83.8 Megawatts (MW) of solar panels installed, compared to Indiana which has had 275.6 MW of solar panels installed. As we are studying the impact of this use on adjacent property values, we have included two established solar farms in Indiana, focusing on similar rural and transitioning areas, that we believe are comparable to those locations proposed in Illinois.

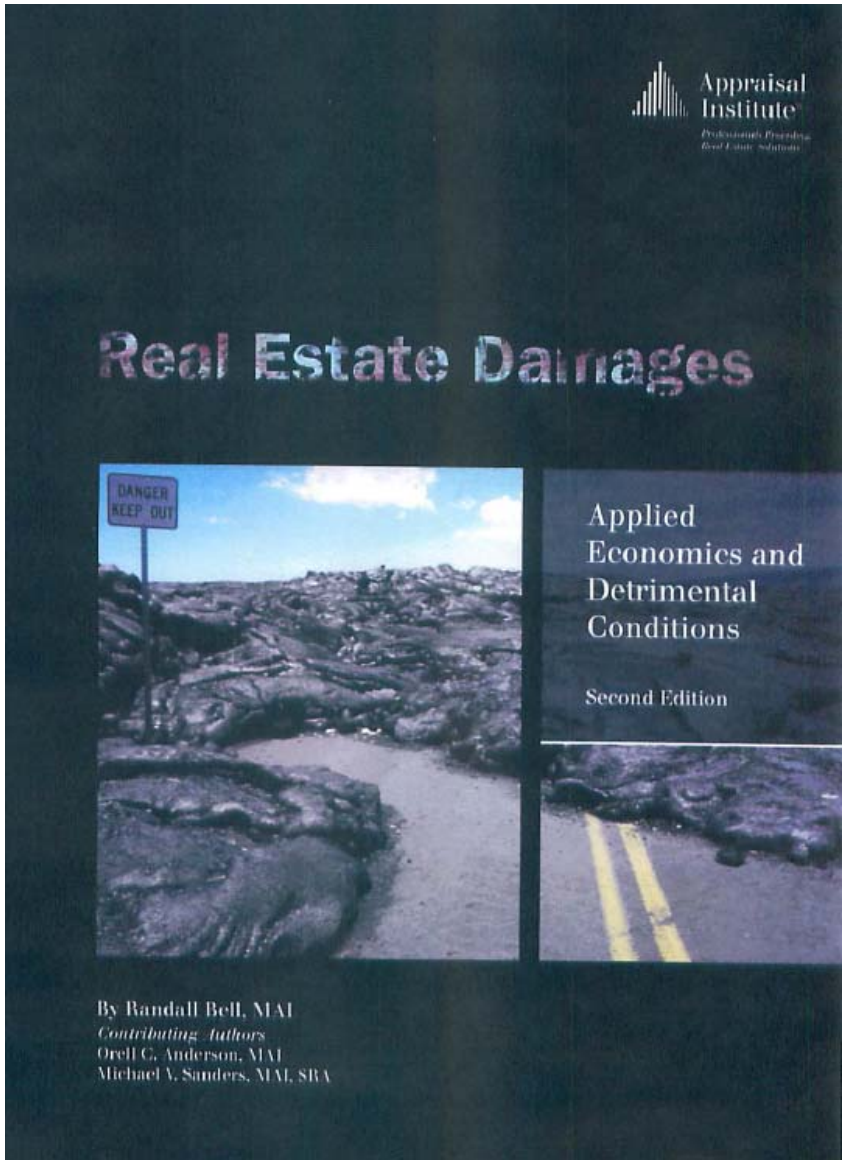
Our study includes research and analyses of existing solar farms and the property value trends of the adjacent land uses, including agricultural and residential properties; review of publishes studies, and discussions with market participants, summarized as follows:

- **Solar Farm 1 (*Grand Ridge Solar Farm*)** is located near the City of Streator in LaSalle County, Illinois, in a primarily rural area, on two contiguous parcels totaling 160 acres. Surrounding uses consist of agricultural land, some with homesteads, and single family homes to the northwest. We found one adjoining property which qualified for a paired sales analysis. (Completed 2012, 20 MW AC Project)
- ***Solar Farm 2 (Portage Solar Farm)*** is located near the City of Portage, in Porter County, Indiana. This solar farm is situated in a residential area on a 56-acre parcel of land. The surrounding uses consist of agricultural land to the north and east, and residential uses such as single family homes to the west and northwest, and multifamily apartments to the south. We found two adjoining properties that qualified for a paired sales analysis. (2012, 1.5 MW Project)
- **Solar Farm 3 (*Dominion Indy Solar Farm III*)** is located in a suburban, yet rural area outside of Indianapolis, in Marion County, Indiana, on a parcel totaling 134 acres. The surrounding uses consist of agricultural land to the east, west and south, and a single family subdivision to the north. We found six adjoining properties which qualified for a paired sales analysis. (Completed 2013, 11.9 MW Project)

- **Solar Farm 4 (*IMPA Frankton Solar Farm*)** is located in the Town of Frankton, in Madison County, Indiana. This solar farm is situated in a fairly rural area and is located on a 13-acre parcel. The surrounding uses consist of single family homes to the east, agricultural land to the south, west, and north, and some baseball fields as well. We found two adjoining properties which qualified for a paired sales analysis. (Completed 2014, 1 MW Project)
- ***Solar Farm 5 (Valparaiso Solar Farm)*** is located near the City of Valparaiso, in Porter County, Indiana. This solar farm is situated in a fairly rural area on two contiguous parcels totaling 27.9 acres. The surrounding uses consist of vacant land to the north, and single family homes to the east, south and west. We considered two adjoining properties which qualified for a paired sales analysis. (Completed 2012, 1.3 MW Project)

We have performed a paired sales analysis for each adjoining property that fit the criteria for analysis that were adjacent to the solar farms we studied. The sales adjacent to solar farms, or Test Areas, were compared to agricultural land sales and single family home sales not adjacent to solar farms within the same county as the subject solar farms, or Control Areas. **We analyzed 15 adjoining property sales in Test Areas and 63 comparable sales in Control Areas,** collectively, for the Grand Ridge Solar Farm, the Portage Solar Farm, the IMPA Frankton Solar Farm, the Dominion Indy III Solar Farm, the Valparaiso LLC Solar Farm, over the past seven years.

Property Value Impact Study - Methodology



Paired Sales Analysis

This type of analysis compares potentially impacted properties located in "***Test Areas"*** with unimpacted properties called "***Control Areas***".

Test Areas: A group of sales located adjacent to Existing Solar Farms.

Control Areas: A group of otherwise similar properties not located adjacent to Existing Solar Farms.

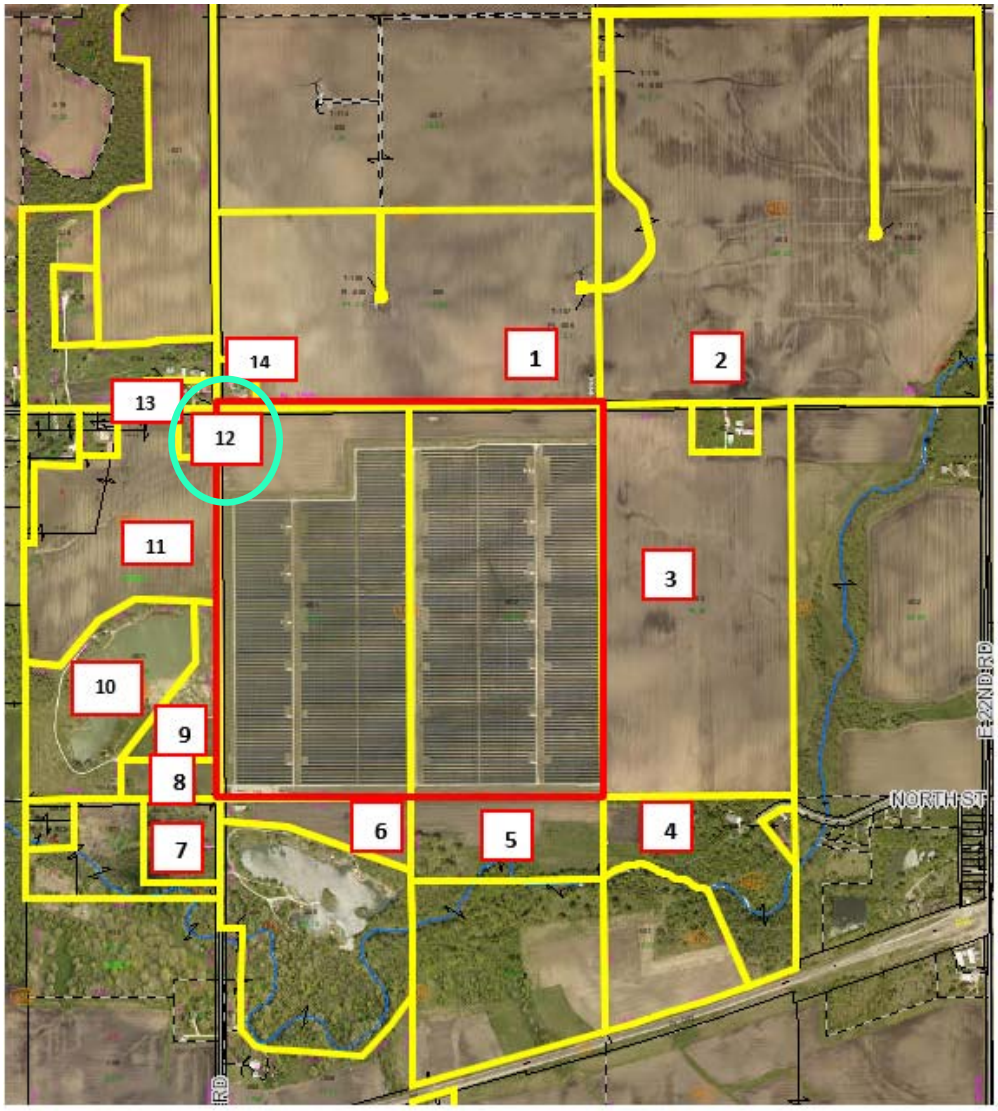
"If a legitimate detrimental condition exists, there will likely be *a measurable and consistent difference* between the two sets of market data; if not, there will likely be no significant difference between the two sets of data".

The Appraisal Institute's Text, page 25.

Solar Farm 1:
Grand Ridge Solar Farm-Streator, IL

Disclaimer: *This summary of our conclusions is limited to the intended use, intended users (Cypress Creek Renewables, Inc..), and purpose stated within our formal impact study consulting report. No part of this report may be reproduced or modified in any form, or by any means, without the prior written permission of CohnReznick, LLP.*

Solar Farm 1:
Grand Ridge Solar Farm-Streator, IL



CohnReznick Paired Sale Analysis		
1	**Potentially Impacted by Solar Farm**	**Adjusted Median Price Per SF**
Control Area Sales (5)	No: Not adjoining solar farm	$74.35
Adjoining Property # 12 (Test Area)	Yes: Solar Farm was completed by the sale date	$79.90
Difference		**7.46%**

Solar Farm Opened 12/2013
Adjoining Single Family Home Sold 10/2016

479 feet
(House to Solar Panel)

Solar Farm 2:
Portage Solar Farm-Porter County, IN

4,255 Square Foot Estate Home Under Construction
4BR/5 BA with Pool, Attached Garage and Pond
April 2018 ($465,000), 2 years AFTER Solar Farm

CohnReznick Paired Sale Analysis

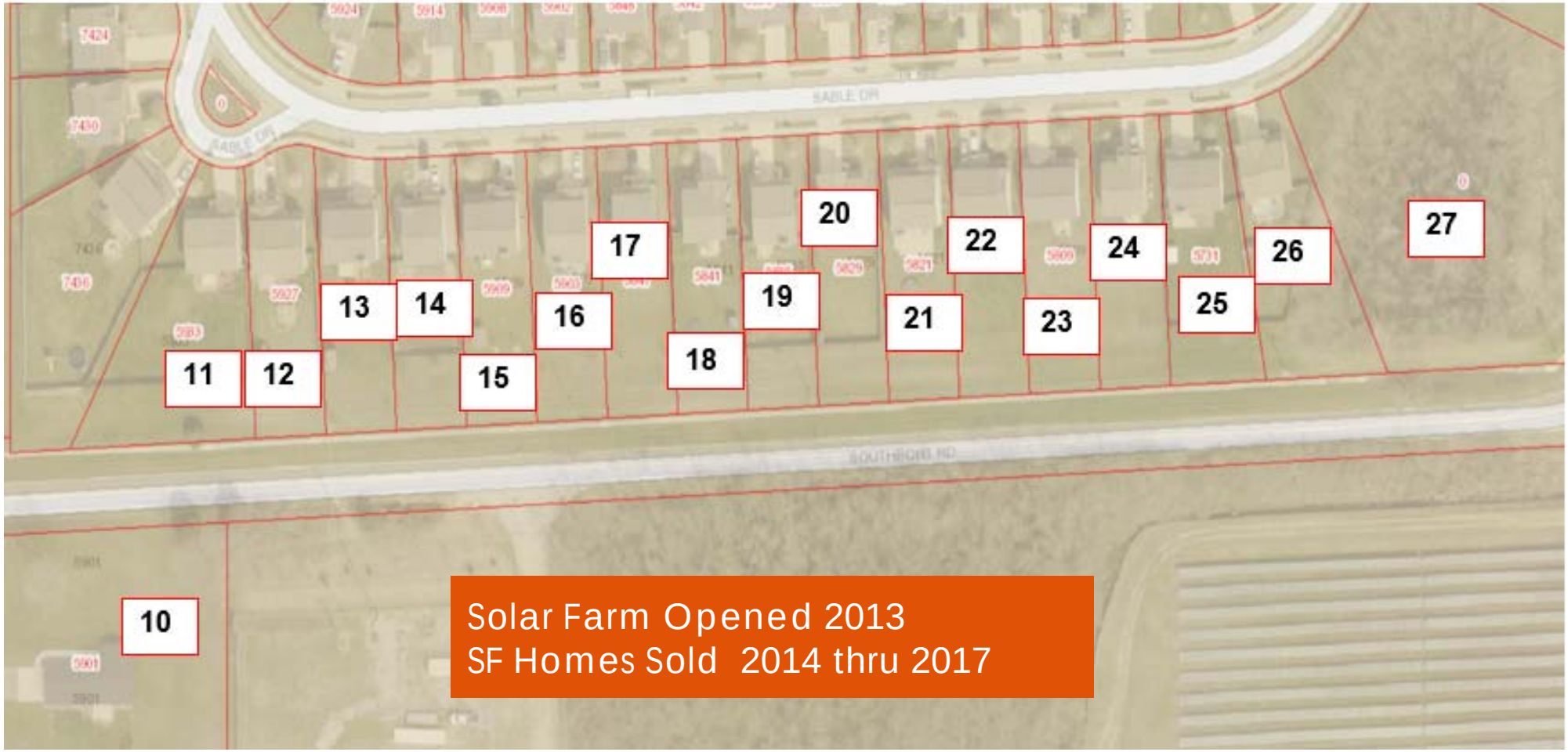
2-1	Potentially Impacted by Solar Farm	Adjusted Median Price Per Acre
Control Area Sales (9)	No: Not adjoining solar farm	$7,674
Adjoining Property 1 (Test Area)	Yes: Solar Farm was completed by the sale date	$8,000
Difference		4.25%

CohnReznick Paired Sale Analysis

2-2	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Control Area Sales (7)	No: Not adjoining solar farm	$84.27
Adjoining Property 7 (Test Area)	Yes: Solar Farm was completed by the sale date	$84.35
Difference		0.10%

Solar Farm 3:
Dominion Indy Solar III-Indianapolis, IN

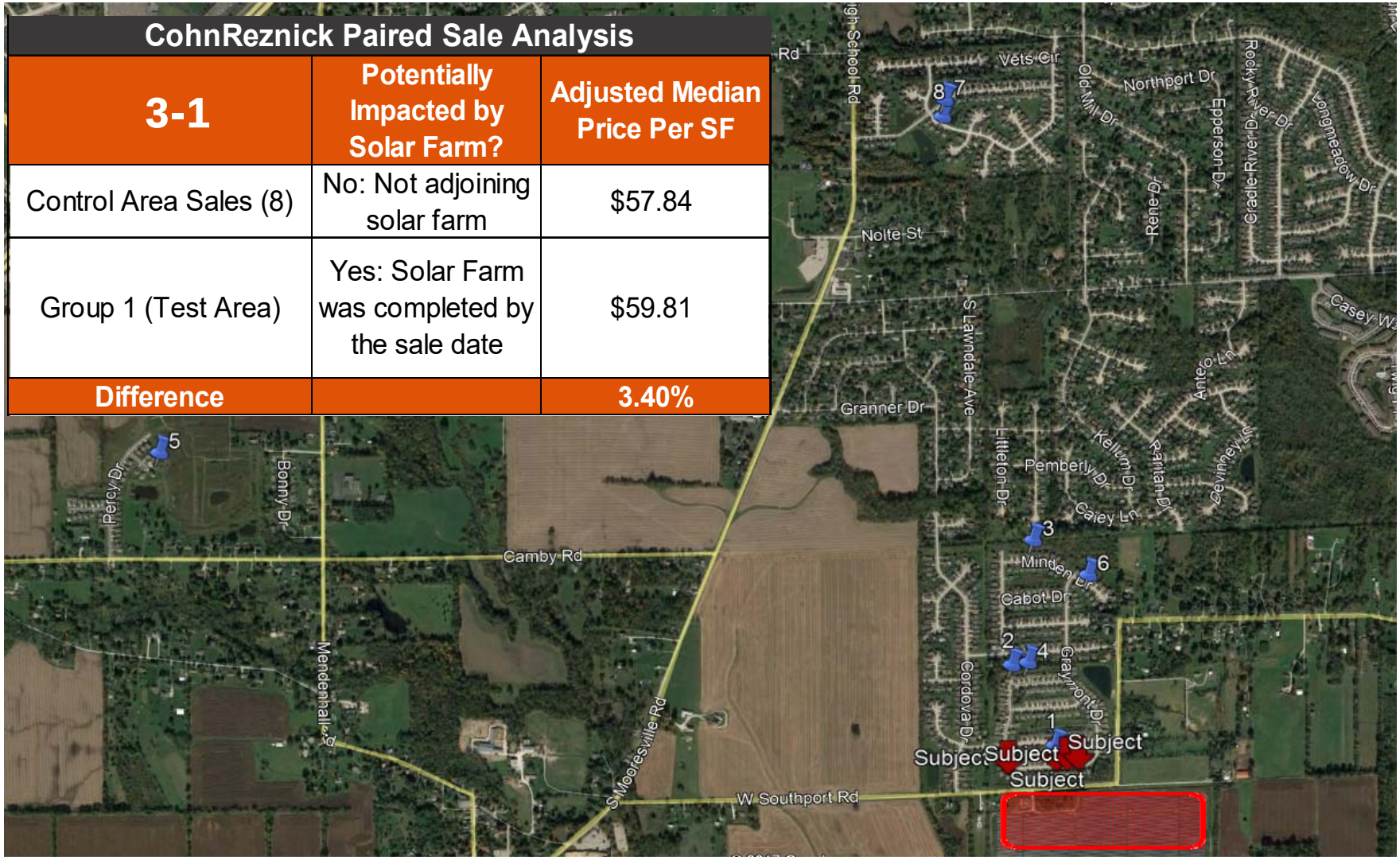
Solar Farm 3:
Dominion Indy Solar III-Indianapolis, IN



Solar Farm 3:
Dominion Indy Solar III-Indianapolis, IN

Group 1 Comparable Sales

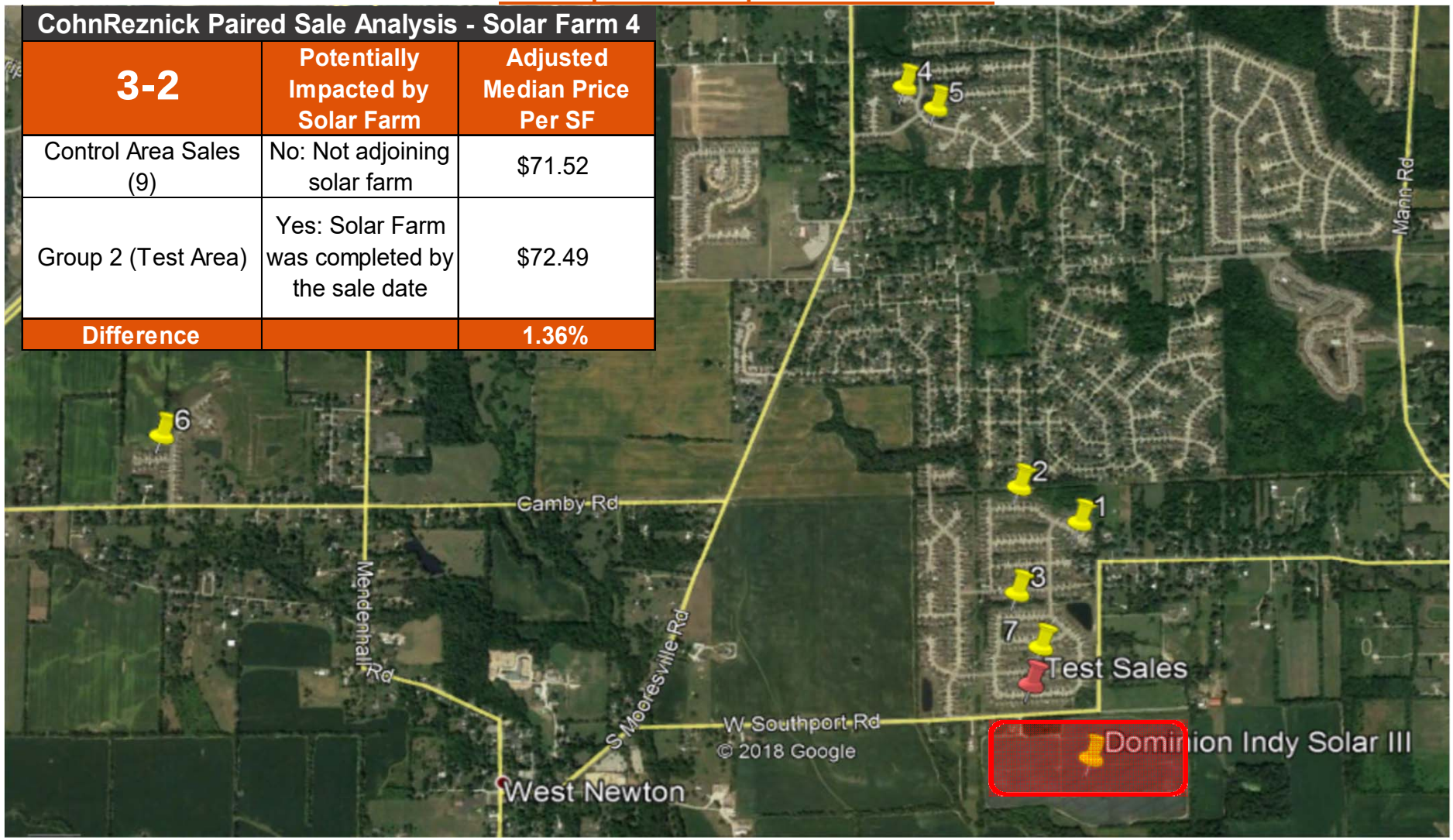
CohnReznick Paired Sale Analysis		
3-1	**Potentially Impacted by Solar Farm?**	**Adjusted Median Price Per SF**
Control Area Sales (8)	No: Not adjoining solar farm	$57.84
Group 1 (Test Area)	Yes: Solar Farm was completed by the sale date	$59.81
Difference		**3.40%**



Solar Farm 3:
Dominion Indy Solar III-Indianapolis, IN

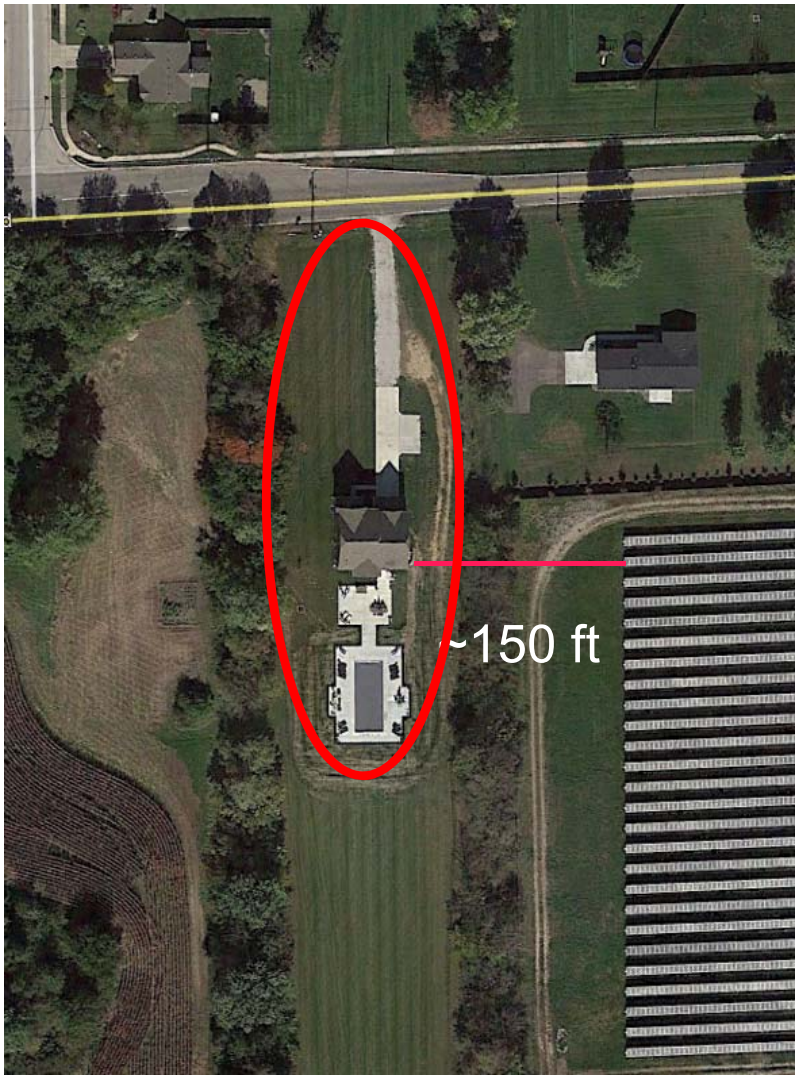
Group 2 Comparable Sales

CohnReznick Paired Sale Analysis - Solar Farm 4		
3-2	**Potentially Impacted by Solar Farm**	**Adjusted Median Price Per SF**
Control Area Sales (9)	No: Not adjoining solar farm	$71.52
Group 2 (Test Area)	Yes: Solar Farm was completed by the sale date	$72.49
Difference		**1.36%**



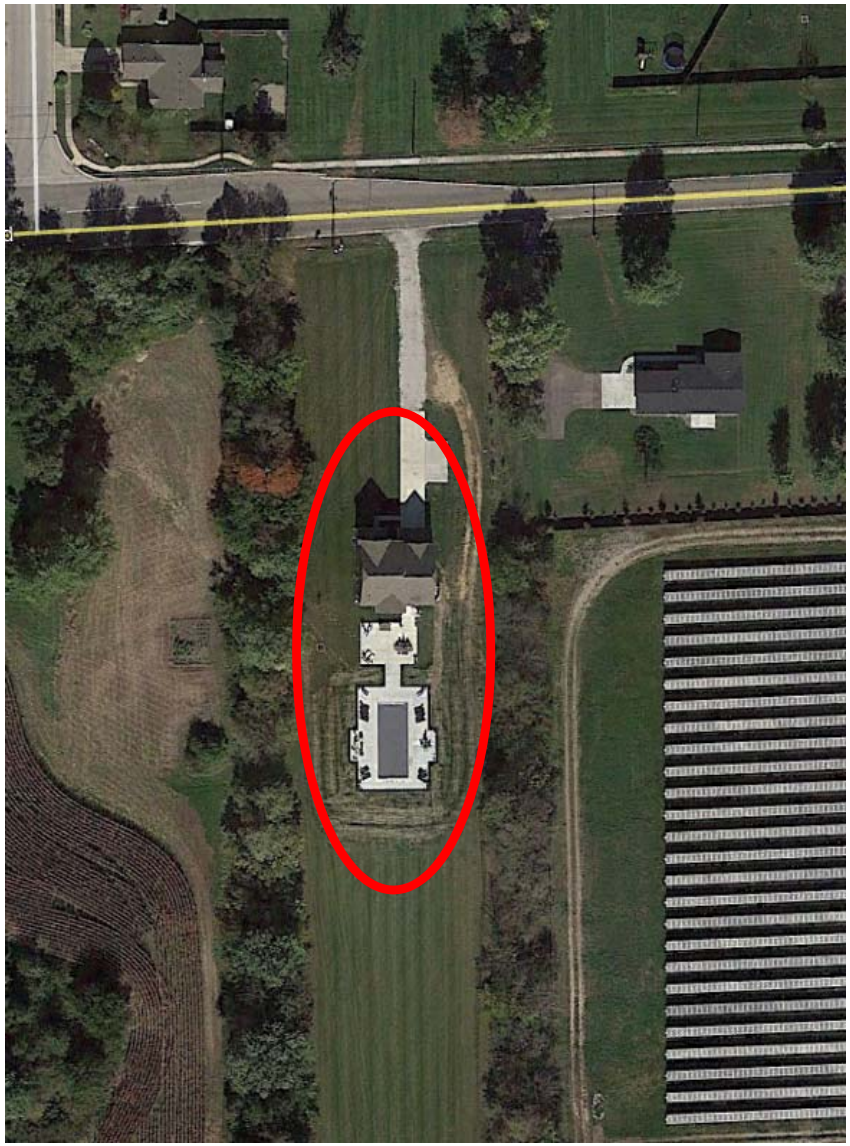
Dominion INDY III Solar Farm: Adjacent Property 9

Sept 2014 Image, Solar Farm built 2013



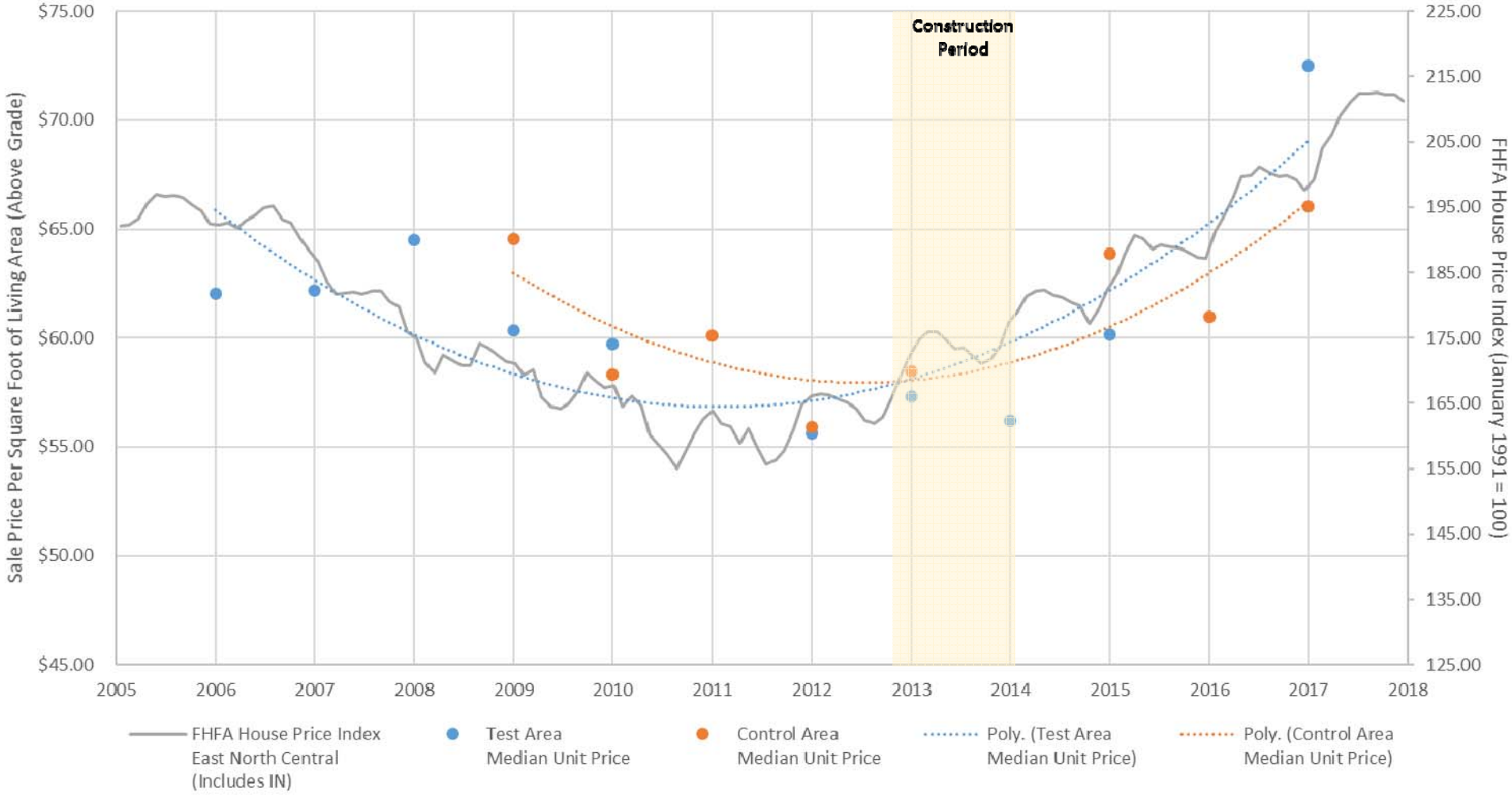
Completed Estate Home
Oct 2016 – 3 Years AFTER Solar Farm

Dominion INDY III Solar Farm: Adjacent Property 9



New Estate Home sold on March 24, 2015 for $449,545. Home features an attached garage and an in-ground swimming pool.

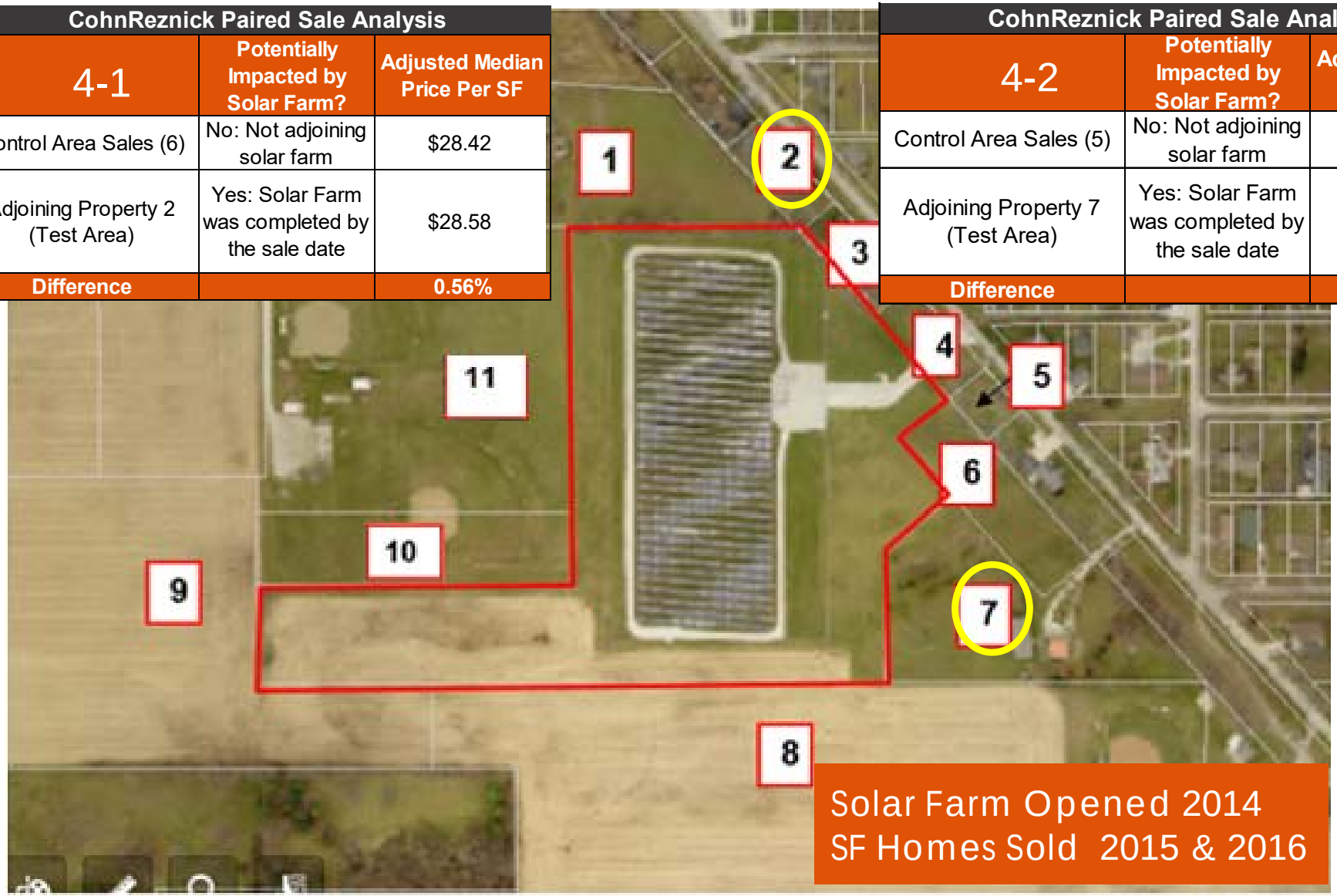
Before & After Analysis



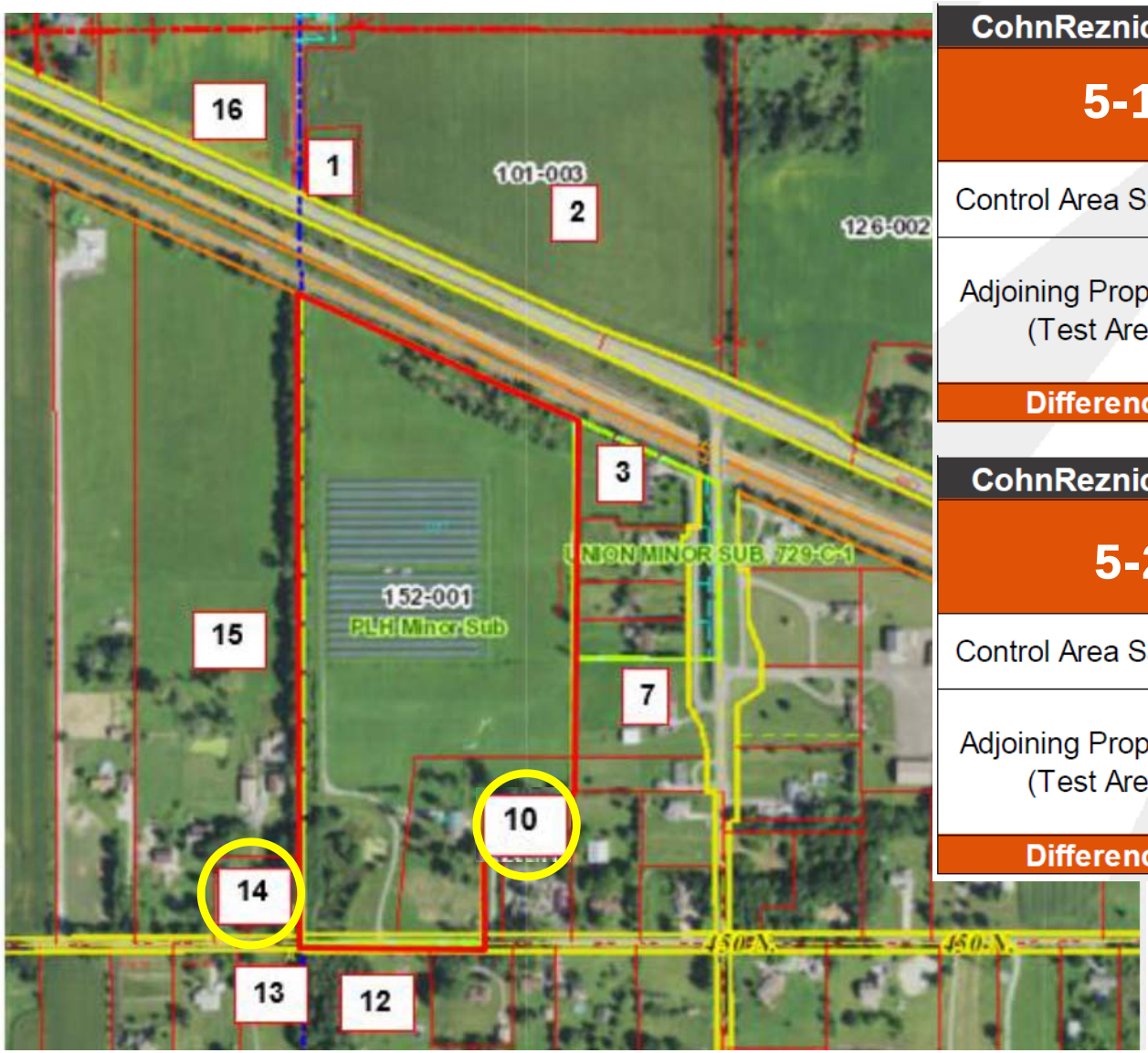
Solar Farm 4:
IMPA Frankton Solar Farm-Frankton, IN

CohnReznick Paired Sale Analysis		
4-1	Potentially Impacted by Solar Farm?	Adjusted Median Price Per SF
Control Area Sales (6)	No: Not adjoining solar farm	$28.42
Adjoining Property 2 (Test Area)	Yes: Solar Farm was completed by the sale date	$28.58
Difference		0.56%

CohnReznick Paired Sale Analysis		
4-2	Potentially Impacted by Solar Farm?	Adjusted Median Price Per SF
Control Area Sales (5)	No: Not adjoining solar farm	$51.47
Adjoining Property 7 (Test Area)	Yes: Solar Farm was completed by the sale date	$52.40
Difference		1.81%



Solar Farm 5:
Valparaiso Solar LLC, IN



CohnReznick Paired Sale Analysis - Solar Farm 5		
5-1	**Potentially Impacted by Solar Farm**	**Adjusted Median Price Per SF**
Control Area Sales (5)	No: Not adjoining solar farm	$79.95
Adjoining Property 10 (Test Area)	Yes: Solar Farm was completed by the sale date	$82.42
Difference		**3.09%**

CohnReznick Paired Sale Analysis - Solar Farm 5		
5-2	**Potentially Impacted by Solar Farm**	**Adjusted Median Price Per SF**
Control Area Sales (5)	No: Not adjoining solar farm	$64.07
Adjoining Property 14 (Test Area)	Yes: Solar Farm was completed by the sale date	$62.11
Difference		**-3.06%**

Summary of Findings

CohnReznick Impact Study Analysis Conclusions								
	Solar Farm	Adj. Property Number	Adjoining Property Sale (Test Area) Price Per Unit	Control Area Sales Median Price Per Unit	% Difference	Feet from Panel to Lot	Feet From Panel to House	Impact Found
1	Grand Ridge Solar	12	$79.90	$74.35	+7.46%	386	479	No Impact
2	Portage Solar	1	$8,000	$7,674	+4.25%	874	1,227	No Impact
	Portage Solar	7	$84.35	$84.27	+0.10%	1,196	1,320	No Impact
3	MPA Frankton	2	$25.58	$26.42	+0.56%	83	145	No Impact
	MPA Frankton	7	$52.40	$51.47	+1.81%	208	414	No Impact
4	Indy Solar III	Group 1 (4)	$59.10	$57.84	+2.18%	157 to	230 to	No Impact
	Indy Solar III	Group 2 (3)	$72.49	$71.52	+1.36%	329	404	No Impact
	Indy Solar III	2	$8,210	$8,091	+1.47%	186	n/a	No Impact
5	Valparaiso Solar LLC	10	$82.42	$79.95	+3.09%	400	521	No Impact
	Valparaiso Solar LLC	14	$82.11	$84.07	-3.06%	595	678	No Impact
Average Variance in Sale Prices for Test to Control Areas					**+1.92%**			

15 Adjoinging Test Sales Studied and compared to 63 Control Sales.

Marketing Time Averages: Adjoining Test Sales 162 days; Control Area Sales 171 days

Based upon our examination, research, and analyses of the existing solar farm uses, the surrounding areas, and an extensive market database, we have concluded that ***no consistent negative impact has occurred to adjacent property that could be attributed to proximity to the adjacent solar farm,*** with regard to unit sale prices or other influential market indicators. This conclusion has been confirmed by numerous County Assessors who have also investigated this use's potential impact.

MARKET COMMENTARY

We have additionally contacted market participants such as assessors and brokers. Our conversations with these market participants are noted below.

	Person Interviewed	Position	Solar Farm	Any Impact Identified?
		Assessors		
1	Viki Crouch	Otter Creek Township Assessor	Grand Ridge Solar Farm (LaSalle, IL)	None
2	James Weisiger	Champaign Township Assessor	University of Illinois Solar Farm (Champaign, IL)	None
3	Missy Tetrick	Marion County Assessor (Valuation Analyst)	Indy Solar, I, II, and III (Marion County, IN)	None
4	Ken Crowley	Rockford Township Assessor	Rockford Solar Farm (Winnebago, IL)	None
5/6	Ken Surface	Senior VP of Nexus Group (Assessor for 20 Counties in IN)	Lanesville Solar Farm & Ellettsville Solar Farm (Harrison & Monroe Counties, IN)	None
7	Mendy Lassaline	Perry County Assessor	IMPA Tell City Solar Park (Perry, IN)	None
8	Patti St. Clair	Chief Deputy, St. Joseph's County Assessor	Olive PV Solar Farm (St. Josephs, IN)	None
9	Betty Smith-Hanson	Wayne County Assessor	IMPA Richmond Solar Park (Wayne, IN)	None
10	James Allen	Elkhart County Assessor	Middlebury Solar Farm (Elkhart, IN)	None
		Brokers		
1	Tina Sergenti	Coldwell Banker	Grand Ridge Solar (Sold Adjacent House)	None on price or marketing period
2	Candace Rindahl	ReMax Results	North Star Solar Farm (Sold 2 Adjacent Houses)	None on price or marketing period

Kirkland
Appraisals, LLC

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February 25, 2016

Mr. Nathan Rogers
Ecoplexus, Inc.
650 Townsend Street, Suite 310
San Francisco, CA 94103

RE: Grandy Solar Impact Study

Dear Mr. Rogers:

At your request, I have considered the likely impact of a solar farm proposed to be constructed near Grandy, North Carolina. Specifically, I have been asked to give my professional opinion on whether the proposed solar farm will "substantially injure the value of adjoining or abutting property" and whether "the location and character of the use, if developed according to the plan as submitted and approved, will be in harmony with the area in which it is to be located."

To form an opinion on these issues, I have researched and visited existing and proposed solar farms in North Carolina, researched articles through the Appraisal Institute and other studies, and discussed the likely impact with other real estate professionals. I have not been asked to assign any value to any specific property.

This letter is a limited report of a real property appraisal consulting assignment and subject to the limiting conditions attached to this letter. My client is Ecoplexus, Inc., represented to me by Mr. Nathan Rogers. My findings support the Special Use Permit application. The effective date of this consultation is October 8, 2015, the most recent date of my inspection of the property and surrounding areas. I note that I also inspected the property on April 12, 2015 and provided an impact of this solar farm as of that date as well. I also provided an early version of this report on February 22, 2016.

Proposed Use Description

The proposed solar farm will consist of a fixed solar array located on approximately 121.4 acres on Caratoke Highway, Grandy, North Carolina. This property is currently owned by the Currituck Sunshine Farm, LLC.

Adjoining land is a mix of agricultural, commercial, industrial and residential uses. The project proposes a landscaped buffer to help screen the proposed solar farm from adjoining uses. The matched pair study shows no impact on adjoining residential and agricultural values.

The solar farm will consist of stationary solar panels that will generate no noise beyond the fence, no odor, and less traffic than a residential subdivision. The panels are less than 10 feet in height and will be located behind a chain link fence.

I have considered adjoining uses and included a map to identify each parcel's location. The breakdown of those uses by acreage and number of parcels is summarized below.

Adjoining Use Breakdown

	Acreage	Parcels
Residential	55.33%	80.65%
Commercial	17.90%	12.90%
Industrial	2.58%	3.23%
Substation	0.28%	1.61%
Agricultural	23.91%	1.61%
Total	**100.00%**	**100.00%**

Surrounding Uses

#	MAP ID	Owner	GIS Data Acres	Present Use	% Adjoining Acres	% Adjoining Parcels	Distance in Feet: Home to Panels
1	9921-09-7650	Walker	17.070	Agricultural	23.91%	1.61%	N/A
2	9921-19-4402	Bunch	0.820	Residential	1.15%	1.61%	425
3	9921-19-8519	Titan LLC	0.920	Industrial	1.29%	1.61%	710
4	9921-19-8447	Titan LLC	0.920	Industrial	1.29%	1.61%	N/A
5	9921-19-7382	Moore	0.350	Residential	0.49%	1.61%	600
6	9921-19-8134	Ripley	0.380	Residential	0.53%	1.61%	515
7	9921-18-8987	Arney	0.740	Residential	1.04%	1.61%	575
8	9921-18-5858	Hoarde	1.090	Commercial	1.53%	1.61%	310
9	9921-18-5784	Lewis	1.100	Commercial	1.54%	1.61%	N/A
10	9921-18-6610	Lewis	1.090	Commercial	1.53%	1.61%	250
11	9921-18-6447	Lewis	1.080	Commercial	1.51%	1.61%	N/A
12	9921-18-6363	Lewis	1.010	Commercial	1.41%	1.61%	N/A
13	9921-18-6155	Cross LLC	2.040	Commercial	2.86%	1.61%	350
14	9921-17-6957	Thomas INC	4.552	Commercial	6.38%	1.61%	350
15	9921-17-8801	Wendell	0.820	Commercial	1.15%	1.61%	620
16	9921-17-7614	Lewark	0.440	Residential	0.62%	1.61%	640
17	9921-17-4564	Lewark	0.760	Residential	1.06%	1.61%	N/A
18	9921-17-2445	Shannon	0.430	Residential	0.60%	1.61%	600
19	9921-17-0348	Tevepaugh	0.570	Residential	0.80%	1.61%	N/A
20	9921-07-9418	Tevepaugh	0.480	Residential	0.67%	1.61%	480
21	9921-07-8407	Banks Life	0.510	Residential	0.71%	1.61%	425
22	9921-07-7500	Williams	0.510	Residential	0.71%	1.61%	430
23	9921-07-5544	Baum Life	1.000	Residential	1.40%	1.61%	415
24	9921-07-3585	Banks	0.480	Residential	0.67%	1.61%	415
25	9921-07-2584	Welch	0.470	Residential	0.66%	1.61%	375
26	9921-07-1409	Curr. County	1.160	Residential	1.62%	1.61%	N/A
27	9921-07-1231	Jones	0.750	Residential	1.05%	1.61%	585
28	9921-07-0115	Moore	0.520	Residential	0.73%	1.61%	585
29	9911-97-9009	Person	0.510	Residential	0.71%	1.61%	585
30	9911-97-8324	Howard	0.490	Residential	0.69%	1.61%	400
31	9911-97-7248	Armstrong	0.510	Residential	0.71%	1.61%	415
32	9911-97-6252	Everett	0.520	Residential	0.73%	1.61%	430
33	9911-97-5175	Gillard	0.540	Residential	0.76%	1.61%	N/A
34	9911-97-4089	Moore	0.550	Residential	0.77%	1.61%	N/A
35	9911-97-3093	Gilden	0.620	Residential	0.87%	1.61%	630
36	9911-97-1259	Escobar	4.230	Residential	5.92%	1.61%	N/A
37	N/A	Utility	0.200	N/A	0.28%	1.61%	N/A
38	9911-87-8890	Nolan	0.820	Residential	1.15%	1.61%	N/A
39	9911-87-8953	Baum	0.860	Residential	1.20%	1.61%	375
40	9911-88-7067	Lesh	0.920	Residential	1.29%	1.61%	405
41	9911-88-6034	Wimmer	0.860	Residential	1.20%	1.61%	485
42	9911-88-3088	Brown	0.900	Residential	1.26%	1.61%	770
43	9911-88-3264	Wierzbicki	0.940	Residential	1.32%	1.61%	N/A
44	9911-88-3349	Mills	0.900	Residential	1.26%	1.61%	465
45	9911-88-3585	Nolan	1.000	Residential	1.40%	1.61%	N/A
46	9911-88-4659	Jernigan	0.860	Residential	1.20%	1.61%	N/A
47	9911-88-5831	Newsome	0.850	Residential	1.19%	1.61%	370
48	9911-88-6924	Deluca	0.820	Residential	1.15%	1.61%	400
49	9911-89-6097	Shenk	0.820	Residential	1.15%	1.61%	400
50	9911-89-7230	Fentress	0.920	Residential	1.29%	1.61%	477

Surrounding Uses

#	MAP ID	Owner	GIS Data Acres	Present Use	% Adjoining Acres	% Adjoining Parcels	Distance in Feet: Home to Panels
51	9911-89-7341	Cunningham	1.040	Residential	1.46%	1.61%	490
52	9911-89-8409	Tate	2.030	Residential	2.84%	1.61%	475
53	9911-99-0610	Proffit	1.110	Residential	1.55%	1.61%	N/A
54	9911-99-1577	Holly INC	0.910	Residential	1.27%	1.61%	N/A
55	9911-99-3617	Weatherly	0.720	Residential	1.01%	1.61%	490
56	9911-99-4634	Weatherly	0.840	Residential	1.18%	1.61%	N/A
57	9911-99-5678	Weatherly	0.580	Residential	0.81%	1.61%	N/A
58	9911-99-6783	Cockrell	0.460	Residential	0.64%	1.61%	N/A
59	9911-99-7777	Ols	0.460	Residential	0.64%	1.61%	360
60	9911-99-8860	Scott	0.460	Residential	0.64%	1.61%	395
61	9911-99-9864	Henderson	0.450	Residential	0.63%	1.61%	390
62	9921-09-0877	Watts	0.640	Residential	0.90%	1.61%	N/A
		Total	**71.402**		**100.00%**	**100.00%**	

Closest Home 250

Proposed Landscaping

Landscaping around solar farms tend to follow a trend of larger plants the closer a project is to existing homes. Earlier solar farms from 2013 tend to have less landscaped screens than the ones being approved in 2015 and 2016. Typical landscape screens vary depending on adjoining uses and often use existing mature trees where possible. Where landscaped buffers are needed they typically start at 4 to 6 feet in plant height at time of planting and often have an understory row of shrubs along visible corridors or along existing residential uses. Where adjoining residential uses are closer to the panels the landscaping tends to be taller at time of planting and often have double rows of trees instead of a row of trees and a row of shrubs. Typical spacing on the plants range from 8 to 12 feet on center.

Sometimes there is a third row of low ornamental shrubs near corridors to break up that landscaping screen. In rare occasions near higher priced homes, I have seen 2 to 4 foot berms included with the landscaped plantings, though I have only seen this in approximately 1% of the solar farms that I have observed.

In locations that are primarily agricultural or industrial the screens are typically planted with smaller plants.

This location is largely residential where you would expect a two to three tier landscaping screen.

The proposed landscaping is for Type C landscaped buffer along the eastern boundary facing the highway. A denser landscaped buffer is planned for the other three sides with a Type D buffer using similar plants but spaced closer together. This is a very good example of the landscaping expected near residential uses. The closest home is 250 feet away and the average distance is over 400 feet away. This is consistent with other solar farms in North Carolina as illustrated later in this report. In fact 150 feet between solar panel and home is typical across North Carolina so this project is significantly more removed from the homes than other projects.

A summary of these two landscaping screens is shown below. My conclusions on impact of the project assume that this landscaping plan is part of the project.

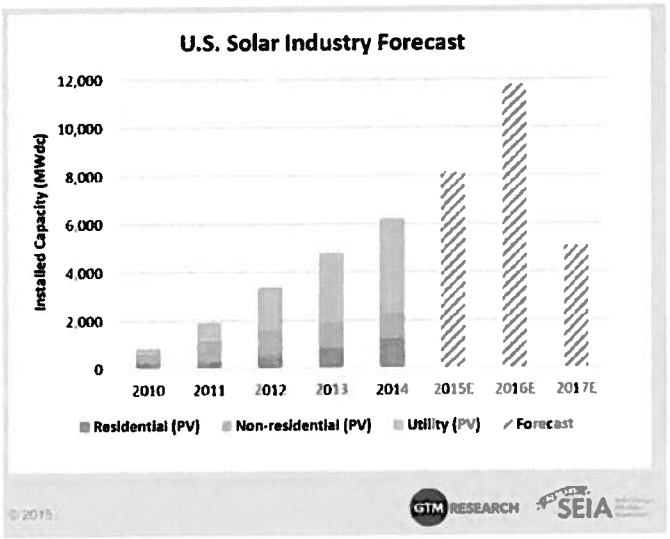
Landscaping

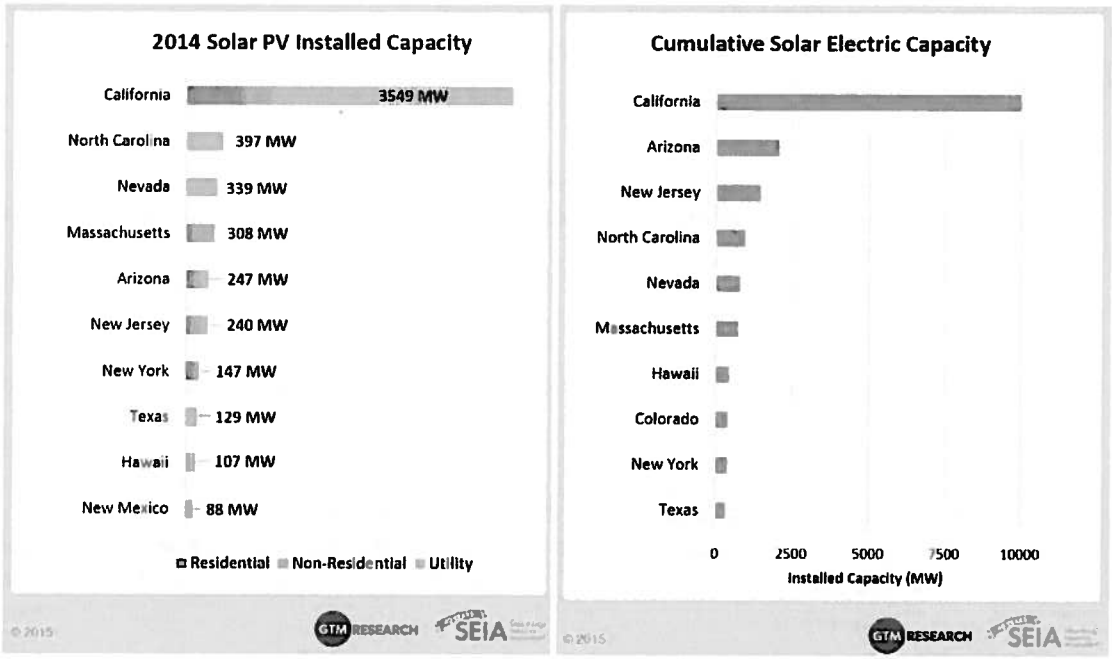
Type C	Distance Width	Ht at Planting	Ht in 3 Years	Spacing(ft)	Plant Type
Screen 1		8		17*	Canopy Tree
Screen 2		6		10 or 14*	Understory Tree
Screen 3				5	Shrub
Total Width			**Setback**	100 and 300	

Type D	Distance Width	Ht at Planting	Ht in 3 Years	Spacing(ft)	Plant Type
Screen 1		8		11*	Canpopy Tree
Screen 2		6		10 or 14*	Understory Tree
Screen 3				3	Shrubs
Total Width			**Setback**	100 and 300	

I. Overview of Solar Farms Development in North Carolina

Across the nation the number of solar installations has dramatically increased over the last few years as changes in technology and the economy made these solar farms more feasible. The charts below show how this market has grown and is expected to continue to grow from 2010 to 2017, the drop off in 2017 is expected due to the expiration of tax credits for solar installations. The U.S. Solar Market Insight Reports for 2010 and 2011 which is put out by the Solar Energy Industries Association note that 2010 was a "breakout" year for solar energy. The continued boom of solar power is shown in the steady growth. North Carolina was ranked as having the second most active photovoltaic installed capacity in 2014.





As shown in the charts above, North Carolina ranked second in installed solar energy in 2014. North Carolina ranked fifth in cumulative installed solar energy in the United States.

II. Market Analysis of the Impact on Value from Solar Farms

I have researched a number of solar farms in North Carolina to determine the impact of these facilities on the value of adjoining property. I have provided a breakdown of the adjoining uses to show what adjoining uses are typical for solar farms and what uses would likely be considered consistent with a solar farm use. This breakdown is included in the Harmony of Use section of this report.

I also conducted a series of matched pair analyses. A matched pair analysis considers two similar properties with only one difference of note to determine whether or not that difference has any impact on value. Within the appraisal profession, matched pair analysis is a well-recognized method of measuring impact on value. In this case, I have considered residential properties adjoining a solar farm versus similar residential properties that do not adjoin a solar farm. I have also considered matched pairs of vacant residential and agricultural land.

As outlined in the discussion of each matched pair, I concluded from the data and my analysis that there has been no impact on sale price for residential, agricultural, or vacant residential land that adjoins the existing solar farms included in my study.

1. Matched Pair – AM Best Solar Farm, Goldsboro, NC

This solar farm adjoins Spring Garden Subdivision which had new homes and lots available for new construction during the approval and construction of the solar farm. The recent home sales have ranged from $200,000 to $250,000. This subdivision sold out the last homes in late 2014. The solar farm is clearly visible particularly along the north end of this street where there is only a thin line of trees separating the solar farm from the single-family homes.

Homes backing up to the solar farm are selling at the same price for the same floor plan as the homes that do not back up to the solar farm in this subdivision. According to the builder, the solar farm has been a complete non-factor. Not only do the sales show no difference in the price paid for the various homes adjoining the solar farm versus not adjoining the solar farm, but there are actually more recent sales along the solar farm than not. There is no impact on the sellout rate, or time to sell for the homes adjoining the solar farm.

I spoke with a number of owners who adjoin the solar farm and none of them expressed any concern over the solar farm impacting their property value.

The data presented on the following page shows multiple homes that have sold in 2013 and 2014 adjoining the solar farm at prices similar to those not along the solar farm. These series of sales indicate that the solar farm has no impact on the adjoining residential use.

The homes that were marketed at Spring Garden are shown below.

AM Best Solar Farm, Goldsboro, NC

Matched Pairs
As of Date: 9/3/2014

Adjoining Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600195570	Helm	0.76	Sep-13	$250,000	2013	3,292	$75.94	2 Story
3600195361	Leak	1.49	Sep-13	$260,000	2013	3,652	$71.19	2 Story
3600199891	McBrayer	2.24	Jul-14	$250,000	2014	3,292	$75.94	2 Story
3600198632	Foresman	1.13	Aug-14	$253,000	2014	3,400	$74.41	2 Story
3600196656	Hinson	0.75	Dec-13	$255,000	2013	3,453	$73.85	2 Story
	Average	1.27		$253,600	2013.4	3,418	$74.27	
	Median	1.13		$253,000	2013	3,400	$74.41	

Adjoining Sales After Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
0	Feddersen	1.56	Feb-13	$247,000	2012	3,427	$72.07	Ranch
0	Gentry	1.42	Apr-13	$245,000	2013	3,400	$72.06	2 Story
	Average	1.49		$246,000	2012.5	3,414	$72.07	
	Median	1.49		$246,000	2012.5	3,414	$72.07	

Adjoining Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600183905	Carter	1.57	Dec-12	$240,000	2012	3,347	$71.71	1.5 Story
3600193097	Kelly	1.61	Sep-12	$198,000	2012	2,532	$78.20	2 Story
3600194189	Hadwan	1.55	Nov-12	$240,000	2012	3,433	$69.91	1.5 Story
	Average	1.59		$219,000	2012	2,940	$74.95	
	Median	1.59		$219,000	2012	2,940	$74.95	

Nearby Sales After Solar Farm Completed

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600193710	Barnes	1.12	Oct-13	$248,000	2013	3,400	$72.94	2 Story
3601105180	Nackley	0.95	Dec-13	$253,000	2013	3,400	$74.41	2 Story
3600192528	Mattheis	1.12	Oct-13	$238,000	2013	3,194	$74.51	2 Story
3600198928	Beckman	0.93	Mar-14	$250,000	2014	3,292	$75.94	2 Story
3600196965	Hough	0.81	Jun-14	$224,000	2014	2,434	$92.03	2 Story
3600193914	Preskitt	0.67	Jun-14	$242,000	2014	2,825	$85.66	2 Story
3600194813	Bordner	0.91	Apr-14	$258,000	2014	3,511	$73.48	2 Story
3601104147	Shaffer	0.73	Apr-14	$255,000	2014	3,453	$73.85	2 Story
	Average	0.91		$246,000	2013.625	3,189	$77.85	
	Median	0.92		$249,000	2014	3,346	$74.46	

Nearby Sales Before Solar Farm Announced

TAX ID	Owner	Acres	Date Sold	Sales Price	Built	GBA	$/GBA	Style
3600191437	Thomas	1.12	Sep-12	$225,000	2012	3,276	$68.68	2 Story
3600087968	Lilley	1.15	Jan-13	$238,000	2012	3,421	$69.57	1.5 Story
3600087654	Burke	1.26	Sep-12	$240,000	2012	3,543	$67.74	2 Story
3600088796	Hobbs	0.73	Sep-12	$228,000	2012	3,254	$70.07	2 Story
	Average	1.07		$232,750	2012	3,374	$69.01	
	Median	1.14		$233,000	2012	3,349	$69.13	

Matched Pair Summary

	Adjoins Solar Farm		Nearby Solar Farm	
	Average	**Median**	**Average**	**Median**
Sales Price	$253,600	$253,000	$246,000	$249,000
Year Built	2013	2013	2014	2014
Size	3,418	3,400	3,189	3,346
Price/SF	$74.27	$74.41	$77.85	$74.46

Percentage Differences

Median Price	-2%
Median Size	-2%
Median Price/SF	0%

I note that 2308 Granville Drive sold again in November 2015 for $267,500, or $7,500 more than when it was purchased new from the builder two years earlier (Tax ID 3600195361, Owner: Leak). The neighborhood is clearly showing appreciation for homes adjoining the solar farm.

The Median Price is the best indicator to follow in any analysis as it avoids outlying samples that would otherwise skew the results. The median sizes and median prices are all consistent throughout the sales both before and after the solar farm whether you look at sites adjoining or nearby to the solar farm. The average for the homes nearby the solar farm shows a smaller building size and a higher price per square foot. This reflects a common occurrence in real estate where the price per square foot goes up as the size goes down. This is similar to the discount you see in any market where there is a discount for buying larger volumes. So when you buy a 2 liter coke you pay less per ounce than if you buy a 16 oz. coke. So even comparing averages the indication is for no impact, but I rely on the median rates as the most reliable indication for any such analysis.

AM Best Solar Farm, Goldsboro, NC

View of home in Spring Garden with solar farm located through the trees and panels – photo taken on 9/23/15.

View from vacant lot at Spring Garden with solar farm panels visible through trees taken in the winter of 2014 prior to home construction. This is the same lot as the photo above.

2. Matched Pair – White Cross Solar Farm, Chapel Hill, NC

A new solar farm was built at 2159 White Cross Road in Chapel Hill, Orange County in 2013. After construction, the owner of the underlying land sold the balance of the tract not encumbered by the solar farm in July 2013 for $265,000 for 47.20 acres, or $5,606 per acre. This land adjoins the solar farm to the south and was clear cut of timber around 10 years ago. I compared this purchase to a nearby transfer of 59.09 acres of timber land just south along White Cross Road that sold in November 2010 for $361,000, or $6,109 per acre. After purchase, this land was divided into three mini farm tracts of 12 to 20 acres each. These rates are very similar and the difference in price per acre is attributed to the timber value and not any impact of the solar farm.

Type	TAX ID	Owner	Acres	Date	Price	$/Acre	Notes	Conf By
Adjoins Solar	9748336770	Haggerty	47.20	Jul-13	$265,000	$5,614	Clear cut	Betty Cross, broker
Not Near Solar	9747184527	Purcell	59.09	Nov-10	$361,000	$6,109	Wooded	Dickie Andrews, broker

The difference in price is attributed to the trees on the older sale.
No impact noted for the adjacency to a solar farm according to the broker.
I looked at a number of other nearby land sales without proximity to a solar farm for this matched pair, but this land sale required the least allowance for differences in size, utility and location.

Matched Pair Summary

	Adjoins Solar Farm		Nearby Solar Farm	
	Average	Median	Average	Median
Sales Price	$5,614	$5,614	$6,109	$6,109
Adjustment for Timber	$500	$500		
Adjusted	$6,114	$6,114	$6,109	$6,109
Tract Size	47.20	47.20	59.09	59.09
Percentage Differences				
Median Price Per Acre	0%			

This matched pair again supports the conclusion that adjacency to a solar farm has no impact on adjoining residential/agricultural land.

3. Matched Pair – Wagstaff Farm, Roxboro, NC

This solar farm is located at the northeast corner of a 594-acre farm with approximately 30 acres of solar farm area. This solar farm was approved and constructed in 2013.

After approval, 18.82 acres were sold out of the parent tract to an adjoining owner to the south. This sale was at a similar price to nearby land to the east that sold in the same time from for the same price per acre as shown below.

Type	TAX ID	Owner	Acres	Present Use	Date Sold	Price	$/AC
Adjoins Solar	0918-17-11-7960	Piedmont	18.82	Agriculatural	8/19/2013	$164,000	$8,714
Not Near Solar	0918-00-75-9812 et al	Blackwell	14.88	Agriculatural	12/27/2013	$130,000	$8,739

Matched Pair Summary	Adjoins Solar Farm		Nearby Solar Farm	
	Average	Median	Average	Median
Sales Price	$8,714	$8,714	$8,739	$8,739
Tract Size	18.82	18.82	14.88	14.88

Percentage Differences	
Median Price Per Acre	0%

This matched pair again supports the conclusion that adjacency to a solar farm has no impact on adjoining residential/agricultural land.

4. Matched Pair – Mulberry, Selmer, TN

This solar farm adjoins two subdivisions with Central Hills having a mix of existing and new construction homes. Lots in this development have been marketed for $15,000 each with discounts offered for multiple lots being used for a single home site. I spoke with the agent with Rhonda Wheeler and Becky Hearnsberger with United County Farm & Home Realty who noted that they have seen no impact on lot or home sales due to the solar farm in this community.

I have included a map below as well as data on recent sales activity on lots that adjoin the solar farm or are near the solar farm in this subdivision both before and after the announced plan for this solar farm facility. I note that using the same method I used to breakdown the adjoining uses at the subject property I show that the predominant adjoining uses are residential and agricultural, which is consistent with the location of most solar farms.

Adjoining Use Breakdown

	Acreage	Parcels
Commercial	3.40%	0.034
Residential	12.84%	79.31%
Agri/Res	10.39%	3.45%
Agricultural	73.37%	13.79%
Total	**100.00%**	**100.00%**

From the above map, I identified four recent sales of homes that occurred adjoining the solar farm both before and after the announcement of the solar farm. I have adjusted each of these for differences in size and age in order to compare these sales among themselves. As shown below after adjustment, the median value is $130,776 and the sales prices are consistent with one outlier which is also the least comparable home consisered. The close grouping and the similar price per point overall as well as the similar price per square foot both before and after the solar farm.

Matched Pairs #	TAX ID	Owner	Date Sold	Sales Price	Acres	Built	GBA	$/GBA	Style	Parking
6&7	0900 A 011.00	Henson	Jul-14	$130,000	2.65	2007	1,511	$86.04	1 Story	2 Garage
12	0900 A 003.00	Amerson	Aug-12	$130,000	1.20	2011	1,586	$81.97	1 Story	2 Garage
15	099C A 003.00	Smallwood	May-12	$149,900	1.00	2002	1,596	$93.92	1 Story	4 Garage
16	099C A 002.00	Hessing	Jun-15	$130,000	1.00	1999	1,782	$72.95	1 Story	2 Garage
		Average		$134,975	1.46	2005	1,619	$83.72		
		Median		$130,000	1.10	2005	1,591	$84.00		

					Adjustments*					
#	TAX ID	Owner	Date Sold	Sales Price	Acres	Built	GBA	Style	Parking	Total
6&7	0900 A 011.00	Henson	Jul-14	$130,000	-$7,500	$2,600	$6,453	$0	$0	$131,553
12	0900 A 003.00	Amerson	Aug-12	$130,000	$0	$0	$0	$0	$0	$130,000
15	099C A 003.00	Smallwood	May-12	$149,900	$0	$6,746	-$939	$0	-$15,000	$140,706
16	099C A 002.00	Hessing	Jun-15	$130,000	$0	$7,800	-$14,299	$0	$0	$123,501
		Average		$134,975	-$1,875	$4,286	-$2,196	$0	-$3,750	$131,440
		Median		$130,000	$0	$4,673	-$470	$0	$0	$130,776

* I adjusted all of the comparables to a base line 2011 Year Built and 1,586 s.f. based on Lot 12

I also considered a number of similar home sales nearby that were both before and after the solar farm was announced as shown below. These homes are generally newer in construction and include a number of larger homes but show a very similar price point per square foot.

Nearby Sales Before Solar Farm Announced

TAX ID	Owner	Date Sold	Sales Price	Acres	Built	GBA	$/GBA	Style	Parking
099B A 019	Durrance	Sep-12	$165,000	1.00	2012	2,079	$79.37	1 Story	2 Garage
099B A 021	Berryman	Apr-12	$212,000	2.73	2007	2,045	$103.67	1 Story	2 Garage
090O A 060	Nichols	Feb-13	$165,000	1.03	2012	1,966	$83.93	1 Story	2 Garage
	Average		$180,667	1.59	2010	2,030	$88.99		
	Median		$165,000	1.03	2012	2,045	$83.93		

Nearby Sales After Solar Farm Announced

TAX ID	Owner	Date Sold	Sales Price	Acres	Built	GBA	$/GBA	Style	Parking
090N A 040	Carrithers	Mar-15	$120,000	1.00	2010	1,626	$73.80	1 Story	2 Garage
099C A 043	Cherry	Feb-15	$148,900	2.34	2008	1,585	$93.94	1 Story	2 Garage
	Average		$134,450	1.67	2009	1,606	$83.87		
	Median		$134,450	1.67	2009	1,606	$83.87		

I then adjusted these nearby sales using the same criteria as the adjoining sales to derive the following breakdown of adjusted values based on a 2011 year built 1,586 square foot home. The adjusted values are consistent with a median rate of $128,665, which is actually lower than the values for the homes that back up to the solar farm.

Nearby Sales Adjusted				Adjustments*					
TAX ID	Owner	Date Sold	Sales Price	Acres	Built	GBA	Style	Parking	Total
099B A 019	Durrance	Sep-12	$165,000	$0	-$825	-$39,127	$0	$0	$125,048
099B A 021	Berryman	Apr-12	$212,000	-$7,500	$4,240	-$47,583	$0	$0	$161,157
090O A 060	Nichols	Feb-13	$165,000	$0	-$825	-$31,892	$0	$0	$132,283
090N A 040	Carrithers	Mar-15	$120,000	$0	$600	-$2,952	$0	$0	$117,648
099C A 043	Cherry	Feb-15	$148,900	-$7,500	$2,234	$94	$0	$0	$143,727
	Average		$165,500	-$1,875	$798	-$30,389	$0	$0	$134,034
	Median		$165,000	$0	-$113	-$35,510	$0	$0	$128,665

* I adjusted all of the comparables to a base line 2011 Year Built and 1,586 s.f. based on Lot 12

If you consider just the 2015 nearby sales, the range is $117,648 to $143,727 with a median of $130,688. If you consider the recent adjoining sales the range is $123,501 to $131,553 with a median of $127,527.

This difference is less than 3% in the median and well below the standard deviation in the sales. The entire range of the adjoining sales prices is overlapped by the range from the nearby sales. These are consistent data sets and summarized below.

Matched Pair Summary

	Adjoins Solar Farm		Nearby After Solar Farm	
	Average	Median	Average	Median
Sales Price	$134,975	$130,000	$134,450	$134,450
Year Built	2005	2005	2009	2009
Size	1,619	1,591	1,606	1,606
Price/SF	$83.72	$84.00	$83.87	$83.87

Percentage Differences

Median Price	3%
Median Size	1%
Median Price/SF	0%

Based on the data presented above, I find that the price per square foot for finished homes are not being impacted negatively by the presence of the solar farm. The difference in pricing in homes in the neighborhood is accounted for by differences in size, building age, and lot size. The median price for a home after those factors are adjusted for are consistent throughout this subdivision and show no impact due to the proximity of the solar farm. This is consistent with the comments from the broker I spoke with for this subdivision as well.

III. Harmony of Use/Compatability

1. Overview for North Carolina

I have visited over 170 solar farms and sites on which solar farms are proposed in North Carolina to determine what uses are compatible with a solar farm. The data I have collected and provide in this report strongly supports the compatibility of solar farms with adjoining agricultural and residential uses. While I have focused on adjoining uses, I note that there are many examples of solar farms being located within a quarter mile of residential developments, including such notable developments as Governor's Club in Chapel Hill, which has a solar farm within a quarter mile as you can see on the following aerial map. Governor's Club is a gated golf community with homes selling for $300,000 to over $2 million.

The subdivisions included in the matched pair analysis also show an acceptance of residential uses adjoining solar farms as a harmonious use.

Beyond these anecdotal references, I have quantified the adjoining uses for a number of solar farm comparables to derive a breakdown of the adjoining uses for each solar farm. The chart below shows the breakdown of adjoining or abutting uses by total acreage. While most of these solar farms were located in North Carolina, the breakdown of adjoining uses is very similar to that shown for Oregon as shown earlier in this report.

Percentage By Adjoining Acreage

Total Solar Farms Reviewed 173

	Res	Ag	Res/AG	Park	Sub	Comm	Ind	All Res Uses	All Comm Uses
Average	13%	57%	22%	1%	0%	0%	5%	94%	5%
Median	6%	63%	7%	0%	0%	0%	0%	100%	0%

Res = Residential, Ag = Agriculture, Sub = Substation, Com = Commercial, Ind = Industrial.

I have also included a breakdown of each solar farm by number of adjoining parcels rather than acreage. Using both factors provides a more complete picture of the neighboring properties.

Percentage By Total Number of Adjoining Parcels

Total Solar Farms Reviewed 173

	Res	Ag	Res/AG	Park	Sub	Comm	Ind	All Res Uses	All Comm Uses
Average	58%	27%	9%	0%	0%	2%	4%	94%	5%
Median	68%	25%	4%	0%	0%	0%	0%	100%	0%

Res = Residential, Ag = Agriculture, Sub = Substation, Com = Commercial, Ind = Industrial.

Both of the above charts show a marked residential and agricultural adjoining use for most solar farms. Every single solar farm considered included an adjoining residential use except for one, which included an adjoining residential/agricultural use. These comparable solar farms clearly support a compatibility with adjoining residential uses along with agricultural uses.

2. Overview for NC Coastal Plains

I have also looked at a subset of the North Carolina data and focused on just the Coastal Plains that includes 94 of the 173 solar farms used above. That information provides a very similar breakdown of adjoining uses as shown above. I further pulled zoning data on these solar farms in the Coastal Plain to derive the following breakdown.

Zoning Mix	Solar Farm	
Residential	18	19.15%
Agricultural	65	69.15%
Commercial	4	4.26%
Industrial	7	7.45%
	94	

As you can see from the data above 69% of the solar farms in Eastern North Carolina are located on land zoned for agricultural use. The next largest zoning category is residential for a total of 89% of the solar farms in Eastern NC being located on residential or agricultural land. Given the data across NC for adjoining uses, this is very consistent and strongly supports the assertion that the subject property, which is zoned A1 for agricultural use is a harmonious location for a solar farm.

3. Overview for Nearby Solar Farm Activity

I have also looked at a subset of the North Carolina data and focused on counties near Currituck. That information provides a very similar breakdown of adjoining uses as shown above with 94% of the zoning being residential or agricultural. The median size of the solar farms is a 5 MW on about 90 acres, though generally, the solar farms only encumber about half of that total acreage.

I note that three of the solar farms listed below have an average distance to homes closer than the distance proposed for the subject property. I note that the data in this chart shows the average distanced and not the closest distance, which was shown in the earlier chart for the subject property. Across the state I generally see around 150 feet being the closest distance between solar panels and homes, though a few years ago they were generally closer to 100 feet.

Nearby Solar Farm Activity

	Output	Acres	Avg. Home Distance	Zoning
Northampton County				
Gutenburg	N/A	882.65	1359	Agricultural
Pecan	N/A	701.59	715	Agricultural
Cottonwood	N/A	34.47	272	Agricultural
Hoke County				
Shelter	N/A	49.02	332	Agricultural
Halifax County				
Cork Oak	N/A	310.386	700	Residential
Sunflower	N/A	1131.58	1132	Residential
Northern Cardinal	N/A	15.176	208	Industrial
Green Heron	N/A	30.55	1068	Residential
Currituck County				
Wildwood	80	2034	674	Agricultural
Pasquotank County				
Morgan Corner N	N/A	107.3	N/A	Agricultural
Morgan Corner S	N/A	72.84	N/A	Agricultural
Pitt County				
Greenville 2	2.475	20.72	N/A	Agricultural
Parmele	5	257.85	N/A	Agricultural
Augustus Farm	5	78.42	1018	Residential
Penny Hill	N/A	208.22	N/A	Agricultural
Beaufort County				
Cattail	N/A	36.97	1440	Residential
Average		373.234	811	
Median		92.86	715	
High		2034	1440	
Low		15.176	208	

4. Examples of Solar Farms in Proximity to Residential Uses

On the following pages I will illustrate a number of nearby solar farms that either were or are being developed in close proximity to residential uses to illustrate the acceptance of this pairing and further support the assertion that the proposed project is harmonious with the location in which it is proposed.

Solar Comparable 1

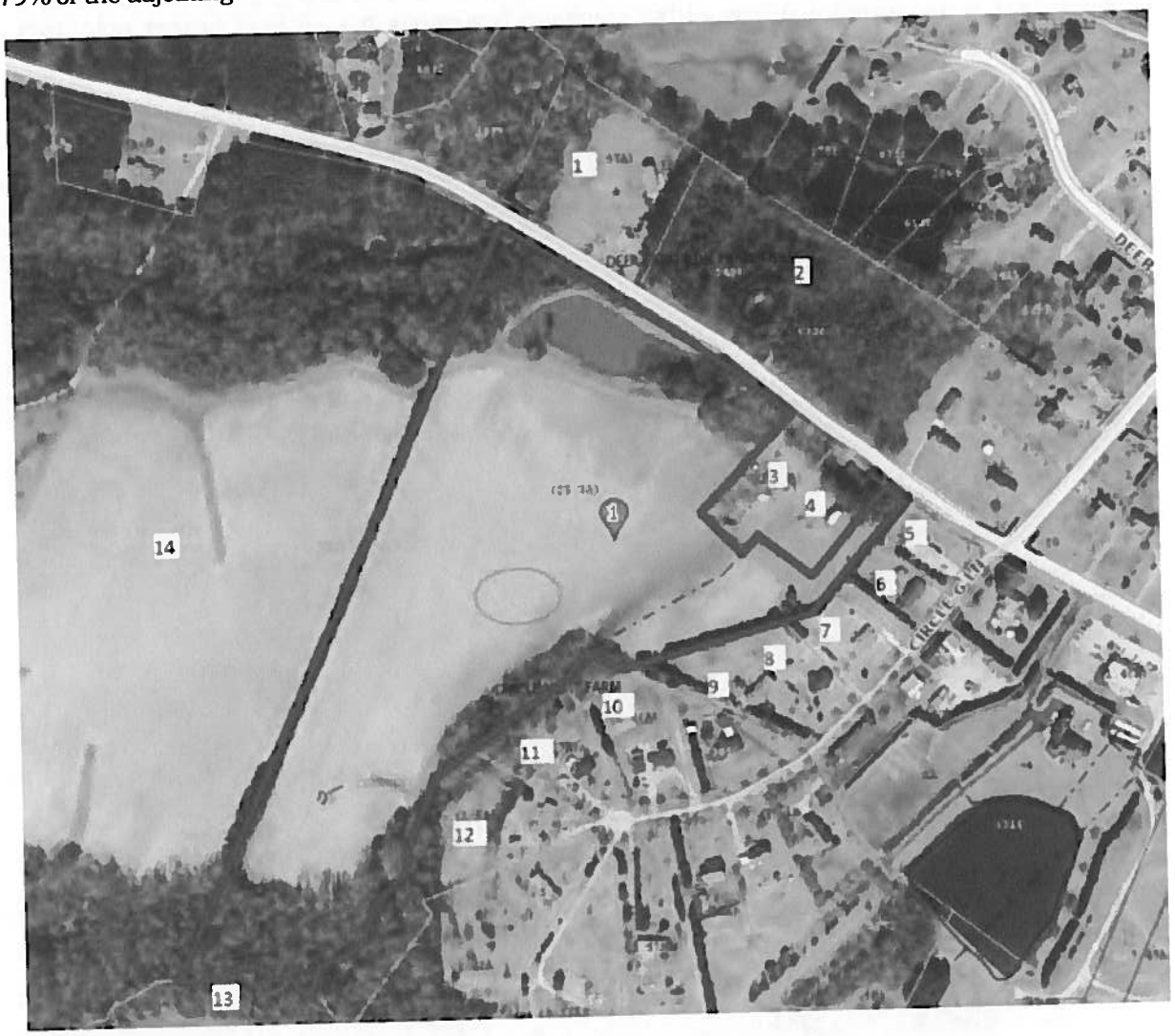
The first example is the Wildwood Solar Farm in Moyock, Currituck County. I've included this project that was approved in 2015 both for the proximity to residential uses on two sides of the project, but also due to the significantly larger size. This is an 80 MW facility on over 2,000 acres that adjoins 43 single family lots, which makes up 80% of the adjoining uses. The closest home will be 360 feet from the closest solar panel.

Solar Comparable 2

The next example is the Vinson Solar Farm in Clayton, Johnston County. This project was approved in 2015. This is a 5 MW facility on 44.26 acres that adjoins 14 single family lots, which makes up 82% of the adjoining uses. The closest home will be 148 feet from the closest solar panel. I also note that there are a few subdivisions located just beyond the adjoining residential lots. It is of further note, that one of the commissioners who approved this project lives in the subdivisions behind these lots.

Solar Comparable 3

The next example is the Landmark Solar Farm in Willow Springs, Johnston County. This project was approved in 2015. This is a proposed facility on 24.71 acres that adjoins 10 single family lots, which makes up 79% of the adjoining uses. The closest home will be 176 feet from the closest solar panel.



Solar Comparable 4

The next example is the Corn Solar Farm in Monroe, Union County. This project was approved in 2015. This is a proposed facility on 430.44 acres out of 484.05 acres. This project will be located 500 feet south of a golf course community located directly to the north of the unleased area shown in the map below. Even excluding those homes from adjoining uses, 58% of the adjoining uses are residential. The closest home will be 203 feet from the closest solar panel.

Solar Comparable 5

The next example is the Red Toad Cleveland Road Solar Farm in Smithfield, Johnston County. This project was approved in 2015. This is a proposed facility on 15 acres out of 161.23 acres. This project actually is the second solar farm located at this location with the clearing shown just to the west of the solar farm location actually containing another solar farm that was completed in 2015. Both of these solar farms are located across the street from a subdivision with the closest home being 80 feet away as shown at location 2 below. The homes across the street are 165 feet away from the closest solar panel.

IV. Specific Factors on Harmony of Use

I have completed a number of Impact Studies related to a variety of uses and I have found that the most common areas for impact on adjoining values typically follow the following hierarchy with descending levels of potential impact. I will discuss each of these categories and how they relate to a solar farm.

1. Hazardous material
2. Odor
3. Noise
4. Traffic
5. Stigma
6. Appearance

5. Hazardous material

The solar farm presents no potential hazardous waste byproduct as part of normal operation. Any fertilizer, weed control, vehicular traffic, or construction will be significantly less than typically applied in a residential development or even most agricultural uses.

The various solar farms that I have inspected and identified in the addenda have no known pending environmental impacts associated with the development and operation.

6. Odor

The various solar farms that I have inspected produced no noticeable odor.

7. Noise

These are passive solar panels with no associated noise beyond a barely audible sound during daylight hours. The transformer reportedly has a hum similar to a fluorescent light in an office building that can only be heard in close proximity to this transformer and the buffers on the property are sufficient to make emitted sounds inaudible from the adjoining properties. No sound is emitted from the facility at night.

The various solar farms that I have inspected were inaudible from the roadways. I heard nothing on any of these sites associated with the solar farm.

8. Traffic

The solar farm will have no onsite employee's or staff. The site requires only minimal maintenance. Relative to other potential uses of the site (such as a residential subdivision), the additional traffic generated by a solar farm use on this site is insignificant.

9. Stigma

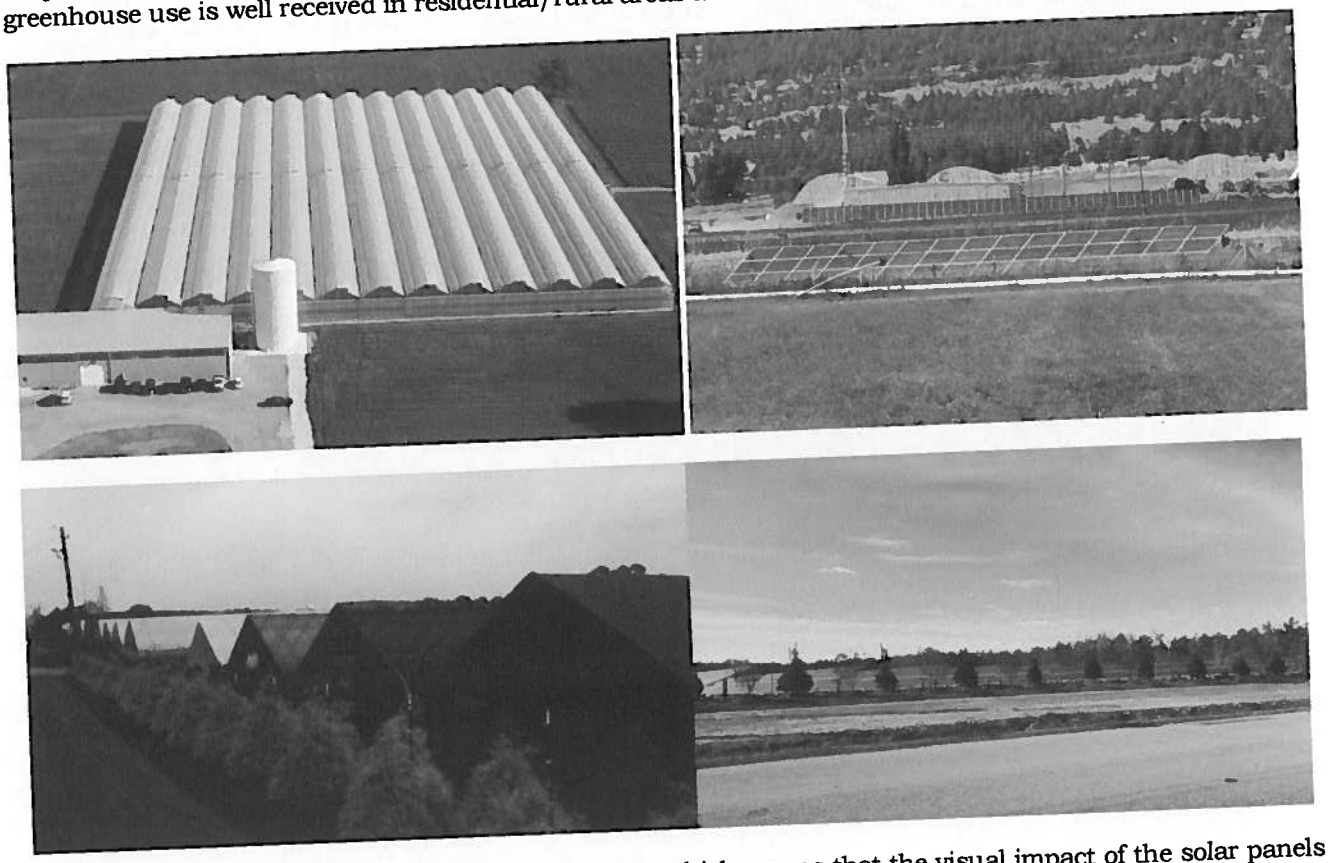
There is no stigma associated with solar farms and solar farms and people generally respond favorably towards such a use. While an individual may express concerns about proximity to a solar farm, there is no specific stigma associated with a solar farm. Stigma generally refers to things such as adult establishments, prisons, rehabilitation facilities, and so forth.

Solar panels have no associated stigma and in smaller collections are found in yards and roofs in many residential communities. Solar panels on a roof are often cited as an enhancement to the property in marketing brochures.

I see no basis for an impact from stigma due to a solar farm.

10. Appearance

Larger solar farms using fixed panels are a passive use of the land that is considered in keeping with a rural/residential area. As shown below, solar farms are comparable to larger greenhouses. This is not surprising given that a greenhouse is essentially another method for collecting passive solar energy. The greenhouse use is well received in residential/rural areas and has a similar visual impact as a solar farm.



The fixed solar panels are all less than 15 feet high, which means that the visual impact of the solar panels will be similar in height to a typical greenhouse and lower than a single story residential dwelling. Were the subject property developed with single family housing, it would have a much greater visual impact on the surrounding area given that a two-story home with attic could be three to four times as high as these proposed panels. The panels will be located behind a chain link fence.

11. Conclusion

On the basis of the factors described above, it is my professional opinion that the proposed solar farm will be in harmony with the area in which it is to be developed. The breakdown of adjoining uses is similar to the other solar farms tracked.

V. Market Commentary

I have surveyed a number of builders, developers and investors regarding solar farms over the last year. I have received favorable feedback from a variety of sources; below are excerpts from my conversations with different clients or other real estate professionals.

I spoke with Betty Cross with Keller Williams Realty in Chapel Hill, who sold the tract of land adjoining the White Cross Road solar farm. She indicated that the solar farm was not considered a negative factor in marketing the property and that it had no impact on the final price paid for the land.

I spoke with Lynn Hayes a broker with Berkshire Hathaway who sold a home at the entrance to Pickards Mountain where the home exits onto the Pickard Mountain Eco Institute's small solar farm. This property is located in rural Orange County west of Chapel Hill. This home closed in January 2014 for $735,000. According to Ms. Hayes the buyer was excited to be living near the Eco Institute and considered the solar farm to be a positive sign for the area. There are currently a number of 10 acre plus lots in Pickards Meadow behind this house with lots on the market for $200,000 to $250,000.

A new solar farm was built on Zion Church Road, Hickory at the Two Lines Solar Farm on the Punch property. After construction of the solar farm in 2013, an adjoining tract of land with 88.18 acres sold for $250,000, or $2,835 per acre. This was a highly irregular tract of land with significant tree cover between it and the solar farm. I have compared this to a current listing of 20.39 acres of land that is located southeast just a little ways from this solar farm. This land is on the market for $69,000, or $3,428 per acre. Generally, a smaller tract of land would be listed for more per acre. Considering a size adjustment of 5% per doubling in size, and a 10% discount for the likely drop in the closed price off of the asking price, I derive an indicated value per acre of the smaller tract of $2,777 per acre. This is very similar to the recently closed sale adjoining the solar farm, which further supports the matched pair analysis earlier in this report.

Rex Vick with Windjam Developers has a subdivision in Chatham County off Mt. Gilead Church Road known as The Hamptons. Home prices in The Hamptons start at $600,000 with homes over $1,000,000. Mr. Vick expressed interest in the possibility of including a solar farm section to the development as a possible additional marketing tool for the project.

Mr. Eddie Bacon, out of Apex North Carolina, has inherited a sizeable amount of family and agricultural land, and he has expressed interest in using a solar farm as a method of preserving the land for his children and grandchildren while still deriving a useful income from the property. He believes that solar panels would not in any way diminish the value for this adjoining land.

I spoke with Carolyn Craig, a Realtor in Kinston, North Carolina who is familiar with the Strata Solar Farms in the area. She noted that a solar farm in the area would be positive: "A solar farm is color coordinated and looks nice." "A solar farm is better than a turkey farm," which is allowed in that area. She would not expect a solar farm will have any impact on adjoining home prices in the area.

Mr. Michael Edwards, a broker and developer in Raleigh, indicated that a passive solar farm would be a great enhancement to adjoining property: "You never know what might be put on that land next door. There is no noise with a solar farm like there is with a new subdivision."

These are just excerpts I've noted in my conversations with different clients or other real estate participants that provided other thoughts on the subject that seemed applicable.

VI. Conclusion

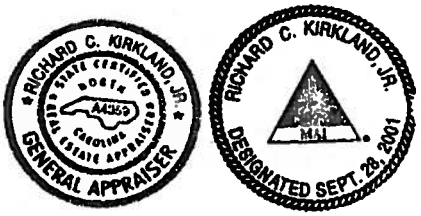
The matched pair analysis shows no impact in home values due to the adjacency to the solar farm as well as no impact to adjacent vacant residential or agricultural land. The criteria for making downward adjustments on property values such as appearance, noise, odor, and traffic all indicate that a solar farm is a compatible use for rural/residential transition areas.

Similar solar farms have been approved adjoining agricultural uses, schools and residential developments. Industrial uses rarely absorb negative impacts from adjoining uses. The adjoining residential uses to other solar farms have included single family homes up to $260,000 on lots as small as 0.74 acres. The solar farm at the Pickards Mountain Eco Institute adjoins a home that sold in January 2014 for $735,000 and in proximity to lots being sold for $200,000 to $250,000 for homes over a million dollars.

Based on the data and analysis in this report, it is my professional opinion that the solar farm proposed at the subject property will maintain or enhance the value of adjoining or abutting property and that the proposed use is in harmony with the area in which it is located.

If you have any further questions please call me any time.

Sincerely,



Richard C. Kirkland, Jr., MAI
State Certified General Appraiser

Limiting Conditions and Assumptions

Acceptance of and/or use of this report constitutes acceptance of the following limiting conditions and assumptions; these can only be modified by written documents executed by both parties.

- The basic limitation of this and any appraisal is that the appraisal is an opinion of value, and is, therefore, not a guarantee that the property would sell at exactly the appraised value. The market price may differ from the market value, depending upon the motivation and knowledge of the buyer and/or seller, and may, therefore, be higher or lower than the market value. The market value, as defined herein, is an opinion of the probable price that is obtainable in a market free of abnormal influences.

- I do not assume any responsibility for the legal description provided or for matters pertaining to legal or title considerations. I assume that the title to the property is good and marketable unless otherwise stated.

- I am appraising the property as though free and clear of any and all liens or encumbrances unless otherwise stated.

- I assume that the property is under responsible ownership and competent property management.

- I believe the information furnished by others is reliable, but I give no warranty for its accuracy.

- I have made no survey or engineering study of the property and assume no responsibility for such matters. All engineering studies prepared by others are assumed to be correct. The plot plans, surveys, sketches and any other illustrative material in this report are included only to help the reader visualize the property. The illustrative material should not be considered to be scaled accurately for size.

- I assume that there are no hidden or unapparent conditions of the property, subsoil, or structures that render it more or less valuable. I take no responsibility for such conditions or for obtaining the engineering studies that may be required to discover them.

- I assume that the property is in full compliance with all applicable federal, state, and local laws, including environmental regulations, unless the lack of compliance is stated, described, and considered in this appraisal report.

- I assume that the property conforms to all applicable zoning and use regulations and restrictions unless nonconformity has been identified, described and considered in this appraisal report.

- I assume that all required licenses, certificates of occupancy, consents, and other legislative or administrative authority from any local, state, or national government or private entity or organization have been or can be obtained or renewed for any use on which the value estimate contained in this report is based.

- I assume that the use of the land and improvements is confined within the boundaries or property lines of the property described and that there is no encroachment or trespass unless noted in this report.

- I am not qualified to detect the presence of floodplain or wetlands. Any information presented in this report related to these characteristics is for this analysis only. The presence of floodplain or wetlands may affect the value of the property. If the presence of floodplain or wetlands is suspected the property owner would be advised to seek professional engineering assistance.

- For this appraisal, I assume that no hazardous substances or conditions are present in or on the property. Such substances or conditions could include but are not limited to asbestos, urea-formaldehyde foam insulation, polychlorinated biphenyls (PCBs), petroleum leakage or underground storage tanks, electromagnetic fields, or agricultural chemicals. I have no knowledge of any such materials or conditions unless otherwise stated. I make no claim of technical knowledge with regard to testing for or identifying such hazardous materials or conditions. The presence of such materials, substances or conditions could affect the value of the property. However, the values estimated in this report are predicated on the assumption that there are no such materials or conditions in, on or in close enough proximity to the property to cause a loss in value. The client is urged to retain an expert in this field, if desired.

- Unless otherwise stated in this report the subject property is appraised without a specific compliance survey having been conducted to determine if the property is or is not in conformance with the requirements of the

Americans with Disabilities Act (effective 1/26/92). The presence of architectural and/or communications barriers that are structural in nature that would restrict access by disabled individuals may adversely affect the property's value, marketability, or utility.

- Any allocation of the total value estimated in this report between the land and the improvements applies only under the stated program of utilization. The separate values allocated to the land and buildings must not be used in conjunction with any other appraisal and are invalid if so used.
- Possession of this report, or a copy thereof, does not carry with it the right of publication.
- I have no obligation, by reason of this appraisal, to give further consultation or testimony or to be in attendance in court with reference to the property in question unless further arrangements have been made regarding compensation to Kirkland Appraisals, LLC.
- Neither all nor any part of the contents of this report (especially any conclusions as to value, the identity of the appraiser, or the firm with which the appraiser is connected) shall be disseminated to the public through advertising, public relations, news, sales, or other media without the prior written consent and approval of Kirkland Appraisals, LLC, and then only with proper qualifications.
- Any value estimates provided in this report apply to the entire property, and any proration or division of the total into fractional interests will invalidate the value estimate, unless such proration or division of interests has been set forth in the report.
- Any income and expenses estimated in this report are for the purposes of this analysis only and should not be considered predictions of future operating results.
- This report is not intended to include an estimate of any personal property contained in or on the property, unless otherwise state.
- This report is subject to the Code of Professional Ethics of the Appraisal Institute and complies with the requirements of the State of North Carolina for State Certified General Appraisers. This report is subject to the certification, definitions, and assumptions and limiting conditions set forth herein.
- The analyses, opinions and conclusions were developed based on, and this report has been prepared in conformance with, our interpretation of the guidelines and recommendations set forth in the Financial Institutions Reform, Recovery, and Enforcement Act of 1989 (FIRREA).
- This is a Real Property Appraisal Consulting Assignment.

Certification – Richard C. Kirkland, Jr., MAI

I certify that, to the best of my knowledge and belief:

1. The statements of fact contained in this report are true and correct;

2. The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal, unbiased professional analyses, opinions, and conclusions;

3. I have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to the parties involved;

4. I have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment;

5. My engagement in this assignment was not contingent upon developing or reporting predetermined results;

6. My compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of the appraisal;

7. The reported analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute;

8. The reported analyses, opinions and conclusions were developed, and this report has been prepared, in conformity with the Uniform Standards of Professional Appraisal Practice.

9. The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives;

10. I have made a personal inspection of the property that is the subject of this report, and;

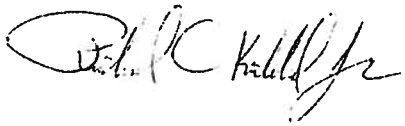
11. No one provided significant real property appraisal assistance to the person signing this certification.

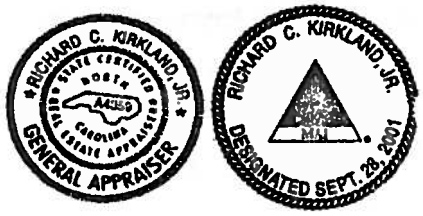
12. As of the date of this report I have completed the requirements of the continuing education program of the Appraisal Institute;

13. I have completed appraisal work on this property within the last three years as discussed on the first page of this report.

Disclosure of the contents of this appraisal report is governed by the bylaws and regulations of the Appraisal Institute and the National Association of Realtors.

Neither all nor any part of the contents of this appraisal report shall be disseminated to the public through advertising media, public relations media, news media, or any other public means of communications without the prior written consent and approval of the undersigned.





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State Certified General Appraiser

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Professional Experience

Kirkland Appraisals, LLC, Raleigh, N.C. Commercial appraiser	2003 – Present
Hester & Company, Raleigh, N.C. Commercial appraiser	1996 – 2003

Professional Affiliations

MAI (Member, Appraisal Institute) designation #11796	2001
NC State Certified General Appraiser # A4359	1999
VA State Certified General Appraiser # 4001017291	
OR State Certified General Appraiser # C001204	
SC State Certified General Appraiser # 6209	

Education

Bachelor of Arts in English, University of North Carolina, Chapel Hill	1993

Continuing Education

Uniform Standards of Professional Appraisal Practice Update	2016
Forecasting Revenue	2015
Wind Turbine Effect on Value	2015
Supervisor/Trainee Class	2015
Business Practices and Ethics	2014
Subdivision Valuation	2014
Uniform Standards of Professional Appraisal Practice Update	2014
Introduction to Vineyard and Winery Valuation	2013
Appraising Rural Residential Properties	2012
Uniform Standards of Professional Appraisal Practice Update	2012
Supervisors/Trainees	2011
Rates and Ratios: Making sense of GIMs, OARs, and DCFs	2011
Advanced Internet Search Strategies	2011
Analyzing Distressed Real Estate	2011
Uniform Standards of Professional Appraisal Practice Update	2011
Business Practices and Ethics	2011
Appraisal Curriculum Overview (2 Days – General)	2009
Appraisal Review - General	2009
Uniform Standards of Professional Appraisal Practice Update	2008
Subdivision Valuation: A Comprehensive Guide	2008
Office Building Valuation: A Contemporary Perspective	2008
Valuation of Detrimental Conditions in Real Estate	2007
The Appraisal of Small Subdivisions	2007
Uniform Standards of Professional Appraisal Practice Update	2006
Evaluating Commercial Construction	2005

Conservation Easements	2005
Uniform Standards of Professional Appraisal Practice Update	2004
Condemnation Appraising	2004
Land Valuation Adjustment Procedures	2004
Supporting Capitalization Rates	2004
Uniform Standards of Professional Appraisal Practice, C	2002
Wells and Septic Systems and Wastewater Irrigation Systems	2002
Appraisals 2002	2002
Analyzing Commercial Lease Clauses	2002
Conservation Easements	2000
Preparation for Litigation	2000
Appraisal of Nonconforming Uses	2000
Advanced Applications	2000
Highest and Best Use and Market Analysis	1999
Advanced Sales Comparison and Cost Approaches	1999
Advanced Income Capitalization	1998
Valuation of Detrimental Conditions in Real Estate	1999
Report Writing and Valuation Analysis	1999
Property Tax Values and Appeals	1997
Uniform Standards of Professional Appraisal Practice, A & B	1997
Basic Income Capitalization	1996

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CYPRESS CREEK RENEWABLES

PROPERTY VALUE IMPACT STUDY

ADJACENT PROPERTY VALUES SOLAR IMPACT STUDY: A STUDY OF NINE EXISTING SOLAR FARMS

Located in Champaign, LaSalle, and Winnebago Counties, Illinois; and, Lake, Porter, Madison, Marion, And Elkhart Counties, Indiana

PREPARED FOR:
Mr. Jason Carr
Director of Community Relations
Cypress Creek Renewables
2660 NE Hwy 20, Suite 610 #30
Bend, OR 97701

SUBMITTED BY:
CohnReznick, LLP
Valuation Advisory Services
200 S Wacker Drive, Suite 2600
Chicago, IL 60606

Patricia L. McGarr, MAI, CRE, FRICS
patricia.mcgarr@cohnreznick.com
Direct: (312) 508-5802

March 20, 2018

EXECUTIVE SUMMARY

The purpose of this real estate impact study is to determine whether the existing solar farm uses under study have had any measurable impact on the value of adjacent properties.

According to the Solar Energy Industries Association (SEIA) 2016 report, Illinois had 81.52 Megawatts (MW) of solar panels installed, compared to Indiana which has had 265.64 MW of solar panels installed. As we are studying the impact of this use on adjacent property values, we have included several of these established solar farms in Indiana, focusing on similar rural and suburban areas, that we believe are comparable to those locations proposed in Illinois.

Our study includes research and analyses of nine existing solar panel farms and the property value trends of the adjacent land uses, including agricultural, single family and residential properties; review of published studies, and discussions with market participants, summarized as follows:

- Solar Farm 1 (*Grand Ridge Solar Farm*) is located near the City of Streator in LaSalle County, Illinois, in a primarily rural area, on two contiguous parcels totaling 160 acres. Surrounding uses consist of agricultural land, some with homesteads, and single family homes to the northwest. We found one adjoining property which qualified for a paired sales analysis.
- Solar Farm 2 *(Portage Solar Farm)* is located near the City of Portage, in Porter County, Indiana. This solar farm is situated in a residential area on a 56-acre parcel of land. The surrounding uses consist of agricultural land to the north and east, and residential uses such as single family homes to the west and northwest, and multifamily apartments to the south. We found two adjoining properties that qualified for a paired sales analysis.
- Solar Farm 3 (*IMPA Frankton Solar Farm*) is located in the Town of Frankton, in Madison County, Indiana. This solar farm is situated in a fairly rural area and is located on a 13-acre parcel. The surrounding uses consist of single family homes to the east, agricultural land to the south, west, and north, and some baseball fields as well. We found two adjoining properties which qualified for a paired sales analysis.
- Solar Farm 4 (*Dominion Indy Solar Farm III*) is located in a suburban, yet rural area outside of Indianapolis, in Marion County, Indiana, on a parcel totaling 134 acres. The surrounding uses consist of agricultural land to the east, west and south, and a single family subdivision to the north. We found six adjoining properties which qualified for a paired sales analysis.
- Solar Farm 5 (*Valparaiso Solar Farm*) is located near the City of Valparaiso, in Porter County, Indiana. This solar farm is situated in a fairly rural area on two contiguous parcels totaling 27.9 acres. The surrounding uses consist of vacant land to the north, and single family homes to the east, south and west. We considered two adjoining properties which qualified for a paired sales analysis.
- Solar Farm 6 (*Middlebury Solar Farm*) is located near the Town of Middlebury, in Elkhart County, Indiana. This solar farm is situated in a fairly rural area on a 33.86-acre parcel. The surrounding uses consist of residential uses to the east, north and west, industrial uses to the south, and a medical office use to the southwest. We considered one adjoining property which qualified for a paired sales analysis.
- Solar Farm 7 (*Rockford Solar Farm*) is located in the City of Rockford in Winnebago County, Illinois, just a little over one mile south of the Chicago-Rockford International Airport and is comprised of three parcels for a total acreage of 182.29 acres. This solar farm was announced for construction in March 2011, and completed in October 2012. The surrounding uses include agricultural and industrial land. Many of the surrounding parcels are owned by the Chicago-Rockford International Airport Authority. We found two adjoining properties which qualified for a paired sales analysis.

- Solar Farm 8 (*Lincoln Solar Farm*) is located near Merrillville, in Lake County, Indiana. This solar farm is situated in a fairly rural area located on one parcel made up of 20 acres. Surrounding uses included agricultural land directly west and north, single family uses to the east, and church use to the south. There were no adjoining properties with sales that fit the criteria to perform a paired sales analysis for Solar Farm 8.
- Solar Farm 9 (*University of Illinois Solar Farm*) is located in the City of Champaign, Champaign County, Illinois, just south of the University Illinois Urbana-Champaign Campus. This solar farm is located on 20.79 acres of land. The solar farm was announced for construction on November 12, 2012, and completed on November 2015. This solar farm is owned and operated by the University of Illinois and is considered one of the largest university solar farms in the country. Surrounding uses include a nature preserve to the east and south, commercial offices to the west, and university-occupied land to the north. There were no adjoining properties with sales that fit the criteria to perform a paired sales analysis for Solar Farm 9.
- We performed a paired sales analysis for each adjoining property that fit the criteria for analysis that were adjacent to the solar farms we studied. The sales adjacent to solar farms, or Test Areas, were compared to agricultural land sales and single family home sales not adjacent to solar farms within the same county as subject solar farms, or Control Areas. **We analyzed 16 adjoining property sales in Test Areas and 72 comparable sales in Control Areas,** collectively, for the Rockford Solar Farm, the Grand Ridge Solar Farm, the Portage Solar Farm, the IMPA Frankton Solar Farm, the Dominion Indy III Solar Farm, the Valparaiso LLC Solar Farm, and the Middlebury Solar Farm over the past five years. The remaining two solar farms did not have data available for analysis.

The basic premise of this comparative analysis is that if there is any impact on the property values, by virtue of their proximity to a solar farm, it would be reflected by such factors as the range of sale prices, differences in unit sale prices, conditions of sale, and overall marketability. When comparing these factors for properties near the solar farm to properties locationally removed from the solar farm, we would expect to see some emerging and consistent pattern of substantial difference in these comparative elements – if, in fact, there was an effect.

We have also reviewed published methodology for measuring impact on property values as well as published studies that specifically analyzed the impact of solar farms on nearby property values. We have also interviewed market participants, including Township Assessors, to give us additional insight as to how the market evaluates farm land and single family homes with views of the solar farm. These studies found little to no measurable and consistent difference in value between the Test Area Sales and the Control Area Sales attributed to the proximity to solar farms and are generally considered a compatible use. Considering all of this information, we can conclude that since the Adjoining Property Sales (Test Area Sales) for the existing solar farms analyzed were not adversely affected by their proximity to solar farms, that properties surrounding other solar farms operating in compliance with all regulatory standards will similarly not be adversely affected, in either the short or long term periods.

March 20, 2018

Mr. Jason Carr
Director of Community Relations
Cypress Creek Renewables
2660 NE Hwy 20, Suite 610 #30
Bend, OR 97701

SUBJECT: Property Value Impact Study
Nine Solar Farms
Located in Champaign, LaSalle, and Winnebago Counties, Illinois; and,
Lake, Porter, Madison, Marion, and Elkhart Counties, Indiana

Dear Mr. Carr:

CohnReznick is pleased to submit the accompanying adjacent property values impact study of the above referenced subject properties. Per the client's request, we have researched three solar farms in Illinois: Grand Ridge in LaSalle County, Illinois (Solar Farm 1), Chicago Rockford International Airport in Winnebago County (Solar Farm 7), and the University of Illinois Solar Farm in Champaign County (Solar Farm 9). We have also researched six solar farms in Indiana: Portage Solar Farm in Porter County, Indiana (Solar Farm 2), IMPA Frankton Solar Farm in Madison County, Indiana (Solar Farm 3), Indy Solar III Farm in Marion County, Indiana (Solar Farm 4), Valparaiso Solar LLC Farm in Porter County, Indiana (Solar Farm 5), Middlebury Solar Farm in Elkhart County, Indiana (Solar Farm 6), and Lincoln Solar Farm in Lake County (Solar Farm 8).

In forming this report, we have researched and visited the existing solar farms in Illinois and Indiana, researched articles and other published studies, and interviewed real estate professionals and Township Assessors, active in the market where solar farms are located, to gain an understanding of market perceptions.

The purpose of the assignment is to determine whether the proximity of the subject facilities (solar farms) resulted in any significant measurable and consistent impact on adjacent property values, given the existing uses and zoning of nearby property at the time of development. The intended use of our opinions and conclusions is to assist the client in addressing local concerns regarding a solar farm's potential impact on surrounding property values, in addition to addressing the required criteria for obtaining approvals for proposed solar energy uses, such as minimizing the impact on adjacent property values. We have not been asked to value any specific property, and we have not done so. The client for the assignment is Cypress Creek Renewables, LLC. The report may be used only for the aforementioned purpose and may not be distributed without the written consent of CohnReznick LLP ("CohnReznick").

The assignment is intended to conform to the Uniform Standards of Professional Appraisal Practice (USPAP), the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute as well as applicable state appraisal regulations.

Based on the analysis in the accompanying report, and subject to the definitions, assumptions, and limiting conditions expressed in the report, our opinion is as follows below.

CONCLUSIONS

We analyzed 16 adjoining property sales and 72 comparable sales, collectively, for the Rockford Solar Farm, the Grand Ridge Solar Farm, the Portage Solar Farm, the IMPA Frankton Solar Farm, the Indy III Solar Farm, the Valparaiso LLC Solar Farm, and the Middlebury Solar Farm over the past five years. The remaining solar farms did not have data available for analysis. We note that proximity to the solar farms has not deterred sales of nearby agricultural land and residential single family homes.

No empirical evidence evolved that indicated a more favorable real estate impact on the Control Area Sales as compared to the adjoining, Test Area Sales with regard to such market elements as:

1. Range of sale prices
2. Differences in unit sale prices
3. Conditions of sale
4. Overall marketability

We have also reviewed published methodology for measuring impact on property values as well as published studies that specifically analyzed the impact of solar farms on nearby property values. We have also interviewed market participants, including Township Assessors, to give us additional insight as to how the market evaluates farm land and single family homes with views of the solar farm. These studies found little to no measurable and consistent difference in value between the Test Area Sales and the Control Area Sales attributed to the proximity to solar farms and are generally considered a compatible use. Considering all of this information, we can conclude that since the Adjoining Property Sales (Test Area Sales) for the existing solar farms analyzed were not adversely affected by their proximity to solar farms, that properties surrounding other solar farms operating in compliance with all regulatory standards will similarly not be adversely affected, in either the short or long term periods.

If you have any questions or comments, please contact the undersigned. Thank you for the opportunity to be of service.

Very truly yours,

CohnReznick, LLP

Patricia L. McGarr, MAI, CRE, FRICS
National Director - Valuation Advisory Services
Certified General Real Estate Appraiser
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Expires 9/30/2019
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Expires 6/30/2018

Sonia K. Singh
Manager

TABLE OF CONTENTS

SCOPE OF WORK

CLIENT

Cypress Creek Renewables, LLC

INTENDED USERS

Cypress Creek Renewables; other intended users may include the client's legal and accounting site development professionals.

INTENDED USE

The intended use of our opinions and conclusions is to assist the client in addressing local concerns regarding a solar farm's potential impact on surrounding property values, in addition to addressing the required criteria for obtaining approvals for proposed solar energy uses, such as minimizing the impact on adjacent property values. The report may be used only for the aforementioned purpose and may not be distributed without the written consent of CohnReznick LLP ("CohnReznick").

PURPOSE

The purpose of this report is to address local concerns regarding a solar farm use having a perceived impact on surrounding property values, and provide a consulting report that can be submitted to municipal planning departments for the purposes of addressing the required criteria for obtaining approvals for proposed solar energy sites.

EFFECTIVE DATE

March 1, 2018

DATE OF REPORT

March 20, 2018

PRIOR SERVICES

USPAP requires appraisers to disclose to the client any services they have provided in connection with the subject property in the prior three years, including valuation, consulting, property management, brokerage, or any other services.

This report is a compilation of the Solar Farms which we have studied over the past year, and is not evaluating a specific subject site. In this instance, there is no "subject property" to disclose.

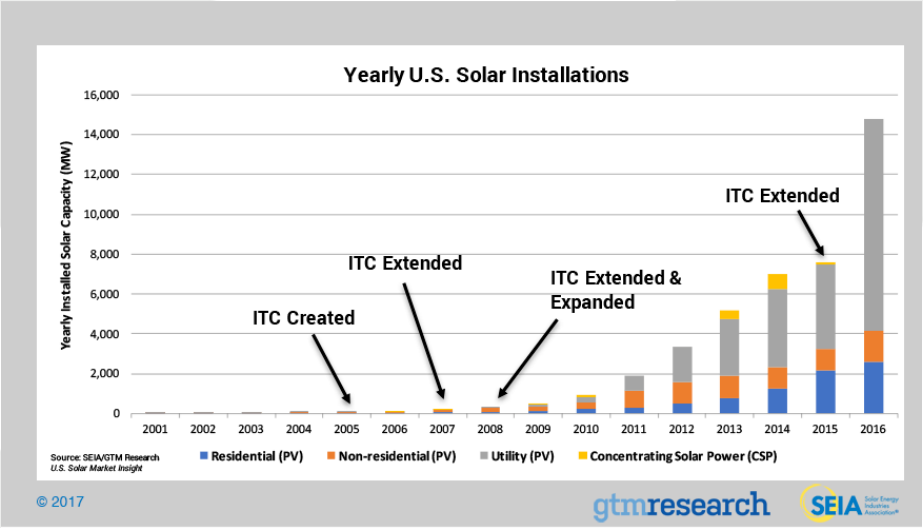
INSPECTION

Patricia L. McGarr and Martin D. Broerman have performed an inspection of the exterior of the properties that are the subject of this impact study on various dates in October 2017. The inspections were conducted via public rights of way.

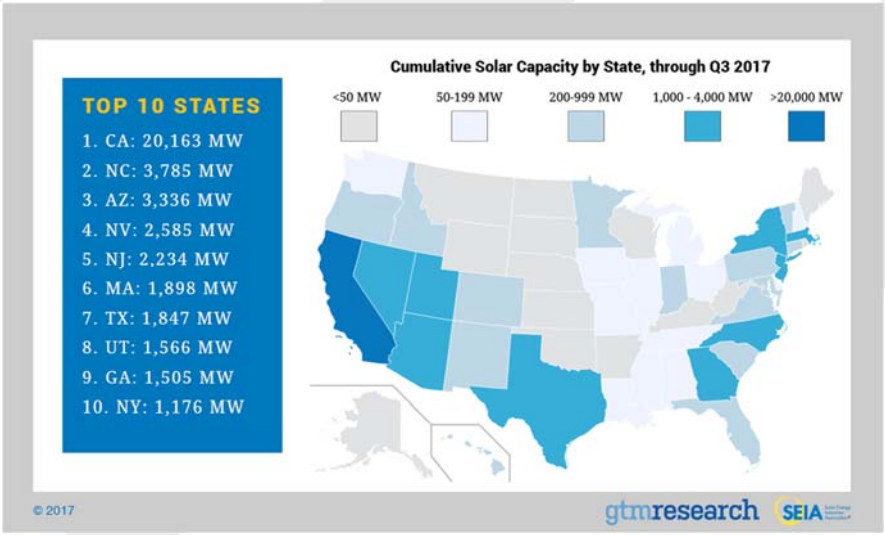
Patricia L. McGarr, Andrew R. Lines, Martin D. Broerman and Sonia K. Singh have viewed the exterior of all comparable data referenced in this report in person, via photographs, or aerial imagery.

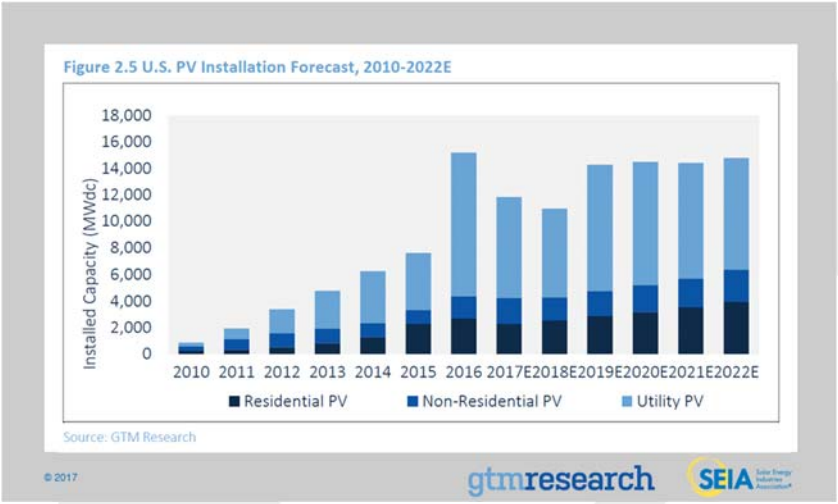
OVERVIEW OF SOLAR DEVELOPMENT

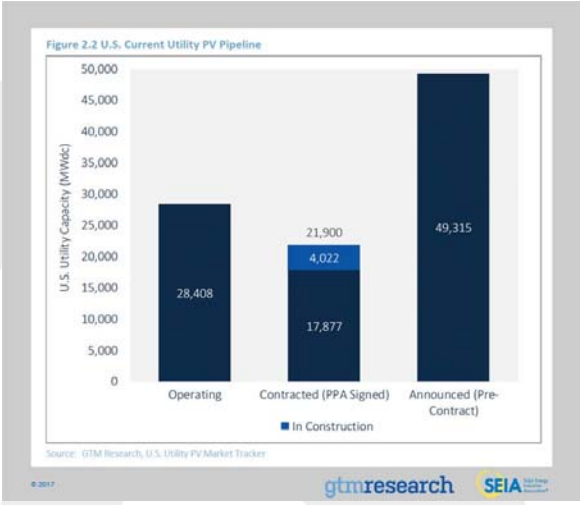
Photovoltaic (PV) cell installations, commonly known as solar cells, increased almost exponentially over the past ten years in the United States as technology and the economic incentives (Solar Investment Tax Credits or ITC) made the installation of solar farms economically reasonable. Majority of these solar farm installations come from larger-scale solar farm developments for utility purposes. The charts below portray the increases of the solar installations in the US as a whole on an annual basis, courtesy of Solar Energy Industries Association (SEIA) and GTM Research.



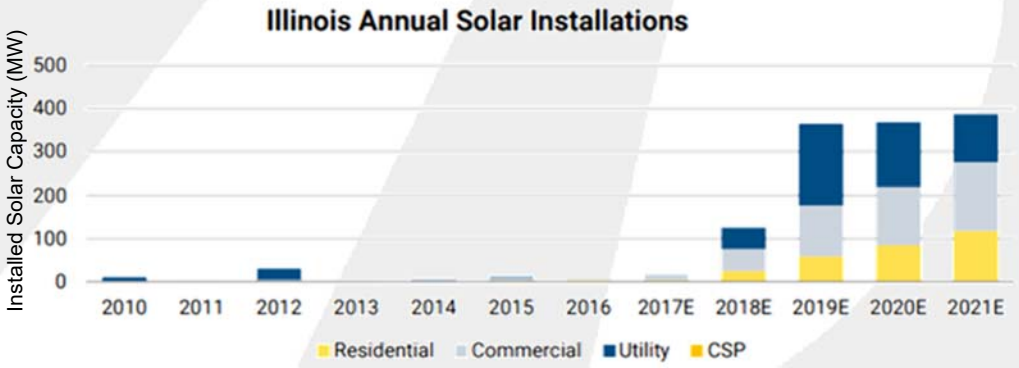
Additionally, nearly 250,000 Americans work in the solar industry. The cost to install solar panels has dropped nationally by 70% since 2010, which has led to the increase in installations. The map below portrays solar capacity by state.



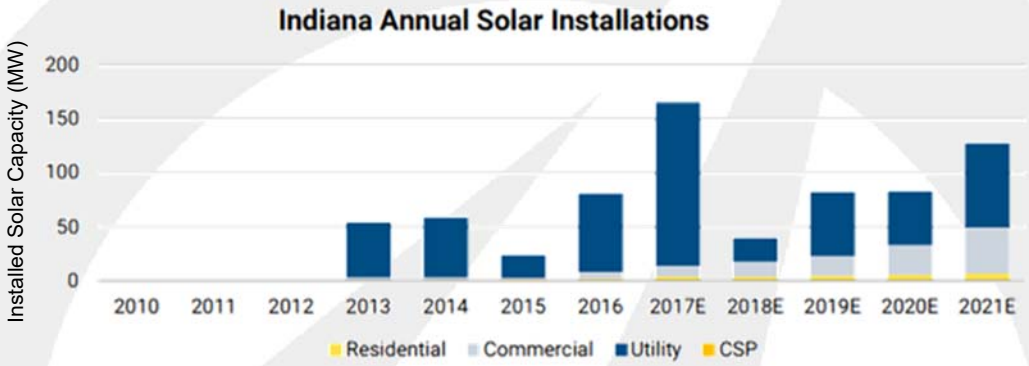




Illinois has recently picked up investment in solar installations. According to the SEIA, to date there was $227.54 million invested in solar, however, only $13.49 million has been invested in 2016. Additionally, to date only 81.52 MW of solar panels are installed, and only 1.7 MW were installed in 2016. Illinois was ranked 33rd in the nation by the SEIA in 2017. Although, this state is relatively behind in solar production, they ranked 17th in solar jobs in 2016.



The state of Indiana has clearly seen a significant uptick in solar investments. According to the Solar Energy Industries Association (SEIA), $384.70 million has been invested in solar, with $104.44 million being invested in 2016 alone. The increase in solar investments is due to the falling costs of installations. According to the SEIA, solar prices have declined by 55% over the past five years in the state. Currently, solar energy powers 31,000 Indiana homes with 265.64 MW of solar installed. Indiana ranks in the middle of the pack comparatively to other states, at 22nd.



MARKET ANALYSIS OF THE IMPACT ON VALUE FROM SOLAR FARMS

METHODOLOGY

According to Randall Bell, PhD, MAI, author of *Real Estate Damages,* published by the Appraisal Institute in 2016, the paired sales analysis is an effective method of determining if there is a detrimental impact on surrounding properties.

> *"This type of analysis may compare the subject property or similarly impacted properties called **Test Areas** (at Points B, C, D, E, or F) with unimpaired properties called **Control Areas** (Point A). A comparison may also be made between the unimpaired value of the subject property before and after the discovery of a detrimental condition. If a legitimate detrimental condition exists, there will likely be a measurable and consistent difference between the two sets of market data; if not, there will likely be no significant difference between the two sets of data. This process involves the study of a group of sales with a detrimental condition, which are then compared to a group of otherwise similar sales without the detrimental condition."*[1]

As an approved method, this technique can be utilized to extract the effect of a single characteristic on value. By definition, paired data analysis is "a quantitative technique used to identify and measure adjustments to the sale prices or rents of comparable properties; to apply this technique, sales or rental data on nearly identical properties is analyzed to isolate a single characteristic's effect on value or rent."[2] The text further describes that this method is theoretically sound when an abundance of market data is available for analysis. It may be impractical for those property types that do not frequently sell, such as commercial properties. *The Appraisal of Real Estate* states that the lack of data can reduce the strength of the analysis, and that "an adjustment derived from a single pair of sales is not necessarily indicative" of the value of the single difference.

We also utilized a Trend Analysis to adjust our comparable Control Sales to a constant valuation date, the date of the Test Area sale. According to the *Dictionary of Real Estate Appraisal, 6th edition,* a Trend Analysis is defined as:

> *"A quantitative technique used to identify and measure trends in the sale prices of comparable properties; useful when sales data on highly comparable properties is lacking but a broad database on properties with less similar characteristics is available. Market sensitivity is investigated by testing various factors that influence sale prices."*

We utilized a Trend Analysis to adjust the Control Sales for market conditions, as this is a variable that affects all properties similarly and can be adjusted for. Given the reduced amount of sale data and sales with highly similar characteristics to the Test Area sales, we concluded that adjusting only for market conditions is reasonable as this is explainable by a linear regression analysis, a form of Trend Analysis. This involved plotting our Control Sales unit sale prices against their sale dates and plotting a "Line of Best Fit" to explain market

[1] *Bell, Randall, PhD, MAI. Real Estate Damages. Third ed. Chicago, IL: Appraisal Institute, 2016.*
[2] *The Appraisal of Real Estate 14th Edition. Chicago, IL: Appraisal Institute, 2013.*

condition trends. We extracted a monthly appreciation rate for each set of Control Sales and applied that to each respective grouping to normalize the sales to a common valuation date.

PUBLISHED STUDIES

We have also considered various studies that consider the impact of solar farms on surrounding property values. The studies range from survey-based formal research to less formal analyses.

The studies show that over the past decade, the solar industry has experienced unprecedented growth. Among the factors contributing to its growth were government incentives, significant capacity additions from existing and new entrants and continual innovation. The incentives made the solar photovoltaic (PV) industry economically attractive for many consumers and as a result set the conditions for the boom. A significant amount of farmland trades have been to solar developers, transaction prices for these deals were reported to be between 30 to 50 percent above normal agricultural land prices in 2016. Clean Energy Trends, a publication developed by Clean Edge, reported in 2013 that investments in new capacity of solar farms increased from approximately $3 billion USD in 2000 to approximately $91 billion USD in 2013, just short of the record of $92 billion USD in 2011. Solar PV installations increased from 31 Gigawatts (GW) in 2012 to a record of approximately 37 GW in 2013. As a result, annual solar PV installations exceed annual wind installations for the first time. Before 2011, annual wind installations were double annual solar PV installations.

Solar farms offer a wide array of economic and environmental benefits to surrounding properties. Unlike other energy sources, solar energy does not produce emissions that may cause negative health effects or environmental damage. Solar farms produce a lower electromagnetic field exposure than most household appliances, such as TV and refrigerators, and studies have confirmed there are no health issues related to solar farms.[3] The Solar Foundation measured that the solar industry employed 22 percent more workers in the period from 2013 to 2015. Solar farm construction in rural areas has also dramatically increased the tax value of the land on which they are built, which has provided a financial boost to some counties. According to Duke University's Center on Globalization, Governance, and Competitiveness ("DUCGCC"), study of solar projects in North Carolina indicated despite the 80% tax abatement, the taxable value of a parcel with a solar farm is significantly larger than the taxable value of that same land under agricultural zoning.

Beyond creating jobs, solar farms are also benefiting the overall long-term agricultural health of the community. As explained by ReThink Energy, a conservation foundation, a typical solar farm has more than two-thirds of the field left open and uncovered by solar panels. This unused land, and also all the land beneath the solar panels, will be left to repair naturally. In the long run this is a better use of land since the soil is allowed to recuperate instead of being ploughed and fertilized year in and year out.

A solar farm can greatly increase the value of land, offering some financial security for the property owner over 20 to 25 years. Once solar panel racking systems are removed, the land can revert to its original use.[4]

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[3] "Electromagnetic Field and Public Health." Media Centre (2013): 1-4. World Health Organization.
[4] NC State Extension. (May 2016). Landowner Solar Leasing: Contract Terms Explained. Retrieved from: https://content.ces.ncsu.edu/landowner-solar-leasing-contract-terms-explained

Studies have also noted that the installation of utility-scale solar on a property has no negative impact on its value. According to a report titled “Mapleton Solar Impact Study” from Kirkland Appraisals, LLC, conducted in Murfreesboro, North Carolina in September 2017, the study found that the proposed solar farm had no impact to adjacent vacant residential, agricultural land, or residential homes. The adjoining land for the paired data sales analysis in the report was primarily low density residential and agricultural uses, although there was one case where the solar farm adjoined to two dense subdivisions of homes.

ADJACENT PROPERTY VALUES IMPACT STUDY

We identified nine solar farms to study with comparable sales where generally the only difference was the attribute under study: proximity to a solar farm.

Ownership and sales history for each adjoining property to an existing solar farm through the effective date of this report is maintained within our workfile. Adjoining properties with no sales data or that sold prior to the development of the solar farm were excluded from further analysis. Adjoining properties that sold during construction were not considered for a paired sales analysis because the impact of being proximate to the solar farm could not be differentiated from the impact of the construction. Adjoining properties that sold in a non-arm's length transaction (such as a transaction between related parties, bank-owned transaction, or between adjacent owners) were excluded from analysis as these are not considered to be reflective of market price levels. The adjoining properties that remained after exclusions were considered for a paired sale analysis.

The difference in price is considered to be the impact of the proximity to the solar farm. Two types of paired sales analyses were considered based on the availability of data:

- Comparing sales of adjoining properties prior to the announcement of the solar farm to sales of adjoining properties after the completion of the solar farm.
- Comparing sales of adjoining properties after the completion of the solar farm to sales of comparable properties that are proximate to solar farms, but not adjoining to them.

We have considered only one type of paired sales analysis, which was comparing sales of properties proximate to the solar farm (Control Area) to the sales of adjoining properties after the completion of the solar farm project (Test Area). We were unable to compare any sales of adjoining properties that occurred prior to the announcement of the solar farm with the sales of the adjoining properties after the completion of the solar farm project as there were no adjoining properties that sold prior to the announcement of the solar farm, within a reasonable period of time.

We have found Control Area sales data through the Northern Illinois Multiple Listing Service (MLS), Zillow, Gateway Sales Disclosure Form website, and the Illinois Land Sales Bulletin, and verified these sales through county records, conversations with brokers, and the County Assessor's Office. It is important to note that these Control Area Sales are not adjoining to any solar farm, nor do they have a view of one from the property. Therefore, the announcement nor the completion of the solar farm use could not have impacted the sales price of these properties.

To make direct comparisons, the sale price of the Control Area sales will need to be adjusted for market conditions to a common date. In this analysis, the common date is the date of the Adjoining Property Sale after the completion of the solar farm. After adjustment, any measurable difference between the sale prices would be indicative of a possible price impact of the solar farm, if any.

Presented on the following pages is a summary of the analyses completed for each of the existing solar farms studied. Detail of these analyses is retained within our workfile.

SOLAR FARM 1: GRAND RIDGE SOLAR FARM, STREATOR, IL

Location: Grand Ridge Solar Farm in LaSalle County, IL

Coordinates: Latitude 41.143421, Longitude -88.758340

PIN: 34-22-100-000, 34-22-101-000

Total Project Size: 160 AC

Date Project Announced: December 31, 2010

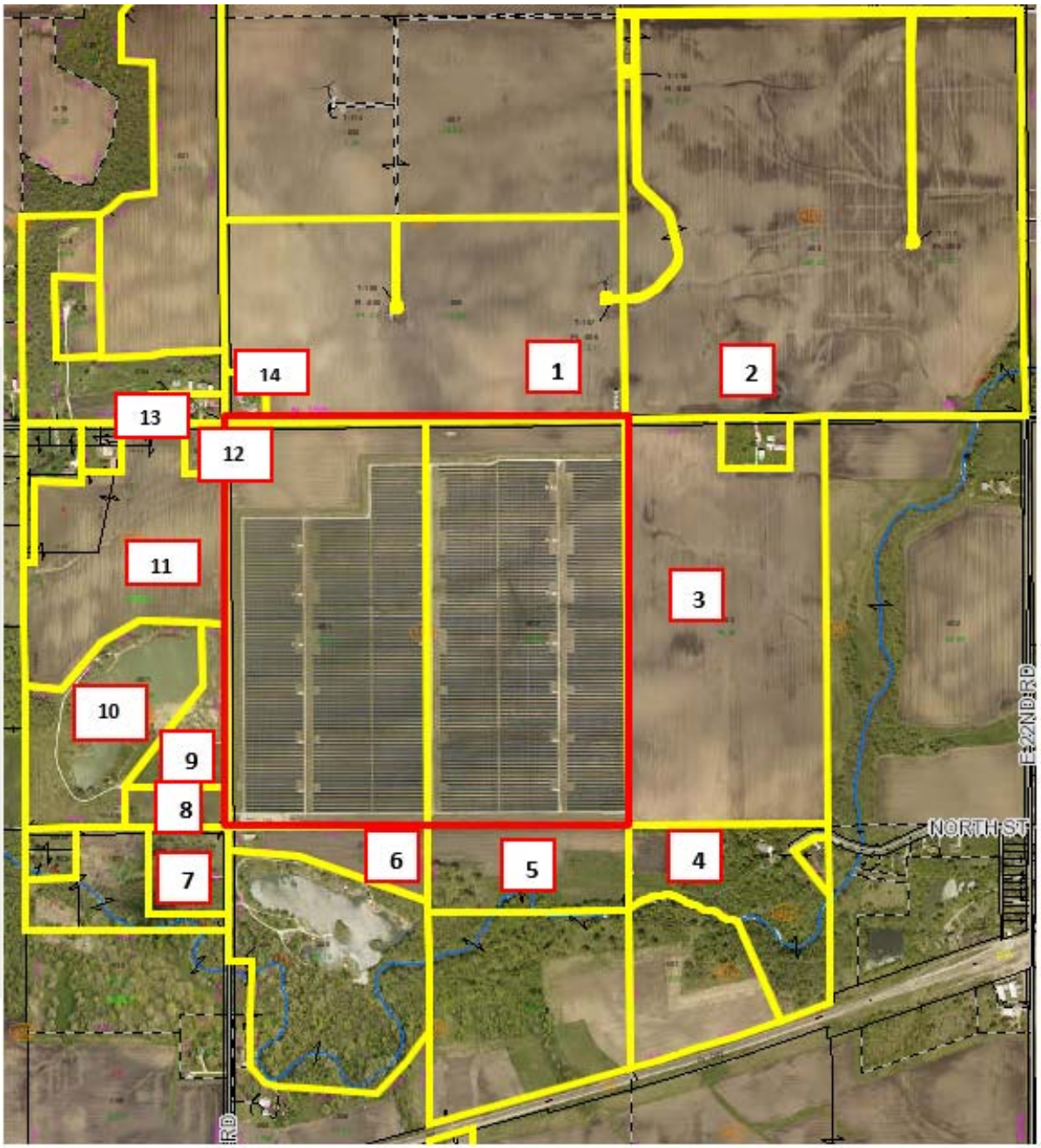
Date Project Completed: July 2012

Project Size: 11.90 AC

Output: 23 MW DC (20 MW AC)

This solar farm is located at the southeast corner at the intersection of 21st and 15th roads. The solar farm was developed by Invenergy and is considered to be one of the largest renewable energy centers in the world. It includes a 210 MW wind farm, 20 MW AC project solar and 1.5 MW advanced-energy storage project all in one location. The solar facility consists of twenty individual 1 MW solar inverters and over 155,000 photovoltaic modules supplied by General Electric. The solar farm has vacant agricultural land to the north and east, and natural vegetation to the east and south. The solar plant is located adjacent to Invenergy's wind farm.

Real Estate Tax Info: Prior to development of the solar farm, during the period between 2009 and 2011, this 160 acre farm paid real estate taxes of about $1,500 per 80 acre parcel ($3,000 per year in total). In the 5 years since the solar farm has been operating, the real estate taxes have increased to about $1,600 per acre ($255,000 per year in total). The map on the following page displays the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.



Solar Farm 1 Adjoining Properties

Adjoining Property 12 (Test Area) was considered for a paired sales analysis, and we analyzed this property as a single-family home use. We analyzed five Control Area single family home sales on similar lot sizes that sold within a reasonable time frame from Adjoining Property 12's sale date, and adjusted the Control Area sales for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment. The result of our analysis for Solar Farm 1 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$74.35
Adjoining Property 12 (Test Area)	Yes: Solar Farm was completed by the sale date	$79.90
Difference		7.46%

Noting the relatively small price differential ***slightly over 5%***, it does not appear that Solar Farm 1 impacted the sales price of Adjoining Property 12 in either direction (positive or negative).

SOLAR FARM 2: PORTAGE SOLAR FARM, PORTAGE TOWNSHIP, IN

Location: Portage Solar Farm in Porter County, IN

Coordinates: Latitude 41.333263, Longitude -87.093015

PIN: 64-06-19-176-001.000-015

Total Project Size: 56 AC

Recorded Owner: PLH Inc

Date Project Announced: February 2012

Date Project Completed: September 2012

Project Size: 1.5 MW

Output: 1.5 MW DC (1.96 MW AC)

This solar farm is located on the south side of Robbins Road, located just outside the City of Portage. The solar farm was developed by Ecos Energy, who is a subsidiary of Allco Renewable Energy Limited. This solar farm is ground mounted has the capacity for 1.5 Megawatts (MW) of power, which is enough to power 300 homes. This solar farm consists of 7,128 solar modules which are of a fixed tilt installation, and contains three inverters. The solar farm is fenced from adjacent properties by a fence that surrounds all of the solar panels. Natural vegetation borders the western and northern sides of the solar farm.

Real Estate Tax Info: The 56 acres of farm land was paying $1,400 per year in taxes. After the solar farm was developed, only 13 acres (23% of the site) was reassessed and the remaining 43 acres continued to be farmed. The total real estate tax bill increased to $16,350 per year after the solar farm was built, including both uses on the site. This indicates that the real estate taxes for the solar farm increased from $25 per acre to $1,175 per acre after the solar farm was developed. The map on the following page displays the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.

Solar Farm 2 Adjoining Properties

Solar Farm 2 Adjoining Properties

Adjoining Properties 1 and 7 (Test Areas) were each considered for a paired sales analysis. Adjoining Property 1 was analyzed as homestead/small farm land tract since at the time of purchase the site was used as agricultural land. The buyer bought it as vacant land and subsequently built a home on site. Adjoining Property 7 was analyzed as a single-family home use.

For Adjoining Property 1, we analyzed nine Control Area homestead/small farm land tract sales that sold within a reasonable time frame from Adjoining Property 1's sale date. For Adjoining Property 7, we analyzed seven Control Area single family home sales that sold within a reasonable time frame from Adjoining Property 7's sale date. All Control area sales were adjusted for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment.

The result of our analyses for Solar Farm 2 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per Acre
Adjusted Control Area Sales	No: Not adjoining solar farm	$7,674
Adjoining Property 1 (Test Area)	Yes: Solar Farm was completed by the sale date	$8,000
Difference		4.25%

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$84.27
Adjoining Property 7 (Test Area)	Yes: Solar Farm was completed by the sale date	$84.35
Difference		0.10%

Noting the relatively small price differential, with both adjacent sales (Adjoining Property 1 or 7) having higher unit sale prices than the Control Area sales, it does not appear that Solar Farm 2 had any negative impact on adjacent property values.

SOLAR FARM 3: IMPA FRANKTON SOLAR FARM, FRANKTON, IN

Location: IMPA Frankton Solar Farm in Madison County, IN

Coordinates: Latitude 40.125701; Longitude -85.4626.88

PIN: 48-08-06-500-012.001-020

Total Project Size: 13 AC

Recorded Owner: IMPA

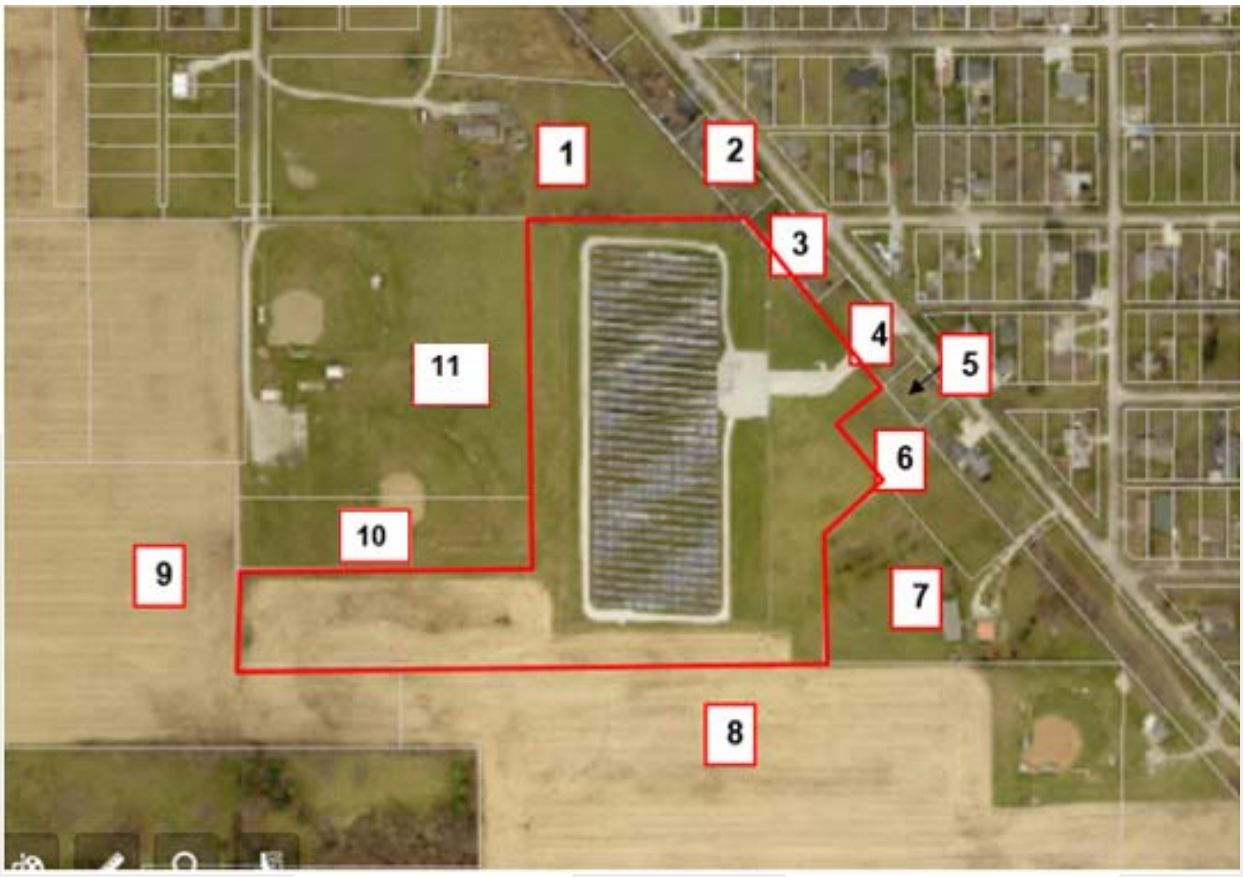
Date Project Announced: November 2013

Date Project Completed: June 2014

Project Size: 1 MW

Output: 1,426 Mwh Annually

This solar farm is located on the west side of South Lafayette Street, located in the Town of Frankton. IMPA Frankton Solar Farm was built in 2014 in joint effort by Inovateus Solar and Indian Municipal Power Agency (IMPA). This solar farm has the capacity for 1 MW and its expected annual output is 1,426 MWh (megawatt hours). The solar farm is separated off from their adjacent properties by a 6' fence that surrounds the entirety of the solar panels. From our inspection of the site we note that the driveway to access the panels slopes downward and allows some views of the site. The map on the following page displays the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.



Solar Farm 3 Adjoining Properties

Adjoining Properties 2 and 7 (Test Areas) were each considered for a paired sales analysis. Adjoining Property 2 was manufactured single family home use. Adjoining Property 7 was analyzed as a single-family home use.

For Adjoining Property 2, we analyzed six Control Area sales that sold within a reasonable time frame from Adjoining Property 2's sale date. For Adjoining Property 7, we analyzed five Control Area sales that sold within a reasonable time frame from Adjoining Property 7's sale date. All Control area sales were adjusted for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment.

The result of our analyses for Solar Farm 3 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$28.42
Adjoining Property 2 (Test Area)	Yes: Solar Farm was completed by the sale date	$28.58
Difference		0.56%

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$51.47
Adjoining Property 7 (Test Area)	Yes: Solar Farm was completed by the sale date	$52.40
Difference		1.81%

Noting the relatively small price differential, in which both Adjoining Property Sales 2 and 7 sold at a slightly higher unit sale price that the Control Area Sales, it does not appear that Solar Farm 3 had any negative impact on adjoining property sales.

SOLAR FARM 4: DOMINION INDY SOLAR III, INDIANAPOLIS, IN

Location: Dominion Indy Solar III, in Marion County, IN

Coordinates: Latitude 39.3914.16, Longitude -86.153485

PIN: 49-13-13-113-001.000-200

Total Project Size: 134 AC

Recorded Owner: PLH Inc

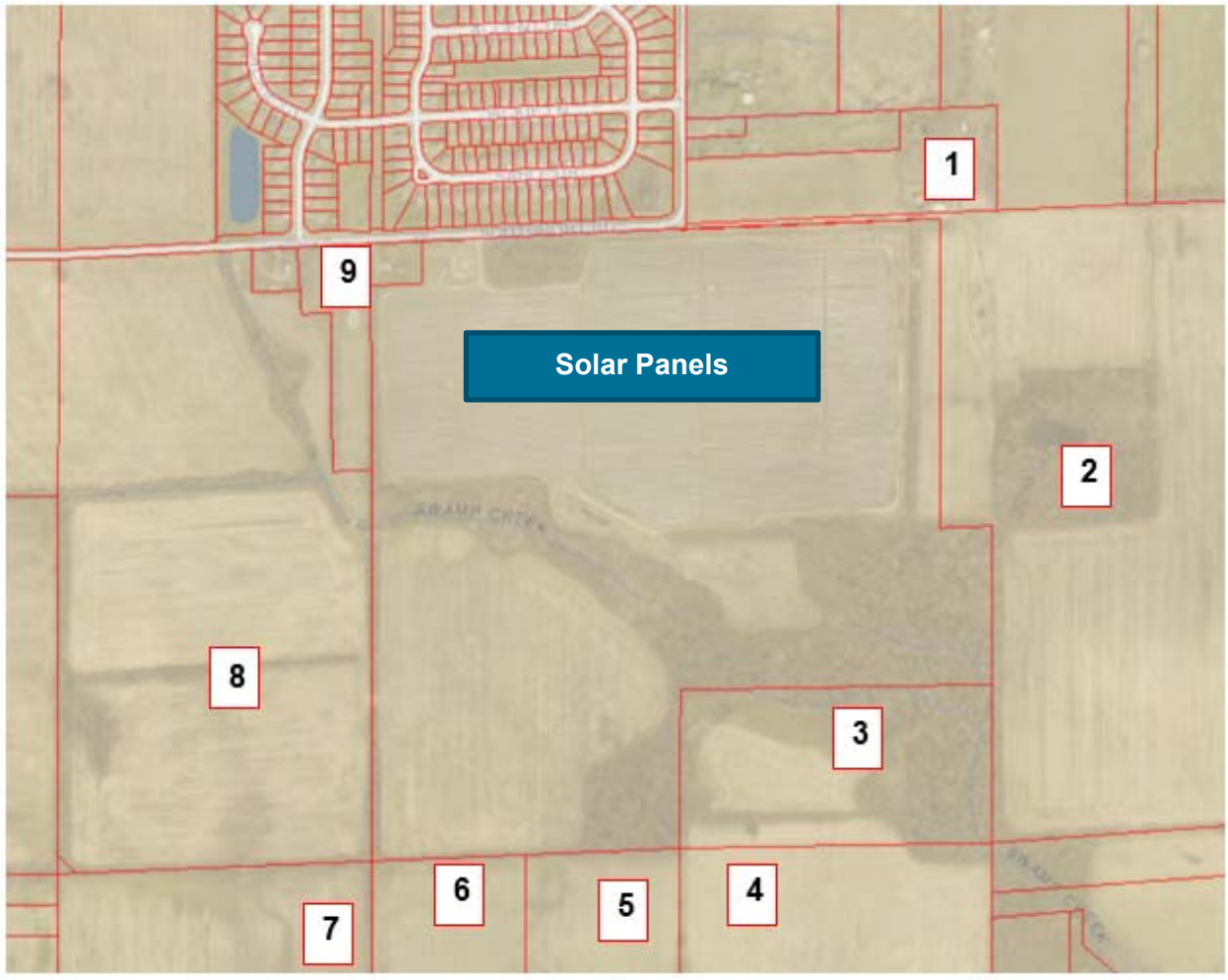
Date Project Announced: August 2012

Date Project Completed: December 2013

Project Size: 11.9 MW

Output: 11.9 MW DC (8.6 MW AC)

This solar farm is located on the southern side of West Southport Road, located approximately eight and a half miles from the heart of Indianapolis. The solar farm was developed by Dominion Renewable Energy. This solar farm is ground mounted has the capacity for 11.9 Megawatts (MW) of power. The panels are mounted in a fixed tilt fashion and there are 12 inverters in this solar farm. The solar farm is lined by a chain link fence that surrounds all of the solar panels. Additionally, there are some natural bushes and trees on all sides of the property; this vegetation has been in place since before development of the solar farm. The maps on the following pages display the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.



Solar Farm 4 Adjoining Properties

Adjoining homes in the Crossfield Subdivision

Solar Farm 4 Adjoining Properties

Several Adjoining Properties (Test Areas) were considered for a paired sales analysis and were analyzed as single-family home uses. Due to the similarities of the adjoining properties that were included in our paired sales analysis, we will conduct the paired sales analysis in two groupings, based on sale dates. The adjoining properties that were considered for a paired sale analysis are indicated in the table below.

#	Address	Sale Price	Site Size (AC)	Beds	Baths	Year Built	Square Feet	Sale date	Groups	PSF
11	5933 SABLE DR	$ 140,000	0.31	3	1.5	2006	2412	12/9/2015	1	$ 58.04
13	5921 SABLE DR	$ 160,000	0.24	4	1.5	2006	2412	9/6/2017	2	$ 66.33
14	5915 SABLE DR	$ 147,000	0.23	3	2.5	2009	2028	5/10/2017	2	$ 72.49
20	5829 SABLE DR	$ 131,750	0.23	4	2.5	2011	2190	12/9/2015	1	$ 60.16
22	5813 SABLE DR	$ 127,000	0.23	4	1.5	2005	2080	3/4/2015	1	$ 61.06
24	5737 SABLE DR	$ 120,000	0.23	3	2.5	2010	2136	2/3/2014	1	$ 56.18

For Group 1, we analyzed eight Control Area sales that sold within a reasonable time frame from the average sale date of the Group 1 sales. For Group 2, we analyzed seven Control Area sales that sold within a reasonable time frame from the average sale date of the Group 2 sales. All Control area sales were adjusted for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment.

The result of our analyses for Solar Farm 4 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$57.84
Group 1 (Test Area)	Yes: Solar Farm was completed by the sale date	$59.81
Difference		3.40%

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$68.67
Group 2 (Test Area)	Yes: Solar Farm was completed by the sale date	$69.14
Difference		0.69%

Noting the relatively small price differential, in which the Test Area Sales were slightly higher than the average for the Control Areas, it does not appear that Solar Farm 4 had any negative impact on adjoining property values.

SOLAR FARM 5: VALPARAISO SOLAR LLC, VAPARAISO, IN

Location: Valparaiso Solar LLC, in Porter County, IN

Coordinates: Latitude 41.301180, Longitude –87.094055

PIN: 64-09-07-152-001.000-019, 64-09-07-152-002.000-019

Total Project Size: 27.9 AC

Recorded Owner: PLH Inc

Date Project Announced: March 2012

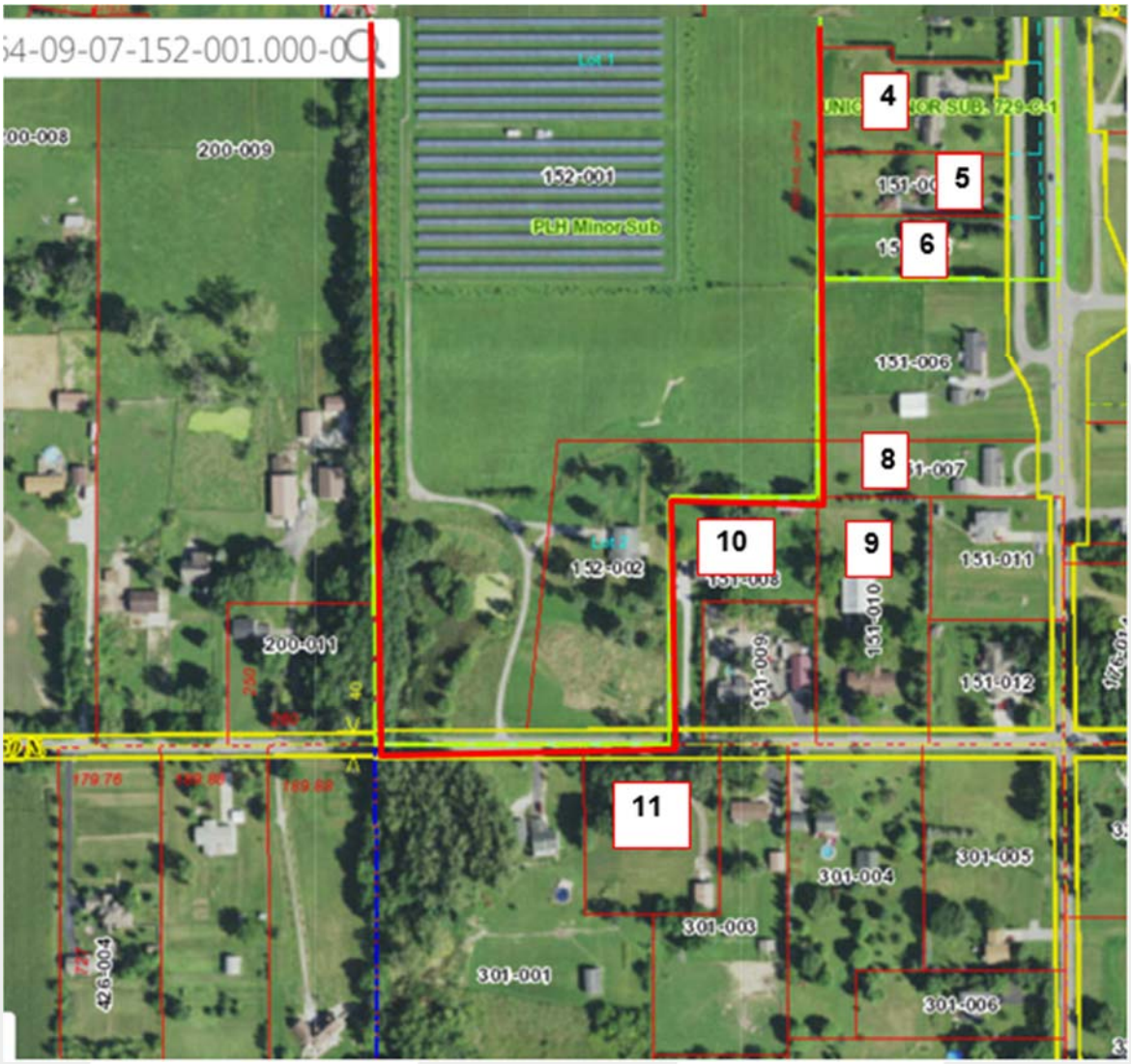
Date Project Completed: December 20, 2012

Project Size: 1.3 MW

Output: 1.3 MW DC (1 MW AC)

This solar farm is located on the southern side of Indiana Route 130 (Railroad Ave), located approximately 35 miles southwest of the Chicago Loop. The solar farm was developed by Sustainable Power Group LLC and has ground mounted capacity for 1.3 Megawatts (MW) of power. The panels are mounted in a fixed tilt fashion and there are 2 inverters in this solar farm. The solar farm is lined by a chain link fence that surrounds all of the solar panels. Additionally, there are some natural bushes and trees to the north and west of the solar panels; this vegetation has been in place since before development of the solar farm. Other small trees were planted spaced out around the perimeter of the solar farm after development. From our inspection, the solar panels cannot be seen from Indiana State Route 130 from the north, nor on N 475 W Road to the east as this is a raised roadway. The adjacent properties to the east of the solar panels have full view of the panels from their backyards. The maps on the following pages display the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.

Solar Farm 5 Adjoining Properties



Solar Farm 5 Adjoining Properties

Adjoining Properties 10 and 14 (Test Areas) were each considered for a paired sales analysis. Both were analyzed as single-family home uses.

For Adjoining Property 10, we analyzed five Control Area sales that sold within a reasonable time frame from Adjoining Property 10's sale date. For Adjoining Property 14, we analyzed five Control Area sales that sold within a reasonable time frame from Adjoining Property 14's sale date. All Control area sales were adjusted for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment.

The result of our analyses for Solar Farm 5 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$79.95
Adjoining Property 10 (Test Area)	Yes: Solar Farm was completed by the sale date	$82.42
Difference		3.09%

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per SF
Adjusted Control Area Sales	No: Not adjoining solar farm	$64.07
Adjoining Property 14 (Test Area)	Yes: Solar Farm was completed by the sale date	$62.11
Difference		-3.06%

Noting the relatively small price differential, with one matched pair reflecting a unit sale price of 3% higher for the adjacent sale and the other matched pair reflecting a 3% lower unit sale price, it does not appear that Solar Farm 5 negatively impacted the sales price of Adjoining Property 10 or 14 in any consistent way.

SOLAR FARM 6: MIDDLEBURY SOLAR FARM, MIDDLEBURY, IN

Location: Middlebury Solar Farm, in Elkhart County, IN

Coordinates: Latitude 41.415202, Longitude –85.411819

PIN: 20-04-35-379-014.000-032

Total Project Size: 33.86 AC

Recorded Owner: PLH Inc/Allco

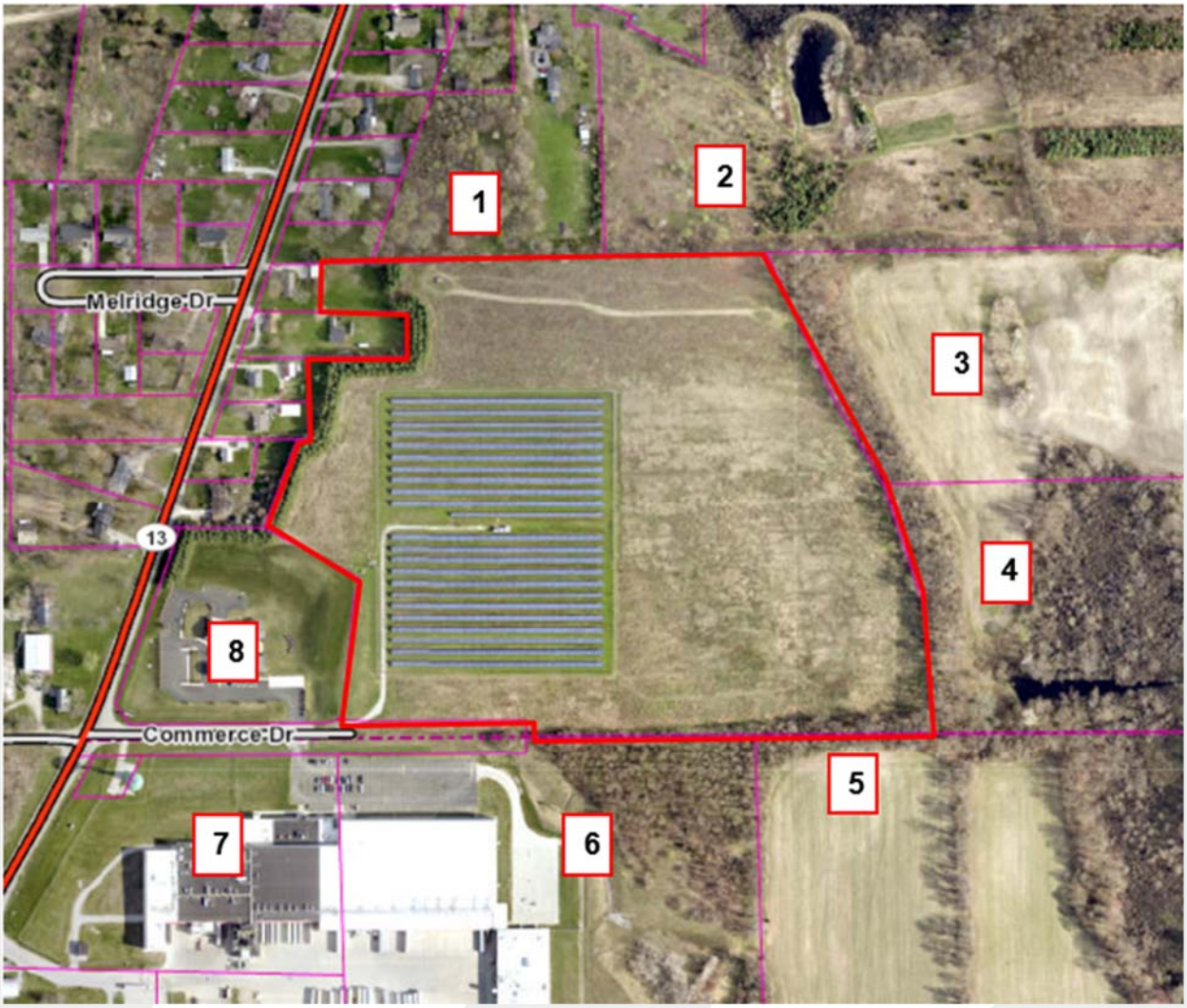
Date Project Announced: December 2011

Date Project Completed: December 2012

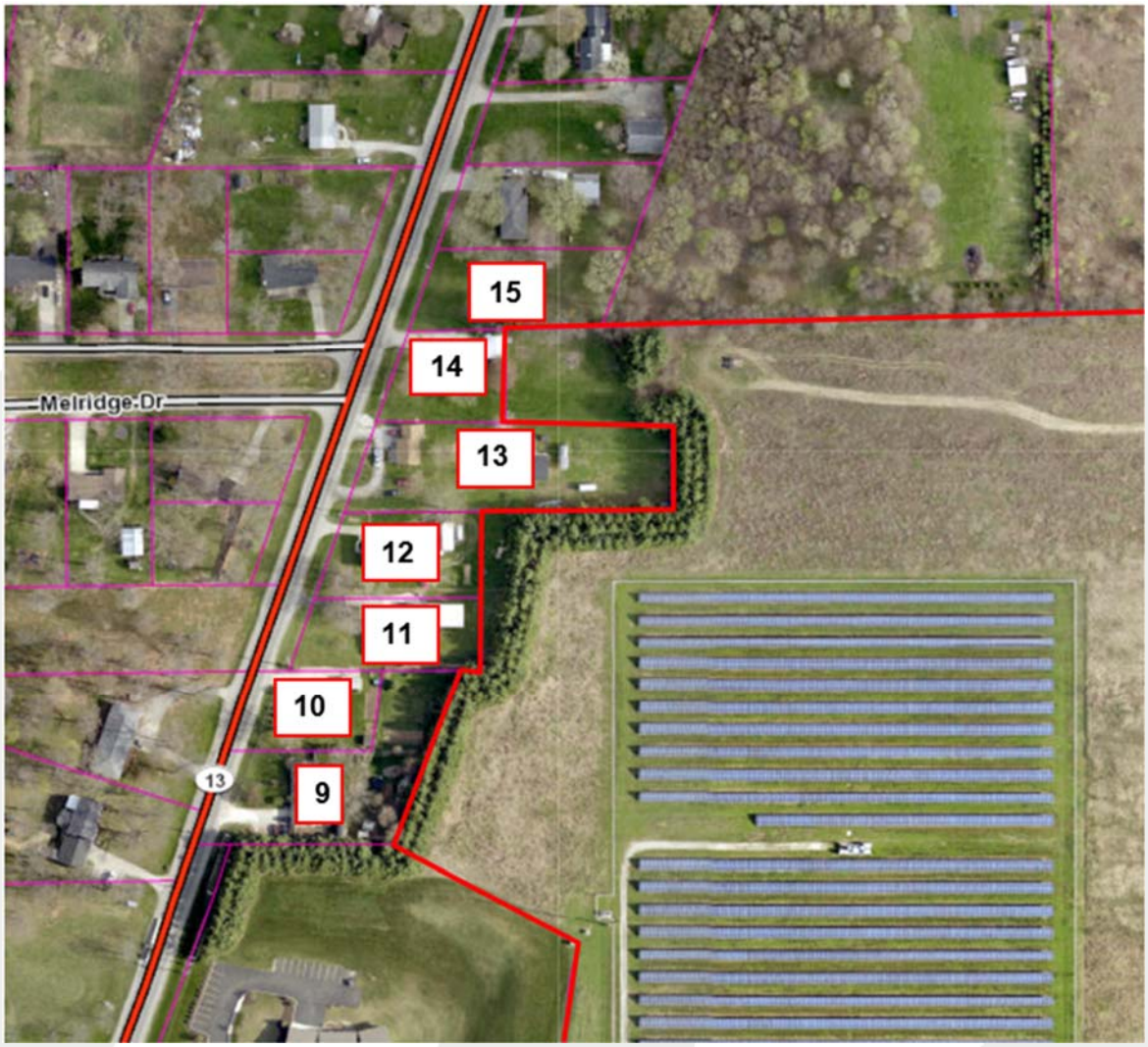
Project Size: 1.5 MW

Output: 1.96 MW DC (1.5 MW AC)

This solar farm is located on the eastern side of Indiana State Route 12, located approximately one and a half miles northeast of downtown Middlebury. The solar farm was developed by Ecos Energy LLC, a subsidiary of Allco Renewable Energy Limited. This solar farm is ground mounted and has the capacity for 1.96 Megawatts (MW) of power. The panels are mounted in a fixed tilt fashion and there are 3 inverters in this solar farm. The solar farm is lined by a chain link fence that surrounds all of the solar panels. Additionally, there are some natural bushes and trees on all sides of the solar panels; this vegetation has been in place since before development of the solar farm. From our inspection, the panels are only visible by the Meijer distribution facility to the south, the medical clinic access road to the southwest, and a slight view is present from the medical clinic's parking lot looking northeast. The medical clinic was developed prior to the solar farm and developed a landscaped berm behind the improvements. This berm was in place prior to development of the solar farm. The maps on the following pages display the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.



Solar Farm 6 Adjoining Properties



Solar Farm 6 Adjoining Properties

Adjoining Property 10 (Test Area) was considered for a paired sales analysis, and we analyzed this property as a single-family home use. We analyzed eight Control Area single family home sales on similar lot sizes that sold within a reasonable time frame from Adjoining Property 10's sale date, and adjusted the Control Area sales for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment. The result of our analysis for Solar Farm 6 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	**Adjusted Median Price Per SF**
Adjusted Control Area Sales	No: Not adjoining solar farm	$104.26
Adjoining Property 10 (Test Area)	Yes: Solar Farm was completed by the sale date	$132.79
Difference		**27.36%**

The unit sale price for Adjoining Property 10 was significantly higher than the median unadjusted and adjusted unit sale prices for the Control Area Sales. This is primarily due to the smaller size of Adjoining Property 10 and larger site area in comparison to the median statistics of the Control Area Sales.

SOLAR FARM 7: ROCKFORD SOLAR FARM, ROCKFORD, IL

Location: Chicago-Rockford International Airport in Winnebago County, IL

Coordinates: Latitude 42.175278, Longitude -89.08833

PINs: 15-26-151-005, 15-26-176-003, 15-26-300-009

Total Land Size: 182.29 AC

Recorded Owner: Greater Rockford Airport Authority

Total Project Size: 70 AC (Total three phases)

Current Project size: 15 AC (Approximate)

Date Project Announced: March 30, 2011

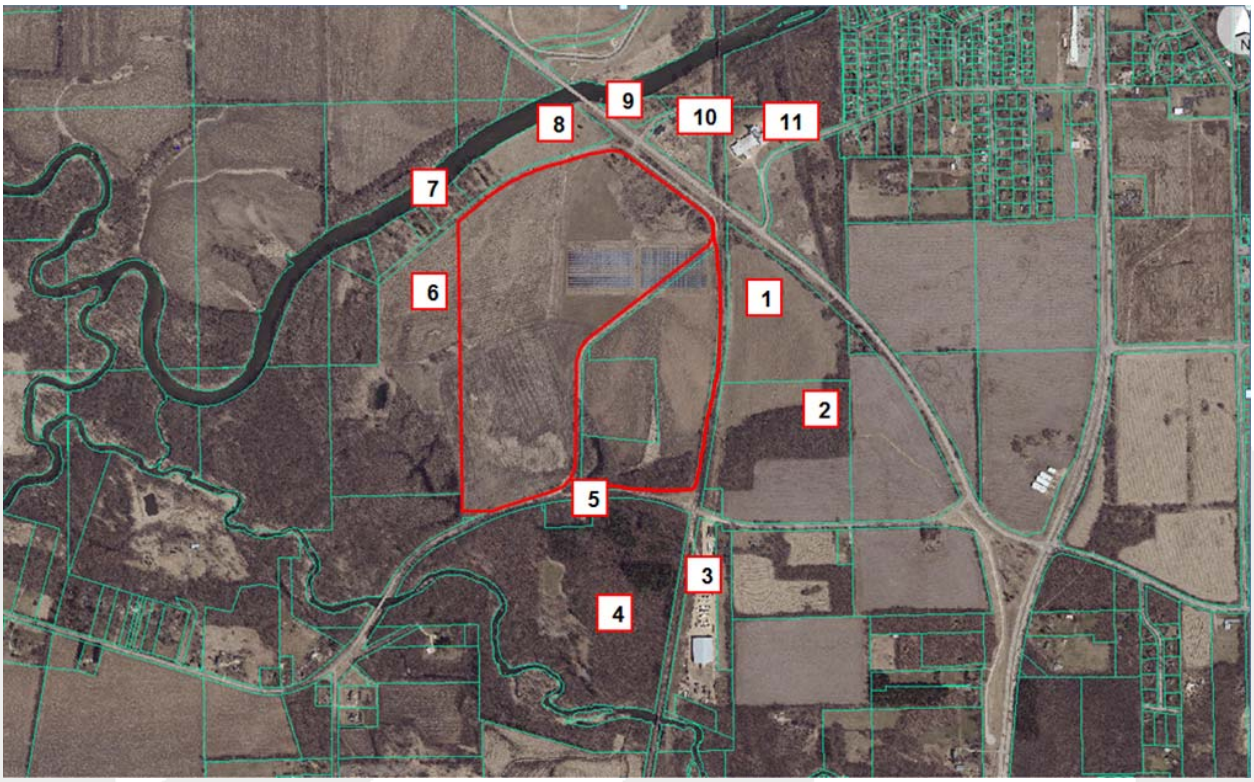
Date Project Completed: October 2012

Current Output: 3.06 MW (Phase I)

Future Output: 62 MW (Total three phases)

This solar farm is located in the City of Rockford, near the banks of Rock River which is about 80 miles northwest of Chicago. The project was initiated as a joint venture effort between Wanxiang American Corporation (Wanxiang) and New Generation Power (NGP) under the name Rockford Solar Partners, LLC. The initial goal of the project was to create hundreds of sustainable, green-collar jobs and provide a lasting economic boost to the state of Illinois, and is the largest airport-based solar photovoltaic (PV) electricity generating facility in the US. In the past, the city of Rockford was predominately a blue-collar capital filled with machine shops and factories. However, due to modernization, many of these workplaces have closed. The city now looks to the renewable energy industry to help stimulate the local economy. The project was also part of a larger, state-wide initiative to increase solar power production and reduce dependence on fossil fuels.

The total cost of Rockford Solar Partner's proposed three-phase, project was approximately $127 million and was financed six months prior to the date it was announced. In March 2010, the solar project received a $4 million USD grant from the Illinois Department of Commerce and Economic Opportunity (DCEO). The first phase of development was completed in October 2012. A railroad track runs along the solar farm to the east, and a series of natural bushes and trees line the panels to the north. There is no proximate natural vegetation to the western and southern areas near the panels; however, there is approximately 1,080 feet between most western solar panel and the western property line. Additionally, there is approximately 2,045 feet between the most southern solar panel and the southern property line. The map on the following page displays the parcels within the solar farm is located (outlined in red). Properties adjoining this parcel are numbered for subsequent analysis.



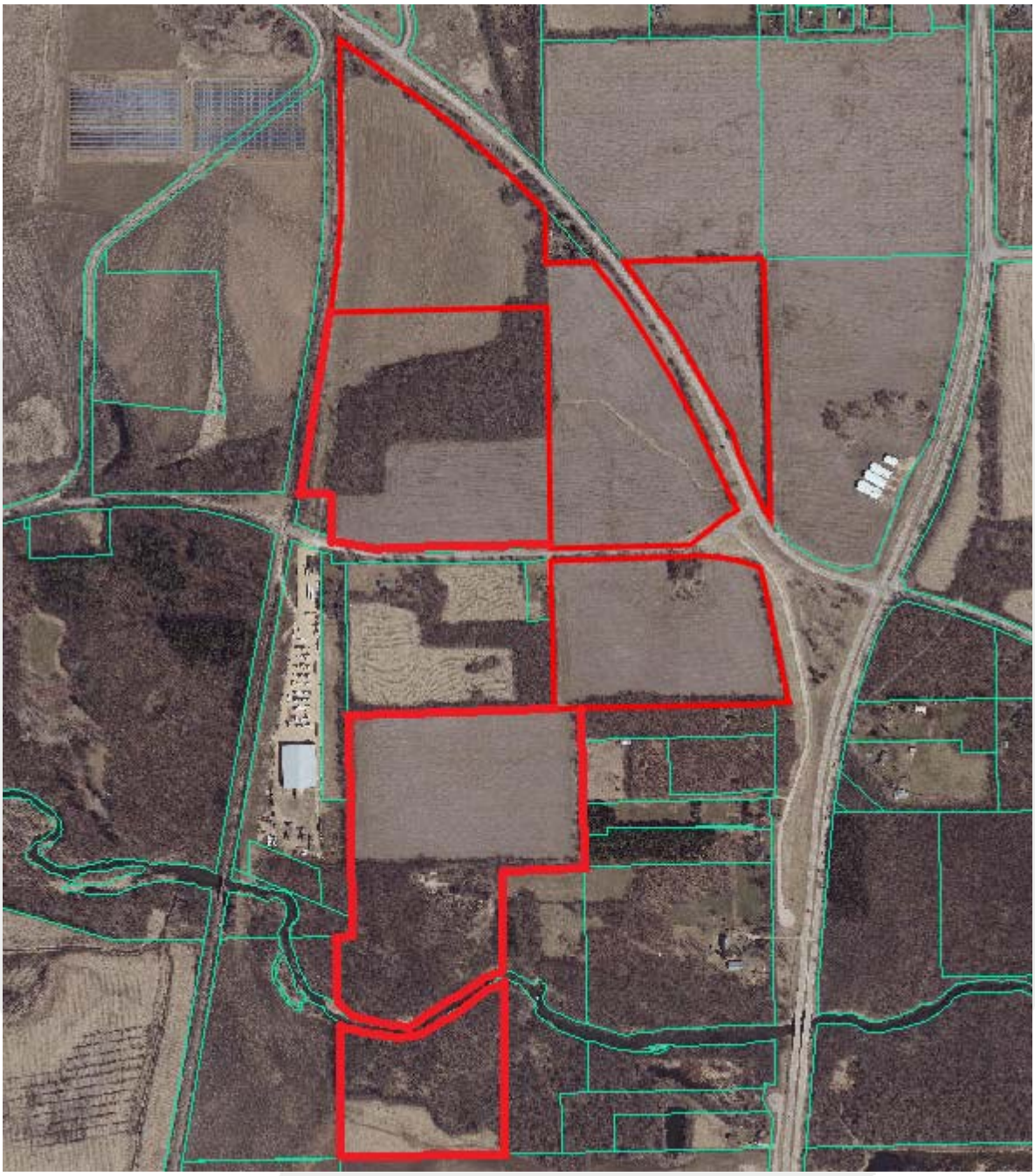
Solar Farm 7 Adjoining Properties

Adjoining Properties 1 and 2 (Test Area) were considered for a paired sales analysis, and we analyzed this property as agricultural land. Adjoining Properties 1 and 2 were sold in 2017, which is a reasonable time after completion of the solar farm. These two parcels sold with a third, contiguous parcel that measures 66.83 acres, for a total size of 214.7 acres, reflecting a unit sale price of $3,942 per acre. Therefore, Adjoining Properties 1 and 2 (Test Area) were considered for a paired sales analysis. Since these properties were sold together, along with a third contiguous parcel, we have considered it as one sale (Test Area Sale). An aerial image of all three of the parcels that sold is presented on the following page, with the parcels outlined in red. Parcel 1 is located within flood zone AE, which has a 1% annual chance of flood hazard, and Parcel 3 is located within flood zone AE and within a regulatory floodway. Parcel 3 also contains freshwaterforested/shrub wetlands on site. The floodplain, floodway and wetlands maps are all presented on the following pages. Additionally, the entire site has a relatively low Productivity Index (PI) of 103. Farm land unit prices are primarily influenced by productivity.

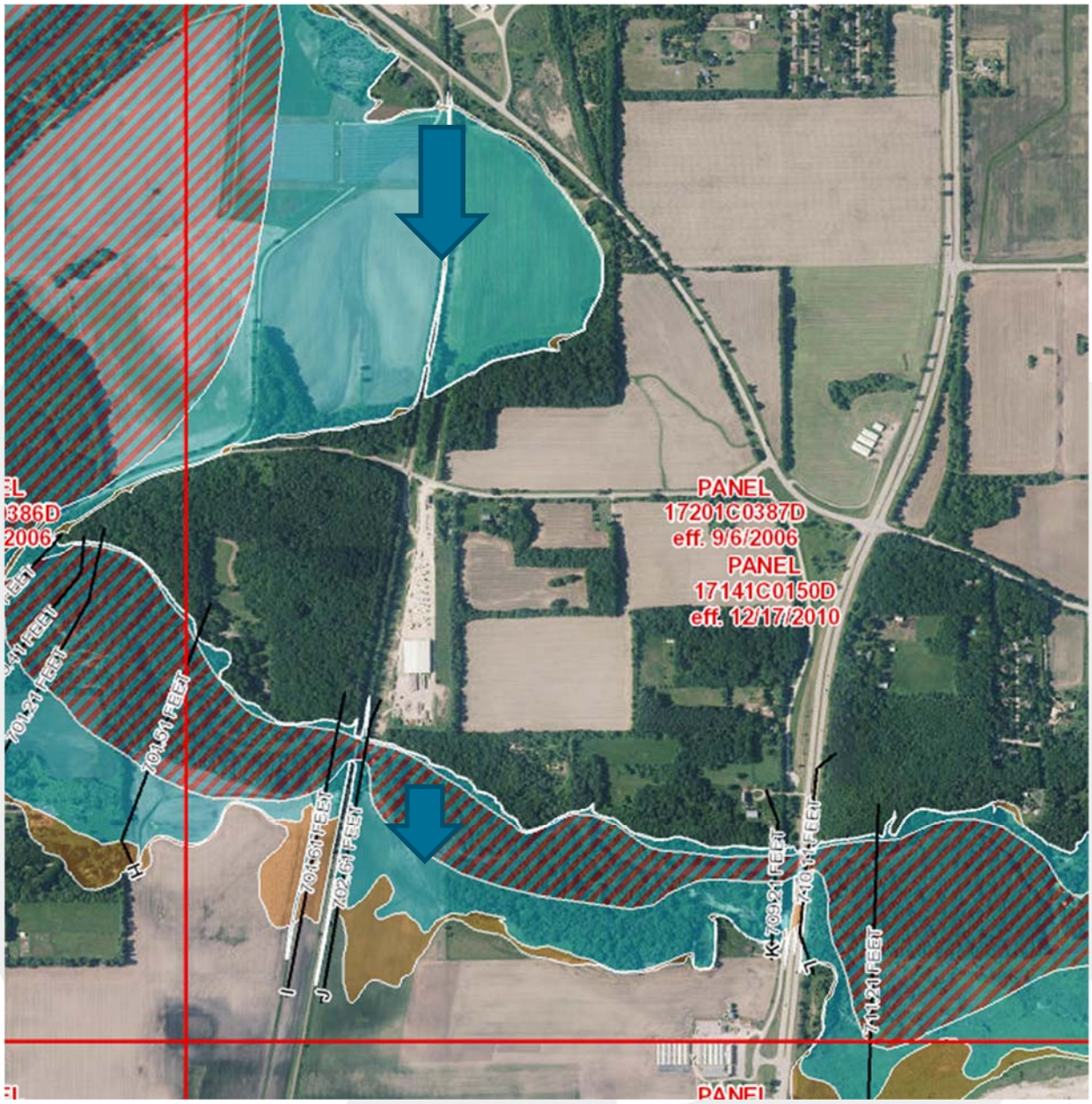
For soils in Illinois, optimum soil PI ranges from 47 to 147. Soil productivity ratings under optimum management for Illinois farmland on this scale are as follows.

Soil Rating	PI Range	Soil Class
Excellent	133-147	Class A
Good	117-132	Class B
Average	100-116	Class C
Fair	Less than 100	

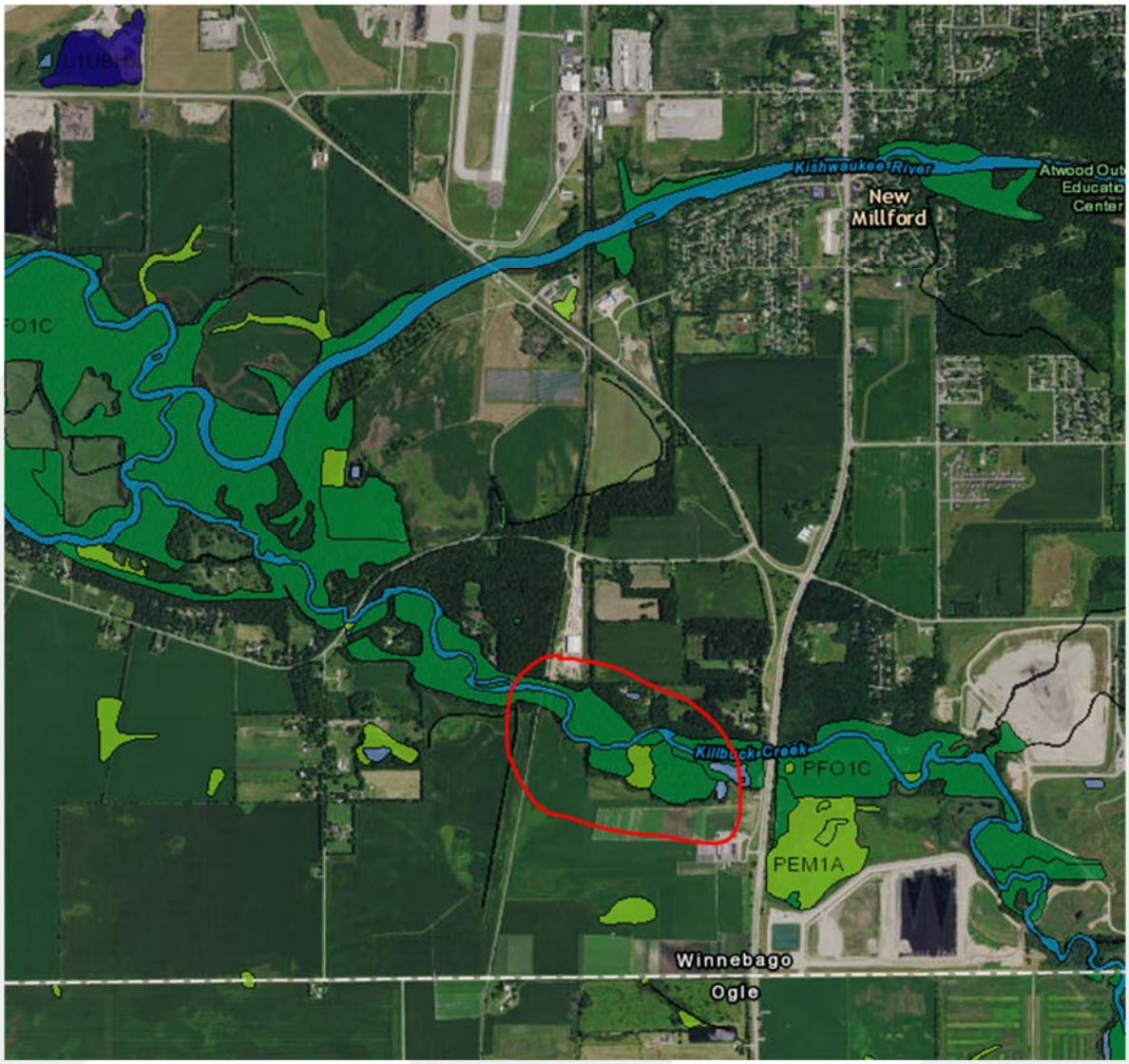
We have presented the adjoining property's surety map on the following pages as well.



Adjoining Properties 1 and 2 (and Contiguous Parcel) Parcel Map

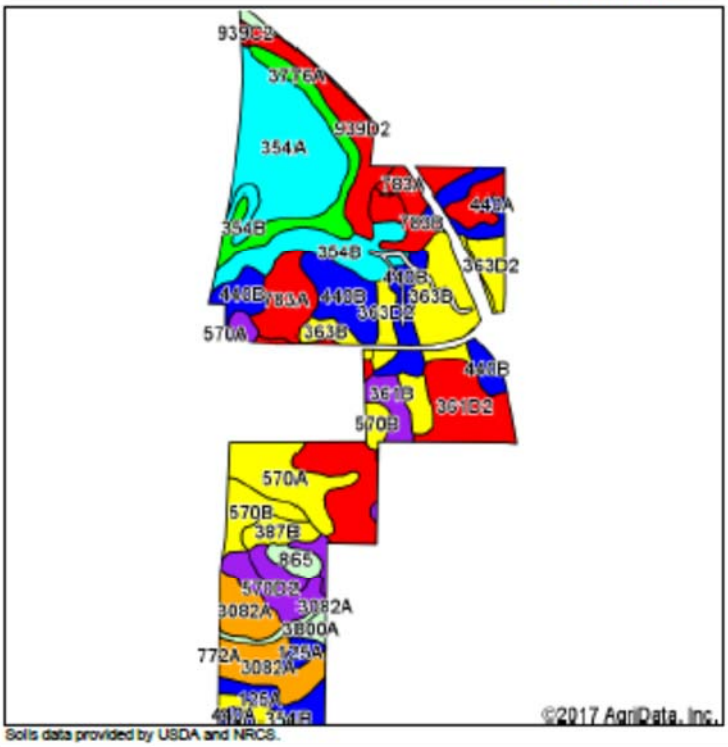


Adjoining Properties 1 and 2 (and Contiguous Parcel) Floodplain Map

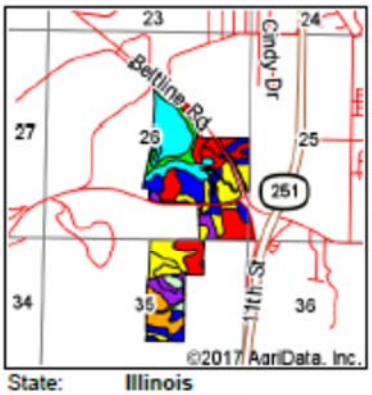


Adjoining Properties 1 and 2 (and Contiguous Parcel) Wetlands Map

Soils Map



Soils data provided by USDA and NRCS.



State: Illinois
County: Winnebago
Location: 26-43N-1E
Township: Rockford
Acres: 221.61
Date: 8/12/2017

Maps Provided by surety

Area Symbol: IL201, Soil Area Version: 12

Code	Soil Description	Acres	Percent of field	Il. State Productivity Index Legend	Subsoil rooting a	Corn Bu/A	Soybeans Bu/A	Wheat Bu/A	Oats Bu/A b	Sorghum c Bu/A	Alfalfa d hay, T/A	Grass-le gume e hay, T/A	Crop productivity index for optimum management
354A	Hononegah loamy coarse sand, 0 to 2 percent slopes	26.25	11.8%		FAV	114	37	47	56	0	0.00	3.51	84
**361D2	Kidder loam, 6 to 12 percent slopes, eroded	24.37	11.0%		FAV	**127	**43	**52	**60	0	**3.26	0.00	**96
**440B	Jasper silt loam, 2 to 5 percent slopes	20.62	9.3%		FAV	**173	**56	**70	**93	0	**5.71	0.00	**129
783A	Flagler sandy loam, 0 to 2 percent slopes	15.47	7.0%		FAV	129	44	51	60	0	2.88	0.00	96
3082A	Millington silt loam, 0 to 2 percent slopes, frequently flooded	14.42	6.5%		FAV	171	54	65	79	0	0.00	5.14	125
**363B	Griswold loam, 2 to 4 percent slopes	14.14	6.4%		FAV	**154	**51	**63	**76	0	**4.72	0.00	**116
570A	Martinsville silt loam, 0 to 2 percent slopes	14.05	6.3%		FAV	155	49	63	75	0	4.52	0.00	114
**354B	Hononegah loamy coarse sand, 2 to 6 percent slopes	13.59	6.1%		FAV	**113	**37	**47	**55	0	0.00	**3.47	**83
3776A	Comfrey loam, 0 to 2 percent slopes, frequently flooded	10.63	4.8%		FAV	185	61	69	89	0	0.00	5.52	138
**939D2	Rodman-Warsaw complex, 6 to 12 percent slopes, eroded	10.31	4.7%		UNF	**113	**40	**45	**54	0	0.00	**3.82	**88
**570B	Martinsville silt loam, 2 to 4 percent slopes	7.37	3.3%		FAV	**153	**49	**62	**74	0	**4.47	0.00	**113

surety

**363D2	Griswold loam, 6 to 12 percent slopes, eroded	6.67	3.0%		FAV	**145	**48	**60	**72	0	**4.44	0.00	**109
125A	Selma loam, 0 to 2 percent slopes	6.23	2.8%		FAV	176	57	70	90	0	0.00	6.38	129
**570D2	Martinsville silt loam, 6 to 12 percent slopes, eroded	6.00	2.7%		FAV	**144	**46	**59	**70	0	**4.20	0.00	**106
440A	Jasper silt loam, 0 to 2 percent slopes	5.59	2.5%		FAV	175	57	71	94	0	5.77	0.00	130
**783B	Flagler sandy loam, 2 to 6 percent slopes	4.38	2.0%		FAV	**128	**44	**50	**59	0	**2.85	0.00	**95
**361B	Kidder loam, 2 to 4 percent slopes	4.16	1.9%		FAV	**136	**46	**55	**63	0	**3.47	0.00	**101
**327D2	Fox silt loam, 6 to 12 percent slopes, eroded	3.74	1.7%		FAV	**139	**45	**55	**68	0	**3.26	0.00	**101
**387B	Ockley silt loam, 2 to 5 percent slopes	3.54	1.6%		FAV	**154	**49	**60	**78	0	**5.34	0.00	**114
865	Pits, gravel	2.52	1.1%		CROP YIELD DATA NOT AVAILABLE						.00	.00	
**290D2	Warsaw loam, 6 to 12 percent slopes, eroded	1.80	0.8%		FAV	**150	**48	**60	**76	0	**4.78	0.00	**111
W	Water	1.44	0.6%										
**332B	Billett sandy loam, 2 to 5 percent slopes	1.43	0.6%		FAV	**134	**44	**53	**63	0	**2.98	0.00	**98
3800A	Psamments, 0 to 2 percent slopes, frequently flooded	1.41	0.6%		CROP YIELD DATA NOT AVAILABLE						.00	.00	
802B	Orthents, loamy, undulating	1.11	0.5%		CROP YIELD DATA NOT AVAILABLE						.00	.00	
**939C2	Rodman-Warsaw complex, 4 to 6 percent slopes, eroded	0.38	0.2%		UNF	**116	**41	**47	**56	0	0.00	**3.94	**91
					Weighted Average	138.3	46.7	55.9	68.2	*-	2.62	1.67	103.4

Table: Optimum Crop Productivity Ratings for Illinois Soil by K.R. Olson and J.M. Lang, Office of Research, ACES, University of Illinois at Champaign-Urbana. Version: 1/2/2012 Amended Table S2 B811
Crop yields and productivity indices for optimum management (B811) are maintained at the following NRES web site:
https://www.ideals.illinois.edu/handle/2142/1027/
** Indexes adjusted for slope and erosion according to Bulletin 811 Table S3
a UNF = unfavorable; FAV = favorable
b Soils in the southern region were not rated for oats and are shown with a zero "0".
c Soils in the northern region or in both regions were not rated for grain sorghum and are shown with a zero "0".
d Soils in the poorly drained group were not rated for alfalfa and are shown with a zero "0".
e Soils in the well drained group were not rated for grass-legume and are shown with a zero "0".

*c: Using Capabilities Class Dominant Condition Aggregation Method

Soils data provided by USDA and NRCS. Soils data provided by University of Illinois at Champaign-Urbana.

It is important to note that Adjoining Property 2 and the third contiguous parcel have heavily wooded areas on their parcels. The following table outlines the characteristics of Adjoining Property 1-2 and the third contiguous parcel.

Adjoining Properties 1-2 with Third Parcel									
Status	PIN	Address	Sale Price	Site Size (AC)	PI Index	Improvements	Wooded Area %	Sale Price/AC	Sale Date
Sold	15-26-400-003, 15-26-400-001; 15-35-200-001	N/A	$846,555	214.7	103.4	None	25%	$3,943	Apr-17

We analyzed seven Control Area agricultural sales on similar lot sizes that sold within a reasonable time frame from Adjoining Properties 1 and 2's sale date, and adjusted the Control Area sales for market conditions using regression analysis to identify the appropriate monthly market conditions adjustment. We have excluded sales of strictly residential land and included sales of unimproved land that would be mainly used for agricultural purposes and had lower PIs like the Adjoining Properties. The result of our analysis for Solar Farm 7 is presented below.

CohnReznick Paired Sale Analysis		
	Potentially Impacted by Solar Farm	Adjusted Median Price Per Acre
Adjusted Control Area Sales	No: Not adjoining solar farm	$4,075
Adjoining Properties 1-2 (Test Area)	Yes: Solar Farm was completed by the sale date	$3,943
Difference		**-3.23%**

The unit sale price of Adjoining Properties 1 and 2 (Test Area) was slightly lower than the median adjusted unit sale price of Control Area Sales. Noting the relatively small price differential reflecting a 3% lower unit sale price, it does not appear that Solar Farm 7 negatively impacted the sales price of Adjoining Properties 1 and 2.

SOLAR FARM 8: LINCOLN SOLAR FARM, LAKE COUNTY, IN

Location: Lincoln Solar Farm in Lake County, IN

Coordinates: Latitude 41.274994, Longitude -87.153610

PIN: 45-13-30-200-010.000-030

Total Project Size: 20 AC

Recorded Owner: PLH Inc

Date Project Announced: January 2012

Date Project Completed: September 2012

Project Size: 1.5 MW

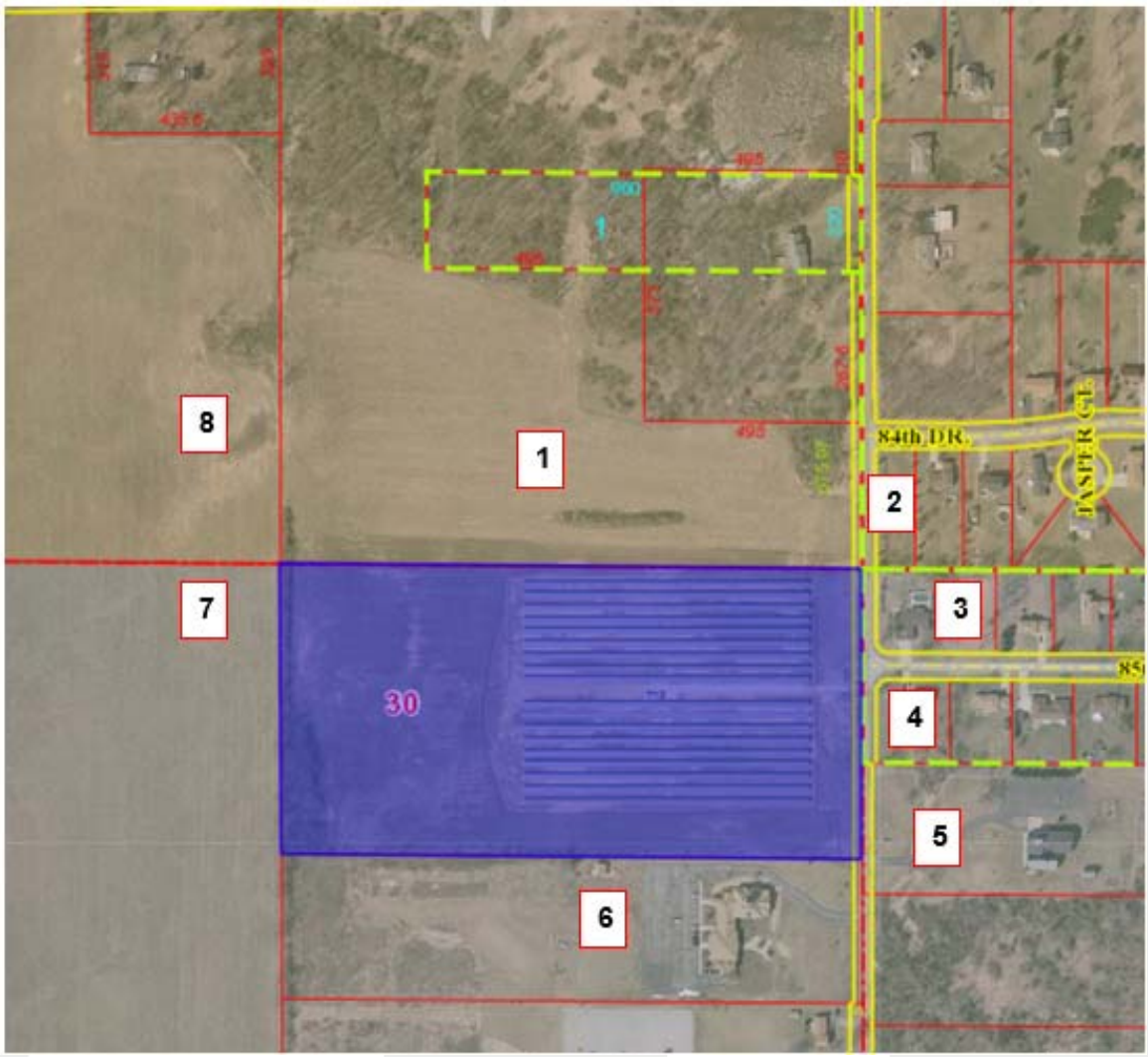
Output: 1.5 MW DC (1.98 MW AC)

This solar farm is located on the western side of Grand Boulevard, located approximately three miles east of the Town of Merrillville. The solar farm was developed by Ecos Energy, who is a subsidiary of Allco Renewable Energy Limited. This solar farm is ground mounted has the capacity for 1.5 Megawatts (MW) of power, which is enough to power 300 homes. This solar farm consists of 7,128 solar modules which are of a fixed tilt installation, and contains three inverters. The subject solar farm is separated from adjacent properties by a 6 foot chain link fence topped with barbed wire that surrounds all of the solar panels. There is no adjacent natural or landscaped vegetation. The panels are visible to all adjacent property owners. From our inspection, it does appear the neighbor to the south (Protection of the Virgin Mary Orthodox Church) had planted medium sized pines (6'). In their current growth, they do not block total view of the solar panels. See images on the following page.

Imagery Dated October 2017

Imagery Dated April 2017

The map below displays the parcels within the solar farm is located (shaded in blue). Properties adjoining this parcel are numbered for subsequent analysis.



Solar Farm 8 Adjoining Properties

For Solar Farm 8, there were no adjoining properties with sales that fit the criteria to perform a paired sales analysis.

SOLAR FARM 9: UNIVERSITY OF ILLINOIS SOLAR FARM, CHAMPAIGN, IL

Location: University of Illinois at Urbana-Champaign in Champaign County, IL

Coordinates: Latitude 40.08223, Longitude -88.244399

PIN: 03-20-25-226-006

Total Project Size: 20.79 AC

Recorded Owner: Phoenix Solar South Farms

Date Project Announced: November 12, 2012

Date Project Completed: November 2015

Output: 5.87 MW

The solar farm is located south of Windsor Road and east of US Route 45, near the University of Illinois, and is considered to be one of the largest university solar arrays in the country. The university signed a 10-year power purchase agreement with Phoenix South Solar Farms, LLC in November 2012 to purchase all electricity produced by the solar farm and deliver it directly to the campus grid. In addition, the university will own/receive all current and future Renewable Energy Certificates (RECs) and emission credits associated with energy from the solar farm. In addition, Phoenix South Solar Farms was hired to design, build, and operate the solar farm. The solar farm produces an estimated 7.86 million kilowatt-hours (kWh) annually or approximately two percent of the annual electrical demand for the university campus. Additional research estimates the solar farm will generate up to 91 percent of its original output even in year 20 of the project and collect energy for up to 40 years. The total cost of the project was approximately $15.5 million over 20 years, of which the Student Sustainability Committee provided $1.05 million USD and the Campus Utility Budget provided $4.25 million USD. There is natural vegetation of small trees and bushes to the east, north, and west. The map on the following page displays the parcels within the solar farm is located (outlined in pink). Properties adjoining this parcel are numbered for subsequent analysis.

Solar Farm 9 Adjoining Properties

Solar Farm 9 Adjoining Properties

For Solar Farm 9, there were no adjoining properties with sales that fit the criteria to perform a paired sales analysis.

SUMMARY OF ADJOINING USES

The table below summarizes each subject solar farm's adjoining uses.

Solar Farm	Parcel ID	Owner	Acreage % of Surrounding Agricultural Uses	Acreage % of Surrounding Residential Uses	Acreage % of Surrounding Industrial Uses	Acreage % of Surrounding Office Uses	Acreage % of Surrounding Other Uses	Average Distance from Panels to Improvements
Grand Ridge	34-22-100-000; 32-22-101-000	Missel, Eugene / Dorothy Ttee	97.60%	1.40%	0.00%	0.00%	1.00%	553
Portage	64-06-19-176-001.000-015	PLH LLC	65.50%	34.50%	0.00%	0.00%	0.00%	991
IMPA Frankton	48-08-06-500-012.001-020	IMPA	76.30%	5.70%	0.00%	0.00%	18.00%	236
Indy Solar III	49-13-13-113-001.000-200	Indy Solar Development LLC	97.70%	2.30%	0.00%	0.00%	0.00%	474
Valparaiso Solar LLC	64-09-07-152-001.000-019, 64-09-07-152-002.000-019	PLH Inc	81.60%	18.40%	0.00%	0.00%	0.00%	659
Middlebury Solar Farm	20-04-35-379-014.000-032	Plh Llc C/o Allco	0.00%	81.50%	15.60%	2.90%	0.00%	379
Rockford	15-26-151-003, -300-009, -176-003	Greater Rockford Airport Authority	50.30%	0.00%	49.70%	0.00%	0.00%	1,876
Lincoln Solar	45-13-30-200-010.000-030	PLH LLC	76.40%	2.60%	0.00%	0.00%	21.00%	567
University of Illinois	03-20-25-266-006	Phoenix Solar South Farms	60.60%	0.00%	0.00%	3.90%	35.50%	552

Overall, the vast majority of the surrounding acreage for each comparable solar farm, with the exception of the Middlebury Solar Farm, is made up of agricultural land, some of which have homesteads. There are also smaller single family home sites that adjoin to the solar farms we have studied. We have found that these comparable solar farms are sound comparables in terms of adjoining uses, location, and size.

Five of the seven studies with paired sale analyses reflected sales of property adjoining an existing solar farm in which the unit sale prices were effectively the same or higher (+0.10% to +27.36%) than the comparable Control Area sales that were not near any solar farms.

Considering this analysis, we conclude that there was no demonstrated impact on adjacent property values that was associated with proximity to solar farms.

MARKET COMMENTARY

We have additionally contacted market participants such as appraisers, brokers, and developers. Our conversations with these market participants are noted below.

We contacted the selling broker of the Adjoining Property 12 of the **Grand Ridge Solar Farm**, Tina Sergenti with Coldwell Banker, and were told that the proximity of the solar farm had no impact on the marketing time or selling price of the property.

We contacted the Lake County Indiana Assessor, Jerome Prince, to discuss the recent developments of solar farms in Indiana and how it would impact property values of adjacent properties. He directed us to his colleague, Robert Metz, who is familiar with the **Lincoln Solar Farm** in Merrillville. He stated that "there doesn't seem to be a major impact in my initial investigation." He also stated that "*sales in the homes to the east of that site have sold and haven't seen any value diminished*."

We spoke with James Allen, who is a county assessor in Elkhart County, Indiana. He stated that he conducted a study on residential properties with one acre and greater to see if there was any impact with the **Middlebury Solar Farm** *and found no impact on land or property values.*

We spoke with Ken Surface, a Senior Vice President of Nexus Group. Nexus Group is a large valuation group in Indiana and has been hired by 20 counties in Indiana regarding property assessments. Mr. Surface is familiar with the solar farm sites in Harrison County (**Lanesville Solar Farm**) and Monroe County (**Ellettsville Solar Farm**) and stated he has noticed *no impact on property values from these sites*.

We have spoken to Mendy Lassaline, the County Assessor for Perry County, Indiana. She stated that she has seen *no impact on land or residences from the solar farm* in her county (**IMPA Tell City Solar Park**).

We interviewed Patti St. Clair, the Chief Deputy to the St. Josephs County Assessor in Indiana. She stated that she has seen *no impact from the solar farm on land or properties* in her county (**Olive PV Solar Farm**). Additionally, she stated that *no appeals have come in to her office stating that this solar farm has had any negative effect.*

According to Betty Smith-Hanson, the Wayne County Assessor in Indiana, there has been *no impact on land or property values from the solar farm* in her county (**IMPA Richmond Solar Park**).

Finally, we interviewed Missy Tetrick, a Commercial Valuation Analyst for the Marion County Indiana Assessor. She mentioned the **Indy Solar I, II, and III sites** and stated that she saw *no impact on land or property prices from these solar farms*.

SOLAR FARM FACTORS ON HARMONY OF USE

The data from the solar farms included in this Property Value Impact Study, clearly indicates that solar farms are generally a compatible use with agricultural and residential uses.

The following section analyzes specific physical characteristics of solar farms and is based on research and our solar farm site visits.

Appearance: Most solar panels have a similar appearance to a greenhouse or single story residence and are usually not more than 10 feet high. As previously mentioned, developers generally surround a solar farm with a fence and often leave existing perimeter foliage, which minimizes the visibility of the farm. The physical characteristics of solar farms are compatible with adjoining agricultural and residential uses.

Noise: Solar panels in general are effectively silent and noise levels are minimal, similar to ambient noise. The only two sources of noise include the tracking motors and inverters housed in a sound-proofed container, which produce a quiet hum. However, neither source are typically heard outside the facility fence. Additionally, solar farms don't emit sound at nighttime.

Odor: Solar panels do not produce any byproduct or odor.

Traffic: The solar farm does not require regular maintenance from on-site employees and as a result does not attract traffic during daily operation aside from the initial construction and installation of the farm.

Hazardous Material: Modern solar panel arrays are constructed to U.S. government standards, and contain only aluminum, glass, silicon and EVA (a high-grade plastic); all of these materials are recyclable.

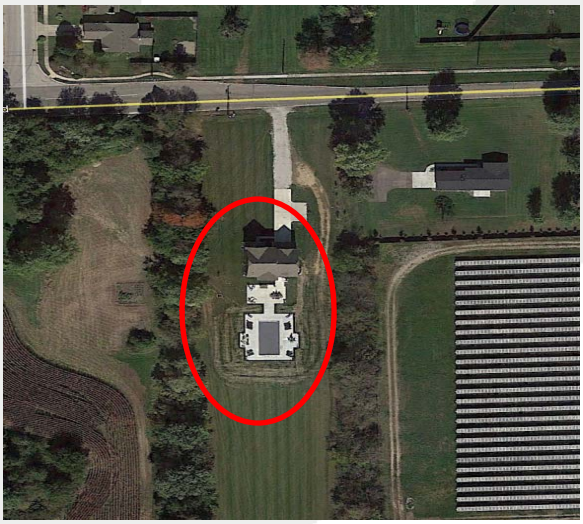
COMPATIBILITY WITH EXISTING USES

We have examined multiple instances where adjoining property owners have developed homes next to an operational solar farm, which shows that the presence of solar farms has not deterred new development. In Solar Farm 4, the adjacent land to the west was purchased and subsequently developed with a large estate home – after the solar panels had been in operation for years. Supporting aerial imagery is presented below.

Portage Solar Farm (Solar Farm 2)
October 2015

Portage Solar Farm (Solar Farm 2)
October 2016

Dominion INDY III Solar Farm (Solar Farm 4)
September 2014



Dominion INDY III Solar Farm (Solar Farm 4)
October 2016

SUMMARY AND FINAL CONCLUSIONS

We have reviewed published methodology for measuring impact on property values as well as published studies that analyzed the impact of solar farms on property values. We have also interviewed market participants to give us additional insight as to how the market evaluates farm land and single family homes with views of the solar farm. These studies found little to no measurable and consistent difference between the Test Area Sales and the Control Area Sales attributed to the solar farms, and are generally considered a compatible use. We then can conclude that since the Adjoining Property Sales (Test Area Sales) were not adversely affected by their proximity to the solar farm, that properties surrounding other proposed solar farms operating in compliance with all regulatory standards will similarly not be adversely affected, in either the short or long term periods.

The purpose of this property value impact study is to determine whether the presence of a solar farm has caused a measurable and consistent difference in values between the Test Area Sales and the Control Area Sales. A summary of our findings for the paired sales analyses is presented below.

CohnReznick Impact Study Analysis Conclusions

	Solar Farm	Adj. Property Number	Adjoining Property Sale (Test Area) Price Per Unit	Control Area Sales Median Price Per Unit	% Difference	Impact Found
1	Grand Ridge Solar	12	$79.90	$74.35	+7.5%	No Impact
2	Portage Solar	1	$8,000	$7,674	+4.3%	No Impact
	Portage Solar	7	$84.35	$84.27	+0.1%	No Impact
3	IMPA Frankton	2	$25.58	$28.42	+0.6%	No Impact
	IMPA Frankton	7	$52.40	$51.47	+1.8%	No Impact
4	Indy Solar III	Group 1	$59.81	$57.84	+3.4%	No Impact
	Indy Solar III	Group 2	$69.14	$68.67	+0.7%	No Impact
5	Valparaiso Solar LLC	10	$82.42	$79.95	+3.1%	No Impact
	Valparaiso Solar LLC	14	$62.11	$64.07	-3.1%	No Impact
6	Middlebury Solar	10	$132.79	$104.23	+27.4%	No Impact
7	Rockford Solar	1 & 2	$3,943	$4,075	-3.2%	No Impact
Average Variance in Sale Prices for Test to Control Areas					**+3.9%**	

Based upon our examination, research, and analyses of the existing solar farm uses, the surrounding areas, and an extensive market database, we have concluded that ***no consistent negative impact has occurred to adjacent property that could be attributed to proximity to the adjacent solar farm***, with regard to unit sale prices or other influential market indicators. This conclusion has been confirmed by numerous County Assessors who have also investigated this use's potential impact.

If you have any questions or comments, please contact the undersigned. Thank you for the opportunity to be of service.

Respectfully submitted,

CohnReznick, LLP

Patricia L. McGarr, MAI, CRE, FRICS
National Director - Valuation Advisory Services
Certified General Real Estate Appraiser
Illinois License No. #553.000621
Expires 9/30/2019
Indiana License No. #CG49600131
Expires 6/30/2018

Martin D. Broerman, MAI
Senior Manager
Certified General Real Estate Appraiser
Illinois License No. #553.002252
Expires 9/30/2019
Indiana License No. #CG41400050
Expires 6/30/2018

Andrew R. Lines, MAI
Principal
Certified General Real Estate Appraiser
Illinois License No. #553.001841
Expires 9/30/2019
Indiana License No. #CG41500037
Expires 6/30/2018

Sonia K. Singh
Manager

CERTIFICATION

We certify that, to the best of our knowledge and belief:

1. The statements of fact and data reported are true and correct.
2. The reported analyses, opinions, and conclusions in this consulting report are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions.
3. We have no present or prospective interest in the property that is the subject of this report and no personal interest with respect to the parties involved.
4. We have performed no services, as an appraiser or in any other capacity, regarding the property that is the subject of this report within the three-year period immediately preceding acceptance of this assignment.
5. We have no bias with respect to the property that is the subject of this report or the parties involved with this assignment.
6. Our engagement in this assignment was not contingent upon developing or reporting predetermined results.
7. Our compensation for completing this assignment is not contingent upon the development or reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this report.
8. Our analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with the requirements of the Code of Professional Ethics and Standards of Professional Appraisal Practice of the Appraisal Institute, which includes the Uniform Standards of Professional Appraisal Practice (USPAP).
9. The use of this report is subject to the requirements of the Appraisal Institute relating to review by its duly authorized representatives.
10. Patricia L. McGarr, MAI, CRE, FRICS has made a personal inspection of the properties that is the subject of this work. Andrew R. Lines, MAI, Martin D. Broerman, MAI, and Sonia K. Singh have not made a personal inspection of the properties.
11. We have not relied on unsupported conclusions relating to characteristics such as race, color, religion, national origin, gender, marital status, familial status, age, and receipt of public assistance income, handicap, or an unsupported conclusion that homogeneity of such characteristics is necessary to maximize value.
12. Michael F. Antypas provided significant appraisal consulting assistance to the persons signing this certification.
13. We have experience in reviewing properties similar to the subject and are in compliance with the Competency Rule of USPAP.
14. As of the date of this report, Patricia L. McGarr, MAI, CRE, FRICS, Andrew R. Lines, MAI, and Martin D. Broerman, MAI have completed the continuing education program of the Appraisal Institute.
15. As of the date of this report, Sonia K. Singh has completed the Standards and Ethics Education Requirements for Candidates of the Appraisal Institute.

If you have any questions or comments, please contact the undersigned. Thank you for the opportunity to be of service.

Respectfully submitted,

CohnReznick, LLP

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Indiana License No. #CG41500037
Expires 6/30/2018

Sonia K. Singh
Manager

ASSUMPTIONS AND LIMITING CONDITIONS

This report is based on the following assumptions, except as otherwise noted in the report.

1. The title is marketable and free and clear of all liens, encumbrances, encroachments, easements and restrictions. The property is under responsible ownership and competent management and is available for its highest and best use.
2. There are no existing judgments or pending or threatened litigation that could affect the value of the property.
3. There are no hidden or undisclosed conditions of the land or of the improvements that would render the property more or less valuable. Furthermore, there is no asbestos in the property.
4. The revenue stamps placed on any deed referenced herein to indicate the sale price are in correct relation to the actual dollar amount of the transaction.
5. The property is in compliance with all applicable building, environmental, zoning, and other federal, state and local laws, regulations and codes.
6. The information furnished by others is believed to be reliable, but no warranty is given for its accuracy.

This report is subject to the following limiting conditions, except as otherwise noted in the report.

1. An appraisal is inherently subjective and represents our opinion as to the value of the property appraised.
2. The conclusions stated in our appraisal apply only as of the effective date of the appraisal, and no representation is made as to the effect of subsequent events.
3. No changes in any federal, state or local laws, regulations or codes (including, without limitation, the Internal Revenue Code) are anticipated.
4. No environmental impact studies were either requested or made in conjunction with this appraisal, and we reserve the right to revise or rescind any of the value opinions based upon any subsequent environmental impact studies. If any environmental impact statement is required by law, the appraisal assumes that such statement will be favorable and will be approved by the appropriate regulatory bodies.
5. Unless otherwise agreed to in writing, we are not required to give testimony, respond to any subpoena or attend any court, governmental or other hearing with reference to the property without compensation relative to such additional employment.
6. We have made no survey of the property and assume no responsibility in connection with such matters. Any sketch or survey of the property included in this report is for illustrative purposes only and should not be considered to be scaled accurately for size. The appraisal covers the property as described in this report, and the areas and dimensions set forth are assumed to be correct.
7. No opinion is expressed as to the value of subsurface oil, gas or mineral rights, if any, and we have assumed that the property is not subject to surface entry for the exploration or removal of such materials, unless otherwise noted in our appraisal.
8. We accept no responsibility for considerations requiring expertise in other fields. Such considerations include, but are not limited to, legal descriptions and other legal matters such as legal title, geologic considerations such as soils and seismic stability, and civil, mechanical, electrical, structural and other engineering and environmental matters.

9. The distribution of the total valuation in the report between land and improvements applies only under the reported highest and best use of the property. The allocations of value for land and improvements must not be used in conjunction with any other appraisal and are invalid if so used. The appraisal report shall be considered only in its entirety. No part of the appraisal report shall be utilized separately or out of context.
10. Neither all nor any part of the contents of this report (especially any conclusions as to value, the identity of the appraisers, or any reference to the Appraisal Institute) shall be disseminated through advertising media, public relations media, news media or any other means of communication (including without limitation prospectuses, private offering memoranda and other offering material provided to prospective investors) without the prior written consent of the person signing the report.
11. Information, estimates and opinions contained in the report, obtained from third-party sources are assumed to be reliable and have not been independently verified.
12. Any income and expense estimates contained in the appraisal report are used only for the purpose of estimating value and do not constitute predictions of future operating results.
13. If the property is subject to one or more leases, any estimate of residual value contained in the appraisal may be particularly affected by significant changes in the condition of the economy, of the real estate industry, or of the appraised property at the time these leases expire or otherwise terminate.
14. No consideration has been given to personal property located on the premises or to the cost of moving or relocating such personal property; only the real property has been considered.
15. The current purchasing power of the dollar is the basis for the value stated in our appraisal; we have assumed that no extreme fluctuations in economic cycles will occur.
16. The value found herein is subject to these and to any other assumptions or conditions set forth in the body of this report but which may have been omitted from this list of Assumptions and Limiting Conditions.
17. The analyses contained in the report necessarily incorporate numerous estimates and assumptions regarding property performance, general and local business and economic conditions, the absence of material changes in the competitive environment and other matters. Some estimates or assumptions, however, inevitably will not materialize, and unanticipated events and circumstances may occur; therefore, actual results achieved during the period covered by our analysis will vary from our estimates, and the variations may be material.
18. The *Americans with Disabilities Act (ADA)* became effective January 26, 1992. We have not made a specific survey or analysis of any property to determine whether the physical aspects of the improvements meet the *ADA* accessibility guidelines. In as much as compliance matches each owner's financial ability with the cost to cure the non-conforming physical characteristics of a property, we cannot comment on compliance to *ADA*. Given that compliance can change with each owner's financial ability to cure non-accessibility, the value of the subject does not consider possible non-compliance. A specific study of both the owner's financial ability and the cost to cure any deficiencies would be needed for the Department of Justice to determine compliance.
19. The appraisal report is prepared for the exclusive benefit of the Client, its subsidiaries and/or affiliates. It may not be used or relied upon by any other party. All parties who use or rely upon any information in the report without our written consent do so at their own risk.
20. No studies have been provided to us indicating the presence or absence of hazardous materials on the subject property or in the improvements, and our valuation is predicated upon the assumption that the

subject property is free and clear of any environment hazards including, without limitation, hazardous wastes, toxic substances and mold. No representations or warranties are made regarding the environmental condition of the subject property and the person signing the report shall not be responsible for any such environmental conditions that do exist or for any engineering or testing that might be required to discover whether such conditions exist. Because we are not experts in the field of environmental conditions, the appraisal report cannot be considered as an environmental assessment of the subject property.

21. The person signing the report may have reviewed available flood maps and may have noted in the appraisal report whether the subject property is located in an identified Special Flood Hazard Area. We are not qualified to detect such areas and therefore do not guarantee such determinations. The presence of flood plain areas and/or wetlands may affect the value of the property, and the value conclusion is predicated on the assumption that wetlands are non-existent or minimal.
22. CohnReznick is not a building or environmental inspector. CohnReznick does not guarantee that the subject property is free of defects or environmental problems. Mold may be present in the subject property and a professional inspection is recommended.
23. The appraisal report and value conclusion for an appraisal assumes the satisfactory completion of construction, repairs or alterations in a workmanlike manner.
24. CohnReznick an independently owned and operated company, has prepared the appraisal for the specific purpose stated elsewhere in the report. The intended use of the appraisal is stated in the General Information section of the report. The use of the appraisal report by anyone other than the Client is prohibited except as otherwise provided. Accordingly, the appraisal report is addressed to and shall be solely for the Client's use and benefit unless we provide our prior written consent. We expressly reserve the unrestricted right to withhold our consent to your disclosure of the appraisal report (or any part thereof including, without limitation, conclusions of value and our identity), to any third parties. Stated again for clarification, unless our prior written consent is obtained, no third party may rely on the appraisal report (even if their reliance was foreseeable).
25. The conclusions of this report are estimates based on known current trends and reasonably foreseeable future occurrences. These estimates are based partly on property information, data obtained in public records, interviews, existing trends, buyer-seller decision criteria in the current market, and research conducted by third parties, and such data are not always completely reliable. CohnReznick and the undersigned are not responsible for these and other future occurrences that could not have reasonably been foreseen on the effective date of this assignment. Furthermore, it is inevitable that some assumptions will not materialize and that unanticipated events may occur that will likely affect actual performance. While we are of the opinion that our findings are reasonable based on current market conditions, we do not represent that these estimates will actually be achieved, as they are subject to considerable risk and uncertainty. Moreover, we assume competent and effective management and marketing for the duration of the projected holding period of this property.
26. All prospective value estimates presented in this report are estimates and forecasts which are prospective in nature and are subject to considerable risk and uncertainty. In addition to the contingencies noted in the preceding paragraph, several events may occur that could substantially alter the outcome of our estimates such as, but not limited to changes in the economy, interest rates, and capitalization rates, behavior of consumers, investors and lenders, fire and other physical destruction, changes in title or

conveyances of easements and deed restrictions, etc. It is assumed that conditions reasonably foreseeable at the present time are consistent or similar with the future.

27. While this appraisal has been proofed for typographical errors, mathematical inaccuracies, and other discrepancies, others may be discovered in subsequent reviews performed by the client or their designated agent. We reserve the right to correct any typographical errors, mathematical inaccuracies, or other discrepancies that may affect the estimate of value contained in the report. These corrections will be corrected promptly upon the written request of the client.

ADDENDUM A:
APPRAISER QUALIFICATIONS

Patricia L. McGarr, MAI, CRE, FRICS, CRA

Principal,
National Director, Valuation Advisory Services

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Patricia L. McGarr, MAI, CRE, FRICS, CRA, is a principal and National Director of CohnReznick Advisory Group's Valuation Advisory Services practice who is based in Chicago. Pat's experience includes market value appraisals of varied property types for acquisition, condemnation, mortgage, estate, ad valorem tax, litigation, zoning, and other purposes. Pat has been involved in the real estate business since 1980. From June 1980 to January 1984, she was involved with the sales and brokerage of residential and commercial properties. Her responsibilities during this time included the formation, management, and training of sales staff in addition to her sales, marketing, and analytical functions. Of special note was her development of a commercial division for a major Chicago-area brokerage firm.

Since January 1984, Pat has been exclusively involved in the valuation of real estate. Her experience includes the valuation of a wide variety of property types including residential, commercial, industrial, and special purpose properties including such diverse subjects as quarries, marinas, riverboat gaming sites, shopping centers, manufacturing plants, and office buildings. She is also experienced in the valuation of leasehold and leased fee interests. Pat has performed appraisal assignments throughout Illinois and the Chicago Metropolitan area as well as Wisconsin, Indiana, Michigan, New York, New Jersey, California, Nevada, Florida, Utah, Texas, and Ohio. Pat has gained substantial experience in the study and analysis of the establishment and expansion of sanitary landfills in various metropolitan areas including the preparation of real estate impact studies to address criteria required by Senate Bill 172. She has also developed an accepted format for allocating value of a landfill operation between real property, landfill improvements, and franchise (permits) value.

Over the past several years, Pat has developed a valuation group that specializes in serving utility companies establish new utility corridors for electric power transmission and pipelines. This includes determining acquisition budgets, easement acquisitions, and litigation support. Pat has considerable experience in performing valuation impact studies on potential detrimental conditions and has studied properties adjoining landfills, waste transfer stations, stone quarries, cellular towers, schools, electrical power transmission lines, "Big Box" retail facilities, levies, properties with restrictive covenants, landmark districts, environmental contamination, airports, material defects in construction, stigma, and loss of view amenity for residential high rises.

Pat has qualified as an expert valuation witness in numerous local, state and federal courts.

Pat's has participated in specialized real estate appraisal education and has completed more than 50 courses and seminars offered by the Appraisal Institute totaling more than 600 classroom hours, including real estate transaction courses as a prerequisite to obtaining a State of Illinois Real Estate Salesman License.

Pat has earned the professional designations of Counselors of Real Estate (CRE), Member of the Appraisal Institute (MAI), Fellow of Royal Institution of Chartered Surveyors (FRICS) and Certified Review Appraiser (CRA).

She is also a certified general real estate appraiser with active licenses in California, District of Columbia, Florida, Illinois, Indiana, Las Vegas, Maryland, New Jersey, New York, Texas and Wisconsin.

Education

- North Park University: Bachelor of Science, General Studies

Professional Affiliations

- National Association of Realtors
- CREW Commercial Real Estate Executive Women
- IRWA International Right Of Way Association

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Andrew R. Lines, MAI, is a partner for CohnReznick Advisory Group's Valuation Advisory practice who is based in the Chicago office and has been a CohnReznick employee for over six years. Andrew has been involved in the real estate business for more than 15 years and has performed valuations on a wide variety of real property types including single- and multi-unit residential (including LIHTC), student housing, office, retail, industrial, mixed-use and special purpose properties including landfills, waste transfer stations, marinas, hospitals, universities, telecommunications facilities, data centers, self- storage facilities, racetracks, CCRCs, and railroad corridors. He is also experienced in the valuation of leasehold, leased fee, and partial interests, as well as purchase price allocations (GAAP, IFRS and IRC 1060) for financial reporting.

Valuations have been completed nationwide for a variety of assignments including mortgage financing, litigation, tax appeal, estate gifts, asset management, workouts, and restructuring, as well as valuation for financial reporting including purchase price allocations (ASC 805), impairment studies, and appraisals for investment company guidelines and REIS standards. Andrew has qualified as an expert witness, providing testimony for eminent domain cases in the states of IL and MD. Andrew has also performed appraisal review assignments for accounting purposes (audit support), asset management, litigation and as an evaluator for a large Midwest regional bank.

Andrew has earned the professional designation of Member of the Appraisal Institute (MAI). He has also qualified for certified general commercial real estate appraiser licenses in Arizona, California, Maryland, Florida, Wisconsin, Georgia, Illinois, Indiana, New Jersey and New York. Temporary licenses have been granted in Connecticut, Colorado, Ohio, Pennsylvania, Idaho, Kansas, Minnesota and South Carolina.

Education

- Syracuse University: Bachelor of Fine Arts

Professional Affiliations

- Chicago Chapter of the Appraisal Institute - Alternate Regional Representative (2016 – Present)
- International Real Estate Management (IREM)
- National Council of Real Estate Investment Fiduciaries (NCREIF)

Community Involvement

- Fellows Alumni Network - World Business Chicago, Founding member
- Syracuse University Regional Council – Active Member
- Syracuse University Alumni Association of Chicago, Past Board member
- Chicago Friends School – Board Member

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Martin D. Broerman, MAI is a senior manager in CohnReznick Advisory Group's Valuation Advisory Services practice and is based in the Chicago office. He has been involved in the commercial real estate valuation business for more than 11 years. Martin's experience includes market value appraisals of varied property types for portfolio analysis, acquisition/disposition, condemnation, financing, estate planning, tax appeal, litigation, and other purposes. He performs valuations on a wide variety of real property types including retail, industrial, office, residential, and special purpose properties.

Martin's retail assignments have ranged from freestanding retail stores to shopping centers of all varieties. His industrial assignments include distribution warehouses, cold storage warehouses, R&D facilities, truck terminals, manufacturing facilities and data centers. Martin's office assignments include hi-rise downtown offices, low- to mid-rise suburban offices, and medical office buildings. His residential assignments include single family homes, apartment projects of all sizes, residential subdivisions, and condominium developments/conversions. Martin's specialized real estate assignments include portfolio analysis, utility corridors, right-of-way projects, pipelines, mixed-use properties, ground leaseholds, healthcare facilities, parking garages, vacant land, and various easement valuations. His extensive experience in commercial real estate is focused on properties located in the Chicago metropolitan area, but includes significant assets located nationwide.

Martin has served an array of clients, including municipalities, lenders, law firms, investment firms, utility companies, private corporations, educational institutions, developers, and various governmental agencies including the Illinois Department of Transportation (IDOT) and General Services Administration (GSA).

Martin is a certified general real estate appraiser with active licenses in Illinois, Indiana and Ohio.

Education

- DePaul University: Bachelor of Science, Commerce, Finance
- Triton College: Associate of Arts, Business Administration

Professional Affiliations

- Appraisal Institute
- International Right-of-Way Association

Sonia K. Singh

Manager, Valuation Advisory Services

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Sonia K. Singh is a manager in CohnReznick Advisory Group's Valuation Advisory practice who is based in the Bethesda office. She has been engaged in real estate valuation and other real estate consulting services for the past six years and has valued over $2.5 billion in real property.

She is adept at valuing a variety of real estate property types across the United States, including the following: right-of-way acquisitions for utility corridors; single- and multi-tenant industrial buildings; historic redevelopment projects; freestanding and retail shopping centers; trophy, class A office buildings; continuing care retirement communities; marinas; car dealerships; athletic clubs; boutique and luxury flag hotels with for-sale residential villas; and medical office buildings with a surgical center. Real estate appraisals have been prepared for pending litigation matters, estate planning, estate & gift tax purposes, and asset management.

In addition to real estate appraisal services, she has completed over 1,500 hours related to generating purchase price allocations for the acquisition of tangible and intangible assets for financial reporting purposes under the guidance of ASC 805. Other experienced real estate consulting services include useful life analysis, appraisal review, statistical analysis, and financial forecasts for development projects. Several impact studies were prepared by her and her peers measuring the impact, if any, of economic and environmental influences on property values.

Other services she provided significant assistance with include useful life analysis of real estate and valuation of minority interests for gift and estate tax purposes. In addition, she has developed several financial forecasts for real estate development to illustrate profit measures as well as return on capital for potential investors.

Sonia is working towards obtaining a Certified General Real Estate Appraiser license for the state of Virginia. She has also completed the following actuarial exams: Probability, Financial Mathematics, and Models for Financial Economics.

Education

- University of Illinois: Bachelor of Science, Actuarial Science

Professional Affiliations

- Appraisal Institute, Practicing Affiliate
- Urban Land Institute, Associate Member

Michael F. Antypas

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Michael Antypas is a consultant in CohnReznick Advisory Group's Valuation Advisory Services practice and is based in the Bethesda office. He has assisted other associates and appraisers in the valuation of a variety of retail shopping centers, hotels, market rate and restricted rental apartment properties, Class A office complexes with GSA tenants, mixed-use properties, developable land, and single family rental home portfolios owned by REITs. He has also completed solar farm impact studies, appraisals for eminent domain disputes, as well as purchase price allocations on various senior living facilities, medical office buildings, and retail centers. In addition, Michael is certified in working with Argus Enterprise valuation software. He is a practicing affiliate in the Appraisal Institute and is working towards becoming a Certified General Real Estate Appraiser.

He graduated from the Villanova School of Business in May of 2016. Some of his other experience working in Real Estate originated through interning with commercial brokers. Throughout his senior year in college, Michael interned with Newmark Grubb Knight Frank as a Capital Markets intern. There he helped create and revise many marketing packages for the firm's senior managing directors. He also assisted in developing underwriting models and projections for offering memorandums. He also worked with a boutique restaurant broker in Washington D.C, Papadopoulos Properties where he compiled market research for his client's use and surveyed prospective restaurants to gauge their interest in expanding to the Washington D.C. market.

Education

- Villanova University: Bachelor of Business Administration, Finance and Real Estate, Minor in Business Analytics

Certifications

- Argus Enterprise Certified

Professional Affiliations

- Appraisal Institute, Practicing Affiliate

CLEANENERGYRESULTS

Questions & Answers

Ground-Mounted Solar Photovoltaic Systems

Westford Solar Park, photo courtesy of EEA

June 2015

Massachusetts Department of Energy Resources
Massachusetts Department of Environmental Protection
Massachusetts Clean Energy Center

Table of Contents

Background

Encouraging increased use of solar photovoltaic (PV) technology, which converts sunlight directly into electricity, is a key priority for state clean energy efforts. The environmental benefits of solar PV abound. Unlike conventional fossil fuel power generation (such as coal, gas and oil), generating electricity with ground-mounted solar PV involves no moving parts, uses no water, and produces no direct emissions of climate-warming greenhouse gases.

Solar PV environmental and energy benefits, combined with strong incentives available for solar projects, have significantly increased the use of this technology recently. The Commonwealth's vibrant solar industry has a variety of ownership and financing options for Massachusetts residents and businesses looking to install solar PV systems. Purchasing a solar PV system generally involves upfront installation and equipment costs, but there are significant upfront and production-based incentives[1].

As the Massachusetts clean energy sector grows, the Baker Administration is working to ensure that solar PV and other clean energy technologies are sited in a way that is most protective of human health and the environment, and minimizes impacts on scenic, natural, and historic resources.

Purpose of Guide

This guide is intended to help local decision-makers and community members answer common questions about ground-mounted solar PV development. Ground-mounted solar PV has many proven advantages and there has been a steady growth of well received projects in the Commonwealth. However, these systems are still relatively new and unfamiliar additions to our physical landscape.

This guide focuses on questions that have been raised concerning the installation and operation of ground-mounted solar PV projects. It provides summaries and links to existing research and studies that can help understand solar PV technology in general and ground-mounted solar in particular.

Solar PV panels can and are of course also installed on buildings[2], car ports or light poles. This guide focuses on ground-mounted systems since most questions relate to this type of solar installation.

Developed through the partnership of the Massachusetts Department of Energy Resources (DOER), the Massachusetts Department of Environmental Protection (MassDEP), and the Massachusetts Clean Energy Center (MassCEC), this guide draws from existing recent literature in the United States and abroad and is not the result of new original scientific studies. The text was reviewed by the National Renewable Energy Laboratory (NREL).

As more or new information becomes available, the guide will be updated and expanded accordingly.

[1] For a comprehensive overview, start at http://masscec.com/index.cfm/page/Solar-PV/pid/12584

[2] For an overview of the multiple options for siting PV and buildings in the same footprint, see the Solar Ready Buildings Planning Guide, NREL, 2009.

Solar PV Projects Are Sited Locally

The siting authority for solar PV projects resides at the local - not the state - level. One purpose of this guide is to inform and facilitate local efforts to expand clean energy generation in a sustainable way, and provide a consolidated source of existing research and information that addresses common questions faced by communities.

As part of the Green Communities Act of 2008, DOER and the Massachusetts Executive Office of Energy and Environmental Affairs (EOEEA) developed a model zoning by-law/ordinance called "as-of-right siting" that does not require a special permit. It is designed to help communities considering adoption of zoning for siting of large-scale solar. This model zoning by-law/ordinance provides standards for the placement, design, construction, operation, monitoring, modification and removal of new large-scale ground-mounted solar PV installations. The latest version of the model by-law was published in December 2014[3]. It provides useful information that will not be repeated extensively in this guide.

Consider Impacts of Other Possible Developments at Site

Use of land for the purpose of solar photovoltaic power generation should be compatible with most other types of land usage. However, DOER strongly discourages designating locations that require significant tree cutting because of the important water management, cooling and climate benefits trees provide. DOER encourages designating locations in industrial and commercial districts, or on vacant, disturbed land.

When assessing the impact of new ground-mounted solar arrays, communities and other stakeholders should carefully consider other types of development that might take place in a particular location if there was no solar installation. Stakeholders should bear in mind the higher or lower impacts that those alternatives might have in terms of noise, air pollution or landscape. These alternative impacts fall outside the scope of this guide, but are relevant when looking at individual projects.

[3] http://www.mass.gov/eea/docs/doer/green-communities/grant-program/model-solar-zoning.pdf

Hazardous Materials

The Question: What, if any, health risks do chemicals used to manufacture solar panels and other devices used in solar PV arrays pose if they are released into the environment?

Bottom Line: Because PV panel materials are enclosed, and don't mix with water or vaporize into the air, there is little, if any, risk of chemical releases to the environment during normal use. The most common type of PV panel is made of tempered glass, which is quite strong. They pass hail tests, and are regularly installed in Arctic and Antarctic conditions. Only in the unlikely event of a sufficiently hot fire is there a slight chance that chemicals could be released. This is unlikely because most residential fires are not hot enough to melt PV components and PV systems must conform to state and federal fire safety, electrical and building codes.

Transformers used at PV installations, that are similar to the ones used throughout the electricity distribution system in cities and towns, have the potential to release chemicals if they leak or catch fire. Transformer coolants containing halogens have some potential for toxic releases to the air if combusted. However, modern transformers typically use non-toxic coolants, such as mineral oils. Potential releases from transformers using these coolants at PV installations are not expected to present a risk to human health.

More Information: Ground-mounted PV solar arrays are typically made up of panels of silicon solar cells covered by a thin layer of protective glass, which is attached to an inert solid underlying substance (or "substrate"). While the vast majority of PV panels currently in use are made of silicon, certain types of solar cells may contain cadmium telluride (CdTe), copper indium diselenide (CIS), and gallium arsenide (GaAs).

All solar panel materials, including the chemicals noted above, are contained in a solid matrix, insoluble and non-volatile at ambient conditions, and enclosed. Therefore, releases to the ground from leaching, to the air from volatilization during use, or from panel breakage, are not a concern. Particulate emissions could only occur if the materials were ground to a fine dust, but there is no realistic scenario for this. Panels exposed to extremely high heat could emit vapors and particulates from PV panel components to the air. However, researchers have concluded that the potential for emissions derived from PV components during typical fires is limited given the relatively short-duration of most fires and the high melting point (>1000 degrees Celsius) of PV materials compared to the roof level temperatures typically observed during residential fires (800-900 degrees Celsius). In the rare instance where a solar panel might be subject to higher temperatures, the silicon and other chemicals that comprise the solar panel would likely bind to the glass that covers the PV cells and be retained there.

Release of any toxic materials from solid state inverters is also unlikely provided appropriate electrical and installation requirements are followed. For more information on public safety and fire, see the Public Safety section of this document.

We should also note that usually the rain is sufficient to keep the panels clean, so no extra cleaning in which cleaning products might be used, is necessary.

Resources:

Fthenakis, V.M., Overview of Potential Hazards in *Practical Handbook of Photovoltaics: Fundamentals and Applications, General editors T. Markvart and L. Castaner, to be published by Elsevier in 2003*.

Fthenakis, V.M. Life cycle impact analysis of cadmium in CdTe PV production. Renewable and Sustainable Energy Reviews 8, 303-334, 2004.

Fthenakis V.M., Kim H.C., Colli A., and Kirchsteiger C., Evaluation of Risks in the Life Cycle of Photovoltaics in a Comparative Context, 21st European Photovoltaic Solar Energy Conference, Dresden, Germany, 4-8 September 2006.

Moskowitz P. and Fthenakis V., Toxic materials released from photovoltaic modules during fires; health risks, Solar Cells, 29, 63-71, 1990.

Sherwani, A.F., Usmani, J.A., & Varun. Life cycle assessment of solar PV based electricity generation systems: A review. Renewable and Sustainable Energy Reviews. 14, 540-544, 2010.

Zayed, J; Philippe, S (2009-08). "Acute Oral and Inhalation Toxicities in Rats With Cadmium Telluride" (PDF). *International journal of toxicology* (International Journal of Toxicology) **28** (4): 259–65. doi:10.1177/1091581809337630. PMID 19636069. http://ijt.sagepub.com/cgi/content/short/28/4/259.

End-of-Life/Decommissioning

Question: How do I manage solar panels after they are decommissioned and no longer in use? Can they be recycled and do hazardous waste disposal requirements apply?

Bottom Line: As more solar panels are decommissioned interest in recycling the panels has increased in Europe and the U.S. Massachusetts regulations ensure proper disposal and recycling of panels if they have components that constitute solid or hazardous waste under state regulations.

More information: The average life of solar PV panels can be 20-30 years (or longer) after initial installation. PV cells typically lose about 0.5% of their energy production capacity per year. At the time of decommissioning, panels may be reused, recycled or disposed. Since widespread use of solar PV is recent in Massachusetts, only a small percentage of solar panels in use in the state have had to be replaced due to damage or reached the end of their useful lifetime. A significant increase in the amount of end-of-life PV modules is expected over the next few decades.

When solar panels are decommissioned and discarded, state rules require that panel disposal be "properly managed" pursuant to the Massachusetts hazardous waste regulations, 310 CMR 30.000. There are many different types of solar panels used in ground-mounted or roof mounted solar PV systems; some of these panels have components that may require special hazardous waste disposal or recycling. Solar module manufacturers typically provide a list of materials used in the manufacturing of their product, which may be used to determine the proper disposal requirements at the time of decommissioning. Under the hazardous waste regulations, the burden is on the generator of the panels to determine if the waste being generated (the solar panels) is hazardous or not. This determination can be made using "knowledge" (i.e. an MSDS sheet listing the materials used in manufacture of the panels) or testing (i.e. the Toxicity Characteristic Leaching Procedure – TCLP).

If a panel is tested and passes TCLP then it is regulated as a solid waste; if it fails TCLP then it is regulated as a hazardous waste.

However, if the solar panel is determined to be hazardous due solely to the presence of metal-bearing circuit boards, the panels may be conditionally exempt from the hazardous waste regulations if destined for recycling. See 310 CMR 30.202(5)(d)-(e) in the Mass. Hazardous Waste Regulations.[4]

People who lease land for solar projects are encouraged to include end-of-life panel management as part of the lease. In cases where panels are purchased, owners need to determine whether the end-of

[4] (5) The following materials are not subject to 310 CMR 30.200, or any other provision of 310 CMR 30.000:

(d) Whole used circuit boards being recycled provided they are free of mercury switches, mercury relays, nickel-cadmium batteries, or lithium batteries.

(e) Shredded circuit boards being recycled provided that they are:

1. managed in containers sufficient to prevent a release to the environment prior to recovery; and,

2. free of mercury switches, mercury relays and nickel-cadmium batteries and lithium batteries.

life panels are a solid or hazardous waste and dispose or recycle the panels appropriately. Massachusetts regulations require testing of waste before disposal.

Because of the various materials used to produce solar panels (such as metal and glass), interest in recycling of solar modules has grown. Throughout Europe, a not-for-profit association (PV Cycle) is managing a voluntary collection and recycling program for end-of-life PV modules. The American photovoltaic industry is not required by state or federal regulation to recycle its products, but several solar companies are starting to recycle on a voluntary basis. Some manufacturers are offering end-of-life recycling options and independent companies looking to recycle solar modules are growing. This allows for the recycling of the PV panels and prevents issues with the hazardous materials. Currently, the California Department of Toxic Substances Control is considering standards for the management of solar PV panels at the end of their use.

DOER's model zoning provides language on requirements for abandonment and decommissioning of solar panels for use by local officials considering local approvals for these projects.

Resources

End-of-life PV: then what? - Recycling solar PV panels
http://www.renewableenergyfocus.com/view/3005/end-of-life-pv-then-what-recycling-solar-pv-panels/

MassDEP Hazardous Waste Regulations 310 CMR 30.000
http://www.mass.gov/eea/agencies/massdep/recycle/regulations/310-cmr-30-000.html

PV Cycle, Europe: http://www.pvcycle.org/

California Department of Toxic Substances Control, Proposed Standards for the Management of Hazardous Waste Solar Modules,
http://www.dtsc.ca.gov/LawsRegsPolicies/Regs/Reg_Exempt_HW_Solar_Panels.cfm

Ambient Temperature ("Heat Island")

The Question: Does the presence of ground-mounted solar PV arrays cause higher ambient temperatures in the surrounding neighborhood (i.e., the "heat island" effect)?

Bottom Line: All available evidence indicates that there is no solar "heat island" effect caused by the functioning of solar arrays. Cutting shade trees for solar PV might increase the need for cooling if those trees were shading buildings. This is primarily a concern in town centers and residential areas (locations where large ground-mounted PV is not encouraged) and is a potential impact of any development activity that requires tree-cutting.

More Information: All available evidence indicates that there is no solar "heat island" effect caused by the functioning of solar arrays. Solar panels absorb photons from direct sunlight and convert it to electricity. This minimizes the likelihood of substantially changing temperatures at the site or the surrounding neighborhood. For an area with no PV system, solar energy impacting the ground is either reflected or absorbed. There is no research to support heat production from the solar panels themselves.

Sunpower, a private solar manufacturer, conducted a study on the impact of solar PV on the local temperature, and concluded that a solar PV array can absorb a higher percentage of heat than a forested parcel of land without an array. The study points out that while solar PV modules can reach high operating temperatures up to 120 degrees Fahrenheit, they are thin and lightweight and therefore do not store a large amount of heat. Because of this, and the fact that panels are also shown to cool to ambient air temperature shortly after the sun sets, the Sunpower study concludes that the area surrounding a large-scale solar array is unlikely to experience a net heating change from the panels.

If trees are removed that were previously shading a building, that building could get warmer in full sunshine than when the trees were shading it. The June 1, 2011 tornado that ripped through Western Massachusetts created an opportunity to empirically measure the effects of the loss of neighborhood trees on temperatures and air humidity in the streets. A report by the U.S. Department of Agriculture Forest Service concluded that daily mean morning and afternoon temperatures were typically greater in the tornado-impacted neighborhood in Springfield, Massachusetts than in the unaffected neighborhood and forest sites, but were similar at night. Residents noted increased use of air-conditioning units and an overall increase in energy costs in July and August of 2011.

Resources:

SUNPOWER, Impact of PV Systems on Local Temperature, July 2010

USDA Forest Services report: http://www.regreenspringfield.com/wp-content/uploads/2011/11/tornado%20climate%20report%203.pdf

Electric and Magnetic Fields (EMF)

The Question: What, if any, health risks do the electric and magnetic fields (EMF) from solar panels and other components of solar PV arrays pose?

Bottom Line: Electric and magnetic fields are a normal part of life in the modern world. PV arrays generate EMF in the same extremely low frequency (ELF) range as electrical appliances and wiring found in most homes and buildings. The average daily background exposure to magnetic fields is estimated to be around one mG (milligauss – the unit used to measure magnetic field strength), but can vary considerably depending on a person's exposure to EMF from household electrical devices and wiring. The lowest exposure level that has been potentially associated with a health effect is three mG. Measurements at three commercial PV arrays in Massachusetts demonstrated that their contributions to off-site EMF exposures were low (less than 0.5 mG at the site boundary), which is consistent with the drop off of EMF strength based on distance from the source.

More Information: Solar PV panels, inverters and other components that make up solar PV arrays produce extremely low frequency EMF when generating and transmitting electricity. The extremely low frequency EMF from PV arrays is the same as the EMF people are exposed to from household electrical appliances, wiring in buildings, and power transmission lines (all at the power frequency of 60 hertz). EMF produced by cell phones, radios and microwaves is at much higher frequencies (30,000 hertz and above).

Electric fields are present when a device is connected to a power source, but are shielded or blocked by common materials, resulting in low potential for exposures. On the other hand, magnetic fields, which are only generated when a device is turned on, are not easily shielded and pass through most objects, resulting in greater potential for exposure. Both types of fields are strongest at the source and their strength decreases rapidly as the distance from the source increases. For example, the magnetic field from a vacuum cleaner six inches away from the motor is 300 mG and decreases to two mG three feet away. People are exposed to EMF during normal use of electricity and exposure varies greatly over time, depending on the distance to various household appliances and the length of time they are on. The daily average background level of magnetic fields for US residents is one mG.

EMF from PV Arrays: Solar PV panels produce low levels of extremely low frequency (ELF) EMF, with measured field strengths of less than one mG three inches from the panel. Solar PV power inverters, transformers and conduits generate higher levels of ELF-EMF. The amount of ELF-EMF is proportional to the electrical capacity of the inverter and is greater when more current (electricity) is flowing through a power line.

In a study of two PV arrays (using 10-20 kW invertors) in Kerman and Davis, California, the magnetic field was highest at the inverters and transformers, but decreased rapidly to less than one mG within 50 feet of the units, well within the boundary of the PV array (Chang and Jennings 1994). This data indicates that extremely low frequency EMF field strengths at residences near systems of this size would be below the typical levels experienced by most people at home. The highest extremely low frequency EMF (up to 1,050 mG) was found next to an inverter unit at the point of entry of the electrical conduits. Even this

value is less than the extremely low frequency EMF reported for some common household devices such as an electric can opener with a maximum of 1500 mG at 6 inches.

In a recent study of three ground mounted PV arrays in Massachusetts, the above results were confirmed. The PV arrays had a capacity range of 1 to 3.5 MW. Magnetic field levels along the PV array site boundary were in the very low range of 0.2 to 0.4 mG. Magnetic fields at 3 to 7 feet from the inverters ranged from 500 to 150 mG. At a distance of 150 feet from the inverters, these fields dropped back to very low levels of 0.5 mG or less, and in many cases to much less than background levels (0.2 mG).

Potential Health Effects: Four research studies have reported an association between three to four mG EMF exposure and childhood leukemia, while 11 other studies have not. These studies are inconsistent and do not demonstrate a causal link that would trigger a World Health Organization (WHO) designation of EMF as a possible carcinogen[5]. Studies looking at other cancers in humans and animals have not found evidence of a link to residential ELF-EMF exposure.

Reference Exposure Levels: To protect the general public from health effects from short-term high level magnetic fields, the International Commission on Non-Ionizing Radiation Protection (ICNIRP, 2010) advised an exposure limit for extremely low frequency magnetic fields at 2000 mG. ICNIRP determined that the evidence on the impact of long-term exposure to low level magnetic fields was too uncertain to use to set a guideline. Guidelines for the magnetic field allowed at the edge of transmission line right-of-ways have been set at 200 mG by Florida and New York. Exposure to magnetic fields greater than 1000 mG is not recommended for people with pacemakers or defibrillators (ACGIH, 2001).

Resources:

American Conference of Government Industrial Hygienist (ACGIH). 2001. as cited in NIEHS 2002.

Chang, GJ and Jennings, C. 1994. Magnetic field survey at PG&E photovoltaic sites. PG&E R&D Report 007.5-94-6.

Electric Power Research Institute (EPRI). 2012. EMF and your health. http://my.epri.com/portal/server.pt?Abstract_id=000000000001023105.

International Commission on Non-Ionizing Radiation Protection (ICNIRP). 2010. ICNIRP Guidelines for limiting exposure to time-varying electric and magnetic fields (1 Hz – 100kHz). Health Physics 99(6):818-836.

National Cancer Institute (NCI). 2005. Magnetic Field Exposure and Cancer: Questions and Answers. U.S. Department of Health and Human Services, National Institutes of Health. Available http://www.cancer.gov/cancertopics/factsheet/Risk/magnetic-fields, accessed May 14, 2012.

[5] WHO has designated ELF-EMF as a possible carcinogen. The use of the label "possible carcinogen" indicates that there is not enough evidence to designate ELF-EMF as a "probable carcinogen "or "human carcinogen," the two indicators of higher potential for being carcinogenic in humans.

National Institute of Environmental Health Science (NIEHS) 2002. Electric and Magnetic Fields Associated with the Use of Electric Power: Questions and Answers. Available http://www.niehs.nih.gov/health/assets/docs_p_z/results_of_emf_research_emf_questions_answers_booklet.pdf, accessed May 11, 2012.

National Institute of Environmental Health Science (NIEHS) web page on EMF. Available http://www.niehs.nih.gov/health/topics/agents/emf/, accessed May 11, 2012.

Oregon Department of Transportation (Oregon DOT). Scaling public concerns of electromagnetic fields produced by solar photovoltaic arrays. Produced by Good Company for ODOT for the West Linn Solar Highway Project. Available www.oregon.gov/ODOT/HWY/OIPP/docs/emf**concerns**.pdf.

World Health Organization (WHO). 2007. Electromagnetic fields and public health: Exposure to extremely low frequency fields. Fact sheet N°322. June 2007. Available http://www.who.int/mediacentre/factsheets/fs322/en/index.html, accessed May 16, 2012. This fact sheet provides a short summary of the in-depth review documented in the WHO 2007, Environmental Health Criteria 238. Available http://www.who.int/peh-emf/publications/elf_ehc/en/index.html.

Property Values

Question: How do ground-mounted solar PV arrays adjacent to residential neighborhoods influence the property values in those neighborhoods?

Bottom Line: No research was found specific to ground-mounted solar PV and property values. Residential property value research on roof-mounted solar PV and wind turbines illustrates no evidence of devaluation of homes in the area. Municipalities that adopt zoning for solar facilities may want to consider encouraging project developers to include screening vegetation along site borders to minimize visual impacts on surrounding neighborhoods.

More Information: A review of literature nationwide shows little evidence that solar arrays influence nearby property values. An analysis focused on roof-mounted solar PV done by the U.S. Department of Energy Lawrence Berkeley National Laboratory concludes that household solar installation actually increases home property values. This research analyzes a large dataset of California homes that sold from 2000 through mid-2009 with PV installed. Across a large number of repeat sales model specifications and robustness tests, the analysis finds strong evidence that California homes with PV systems have sold for a premium over comparable homes without PV systems.

Resources:

An Analysis of the Effects of Residential Photovoltaic Energy Systems on Home Sales Prices in California
http://emp.lbl.gov/sites/all/files/lbnl-4476e.pdf

Public Safety (including fires)

Question: What public safety issues arise from people's (including children) access to areas where solar arrays are installed? Can electrical and other equipment associated with solar projects cause electrical fires?

Bottom Line: Large-scale ground-mounted arrays are typically enclosed by fencing. This prevents children and the general public from coming into contact with the installations, thus preventing unsafe situations. The National Electric Code has mandatory requirements to promote the electrical safety of solar PV arrays. Emergency personnel responding to potential emergencies at a solar PV site face the most risk, but the solar industry and firefighters provide training and education for emergency personnel to ensure that the proper safety precautions are taken.

More Information: The National Electric Code has mandatory requirements for the electrical safety of solar PV arrays. To protect against intruders, Article 690 of the National Electric Code covers the safety standards for solar PV installation and requires that conductors installed as part of solar PV be "not readily accessible". With a large-scale ground-mounted array, a fence is typically installed around the system to prevent intruders. Some communities have solar PV or signage by-laws that require identification of the system owner and 24-hour emergency contact information.

DOER's Model by-Law/ordinance requires owners of solar PV facilities to provide a copy of the project summary, electrical schematic, and site plan to the local fire chief, who can then work with the owner and local emergency services to develop an emergency response plan.

These measures can be combined with products to prevent theft of the panels. Some are very low cost options (fastener type) while there are other options that are more expensive (alarm system type) but also more effective. The biggest potential risk associated with solar PV systems is the risk of shock or electrocution for firefighters and other emergency responders who could come in contact with high voltage conductors. A 2010 study on firefighter safety and emergency response for solar PV systems by the Fire Protection Research Foundation, based in Quincy, Massachusetts, recommended steps firefighters can take when dealing with wiring and other components that may be energized. The Solar Energy Business Association of New England (SEBANE) has been working to provide training and education to first-responders to identify and avoid potential hazards when responding to a solar PV fire.

For more information about toxics/fires, see the Hazardous Materials Section.

Resources:

Moskowitz, P.D. and Fthenakis, V.M., Toxic Materials Released from Photovoltaic Modules During Fires: Health Risks, Solar Cells, 29, 63-71, 1990. 21.

Solar America Board for Codes and Standards
http://www.solarabcs.org/about/publications/reports/blindspot/pdfs/BlindSpot.pdf

Fire Fighter Safety and Emergency Response for Solar Power Systems: Final Report, May 2010. Prepared by The Fire Protection Research Foundation

National Electric Code Article 250: Grounding and Bonding, Article 300: Wiring Methods, Article 690 Solar PV Systems, Article 705 Interconnected Electric Power Production Sources

Historic Preservation

The Question: What are the appropriate standards when land with historical or archaeological significance is developed for large-scale solar PV arrays?

Bottom Line: Parties undertaking solar PV projects with state or federal agency involvement must provide the Massachusetts Historical Commission (MHC) with complete project information as early as possible in the planning stage, by mail to the MHC's office (see Resources). Parties should also contact local planning, historical or historic district commissions to learn about any required local approvals. Municipalities should also take the presence of historic resources into account when establishing zoning regulations for solar energy facilities in order to avoid or minimize impacts.

More Information: Land being evaluated for the siting of large-scale solar PV has historical or archaeological significance including properties listed in the National or State Registers of Historic Places and/or the Inventory of Historic and Archaeological Assets of the Commonwealth.

Federal and state laws require that any new construction, demolition or rehabilitation projects (including new construction of solar PV) that propose to use funding, licenses or permits from federal or state government agencies must be reviewed by the MHC so that feasible alternatives are developed and implemented to avoid or mitigate any adverse effects to historic and archaeological properties. Projects receiving federal funding, licenses or permits are reviewed by the involved federal agency in consultation with the MHC and other parties in compliance with Section 106 of the National Historic Preservation Act of 1966 (16 U.S.C. 470f) and the implementing regulations (36 CFR 800) in order to reach agreement to resolve any adverse effects. Projects receiving state funding, licenses or permits must notify the MHC in compliance with M.G.L. c. 9, ss. 26-27C and the implementing regulations 950 CMR 71. If the MHC determines that the project will have an adverse effect, the involved state agency, the project proponent, the local historical preservation agencies, and other interested parties consult to reach an agreement that outlines measures to be implemented to avoid, minimize, or mitigate adverse effects. For projects with both federal and state agency involvement, the Section 106 process is used.

Some communities have local preservation ordinances or established local historic districts that require local approval for new construction visible from a public way. Local historic district commissions have adopted design guidelines for new construction within their historic districts and historic neighborhoods. However, these guidelines must account for Chapter 40C Section 7 of the General Laws, which requires a historic district commission to consider the policy of the Commonwealth to encourage the use of solar energy systems and to protect solar access.

Resources:

Federal Agency Assisted Projects:

Section 106 review information and the federal regulations 36 CFR 800 are available at the Advisory Council on Historic Preservation (ACHP) web site: www.achp.gov. Check with the involved federal agency for how they propose to initiate the MHC notification required by 36 CFR 800.3.

State Agency Assisted Projects:

Massachusetts General Laws Chapter 9, sections 26-27C

MHC Regulations 950 CMR 71 (available from the State House Bookstore)

MHC Review & Compliance FAQs http://www.sec.state.ma.us/mhc/mhcrevcom/revcomidx.htm

MHC Project Notification Form (PNF) & Guidance for Completing the PNF and required attachments (USGS locus map, project plans, current photographs keyed to the plan). Mail or deliver the complete project information to the MHC's office: http://www.sec.state.ma.us/mhc/mhcform/formidx.htm

General Guidance about Designing Solar PV Projects on Historic Buildings and in Historic Areas: http://www.nrel.gov/docs/fy11osti/51297.pdf

Noise

Question: Do the inverters, transformers or other equipment used as part of ground-mounted solar PV create noise that will impact the surrounding neighborhood?

Bottom Line: Ground-mounted solar PV array inverters and transformers make a humming noise during daytime, when the array generates electricity. At 50 to 150 feet from the boundary of the arrays, any sound from the inverters is inaudible. Parties that are planning and designing ground-mounted solar PV should explore options to minimize noise impacts to surrounding areas. This could include conducting pre-construction sound studies, evaluating where to place transformers, and undertaking appropriate noise mitigation measures.

More Information: Most typically, the source of noise associated with ground-mounted solar PV comes from inverters and transformers. There also may be some minimal noise from switching gear associated with power substations. The crackling or hissing sound caused by high-voltage transmission lines (the "Corona Effect") is not a concern in the case of solar PV, which uses lower voltage lines.

Parties siting ground-mounted solar PV projects should consult equipment manufacturers to obtain information about sound that can be expected from electrical equipment, since this can vary. For example, according to manufacturer's information, a SatCon Powergate Plus 1 MW Commercial Solar PV Inverter has an unshielded noise rating of 65 decibels (dBA) at five feet. This is approximately the sound equivalent of having a normal conversation with someone three feet away. Another source of information is the National Electrical Manufacturers Association (NEMA) standards, which will provide maximum sound levels from various equipment arrays. From NEMA, a large dry-type transformer (2001-3333 kVA) that is forced air cooled and ventilated has an average sound level of 71 dBA, which is approximately the sound level one would expect from a vacuum cleaner at ten feet. There may be several such units on a substantially sized PV site, which would increase the sound level to some degree.

Sound impacts from electrical equipment can be modeled to the property line or nearest sensitive receptor (residence). Sound impacts can be mitigated with the use of enclosures, shielding and careful placement of the sound-generating equipment on-site. The rule of thumb for siting noise-generating equipment is that the sound impact can be reduced by half by doubling the distance to the receptor.

In some areas both in the US and Canada, sound impact analysis is required as part of the permitting process for large PV systems. For example, in the Province of Ontario, Canada, any project greater than 12 MW is required to perform a sound impact analysis (Ontario 359/09). California also requires a sound impact analysis for large PV projects. Massachusetts currently has no such requirement, but the reader should note that ground-mounted systems in Massachusetts very rarely go over 6 MW, which is half the size of the 12 MW that triggers a sound analysis in Ontario.

A recent study measured noise levels at set distances from the inverters and from the outer boundary of three ground-mounted PV arrays in Massachusetts with a capacity range of 1 to 3.5 MW. Close to the inverters (10 feet), sound levels varied from an average of 55 dBA to 65 dBA. Sound levels along the fenced boundary of the PV arrays were generally at background levels, though a faint inverter hum could be heard at some locations. Any sound from the PV array and equipment was inaudible and

sound levels were at background levels at setback distances of 50 to 150 feet from the boundary. Project developers should consult with local planning and zoning officials to determine if local noise ordinances may be applicable. Many local noise ordinances establish absolute limits on project impact noise (such as a 40 dBA nighttime limit). In these communities, a noise impact assessment may be required.

Resources:

NEMA Standards Publication No. TR=1-1993(R2000), *Transformers, Regulators and Reactors*

Noise Assessment: Borrego 1 Solar Project, MUP 3300-10-26 Prepared by Ldn Consulting, Inc, Fallbrook, CA. January 14, 2011

Ontario Regulation 359/09 Renewable Energy Approval (REA) Regulation, Ontario Ministry of the Environment, Canada http://www.ontario.ca/environment-and-energy/renewable-energy-approvals

Tech Environmental, Study of Acoustic and EMF levels from Solar Photovoltaic Projects, Prepared for the Massachusetts Clean Energy Center, December 2012, http://images.masscec.com/uploads/attachments/Create%20Basic%20page/Study_of_Acoustic_and_EMF_Levels_from_Solar_Photovoltaic_Projects.pdf

Water-Related Impacts

Question: Can chemicals that might be contained in solar PV threaten public drinking water systems? Will flooding occur in cases where trees must be removed in order to install the solar arrays? How do we ensure that wetland resources are protected?

Bottom Line: Rules are in place to ensure that ground-mounted solar arrays are installed in a ways that protect public water supplies, wetlands, and other water resource areas. All solar panels are contained in a solid matrix, are insoluble and are enclosed. Therefore, releases are not a concern.

More Information: Because trees offer multiple water management, cooling and climate benefits, clear-cutting of trees for the installation of ground-mounted solar PV is discouraged. For projects that do propose to alter trees, the Massachusetts Environmental Policy Act (MEPA) has thresholds for the proposed alteration of a certain number of acres of land, the size of electrical facilities, and other criteria that trigger state review of proposed projects. Clear cutting of trees and other aspects of proposed projects would be reviewed through an Environmental Notification Form/Environmental Impact Statement if thresholds are triggered. More information is available at:

MassDEP has determined that the installation of solar arrays can be compatible with the operation and protection of public drinking water systems. This includes the installation of solar arrays within the Zone I, which is a 400-foot protective radius around a public ground water well. Solar projects proposed on lands owned by public water systems outside the Zone I may be approved subject to standard best management practices, such as the proper labeling, storage, use, and disposal of products. MassDEP has a guidance/review process in place to ensure that the installation of ground-mounted solar PV in these areas protects public water supplies.

Installing solar arrays on undeveloped land can preserve the permeable nature of the land surface provided the project design minimizes disturbance to natural vegetative cover, avoids concentrated runoff, and precipitation is otherwise recharged into the ground to the greatest extent practicable. Storm water flow, as well as information about site-specific soils and slope, is taken into account during the design and installation of solar arrays.

MassDEP discourages installation of ground-mounted solar PV systems in wetland areas, including riverfront locations. Solar projects within wetland areas are unlikely to comply with the performance standards in the Wetlands Protection Act regulations. If a solar installation is proposed in a wetland, a riverfront area, a floodplain, or within 100 feet of certain wetlands, the project proponent must file a notice of intent (or application to work in wetland areas) with the local Conservation Commission, which administers the Wetlands Protection Act at the municipal level. Copies should also go to MassDEP. Solar installations may be sited near, but outside of wetlands, in a manner that protects the functions of wetlands and that minimizes impacts from associated activities such as access and maintenance. Ancillary structures related to construction of a solar installation or transmission of power may be permitted to cross rivers and streams using best design and management practices.

Resources:

More information about the Wetlands Protection Act requirements may be found in the implementing regulations at 310 CMR 10.00: http://www.mass.gov/eea/agencies/massdep/water/regulations/310-cmr-10-00-wetlands-protection-act-regulations.html

MassDEP Guidance for Siting Wind and Solar in Public Water Supply Land: http://www.mass.gov/eea/agencies/massdep/water/regulations/wind-and-solar-energy-project-on-public-water-supply-land.html

MassDEP Chapter 91 Guidance for Renewable Energy Projects: http://www.mass.gov/eea/agencies/massdep/water/reports/chapter-91-licensing-and-renewable-energy.html

Glare

Question: How important is reflectivity and potential visual impacts from solar projects, especially near airports?

Bottom Line: Solar panels are designed to reflect only about 2 percent of incoming light, so issues with glare from PV panels are rare. Pre-construction modeling can ensure that the placement of solar panels prevents glare.

More Information: Solar panels are designed to absorb solar energy and convert it into electricity. Most are designed with anti-reflective glass front surfaces to capture and retain as much of the solar spectrum as possible. Solar module glass has less reflectivity than water or window glass. Typical panels are designed to reflect only about 2 percent of incoming sunlight. Reflected light from solar panels will have a significantly lower intensity than glare from direct sunlight.

An analysis of a proposed 25-degree fixed-tilt flat-plate polycrystalline PV system located outside of Las Vegas, Nevada showed that the potential for hazardous glare from flat-plate PV systems is similar to that of smooth water and not expected to be a hazard to air navigation.

Many projects throughout the US and the world have been installed near airports with no impact on flight operations. United Kingdom and U.S. aircraft accident databases contain no cases of accidents in which glare caused by a solar energy facility was cited as a factor.

When siting solar PV arrays pre-construction modeling can ensure the panels are placed in a way that minimizes any potential glare to surrounding areas.

Resources:

Technical Guidance for Evaluating Selected Solar Technologies on Airports, Federal Aviation Administration, November 2010 (currently under review), http://www.faa.gov/airports/environmental/policy_guidance/media/airport_solar_guide.pdf

A Study of the Hazardous Glare Potential to Aviators from Utility-Scale Flat-Plate Photovoltaic Systems, Black & Veatch Corporation, August 2011, http://www.isrn.com/journals/re/2011/651857/

Solar Photovoltaic Energy Facilities, Assessment of Potential Impact on Aviation, Spaven Consulting, January 2011: http://www.solarchoice.net.au/blog/solar-panels-near-airports-glare-issue/

Endangered Species and Natural Heritage

Question: Who ensures that rare animal and plant species and their habitats are not displaced or destroyed during the construction of ground-mounted solar PV?

Bottom Line: Rules are in place to ensure that the installation of ground-mounted solar arrays protects state-listed rare species and animals and plants. Project proponents can check with the local Conservation Commission to determine if the footprint of the solar PV project lies within a rare species habtat.

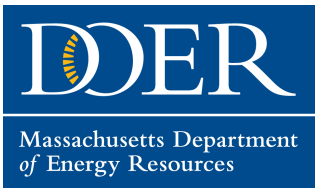
More Information: The Massachusetts Natural Heritage and Endangered Species Program (NEHSP) was created under the Massachusetts Endangered Species Act (MESA) and is responsible for protecting rare animal and plant species and their habitats from being displaced or destroyed. Specifically, NEHSP reviews projects proposed for:

- **Priority Habitats:** These are areas known to be populated by state-listed rare species of animals or plants. Any project that could result in the alteration of more than two acres of Priority Habitat is subject to NHESP regulatory review. Projects will need to file a MESA Information Request Form, along with a project plan, a U.S. Geological Survey (USGS) topographical map of the site, and a $50 processing fee. NHESP will let project administrators know within 30 days if the filing is complete, then will determine within the next 60 days whether the project, as proposed, would result in a "take" of state-listed rare species that might require the project to redesign, scale down, or abandon its plan.
- **Estimated Habitats:** These are a sub-set of Priority Habitats that are based on the geographical range of state-listed rare wildlife – particularly animals that live in and around wetlands. If the project is proposed for one of these areas and the local Conservation Commission requires filing a Notice of Intent (NOI) under the Wetlands Protection Act, the project will need to submit copies of the NOI, project plans and a U.S. Geological Survey (USGS) topographical map to NHESP. Within 30 days of receiving this information, NHESP will send its comments to the Conservation Commission, with copies to the project administrator, project consultants, and the Department of Environmental Protection (MassDEP).

Resources:

To learn more about the NHESP review process and download a MESA Information Request Form, visit: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/regulatory-review/mass-endangered-species-act-mesa/

For list of rare animal and plant species in Massachusetts, visit: http://www.mass.gov/eea/agencies/dfg/dfw/natural-heritage/species-information-and-conservation/mesa-list/list-of-rare-species-in-massachusetts.html


DOER
Massachusetts Department
of Energy Resources


MassDEP


MASSACHUSETTS
CLEAN ENERGY
CENTER

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MEMORANDUM

TO: Bartholomew County Plan Commission Members

FROM: Emilie Pinkston

DATE: August 3, 2022

RE: Model Ordinance for Indiana Local Governments

Mr. Niemoeller also included the Model Ordinance for Indiana Local Governments in his packet of materials for the Commission. However, in an effort to limit duplication, that document was not included here because it was also included in the packet of materials from Mary Solada (Denton Bingham Greenebaum LLP). To read the Model Ordinance for Indiana Local Governments, please refer to the packet of materials provided by Ms. Solada.