Full Environmental Assessment Form
Part 1 - Project and Setting

Instructions for Completing Part 1

Part 1 is to be completed by the applicant or project sponsor. Responses become part of the application for approval or funding, are subject to public review, and may be subject to further verification.

Complete Part 1 based on information currently available. If additional research or investigation would be needed to fully respond to any item, please answer as thoroughly as possible based on current information; indicate whether missing information does not exist, or is not reasonably available to the sponsor; and, when possible, generally describe work or studies which would be necessary to update or fully develop that information.

Applicants/sponsors must complete all items in Sections A & B. In Sections C, D & E, most items contain an initial question that must be answered either "Yes" or "No". If the answer to the initial question is "Yes", complete the sub-questions that follow. If the answer to the initial question is "No", proceed to the next question. Section F allows the project sponsor to identify and attach any additional information. Section G requires the name and signature of the applicant or project sponsor to verify that the information contained in Part 1is accurate and complete.

A. Project and Applicant/Sponsor Information.

Name of Action or Project: ELP Marlborough Solar LLC		
Project Location (describe, and attach a general location map): 335 Bingham Road, Marlborough, NY 12542, Tax ID: 108.3-3-21		
Brief Description of Proposed Action (include purpose or need): The proposed project is a 5-megawatt community solar array. The project will utilize inverters located on equipment pads to convert the power from direct current (DC) to alternating current (AC). A lithium-ion battery energy storage system, which will store the energy generated by the solar panels, is also proposed to be sited on the equipment pads. The project will connect to Central Hudson's distribution system on Bingham Road in the pole configuration required by the utility's standards.		
Name of Applicant/Sponsor: ELP Marlborough Solar LLC	Telephone: (201) 275-4795 E-Mail: jbf@vcrenewables.com	
Address: 14 Arrow Street, Suite 22		
City/PO: Cambridge	State: MA	Zip Code: 02138
Project Contact (if not same as sponsor; give name and title/role): Christopher Knox, P.E. (Crawford & Associates Engineering & Land Surveying, P.C.)	Telephone: (518) 828-2700 E-Mail: cknox@crawfordandassociates.com	
Address: 1 Hudson City Centre, Suite 300		
City/PO: Hudson	State: NY	Zip Code: 12534
Property Owner (if not same as sponsor): Joel V Truncali & William M Truncali	Telephone: (845) 541-5635 E-Mail: joeltruncali@gmail.com	
Address: 27 Bingham Road		
City/PO: Marlboro	State: NY	Zip Code: 12542

B. Government Approvals

B. Government Approvals, Funding, or Sponsorship. ("Funding" includes grants, loans, tax relief, and any other forms of financial assistance.)		
Government Entity	**If Yes: Identify Agency and Approval(s) Required**	**Application Date (Actual or projected)**
a. City Counsel, Town Board, or Village Board of Trustees ☐Yes☑No		
b. City, Town or Village Planning Board or Commission ☑Yes☐No	Town of Marlborough Planning Board (SUP and SPR)	April 2024
c. City, Town or Village Zoning Board of Appeals ☐Yes☑No		
d. Other local agencies ☑Yes☐No	Town of Marlborough Highway Dept. (Curb Cut / Road Cut Permit)	TBD
e. County agencies ☑Yes☐No	Ulster County Planning Board (Referral)	TBD
f. Regional agencies ☐Yes☑No		
g. State agencies ☑Yes☐No	NYSDEC (GP-0-20-001), NYSERDA (NY-Sun)	TBD
h. Federal agencies ☐Yes☑No		

i. Coastal Resources.
i. Is the project site within a Coastal Area, or the waterfront area of a Designated Inland Waterway? ☑Yes☐No

ii. Is the project site located in a community with an approved Local Waterfront Revitalization Program? ☐Yes☑No

iii. Is the project site within a Coastal Erosion Hazard Area? ☐Yes☑No

C. Planning and Zoning

C.1. Planning and zoning actions.

Will administrative or legislative adoption, or amendment of a plan, local law, ordinance, rule or regulation be the only approval(s) which must be granted to enable the proposed action to proceed? ☐Yes☑No

- **If Yes,** complete sections C, F and G.
- **If No,** proceed to question C.2 and complete all remaining sections and questions in Part 1

C.2. Adopted land use plans.

a. Do any municipally- adopted (city, town, village or county) comprehensive land use plan(s) include the site where the proposed action would be located? ☑Yes☐No

If Yes, does the comprehensive plan include specific recommendations for the site where the proposed action would be located? ☐Yes☑No

b. Is the site of the proposed action within any local or regional special planning district (for example: Greenway; Brownfield Opportunity Area (BOA); designated State or Federal heritage area; watershed management plan; or other?) ☐Yes☑No

If Yes, identify the plan(s):

c. Is the proposed action located wholly or partially within an area listed in an adopted municipal open space plan, or an adopted municipal farmland protection plan? ☐Yes☑No

If Yes, identify the plan(s):

C.3. Zoning

a. Is the site of the proposed action located in a municipality with an adopted zoning law or ordinance. ☑ Yes ☐ No
If Yes, what is the zoning classification(s) including any applicable overlay district?

b. Is the use permitted or allowed by a special or conditional use permit? ☑ Yes ☐ No

c. Is a zoning change requested as part of the proposed action? ☐ Yes ☑ No
If Yes,
i. What is the proposed new zoning for the site?

C.4. Existing community services.

a. In what school district is the project site located? Marlboro Central School District

b. What police or other public protection forces serve the project site?
NYSP, Ulster County Sheriff's Office

c. Which fire protection and emergency medical services serve the project site?
FD091 - Marlborough Fire

d. What parks serve the project site?
Cluett Schantz Memorial Park

D. Project Details

D.1. Proposed and Potential Development

a. What is the general nature of the proposed action (e.g., residential, industrial, commercial, recreational; if mixed, include all components)? Commercial, 5 MW solar facility

b. a. Total acreage of the site of the proposed action? 80.10 acres
b. Total acreage to be physically disturbed? +/- 28 acres
c. Total acreage (project site and any contiguous properties) owned or controlled by the applicant or project sponsor? 80.10 acres

c. Is the proposed action an expansion of an existing project or use? ☐ Yes ☑ No
i. If Yes, what is the approximate percentage of the proposed expansion and identify the units (e.g., acres, miles, housing units, square feet)? % Units:

d. Is the proposed action a subdivision, or does it include a subdivision? ☐ Yes ☑ No
If Yes,
i. Purpose or type of subdivision? (e.g., residential, industrial, commercial; if mixed, specify types)
ii. Is a cluster/conservation layout proposed? ☐ Yes ☐ No
iii. Number of lots proposed?
iv. Minimum and maximum proposed lot sizes? Minimum Maximum

e. Will the proposed action be constructed in multiple phases? ☐ Yes ☑ No
i. If No, anticipated period of construction: months
ii. If Yes:
- Total number of phases anticipated
- Anticipated commencement date of phase 1 (including demolition) month year
- Anticipated completion date of final phase month year
- Generally describe connections or relationships among phases, including any contingencies where progress of one phase may determine timing or duration of future phases:

f. Does the project include new residential uses? ☐Yes ☑No

If Yes, show numbers of units proposed.

	One Family	Two Family	Three Family	Multiple Family (four or more)
Initial Phase				
At completion of all phases				

g. Does the proposed action include new non-residential construction (including expansions)? ☑Yes ☐No

If Yes,

i. Total number of structures TBD

ii. Dimensions (in feet) of largest proposed structure: <15 height; <4 width; and 8 length *per panel

iii. Approximate extent of building space to be heated or cooled: 0 square feet

h. Does the proposed action include construction or other activities that will result in the impoundment of any liquids, such as creation of a water supply, reservoir, pond, lake, waste lagoon or other storage? ☐Yes ☑No

If Yes,

i. Purpose of the impoundment: _____

ii. If a water impoundment, the principal source of the water: ☐ Ground water ☐ Surface water streams ☐ Other specify: _____

iii. If other than water, identify the type of impounded/contained liquids and their source. _____

iv. Approximate size of the proposed impoundment. Volume: _____ million gallons; surface area: _____ acres

v. Dimensions of the proposed dam or impounding structure: _____ height; _____ length

vi. Construction method/materials for the proposed dam or impounding structure (e.g., earth fill, rock, wood, concrete): _____

D.2. Project Operations

a. Does the proposed action include any excavation, mining, or dredging, during construction, operations, or both? (Not including general site preparation, grading or installation of utilities or foundations where all excavated materials will remain onsite) ☐Yes ☑No

If Yes:

i .What is the purpose of the excavation or dredging? _____

ii. How much material (including rock, earth, sediments, etc.) is proposed to be removed from the site?

- Volume (specify tons or cubic yards): _____
- Over what duration of time? _____

iii. Describe nature and characteristics of materials to be excavated or dredged, and plans to use, manage or dispose of them. _____

iv. Will there be onsite dewatering or processing of excavated materials? ☐Yes ☐No

If yes, describe. _____

v. What is the total area to be dredged or excavated? _____ acres

vi. What is the maximum area to be worked at any one time? _____ acres

vii. What would be the maximum depth of excavation or dredging? _____ feet

viii. Will the excavation require blasting? ☐Yes ☐No

ix. Summarize site reclamation goals and plan: _____

b. Would the proposed action cause or result in alteration of, increase or decrease in size of, or encroachment into any existing wetland, waterbody, shoreline, beach or adjacent area? ☐Yes ☑No

If Yes:

i. Identify the wetland or waterbody which would be affected (by name, water index number, wetland map number or geographic description): _____

ii. Describe how the proposed action would affect that waterbody or wetland, e.g. excavation, fill, placement of structures, or alteration of channels, banks and shorelines. Indicate extent of activities, alterations and additions in square feet or acres:

_____

_____

_____

_____

iii. Will the proposed action cause or result in disturbance to bottom sediments? ☐Yes ☐No

If Yes, describe: _____

iv. Will the proposed action cause or result in the destruction or removal of aquatic vegetation? ☐Yes ☐No

If Yes:

- acres of aquatic vegetation proposed to be removed: _____
- expected acreage of aquatic vegetation remaining after project completion: _____
- purpose of proposed removal (e.g. beach clearing, invasive species control, boat access): _____

_____

- proposed method of plant removal: _____
- if chemical/herbicide treatment will be used, specify product(s): _____

v. Describe any proposed reclamation/mitigation following disturbance: _____

_____

c. Will the proposed action use, or create a new demand for water? ☐Yes ☑No

If Yes:

i. Total anticipated water usage/demand per day: _____ gallons/day

ii. Will the proposed action obtain water from an existing public water supply? ☐Yes ☐No

If Yes:

- Name of district or service area: _____
- Does the existing public water supply have capacity to serve the proposal? ☐Yes ☐No
- Is the project site in the existing district? ☐Yes ☐No
- Is expansion of the district needed? ☐Yes ☐No
- Do existing lines serve the project site? ☐Yes ☐No

iii. Will line extension within an existing district be necessary to supply the project? ☐Yes ☐No

If Yes:

- Describe extensions or capacity expansions proposed to serve this project: _____

_____

- Source(s) of supply for the district: _____

iv. Is a new water supply district or service area proposed to be formed to serve the project site? ☐ Yes ☐No

If, Yes:

- Applicant/sponsor for new district: _____
- Date application submitted or anticipated: _____
- Proposed source(s) of supply for new district: _____

v. If a public water supply will not be used, describe plans to provide water supply for the project: _____

_____

vi. If water supply will be from wells (public or private), what is the maximum pumping capacity: _____ gallons/minute.

d. Will the proposed action generate liquid wastes? ☐Yes ☑No

If Yes:

i. Total anticipated liquid waste generation per day: _____ gallons/day

ii. Nature of liquid wastes to be generated (e.g., sanitary wastewater, industrial; if combination, describe all components and approximate volumes or proportions of each): _____

_____

_____

iii. Will the proposed action use any existing public wastewater treatment facilities? ☐Yes ☐No

If Yes:

- Name of wastewater treatment plant to be used: _____
- Name of district: _____
- Does the existing wastewater treatment plant have capacity to serve the project? ☐Yes ☐No
- Is the project site in the existing district? ☐Yes ☐No
- Is expansion of the district needed? ☐Yes ☐No

- Do existing sewer lines serve the project? ☐Yes ☐No
- Will a line extension within an existing district be necessary to serve the project? ☐Yes ☐No

If Yes:

- Describe extensions or capacity expansions proposed to serve this project: _____

iv. Will a new wastewater (sewage) treatment district be formed to serve the project site? ☐Yes ☐No

If Yes:

- Applicant/sponsor for new district: _____
- Date application submitted or anticipated: _____
- What is the receiving water for the wastewater discharge? _____

v. If public facilities will not be used, describe plans to provide wastewater treatment for the project, including specifying proposed receiving water (name and classification if surface discharge or describe subsurface disposal plans):

vi. Describe any plans or designs to capture, recycle or reuse liquid waste: _____

e. Will the proposed action disturb more than one acre and create stormwater runoff, either from new point sources (i.e. ditches, pipes, swales, curbs, gutters or other concentrated flows of stormwater) or non-point source (i.e. sheet flow) during construction or post construction? ☑Yes ☐No

If Yes:

i. How much impervious surface will the project create in relation to total size of project parcel?

_____ Square feet or 0.08 acres (impervious surface)

_____ Square feet or 80.10 acres (parcel size)

ii. Describe types of new point sources. concrete pads and associated equipment

iii. Where will the stormwater runoff be directed (i.e. on-site stormwater management facility/structures, adjacent properties, groundwater, on-site surface water or off-site surface waters)?

onsite vegetated areas and associated on-site stormwater management features (is applicable)

- If to surface waters, identify receiving water bodies or wetlands: _____
- Will stormwater runoff flow to adjacent properties? ☐Yes ☑No

iv. Does the proposed plan minimize impervious surfaces, use pervious materials or collect and re-use stormwater? ☑Yes ☐No

f. Does the proposed action include, or will it use on-site, one or more sources of air emissions, including fuel combustion, waste incineration, or other processes or operations? ☑Yes ☐No

If Yes, identify:

i. Mobile sources during project operations (e.g., heavy equipment, fleet or delivery vehicles)

Light trucks / small lawn care equipment may be used for operation maintenance.

ii. Stationary sources during construction (e.g., power generation, structural heating, batch plant, crushers)

Small portable generators may be used during construction.

iii. Stationary sources during operations (e.g., process emissions, large boilers, electric generation)

n/a

g. Will any air emission sources named in D.2.f (above), require a NY State Air Registration, Air Facility Permit, or Federal Clean Air Act Title IV or Title V Permit? ☐Yes ☑No

If Yes:

i. Is the project site located in an Air quality non-attainment area? (Area routinely or periodically fails to meet ambient air quality standards for all or some parts of the year) ☐Yes ☐No

ii. In addition to emissions as calculated in the application, the project will generate:

- _____Tons/year (short tons) of Carbon Dioxide (CO_2)
- _____Tons/year (short tons) of Nitrous Oxide (N_2O)
- _____Tons/year (short tons) of Perfluorocarbons (PFCs)
- _____Tons/year (short tons) of Sulfur Hexafluoride (SF_6)
- _____Tons/year (short tons) of Carbon Dioxide equivalent of Hydroflourocarbons (HFCs)
- _____Tons/year (short tons) of Hazardous Air Pollutants (HAPs)

h. Will the proposed action generate or emit methane (including, but not limited to, sewage treatment plants, landfills, composting facilities)? ☐Yes ☑No

If Yes:

i. Estimate methane generation in tons/year (metric): _____

ii. Describe any methane capture, control or elimination measures included in project design (e.g., combustion to generate heat or electricity, flaring): _____

i. Will the proposed action result in the release of air pollutants from open-air operations or processes, such as quarry or landfill operations? ☐Yes ☑No

If Yes: Describe operations and nature of emissions (e.g., diesel exhaust, rock particulates/dust):

j. Will the proposed action result in a substantial increase in traffic above present levels or generate substantial new demand for transportation facilities or services? ☐Yes ☑No

If Yes:

i. When is the peak traffic expected (Check all that apply): ☐Morning ☐Evening ☐Weekend ☐Randomly between hours of _____ to _____.

ii. For commercial activities only, projected number of truck trips/day and type (e.g., semi trailers and dump trucks): _____

iii. Parking spaces: Existing _____ Proposed _____ Net increase/decrease _____

iv. Does the proposed action include any shared use parking? ☐Yes ☐No

v. If the proposed action includes any modification of existing roads, creation of new roads or change in existing access, describe:

vi. Are public/private transportation service(s) or facilities available within ½ mile of the proposed site? ☐Yes ☐No

vii Will the proposed action include access to public transportation or accommodations for use of hybrid, electric or other alternative fueled vehicles? ☐Yes ☐No

viii. Will the proposed action include plans for pedestrian or bicycle accommodations for connections to existing pedestrian or bicycle routes? ☐Yes ☐No

k. Will the proposed action (for commercial or industrial projects only) generate new or additional demand for energy? ☐Yes ☑No

If Yes:

i. Estimate annual electricity demand during operation of the proposed action: _____

ii. Anticipated sources/suppliers of electricity for the project (e.g., on-site combustion, on-site renewable, via grid/local utility, or other):

iii. Will the proposed action require a new, or an upgrade, to an existing substation? ☐Yes ☐No

l. Hours of operation. Answer all items which apply.

i. During Construction:

- Monday - Friday: 7 am - 5 pm
- Saturday: 8 am - 3 pm
- Sunday: n/a
- Holidays: n/a

ii. During Operations: facility to operate 24/7, 365 days per year

- Monday - Friday: n/a
- Saturday: n/a
- Sunday: n/a
- Holidays: n/a

m. Will the proposed action produce noise that will exceed existing ambient noise levels during construction, operation, or both? ☑Yes ☐No

If yes:

i. Provide details including sources, time of day and duration:

Installation of access drive, site clearing, and minor grading activities. Installation of racking and solar panels during daytime construction hours for approximately 25 weeks during construction.

ii. Will the proposed action remove existing natural barriers that could act as a noise barrier or screen? ☑Yes ☐No

Describe: Tree and vegetation removal is anticipated that could act as a natural barrier or screen. Noise produced by the solar facility equipment is similar to that of a residential air conditioning unit (~60dB).The project will not change the ambient noise levels of the existing neighborhoo

n. Will the proposed action have outdoor lighting? ☐Yes ☑No

If yes:

i. Describe source(s), location(s), height of fixture(s), direction/aim, and proximity to nearest occupied structures:

ii. Will proposed action remove existing natural barriers that could act as a light barrier or screen? ☐Yes ☐No

Describe:

o. Does the proposed action have the potential to produce odors for more than one hour per day? ☐Yes ☑No

If Yes, describe possible sources, potential frequency and duration of odor emissions, and proximity to nearest occupied structures:

p. Will the proposed action include any bulk storage of petroleum (combined capacity of over 1,100 gallons) or chemical products 185 gallons in above ground storage or any amount in underground storage? ☐Yes ☑No

If Yes:

i. Product(s) to be stored

ii. Volume(s) _____ per unit time _____ (e.g., month, year)

iii. Generally, describe the proposed storage facilities:

q. Will the proposed action (commercial, industrial and recreational projects only) use pesticides (i.e., herbicides, insecticides) during construction or operation? ☐Yes ☑No

If Yes:

i. Describe proposed treatment(s):

ii. Will the proposed action use Integrated Pest Management Practices? ☐Yes ☐No

r. Will the proposed action (commercial or industrial projects only) involve or require the management or disposal of solid waste (excluding hazardous materials)? ☑Yes ☐No

If Yes:

i. Describe any solid waste(s) to be generated during construction or operation of the facility:

- Construction: 1 tons per 1 month (unit of time)
- Operation : n/a tons per n/a (unit of time)

ii. Describe any proposals for on-site minimization, recycling or reuse of materials to avoid disposal as solid waste:

- Construction: Typically, panels and racking systems are delivered on pallets. All pallets, cardboard, and plastic will be recycled as it is received.
- Operation: n/a

iii. Proposed disposal methods/facilities for solid waste generated on-site:

- Construction: Waste generated on-site during construction shall be disposed of at a regulated solid waste / recycling handling facility.
- Operation: n/a

s. Does the proposed action include construction or modification of a solid waste management facility? ☐ Yes ☑ No

If Yes:

i. Type of management or handling of waste proposed for the site (e.g., recycling or transfer station, composting, landfill, or other disposal activities): _____

ii. Anticipated rate of disposal/processing:

- _____ Tons/month, if transfer or other non-combustion/thermal treatment, or
- _____ Tons/hour, if combustion or thermal treatment

iii. If landfill, anticipated site life: _____ years

t. Will the proposed action at the site involve the commercial generation, treatment, storage, or disposal of hazardous waste? ☐ Yes ☑ No

If Yes:

i. Name(s) of all hazardous wastes or constituents to be generated, handled or managed at facility: _____

ii. Generally describe processes or activities involving hazardous wastes or constituents: _____

iii. Specify amount to be handled or generated _____ tons/month

iv. Describe any proposals for on-site minimization, recycling or reuse of hazardous constituents: _____

v. Will any hazardous wastes be disposed at an existing offsite hazardous waste facility? ☐ Yes ☐ No

If Yes: provide name and location of facility: _____

If No: describe proposed management of any hazardous wastes which will not be sent to a hazardous waste facility:

E. Site and Setting of Proposed Action

E.1. Land uses on and surrounding the project site

a. Existing land uses.

i. Check all uses that occur on, adjoining and near the project site.

☐ Urban ☐ Industrial ☐ Commercial ☑ Residential (suburban) ☑ Rural (non-farm)
☐ Forest ☑ Agriculture ☑ Aquatic ☐ Other (specify): _____

ii. If mix of uses, generally describe:

Project site and adjacent lands generally consist of residential properties, agricultural lands, with a mix of meadow, forest, and wetlands (ponds).

b. Land uses and covertypes on the project site.

Land use or Covertype	Current Acreage	Acreage After Project Completion	Change (Acres +/-)
• Roads, buildings, and other paved or impervious surfaces	0.60	0.08	-0.52
• Forested	24	22	-2
• Meadows, grasslands or brushlands (non-agricultural, including abandoned agricultural)	5	53.42	+48.42
• Agricultural (includes active orchards, field, greenhouse etc.)	46.50	0	-46.50
• Surface water features (lakes, ponds, streams, rivers, etc.)	0	0	0
• Wetlands (freshwater or tidal)	4	4	0
• Non-vegetated (bare rock, earth or fill)	0	0	0
• Other Describe: pervious access drive	0	0.60	+0.60

c. Is the project site presently used by members of the community for public recreation? ☐Yes ☑No
i. If Yes: explain: _____

d. Are there any facilities serving children, the elderly, people with disabilities (e.g., schools, hospitals, licensed day care centers, or group homes) within 1500 feet of the project site? ☐Yes ☑No
If Yes,
i. Identify Facilities:

_____

_____

e. Does the project site contain an existing dam? ☐Yes ☑No
If Yes:
i. Dimensions of the dam and impoundment:
- Dam height: _____ feet
- Dam length: _____ feet
- Surface area: _____ acres
- Volume impounded: _____ gallons OR acre-feet

ii. Dam's existing hazard classification: _____
iii. Provide date and summarize results of last inspection:

_____

_____

f. Has the project site ever been used as a municipal, commercial or industrial solid waste management facility, or does the project site adjoin property which is now, or was at one time, used as a solid waste management facility? ☐Yes ☑No
If Yes:
i. Has the facility been formally closed? ☐Yes ☐ No
- If yes, cite sources/documentation: _____

ii. Describe the location of the project site relative to the boundaries of the solid waste management facility:

_____

_____

iii. Describe any development constraints due to the prior solid waste activities: _____

_____

g. Have hazardous wastes been generated, treated and/or disposed of at the site, or does the project site adjoin property which is now or was at one time used to commercially treat, store and/or dispose of hazardous waste? ☐Yes ☑No
If Yes:
i. Describe waste(s) handled and waste management activities, including approximate time when activities occurred:

_____

_____

h. Potential contamination history. Has there been a reported spill at the proposed project site, or have any remedial actions been conducted at or adjacent to the proposed site? ☐Yes ☑ No
If Yes:
i. Is any portion of the site listed on the NYSDEC Spills Incidents database or Environmental Site Remediation database? Check all that apply: ☐Yes ☐No

☐ Yes – Spills Incidents database — Provide DEC ID number(s): _____
☐ Yes – Environmental Site Remediation database — Provide DEC ID number(s): _____
☐ Neither database

ii. If site has been subject of RCRA corrective activities, describe control measures: _____

_____

_____

iii. Is the project within 2000 feet of any site in the NYSDEC Environmental Site Remediation database? ☐Yes ☑No
If yes, provide DEC ID number(s): _____
iv. If yes to (i), (ii) or (iii) above, describe current status of site(s):

_____

_____

v. Is the project site subject to an institutional control limiting property uses? ☐Yes ☐No

- If yes, DEC site ID number: _____
- Describe the type of institutional control (e.g., deed restriction or easement): _____
- Describe any use limitations: _____
- Describe any engineering controls: _____
- Will the project affect the institutional or engineering controls in place? ☐Yes ☐No
- Explain: _____

E.2. Natural Resources On or Near Project Site

a. What is the average depth to bedrock on the project site? ~5 feet

b. Are there bedrock outcroppings on the project site? ☐Yes ☑No
If Yes, what proportion of the site is comprised of bedrock outcroppings? _____ %

c. Predominant soil type(s) present on project site:

Bath-Nassau complex (BnC)	21 %
Bath-Nassau-Rock (BOD)	21 %
Volusia gravelly silt (VoC)	17 %

d. What is the average depth to the water table on the project site? Average: ~2 feet

e. Drainage status of project site soils:
☑ Well Drained: 53 % of site
☐ Moderately Well Drained: 0 % of site
☑ Poorly Drained 47 % of site

f. Approximate proportion of proposed action site with slopes:
☑ 0-10%: 26 % of site
☑ 10-15%: 19 % of site
☑ 15% or greater: 55 % of site

g. Are there any unique geologic features on the project site? ☐Yes ☑No
If Yes, describe: _____

h. Surface water features.

i. Does any portion of the project site contain wetlands or other waterbodies (including streams, rivers, ponds or lakes)? ☑Yes ☐No

ii. Do any wetlands or other waterbodies adjoin the project site? ☑Yes ☐No

If Yes to either *i* or *ii*, continue. If No, skip to E.2.i.

iii. Are any of the wetlands or waterbodies within or adjoining the project site regulated by any federal, state or local agency? ☑Yes ☐No

iv. For each identified regulated wetland and waterbody on the project site, provide the following information:

- Streams: Name 862-371 Classification C
- Lakes or Ponds: Name _____ Classification _____
- Wetlands: Name Federal Waters, Federal Waters, Federal Waters,... Approximate Size _____
- Wetland No. (if regulated by DEC) _____

v. Are any of the above water bodies listed in the most recent compilation of NYS water quality-impaired waterbodies? ☐Yes ☑No

If yes, name of impaired water body/bodies and basis for listing as impaired: _____

i. Is the project site in a designated Floodway? ☐Yes ☑No

j. Is the project site in the 100-year Floodplain? ☐Yes ☑No

k. Is the project site in the 500-year Floodplain? ☐Yes ☑No

l. Is the project site located over, or immediately adjoining, a primary, principal or sole source aquifer? ☐Yes ☑No
If Yes:

i. Name of aquifer: _____

m. Identify the predominant wildlife species that occupy or use the project site:
small mammal species | bird variety | deer

n. Does the project site contain a designated significant natural community? ☐Yes ☑No
If Yes:
i. Describe the habitat/community (composition, function, and basis for designation):
ii. Source(s) of description or evaluation:
iii. Extent of community/habitat:
- Currently: _____ acres
- Following completion of project as proposed: _____ acres
- Gain or loss (indicate + or -): _____ acres

o. Does project site contain any species of plant or animal that is listed by the federal government or NYS as endangered or threatened, or does it contain any areas identified as habitat for an endangered or threatened species? ☐Yes ☑No
If Yes:
i. Species and listing (endangered or threatened):

p. Does the project site contain any species of plant or animal that is listed by NYS as rare, or as a species of special concern? ☐Yes ☑No
If Yes:
i. Species and listing:

q. Is the project site or adjoining area currently used for hunting, trapping, fishing or shell fishing? ☑Yes ☐No
If yes, give a brief description of how the proposed action may affect that use:
Adjoining area may be used of hunting / fishing. Activities should not be affected by the proposed action.

E.3. Designated Public Resources On or Near Project Site

a. Is the project site, or any portion of it, located in a designated agricultural district certified pursuant to Agriculture and Markets Law, Article 25-AA, Section 303 and 304? ☑Yes ☐No
If Yes, provide county plus district name/number: ULST001

b. Are agricultural lands consisting of highly productive soils present? ☐Yes ☑No
i. If Yes: acreage(s) on project site? no areas of "prime farmland"
ii. Source(s) of soil rating(s): USDA Soil Survey

c. Does the project site contain all or part of, or is it substantially contiguous to, a registered National Natural Landmark? ☐Yes ☑No
If Yes:
i. Nature of the natural landmark: ☐ Biological Community ☐ Geological Feature
ii. Provide brief description of landmark, including values behind designation and approximate size/extent:

d. Is the project site located in or does it adjoin a state listed Critical Environmental Area? ☐Yes ☑No
If Yes:
i. CEA name:
ii. Basis for designation:
iii. Designating agency and date:

e. Does the project site contain, or is it substantially contiguous to, a building, archaeological site, or district which is listed on the National or State Register of Historic Places, or that has been determined by the Commissioner of the NYS Office of Parks, Recreation and Historic Preservation to be eligible for listing on the State Register of Historic Places? ☑ Yes ☐ No

If Yes:

i. Nature of historic/archaeological resource: ☐ Archaeological Site ☑ Historic Building or District

ii. Name: Eligible property:BIRDSALL HOUSE/POLHAMUS FARM

iii. Brief description of attributes on which listing is based:

eligible historic building

f. Is the project site, or any portion of it, located in or adjacent to an area designated as sensitive for archaeological sites on the NY State Historic Preservation Office (SHPO) archaeological site inventory? ☐ Yes ☑ No

g. Have additional archaeological or historic site(s) or resources been identified on the project site? ☐ Yes ☑ No

If Yes:

i. Describe possible resource(s): _____

ii. Basis for identification: _____

h. Is the project site within fives miles of any officially designated and publicly accessible federal, state, or local scenic or aesthetic resource? ☐ Yes ☑ No

If Yes:

i. Identify resource: _____

ii. Nature of, or basis for, designation (e.g., established highway overlook, state or local park, state historic trail or scenic byway, etc.): _____

iii. Distance between project and resource: _____ miles.

i. Is the project site located within a designated river corridor under the Wild, Scenic and Recreational Rivers Program 6 NYCRR 666? ☐ Yes ☑ No

If Yes:

i. Identify the name of the river and its designation: _____

ii. Is the activity consistent with development restrictions contained in 6NYCRR Part 666? ☐ Yes ☐ No

F. Additional Information

Attach any additional information which may be needed to clarify your project.

If you have identified any adverse impacts which could be associated with your proposal, please describe those impacts plus any measures which you propose to avoid or minimize them.

G. Verification

I certify that the information provided is true to the best of my knowledge.

Applicant/Sponsor Name Christopher Knox, P.E., C&A Date April 04, 2024

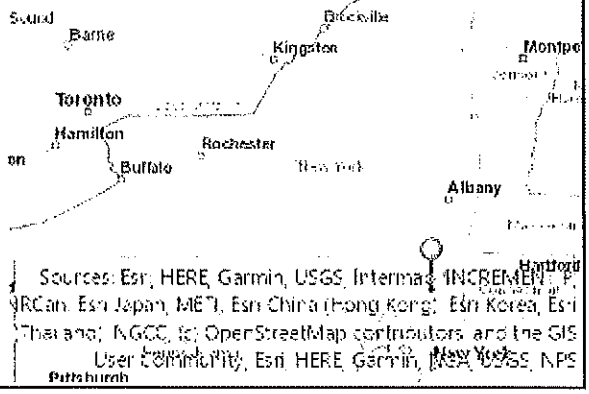
Signature Christopher J. Knox Title Project Manager II

PRINT FORM

EAF Mapper Summary Report

Wednesday, February 21, 2024 1:40 PM

Disclaimer: The EAF Mapper is a screening tool intended to assist project sponsors and reviewing agencies in preparing an environmental assessment form (EAF). Not all questions asked in the EAF are answered by the EAF Mapper. Additional information on any EAF question can be obtained by consulting the EAF Workbooks. Although the EAF Mapper provides the most up-to-date digital data available to DEC, you may also need to contact local or other data sources in order to obtain data not provided by the Mapper. Digital data is not a substitute for agency determinations.



B.i.i [Coastal or Waterfront Area]	Yes
B.i.ii [Local Waterfront Revitalization Area]	No
C.2.b. [Special Planning District]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.
E.1.h [DEC Spills or Remediation Site - Potential Contamination History]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.
E.1.h.i [DEC Spills or Remediation Site - Listed]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.
E.1.h.i [DEC Spills or Remediation Site - Environmental Site Remediation Database]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.
E.1.h.iii [Within 2,000' of DEC Remediation Site]	No
E.2.g [Unique Geologic Features]	No
E.2.h.i [Surface Water Features]	Yes
E.2.h.ii [Surface Water Features]	Yes
E.2.h.iii [Surface Water Features]	Yes - Digital mapping information on local and federal wetlands and waterbodies is known to be incomplete. Refer to EAF Workbook.
E.2.h.iv [Surface Water Features - Stream Name]	862-371
E.2.h.iv [Surface Water Features - Stream Classification]	C
E.2.h.iv [Surface Water Features - Wetlands Name]	Federal Waters
E.2.h.v [Impaired Water Bodies]	No
E.2.i. [Floodway]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.
E.2.j. [100 Year Floodplain]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.

E.2.k. [500 Year Floodplain]	Digital mapping data are not available or are incomplete. Refer to EAF Workbook.
E.2.l. [Aquifers]	No
E.2.n. [Natural Communities]	No
E.2.o. [Endangered or Threatened Species]	No
E.2.p. [Rare Plants or Animals]	No
E.3.a. [Agricultural District]	Yes
E.3.a. [Agricultural District]	ULST001
E.3.c. [National Natural Landmark]	No
E.3.d [Critical Environmental Area]	No
E.3.e. [National or State Register of Historic Places or State Eligible Sites]	Yes - Digital mapping data for archaeological site boundaries are not available. Refer to EAF Workbook.
E.3.e.ii [National or State Register of Historic Places or State Eligible Sites - Name]	Eligible property:BIRDSALL HOUSE/POLHAMUS FARM
E.3.f. [Archeological Sites]	No
E.3.i. [Designated River Corridor]	No

Crawford & Associates Engineering & Land Surveying, PC
Engineering Consultants, Planners, Geologists & Surveyors
Hudson Office – 4411 Route 9 Suite 200 • Hudson, NY 12534
Tel: (518) 828-2700 • Fax: (518) 828-2723 • www.crawfordandassociates.com

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April 05, 2024

Town of Marlborough
Planning Board
21 Milton Turnpike
Milton, NY 12547

ATTN: Chris Brand, Planning Board Chairman

RE: ELP Marlborough Solar, LLC
Stormwater Memo
335 Bingham Road, Town of Marlborough, NY
C&A# 4996.26

Dear Chairman Brand:

Crawford & Associates Engineering, on behalf of ELP Marlborough Solar, LLC, has reviewed the proposed solar project pursuant to the memorandum issued by NYSDEC dated April 05, 2018 for the project located at 335 Bingham Road in the Town of Marlborough, NY. It is anticipated that this project would follow Scenario 1, as described in the memo titled "Solar Panel Construction Stormwater Permitting/SWPPP Guidance", in which only an erosion and sediment control plan would be required. As such, an Erosion & Sediment Control Plan has been prepared detailing within the site plan set titled "ELP Marlborough Solar", dated April 5, 2024, or most recent revision. In addition, it is our understanding that the ELP Marlborough Solar project will disturb greater than one acre, as such, a Stormwater Permit for Construction Activity, GP-0-20-001, and associated Erosion & Sediment Control only SWPPP will be required prior to construction. A copy of the aforementioned memo from NYSDEC is attached for reference.

PRE-DEVELOPMENT CONDITIONS

Using existing site topography, it was determined that the proposed development area consists mostly of mild to moderate slopes, ranging between 5-10%, though some areas ranging in the 10%-20% slope range are included. From the NRCS Web Soil Survey it was determined that the soil consists primarily of Volusia Gravelly Silt Loam (VoB & VoC), which classifies as Hydrologic Soil Group (HSG) D. The remaining area contains soils consisting of Bath-Nassau Complex (BnC) which classifies as HSG C, Lyons-Atherton Complex (LY), and Canandaigua Silt Loam, both of which classify as HSG C/D.

The subject parcel is currently used for agricultural purposes under the property class of "Fruit Crop" and consists of several rows of apple trees making up an approximately 43-acre apple

orchard. The land is comprised of several cover types, including but not limited to meadow (non-grazed), Woods-grass combination, Woods, Brush and Pond. Note that the USDA Urban Hydrology for Small Watersheds TR-55 manual considers an orchard use to be Woods-Grass combination per table 2-2C.

POST-DEVELOPMENT CONDITIONS

The proposed development includes the construction of a 5-MW community solar photovoltaic facility. The solar facility includes approximately 9.6-acres of solar modules with vegetation beneath the modules and between the rows consisting of meadow land cover, 0.62-acres of pervious stone access drive, and 0.03-acres of concrete equipment pad(s) to facilitate the operation of the solar facility.

Minimal changes to the existing topography are proposed and are limited to the minimum required to facilitate the project installation. Approximately 28.6-acres of cover type will be changed from Woods-grass combination to meadow, and approximately 0.75-acres of land will change from brush to meadow which reflects the change of use from orchard to solar. Cover types for the remaining acreage outside the development area will remain unchanged.

CONCLUSION

Considering the proposed changes to the development area described above along with the guidance presented in the memorandum issued by NYSDEC on April 05, 2018, titled "Solar Panel Construction Stormwater Permitting/SWPPP Guidance", it is expected that this project shall require only erosion and sediment controls and associated E&SC only SWPPP. The construction of the solar facility is anticipated to have limited to no impact on the hydrology from pre to post-development conditions. Full hydrology analysis, E&SC only SWPPP, and Stormwater Permit for Construction Activity, GP-0-20-001 would be completed prior to construction.

Attached you will find a copy of the memorandum from NYSDEC dated April 05, 2018 for your reference. Please feel free to reach out with any questions you may have as you review.

Sincerely,
Crawford & Associates Engineering, PC

Christopher J. Knox, PE
Project Manager II

Cc: File 4996.26
H:\WORK\4996.26 Marlborough\Corresp\Permitting\Planning Board\2024.04.05 Site Plan Review\2024.04.05 Stormwater Memo.docx

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Division of Water, Bureau of Water Permits
625 Broadway, Albany, New York 12233-3505
P: (518) 402-8111 I F: (518) 402-9029
www.dec.ny.gov

MEMORANDUM

TO: Regional Water Engineers

FROM: Robert Wither, Chief, South Permit Section

SUBJECT: Solar Panel Construction Stormwater Permitting/SWPPP Guidance

DATE: April 5, 2018

Issue

The Department is seeing an increase in the number of solar panel construction projects across New York State. This has resulted in an increase in the number of questions on Construction General Permit (CGP) and Stormwater Pollution Prevention Plan (SWPPP) requirements from design professionals because the current CGP (GP-0-15-002) does not include a specific reference to the SWPPP requirements for solar panel projects in Tables 1 and 2 of Appendix B. To address this issue, the Division of Water (DOW) has developed the following guidance on CGP/SWPPP requirements for the different types of solar panel projects.

Scenario 1

The DOW considers solar panel projects designed and constructed in accordance with the following criteria to be a "*Land clearing and grading for the purposes of creating vegetated open space (i.e. recreational parks, lawns, meadows, fields)*" type project as listed in Table 1, Appendix B of the CGP. Therefore, the SWPPP for this type of project will typically just need to address erosion and sediment controls.

1. Solar panels are constructed on post or rack systems and elevated off the ground surface,
2. The panels are spaced apart so that rain water can flow off the down gradient side of the panel and continue as sheet flow across the ground surface*,
3. For solar panels constructed on slopes, the individual rows of solar panels are generally installed along the contour so rain water sheet flows down slope*,
4. The ground surface below the panels consist of a well-established vegetative cover (see "Final Stabilization" definition in Appendix A of the CGP),
5. The project does not include the construction of any traditional impervious areas (i.e. buildings, substation pads, gravel access roads or parking areas, etc.),
6. Construction of the solar panels will not alter the hydrology from pre-to post development conditions (see Appendix A of the CGP, for definition of "Alter the hydrology..."). Note: The design professional shall perform the necessary site assessment/hydrology analysis to make this determination.

*Refer to Maryland's "Stormwater Design Guidance- Solar Panel Installations" attached for guidance on panel installation.
**See notes below for additional criteria.

Scenario 2

If the design and construction of the solar panels meets all the criteria above, except for item 6, the project will fall under the "*All other construction activities that include the construction or reconstruction of impervious area or alter the hydrology from pre-to post development conditions, and are not listed in Table 1*" project type as listed in Table 2, Appendix B of the CGP. Therefore, the SWPPP for this type of project must address post-construction stormwater practices designed in accordance with the sizing criteria in Chapter 4 of the NYS Stormwater Management Design Manual, dated January 2015 (Note: Chapter 10 for projects in NYC EOH Watershed). The Water Quality Volume (WQv)/Runoff Reduction Volume (RRv) sizing criteria can be addressed by designing and constructing the solar panels in accordance with the criteria in items 1 – 4 above, however, the quantity control sizing criteria (Cpv, Qp and Qf) from Chapter 4 (or 10) of the Design Manual must still be addressed, unless one of the waiver criteria from Chapter 4 can be applied. **See notes below for additional criteria.

**** Notes**

- Item 1: For solar panel projects where the panels are mounted directly to the ground (i.e. no space below panel to allow for infiltration of runoff), the SWPPP must address post-construction stormwater management controls designed in accordance with the sizing criteria in Chapter 4 of the NYS Stormwater Management Design Manual, dated January 2015 (Note: Chapter 10 for projects in NYC EOH Watershed).

- Item 5: For solar panel projects that include the construction of traditional impervious areas (i.e. buildings, substation pads, gravel access roads or parking areas, etc.), the SWPPP must address post-construction stormwater management controls for those areas of the project. This applies to both Scenario 1 and 2 above.

cc: Carol Lamb-Lafay, BWP
Dave Gasper, BWP

Stormwater Design Guidance – Solar Panel Installations

Revisions to Maryland's stormwater management regulations in 2010 require that environmental site design (ESD) be used to the maximum extent practicable (MEP) to mimic natural hydrology, reduce runoff to reflect forested wooded conditions, and minimize the impact of land development on water resources. This applies to any residential, commercial, industrial, or institutional development where more than 5,000 square feet of land area is disturbed. Consequently, stormwater management must be addressed even when permeable features like solar panel installations exceed 5,000 square feet of land disturbance.

Depending on local soil conditions and proposed imperviousness, the amount of rainfall that stormwater requirements are based on varies from 1.0 to 2.6 inches. However, addressing stormwater management does not mean that structural or micro-scale practices must be constructed to capture and treat large volumes of runoff. Using nonstructural techniques like disconnecting impervious cover reduces runoff by promoting overland filtering and infiltration. Commonly used with smaller or narrower impervious areas like driveways or open roads, the Disconnection of Non-Rooftop Runoff technique (see pp. 5.61 to 5.65 of the **2000 Maryland Stormwater Design Manual**[1]) is a low cost alternative for treating runoff in situations like rows of solar panels.

When non-rooftop disconnection is used to treat runoff, the following factors should be considered:

- The vegetated area receiving runoff must be equal to or greater in length than the disconnected surface (e.g., width of the row of solar panels)
- Runoff must sheet flow onto and across vegetated areas to maintain the disconnection
- Disconnections should be located on gradual slopes (≤ 5%) to maintain sheetflow. Level spreaders, terraces, or berms may be used to maintain sheetflow conditions if the average slope is steeper than 5%. However, installations on slopes greater than 10% will require an engineered plan that ensures adequate treatment and the safe and non-erosive conveyance of runoff to the property line or downstream stormwater management practice.
- Disconnecting impervious surfaces works best in undisturbed soils. To minimize disturbance and compaction, construction vehicles and equipment should avoid areas used for disconnection during installation of the solar panels.
- Groundcover vegetation must be maintained in good condition in those areas receiving disconnected runoff. Typically this maintenance is no different than other lawn or landscaped areas. However, areas receiving runoff should be protected (e.g., planting shrubs or trees along the perimeter) from future compaction.

Depending on the layout and number of panels installed, the disconnection of non-rooftop runoff technique may address some or all of the stormwater management requirements for an individual project. Where the imperviousness is high or there is other infrastructure (e.g., access roads, transformers), additional runoff may need to be treated. In these situations, other ESD techniques or micro-scale practices may be needed to provide stormwater management for these features.

Example 1 – Using Non-Rooftop Disconnection Where the Average Slope ≤ 5%

Several rows of solar panels will be installed in an existing meadow. The soils within the meadow are hydrologic soil group (HSG) B and the average slope does not exceed 5%. Each row of panels is 10 feet wide and the distance between rows is 20 feet. The rows of solar panels will be installed according to Figure 1 below. In this scenario, the disconnection length is the same as the distance between rows (20 feet) and is greater than the width of each row (10 feet). Therefore, each row of panels is adequately disconnected and the runoff from 1.0 inch of rainfall is treated.

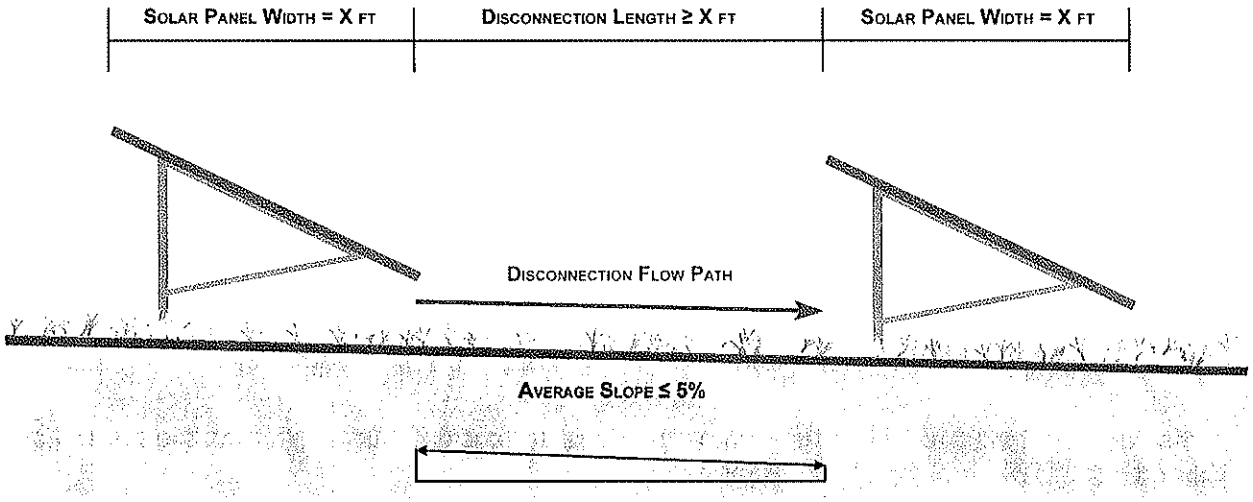

Figure 1. Typical Installation - Slope ≤ 5%

Example 2 – Using Non-Rooftop Disconnection Where the Average Slope ≥ 5% but ≤ 10%

Several rows of solar panels will be installed in an existing meadow. The soils within the meadow are hydrologic soil group (HSG) B and the average slope is greater than 5% but less than 10%. Each row of panels is 10 feet wide and the distance between rows is 20 feet. The rows of solar panels will be installed as shown in Figure 2 below. The disconnection length is the same as the distance between rows (20 feet) and is greater than the width of each row (10 feet). However, in this example, a level spreader (typically 1 to 2-foot wide and 1 foot deep) has been located at the drip edge of each row of panels to dissipate energy and maintain sheetflow.

Discussion

To meet State and local stormwater management requirements, ESD must be used to the MEP to reduce runoff to reflect forested conditions. While all reasonable options for implementing ESD must be investigated, minimally, the runoff from 1 inch of rainfall must be treated. In each of the examples above, there may be additional opportunities to implement ESD techniques or practices and reduce runoff that should be explored. However, simply disconnecting the runoff from the solar panel arrays captures and treats the runoff from 1.0 inch of rainfall. Where imperviousness is low and soil conditions less optimal (e.g., HSG C or D), this may be sufficient to completely address stormwater management requirements. In more dense applications or in sandy soils, additional stormwater management may be required.

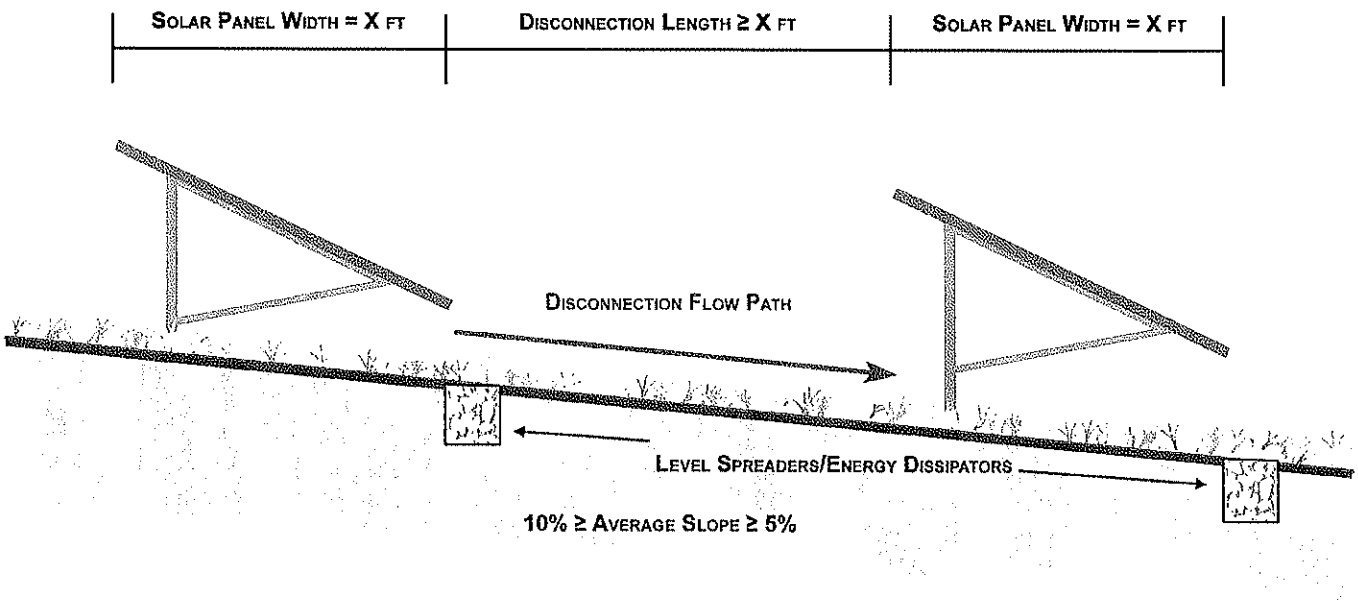

Figure 2. Typical Installation – Slope ≥ 5% but ≤ 10%

Conclusion

The primary purpose of Maryland's stormwater management program is to mimic natural hydrologic runoff characteristics and minimize the impact of land development on water resources. Any land development project that exceeds 5,000 square feet of disturbance, including solar panel projects, must address stormwater management. However, for solar panels, stormwater management may be provided in a cost-effective manner by disconnecting each row of panels and directing runoff over the vegetated areas between the individual rows.

Resources

[1] 2000 Maryland Stormwater Design Manual, Volumes I and II, MDE, October 2000 (http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/MarylandStormwaterDesignManual/Pages/Programs/WaterPrograms/SedimentandStormwater/stormwater_design/index.aspx)

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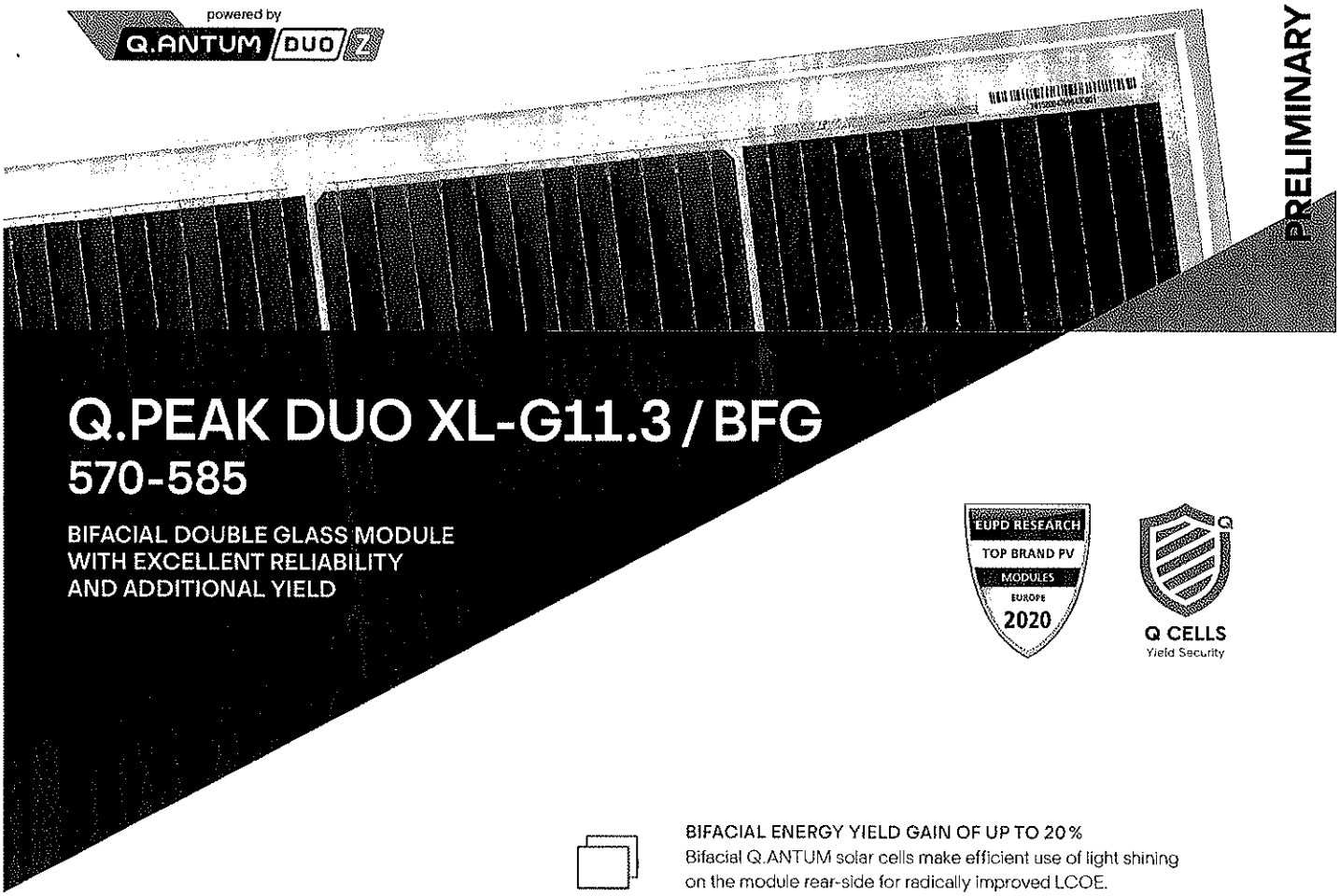
PRELIMINARY

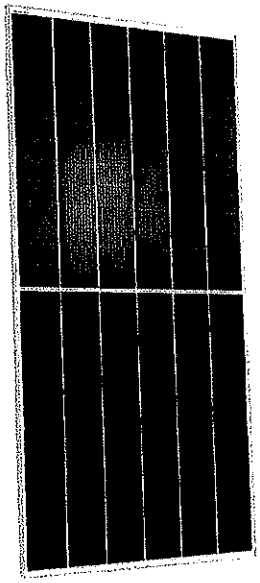


Q.PEAK DUO XL-G11.3 / BFG
570-585

BIFACIAL DOUBLE GLASS MODULE
WITH EXCELLENT RELIABILITY
AND ADDITIONAL YIELD

EUPD RESEARCH TOP BRAND PV MODULES EUROPE 2020

Q CELLS Yield Security



BIFACIAL ENERGY YIELD GAIN OF UP TO 20 %
Bifacial Q.ANTUM solar cells make efficient use of light shining on the module rear-side for radically improved LCOE.

LOW ELECTRICITY GENERATION COSTS
Q.ANTUM DUO Z combines cutting edge cell separation and innovative wiring with Q.ANTUM Technology for higher yield per surface area, lower BOS costs, higher power classes, and an efficiency rate of up to 21.5%.

INNOVATIVE ALL-WEATHER TECHNOLOGY
Optimal yields, whatever the weather with excellent low-light and temperature behavior.

ENDURING HIGH PERFORMANCE
Long-term yield security with Anti LID and Anti PID Technology[1], Hot-Spot Protect and Traceable Quality Tra.Q™.

FRAME FOR VERSATILE MOUNTING OPTIONS
High-tech aluminum alloy frame protects from damage, enables use of a wide range of mounting structures and is certified regarding IEC for high snow (5400 Pa) and wind loads (2400 Pa).

A RELIABLE INVESTMENT
Double glass module design enables extended lifetime with 12-year product warranty and improved 30-year performance warranty[2].

[1] APT test conditions according to IEC/TS 62804-1:2015 method B (−1500 V, 168 h) including post treatment according to IEC 61215-1-1 Ed. 2.0 (CD)
[2] See data sheet on rear for further information

THE IDEAL SOLUTION FOR:

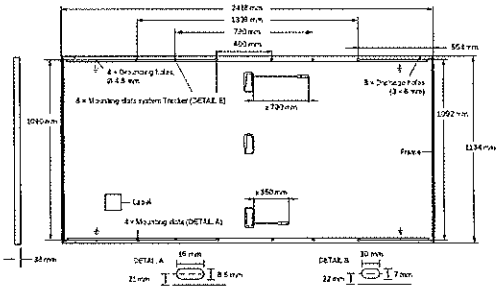
Ground-mounted solar power plants

Engineered in Germany

Q CELLS

MECHANICAL SPECIFICATION

Format	2416 mm × 1134 mm × 35 mm (including frame)
Weight	34.4 kg
Front Cover	2 mm thermally pre-stressed glass with anti-reflection technology
Back Cover	2 mm semi-tempered glass
Frame	Anodised aluminium
Cell	6 × 26 monocrystalline Q.ANTUM solar half cells
Junction box	53-101 mm × 32-60 mm × 15-18 mm Protection class IP67, with bypass diodes
Cable	4 mm² Solar cable; (–) ≥ 700 mm, (–) ≥ 350 mm
Connector	Stäubli MC4-Evo2, Hanwha Q CELLS HQC4; IP68



ELECTRICAL CHARACTERISTICS

POWER CLASS				570		575		580		585	
MINIMUM PERFORMANCE AT STANDARD TEST CONDITIONS, STC[1] AND BSTC[1] (POWER TOLERANCE +5 W / –0 W)											
					BSTC*		BSTC*		BSTC*		BSTC*
Minimum	Power at MPP[1]	P_{MPP}	[W]	570	623.5	575	629.0	580	634.4	585	639.9
	Short Circuit Current[1]	I_{SC}	[A]	13.50	14.77	13.52	14.80	13.55	14.83	13.57	14.86
	Open Circuit Voltage[1]	V_{OC}	[V]	53.50	53.69	53.53	53.72	53.56	53.75	53.59	53.78
	Current at MPP	I_{MPP}	[A]	12.83	14.03	12.87	14.09	12.92	14.14	12.97	14.19
	Voltage at MPP	V_{MPP}	[V]	44.44	44.43	44.66	44.65	44.88	44.87	45.10	45.09
	Efficiency[1]	η	[%]	≥20.8	≥22.8	≥21.0	≥23.0	≥21.2	≥23.2	≥21.4	≥23.4

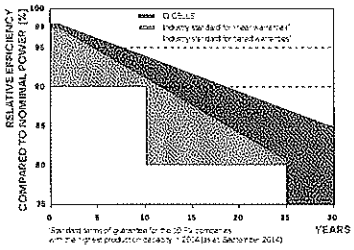
Bifaciality of P_{MPP} and I_{SC} 70 % ± 5 % • Bifaciality given for rear side irradiation on top of STC (front side) • According to IEC 60904-1-2

[1]Measurement tolerances P_{MPP} ±3 %; I_{SC}; V_{OC} ±5 % at STC: 1000 W/m²; *at BSTC: 1000 W/m² + φ × 135 W/m², φ = 70 % ± 5 %, 25 ± 2 °C, AM 1.5 according to IEC 60904-3

MINIMUM PERFORMANCE AT NORMAL OPERATING CONDITIONS, NMOT[2]							
Minimum	Power at MPP	P_{MPP}	[W]	429.1	432.9	436.6	440.4
	Short Circuit Current	I_{SC}	[A]	10.87	10.89	10.91	10.93
	Open Circuit Voltage	V_{OC}	[V]	50.60	50.63	50.66	50.68
	Current at MPP	I_{MPP}	[A]	10.09	10.14	10.18	10.22
	Voltage at MPP	V_{MPP}	[V]	42.51	42.71	42.89	43.08

[2]800 W/m², NMOT, spectrum AM 1.5

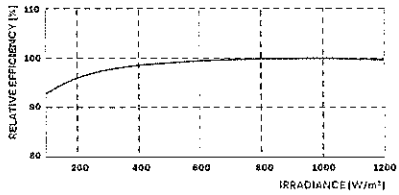
Q CELLS PERFORMANCE WARRANTY



At least 98 % of nominal power during first year. Thereafter max. 0.45 % degradation per year. At least 94 % of nominal power up to 10 years. At least 85 % of nominal power up to 30 years.

All data within measurement tolerances. Full warranties in accordance with the warranty terms of the Q CELLS sales organisation of your respective country.

PERFORMANCE AT LOW IRRADIANCE



Typical module performance under low irradiance conditions in comparison to STC conditions (25 °C, 1000 W/m²).

TEMPERATURE COEFFICIENTS							
Temperature Coefficient of I_{SC}	α	[%/K]	+0.04	Temperature Coefficient of V_{OC}	β	[%/K]	–0.27
Temperature Coefficient of P_{MPP}	γ	[%/K]	–0.34	Nominal Module Operating Temperature	NMOT	[°C]	42±3

PROPERTIES FOR SYSTEM DESIGN

Maximum System Voltage	V_{SYS}	[V]	1500	PV module classification	Class II
Maximum Reverse Current	I_R	[A]	20	Fire Rating based on ANSI / UL 61730	C / TYPE 29[3]
Max. Design Load, Push / Pull		[Pa]	3600 / 1600	Permitted Module Temperature on Continuous Duty	–40 °C – +85 °C
Max. Test Load, Push / Pull		[Pa]	5400 / 2400	[3] New Type is similar to Type 3 but with metallic frame	

QUALIFICATIONS AND CERTIFICATES

IEC 61215:2016, IEC 61730:2016.
This data sheet complies with DIN EN 50380.

Note: Installation instructions must be followed. See the installation and operating manual or contact our technical service department for further information on approved installation and use of this product.

Hanwha Q CELLS GmbH
Sonnenallee 17-21, 06766 Bitterfeld-Wolfen, Germany | **TEL** +49 (0)3494 66 99-23444 | **FAX** +49 (0)3494 66 99-23000 | **EMAIL** sales@q-cells.com | **WEB** www.q-cells.com

Engineered in Germany

 Q.PEAK DUO XL-G11.3_BFG_570-585_2020-11_Rev01_EN

OMCO Choice™

Direct-Bolt Mounting System

Technical Specifications

Manufacturing:	OEM direct, shipped to project sites from OMCO Solar's manufacturing facilities, conveniently located nationwide.
Pre-assembly:	Each rack consists of pre-assembled components, which reduces the bill of material items, allowing rapid site staging and installation.
Materials:	Galvanized steel, per ASTM A653 – latest edition
Hardware:	Zinc-coated to 15 microns per UL 2703, the hardware arrives pre-sorted for easy identification. Additional plating options are available for corrosive environments.
Module compatibility:	OMCO Solar racks are optimized for all commercially available framed solar modules.
In-field flexibility:	Built-in adjustability features account for post misalignment and terrain elevation changes with no additional components. Proprietary custom slot configurations come standard on every fixed-tilt mounting system.
Table configuration:	2-in-portrait is standard, other configurations evaluated per site-specific requirements
Terrain articulation:	Accommodates up to 20% grade change
Foundation options:	Driven piles (C-posts or I-beams)
Tilt angle:	Accommodates from 5°- 45°
Wire management:	Integrated wire management system
Bonding/grounding:	UL 2703 compliant
Post-tolerances:	East to West tolerance 3/4" or 0.75" 1° North to South tolerance 3/4" or 0.75" 1°
Load capacities:	Wind – up to 180 MPH | Snow – up to 90 PSF
Certifications:	ISO 9001:2015 standard, UL 2703 Ed. 1, CPP wind tunnel-tested, NEC compliant
Warranty:	20-year limited warranty

FACTORY DIRECT

- **Reduced lead times**
- **Lower shipping costs**
- **Responsive customer service**
- **Enhanced flexibility**

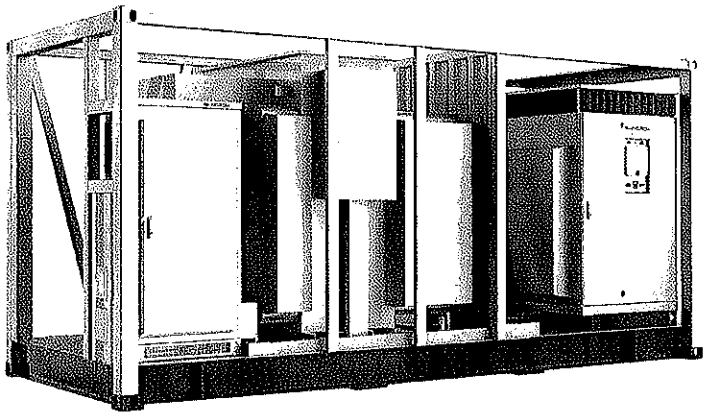
OMCO SOLAR

4550 W. Watkins St., Suite 100
Phoenix, AZ 85043
Tel: 602-352-2700 • Fax: 602-352-2701
info@omcosolar.com

www.omcosolar.com

SG3425UD-MV/ SG3600UD-MV

Turnkey Station for North America 1500 Vdc System - MV Transformer Integrated



HIGH YIELD

- Advanced three-level technology, max. efficiency 98.9%
- Inverter Full Power Operation Up to 45℃
- Effective cooling, wide operation temperature
- Max. DC/AC ratio up to 2.0

SMART O&M

- Integrated current, voltage and MV parameters monitoring function for online analysis and trouble shooting
- Modular design, easy for maintenance

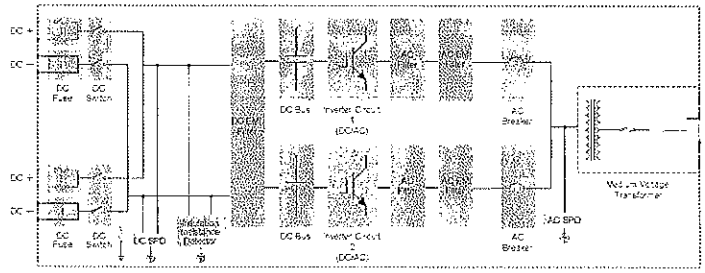
SAVED INVESTMENT

- Low transportation and installation cost due to 20-foot container size design
- DC-coupled storage interface and charging power from the grid, low system cost
- Integrated MV transformer and LV auxiliary power supply
- Q at night optional

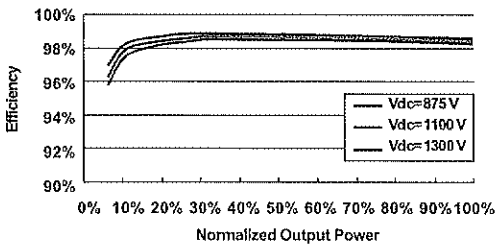
GRID SUPPORT

- Compliance with standards:UL 1741,UL 1741 SA, IEEE 1547, Rule 21 and NEC code
- Low /High voltage ride through (L/HVRT), L/HFRT, soft start/stop
- Active &reactive power control and power ramp rate control

CIRCUIT DIAGRAM



EFFICIENCY CURVE (SG3425UD)



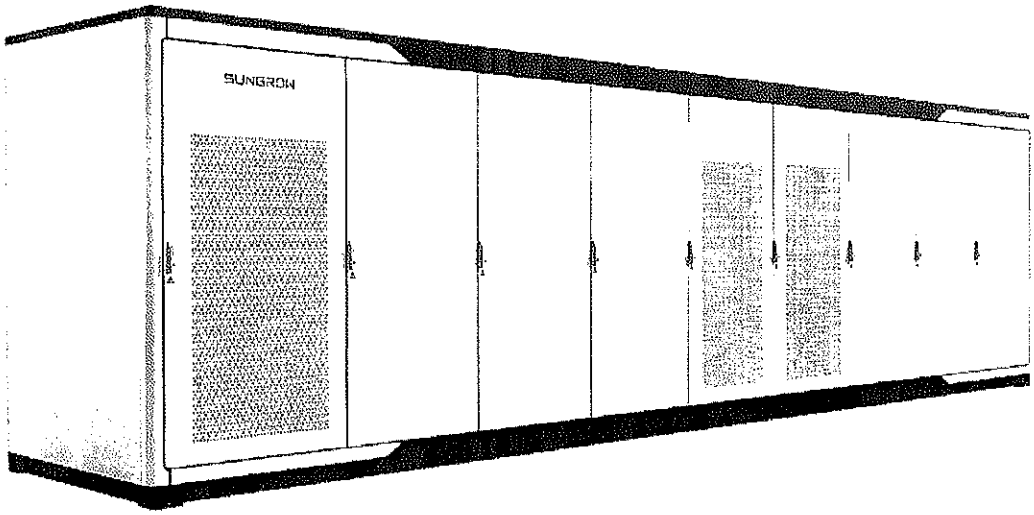
Type designation	SC3425UD-MV	SC3600UD-MV
Input (DC)		
Max. PV input voltage	1500 V	
Min. PV input voltage / Startup input voltage	875 V / 915 V	915 V / 955 V
Available DC fuse sizes	250A ~ 630A	
MPP voltage range	875 – 1300 V	915 – 1300 V
No. of independent MPP inputs	1	
No. of DC inputs	24 (Optional 28)	
Max. DC short-circuit current	2 Switches/5000A(Optional:4 Switches/10000 A)	
PV array configuration	Negative grounding (Optional:Floating)	
Output (AC)		
AC output power	3425 kVA @ 45 °C (113 °F), 3083 kVA @ 50 °C (122 °F)*	3600 kVA @ 45 °C (113 °F), 3240 kVA @ 50 °C (122 °F)*
Nominal grid frequency / Grid frequency range	50 Hz / 45 – 55 Hz, 60 Hz / 50 – 65 Hz	
Harmonic (THD)	< 3 % (at nominal power)	
Power factor at nominal power / Ajustable power factor	> 0.99 / 0.8 leading - 0.8 lagging	
Efficiency		
Inverter Max. efficiency	98.9 %	
Inverter CEC efficiency	98.5 %	
Transformer		
Transformer rated power	3425 kVA	3600 kVA
Transformer max. power	3425 kVA	3600 kVA
LV / MV voltage	0.6 kV / (12 – 35) kV	0.63 kV / (12 – 35) kV
Transformer vector	Dy1(Optional:Dy11,Yny)	
Transformer cooling type	KNAN (Optional: ONAN)	
Protection		
DC input protection	Load break switch + fuse	
Inverter output protection	Circuit breaker	
AC MV output protection	Load break switch + fuse	
Overvoltage protection	DC Type II / AC Type II	
Grid monitoring / Ground fault monitoring	Yes / Yes	
Insulation monitoring	Yes	
Overheat protection	Yes	
General Data		
Dimensions (W*H*D)	6058 * 2896 * 2438 mm 238.5" * 114.0" * 96.0"	
Weight	18000 kg 39683.2 lbs	
Degree of protection	NEMA 4X(Electronic for Inverter) / NEMA 3R(Others)	
Auxiliary power supply	5kVA, 120Vac; Optional: 30kVA, 480Vac/277Vac	
Operating ambient temperature range	-35 to 60 °C (> 45 °C derating) / optional: -40 to 60 °C (> 45 °C derating) -22 to 140 °F (> 113 °F derating) / optional: -40 to 140 °F (> 113 °F derating)	
Allowable relative humidity range	0 - 100 %	
Cooling method	Temperature controlled forced air cooling	
Max. operating altitude	1000 m (Standard) / > 1000 m (Customized) (3280.8 ft (standard) / > 3280.8 ft (Customized))	
DC-coupled storage interface	Optional	
Charging power from the grid	Optional	
Communication	Standard: RS485, Ethernet	
Compliance	UL 1741,IEEE 1547, UL1741 SA, NEC 2020, CSA C22.2 No.107.1-01&16	
Grid support	Q at night function (optional), L/HVRT, L/HFRT, Active & reactive power control and power ramp rate control, Volt-var, Frequency-watt	

*: For sustained operation above 40°C , an optional 60°C temperature rise transformer is recommended

ST2752UX

Liquid Cooling Energy Storage System

Preliminary



LOW COSTS

- Highly integrated ESS for easy transportation and O&M
- All pre-assembled, no battery module handling on site
- 8 hour installation to commission, drop on a pad and make electrical connections

SAFE AND RELIABLE

- DC electric circuit safety management includes fast breaking and anti-arc protection
- Multi level battery protection layers formed by discreet standalone systems offer impeccable safety

EFFICIENT AND FLEXIBLE

- Intelligent liquid cooling ensures higher efficiency and longer battery cycle life
- Modular design supports parallel connection and easy system expansion
- IP55 outdoor cablinet and optional C5 anti-corrosion

SMART AND ROBUST

- Fast state monitoring and faults record enables pre-alarm and faults location
- Integrated battery performance monitorinig and logging

EUROPE

SUNGROW
Clean power for all

Type designation	ST2752UX*
Battery Data	
Cell type	LFP
Battery capacity (BOL)	2752 kWh
System output voltage range	1300 – 1500 V
General Data	
Dimensions of battery unit (W * H * D)	9340*2520*1730 mm
Weight of battery unit	26,000 kg
Degree of protection	IP 55
Operating temperature range	-30 to 50 °C (> 45 °C derating)
Relative humidity	0 ~ 95 % (non-condensing)
Max. working altitude	3000 m
Cooling concept of battery chamber	Liquid cooling
Fire safety standard/Optional	Deluge sprinker heads (standard), Fused sprinkler heads (optional), NFPA69 explosion prevention and ventillation IDLH gases (optional)
Communication interfaces	RS485, Ethernet
Communication protocols	Modbus RTU, Modbus TCP
Compliance	CE, IEC 62477-1, IEC 61000-6-2, IEC61000-6-4, IEC62619
2 HOURS APPLICATION-ST2752UX*4-5000UD-MV	
BOL kWh (DC/AC LV Side)	11,008 kWh DC / 10,379 kWh AC
ST2752UX Quantity	4
PCS Model	SC5000UD-MV
4 HOURS APPLICATION-ST2752UX*8-5000UD-MV	
BOL kWh (DC/AC LV Side)	22,016 kWh / 21,448 kWh
ST2752UX Quantity	8
PCS Model	SC5000UD-MV
Grid Connection Data	
Max.THD of current	< 3 % (at nominal power)
DC component	< 0.5 % (at nominal power)
Power factor	> 0.99 (at nominal power)
Adjustable power factor	1.0 leading – 1.0 lagging
Nominal grid frequency	50 / 60 Hz
Grid frequency range	45 – 55 Hz / 55 – 65 Hz
Transformer	
Transformer rated power	5,000 kVA
LV/MV voltage	0.95 kV / 33 kV
Transformer cooling type	ONAN (Oil Natural Air Natural)
Oil type	Mineral oil (PCB free) or degradable oil on request

For

Interconnection Customer: ELP Marlborough Solar LLC

Applicant: ELP Marlborough Solar LLC

5,000 kW Photovoltaic and Energy Storage (PV+ESS) Generator System

335 Bingham Rd,

Marlborough, NY 12542

Interconnection to Central Hudson Gas and Electric Corp.

NY

Kingston District

Marlboro Substation

13.2 kV Feeder 5004

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the analysis results of the Central Hudson Gas and Electric Corp. ("CHGE" or the "Company") interconnection study based on the proposed interconnection and design submittal from the Interconnection Customer in accordance with the Company Interconnection Requirements for Distributed Energy Resources Connected in Parallel with the CHGE Electrical Delivery System, IEEE Standard 1547-2018 ("IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems"), and "New York State Standardized Interconnection Requirements and Application Process for New Distributed Generators 5 MW or Less Connected in Parallel with Utility Distribution Systems" (NYSSIR). The intent of this report is to assess this project's feasibility, determine its impact to the existing electric power system (EPS), determine interconnection scope and installation requirements, and determine costs associated with interconnecting the Interconnection Customer's generation to the Company's Electric Power System (EPS). This Coordinated Electric System Impact Review (CESIR) study; according to the NYSSIR Section I.C Step 6; identifies the scope, schedule, and costs specific to this Interconnection Customer's installation requirements.

2.0 EXECUTIVE SUMMARY

The total estimated planning grade cost of the work associated with the interconnection of the Interconnection Customer is $[redacted].

The interconnection was found to be feasible with modifications to the existing Company EPS and operating conditions, which are described in detail in the body of this study.

3.0 COMPANY EPS PARAMETERS

Substation	**Marlboro**
Transformer Name	Transformer #2
Transformer Peak Load (kW)	11,770
Contingency Condition Load, N-1 Criteria (kW) (as applicable)	N/A
Daytime Light Load (kW)	2,563
Generation: Total, Connected, Queued Ahead (kW)	7,149 / 2,029 / 91.9
Contingency Condition Generation: Total, Connected, Queued Ahead (kW)	N/A
Supply Voltage (kV)	115
Transformer Maximum Nameplate Rating (MVA)	12 / 16 / 20
Distribution Bus Voltage Regulation	Yes
Transmission GFOV Status	Installed
Bus Tie	Normally Open
Number of Feeders Served from this Bus	3

Connecting Feeder/Line	5004
Peak Load on feeder (kW)	5,655
Daytime Light Load on Feeder (kW)	665
Feeder Primary Voltage at POI (kV)	13.2
Line Phasing at POI	1
Circuit distance from POI to substation	1.97 Miles
Distance from POI to nearest 3-phase (if applicable)	0.687
Line Regulation	Yes
Line/Source Grounding Configuration at POI	Effective
Other Generation: Total, Connected, Queued Ahead (kW)	6,294 / 1,262 / 21.81

System Fault Characteristics without Interconnection Customer DG at POI with System Upgrades Described in Section 6	
Interconnection Customer POI Location	Pole N27104, Bingham Rd
I 3-phase (3LLL)	10,787 Amps
I Line to Ground (3I0)	11,507 Amps
Z1 (100 MVA base)	0.26 + j 0.70 PU
Z0 (100 MVA base)	0.35 +j 1.13 PU

4.0 INTERCONNECTION CUSTOMER SITE

The Interconnection Customer is proposing a new primary service connection with Project No. CH-17631.
The proposed project POI is on Feeder 5004 supplied from Marlboro Substation Transformer #2. The POI is located approximately 1.97 miles from the substation. The POI is on single-phase 7.2 kV. The interconnection includes 135 feet of 336 ACSR Bare OH Conductor, 140 feet of 3/0 AWG ACSR OH Conductor, and 1300 feet of 4/0 AWG AL 15kV rated cable. The PV units are interconnected to the low side (630 V Delta) of two 2.5 MVA customer installed and managed pad-mounted transformers.

The proposed generating system consists of:

- A total of 12,072 HANWHA Q.PEAK_DUO_L-G11.3 BIFACIAL 585 W PV modules
- Two SUNGROW SG3600UD-MV 3600 kVA solar inverters at 630 Vac output and curtailed to 2500 kW each.
- Two, three-phase 2.5 MVA, 630Vac wye - 13.2 kV wye grounded, step-up transformers with 5.75% impedance.

5.0 SYSTEM IMPACT ANALYSIS

The analysis was run at the rated project size in normal system configuration connected to Feeder 5004. The following table shows the impact study results of the proposed 5,000 kW system at unity power factor interconnecting to Central Hudson's distribution system.

Category	Criteria	Limit	Result
Voltage	Overvoltage - Primary	<105% (ANSI C84.1)	Fail
With the addition of the subject generator, the maximum voltage as modeled on the feeder is 105.44% of nominal. The overvoltage will be mitigated by applying the mitigation mentioned in Section 6.0			
Voltage	Overvoltage – Project Inverters	<105% (ANSI C84.1)	Pass
With the addition of the subject generator, there were no overvoltage violations observed at the project inverters.			
Voltage	Undervoltage	>95% (ANSI C84.1)	Pass
With the addition of the subject generator, there were no undervoltage violations observed at the Feeder.			
Voltage	Substation Regulation for Reverse Power	<100% minimum load criteria	Fail
The total proposed generation on Transformer #2, including this project and any projects ahead in queue, is 7.15 MW. The total minimum load on this Transformer is 2.56 MW. Therefore, the generation to load ratio is 279.3%. Reverse flow is expected through Marlboro Substation Transformer #2. Marlboro Transformer #2 LTC control needs to be upgraded by interconnecting customer to handle reverse power flow.			
Voltage	Feeder Regulation for Reverse Power	<100% minimum load to generation ratio	Fail
The total proposed generation on Feeder 5004, including this project and any projects ahead in queue, is 6.29 MW. The total minimum load on this Feeder is 0.67 MW. Therefore, the generation to load ratio is 945.86%. Distribution line regulator 196162 is connected between the proposed project POI and the substation. The violation will be mitigated by applying the mitigation mentioned in Section 6.0.			
Voltage	Fluctuation	<3% steady state from proposed generation on feeder	Pass
The maximum resulting voltage fluctuation at the POI location is 2.58% due to the proposed generation output stepping from 100% to 0%.			
Voltage	Fluctuation	<5% steady state from aggregate DER on substation bus	Pass
The maximum resulting voltage fluctuation at the feeder location is 3.92% due to all generation output stepping from 100% to 0%.			

Category	Criteria	Limit	Result
Voltage	Fluctuation	Regulator tap movement exceeds 1 position, generation change of 75% of nameplate rating does not result in voltage change >½ the bandwidth of any feeder voltage regulating device.	Fail
The steady state load flow results show that the Marlboro Transformer #2 LTC will not have excessive tap movement with the proposed generation online. Distribution line regulator 196162 will have excessive tap movement. The tap movement issue will be mitigated by applying the mitigation options mentioned in Section 6.0.			
Voltage	Flicker	Screen H Flicker	Pass
E_{Pst} = 0.375. Pst at POI = 0.007 at a generation output stepping from 100%-0%.			
Equipment Ratings	Thermal (continuous current)	<100% thermal limits assuming no load	Fail
There are two protective devices between the substation breaker and POI: 280A Recloser N17211 and 65K fuse N43392. The loading on fuse N43392 exceeds its current thermal rating with the proposed project online. There are no thermal violations at overhead or underground line sections with the proposed generation online.			
Equipment Ratings	Withstand (fault current)	<90% withstand limits	Pass
Protection	Unintentional Islanding	Unintentional Islanding Document & Company Guidelines	Fail
The subject generator is 5.0 MW PV. The total interconnection of 6.29 MW exceeds 2/3 of the minimum feeder loading criteria. The proposed interconnection also fails the criteria where the feeder power factor is higher than 0.99 (lag or lead) for an extended period; therefore, reclosing blocking will be required on the 5004 circuit.			
Protection	Protective device coordination	Company Guidelines	Pass
There are no coordination setting changes required at Marlboro Substation.			
Protection	Fault Sensitivity	Rated capabilities of EPS equipment	Pass
The ground fault current change is not greater than 10% at either the point of interconnection or the 13.8 kV bus.			
Protection	Ground Fault Detection	Reduction of reach >10% (by Utility)	Pass
Protection	Overvoltage - Distribution System Fault	<125% voltage rise	Fail

Category	Criteria	Limit	Result
The customer shall provide documented proof that the inverters have fast tripping capability per the IEEE Standard 1547-2018 Section 7.4.2 Transient Overvoltage Limits. If no documentation can be provided, Electric System Protection requires that the customer perform a transient study to prove that there is no overvoltage or that the inverters have fast tripping capability.			
Protection	Effective Grounding	0<R0/X1<1 0<X0/X1<3	Pass
The modeled R0/X1 is 0.91941 and X0/X1 is 2.2512.			
SCADA	Required EMS Visibility for Generation Sources	Monitoring & Control Requirements	Yes
The 5.0 MW subject generator triggers the requirement for SCADA reporting to the Utility via the use of an electronic recloser at the PCC.			
Other			Fail
The SEL-651R settings compromise the required inverter settings.			

6.0 MITIGATIONS FOR SYSTEM IMPACT ANALYSIS FAILURES

The detail below is intended to provide sufficient information and clarity to give the Interconnection Customer an understanding of the relationship of costs and scope associated with the DER interconnection and the system modifications due to the DER impact. This includes any required EPS equipment upgrades. Where scope items are identified, associated labor, equipment rentals, and indirect project support functions (such as engineering and project management) are intended and implied.

Upgrade Required	Cost	Failures Addressed
Reconductor 0.7 miles of single-phase 7.62 kV to three-phase 336 ACSR 13.2 kV	$[redacted]	Construction to facilitate the interconnection
Single-phase recloser N17211 will be upgraded to a three-phase device	$[redacted]	Construction to facilitate the interconnection
Install plant controller for Volt-VAR function. Project inverters will operate in accordance with the NY standard volt-var curve for UL1741-SB certified smart inverters.	Customer Responsibility	Overvoltage
Install two (2) 600 kVAR switched capacitor banks	$[redacted]	Overvoltage
Relocate distribution line regulator 196162 downstream of the proposed project.	$[redacted]	Voltage Fluctuation
Replace 65k fuse N43392 upstream of the proposed project	$[redacted]	Thermal
Install reclose block	$[redacted]	Unintentional Islanding
Upgrade Marlboro Transformer #2 LTC control	$[redacted]	Substation Regulation for Reverse Power Flow
Install electronic recloser at PCC	$[redacted]	Monitoring & Control requirement
New Service	$[redacted]	N/A

The substation upgrades required to facilitate the proposed installation include the following:

- Upgrade Marlboro Transformer #2 LTC control to operate properly with reverse power flow.
- Reclose blocking is required to ensure the feeder will not close into an energized line during feeder outages when the inverters may not detect the island shut off automatically.

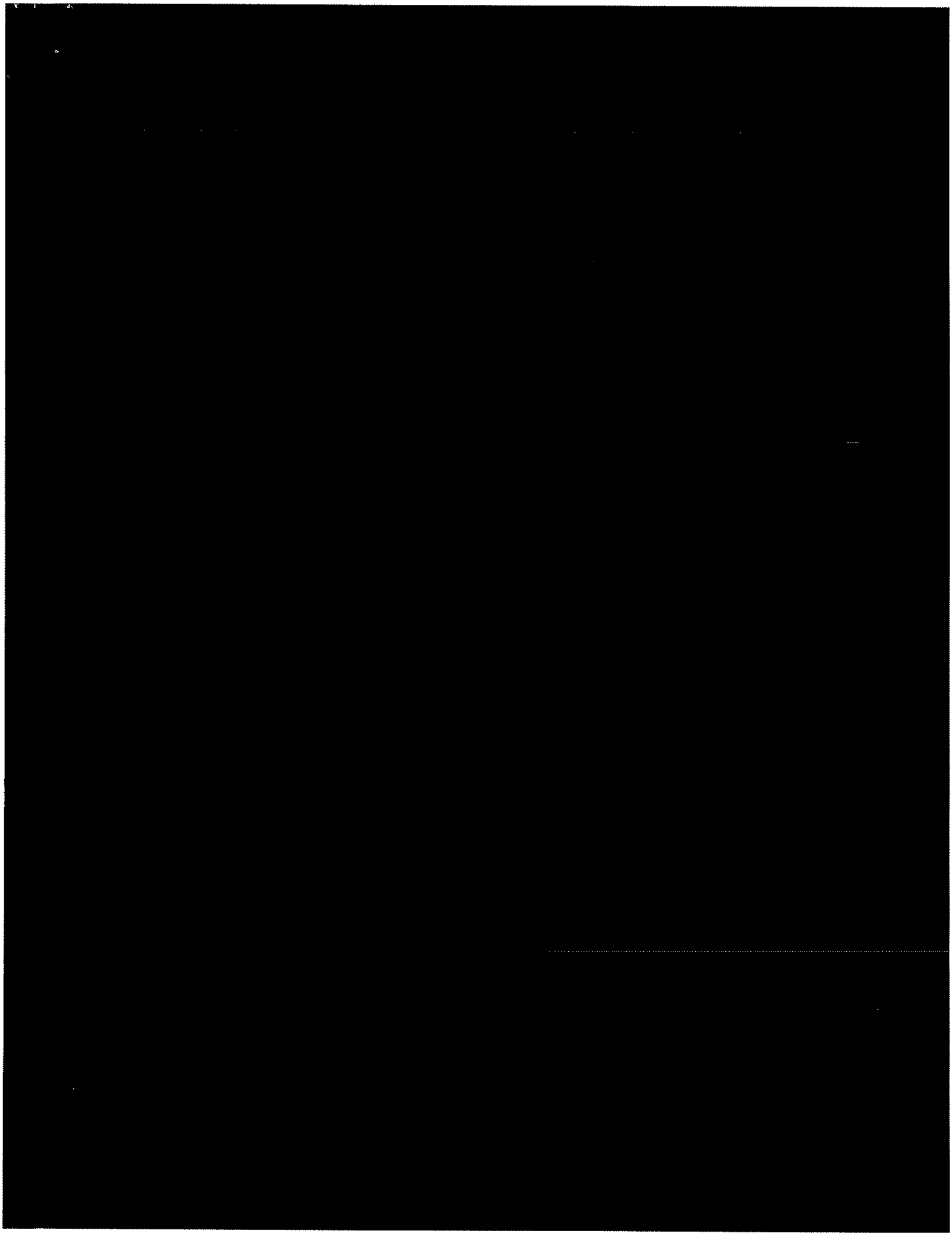
The distribution upgrades required to facilitate the proposed installation include the following:

- Reconductor 0.7 miles of single-phase 7.62 kV to 336 ACSR 13.2 kV to facilitate the interconnection.
- Single-Phase 280A Recloser N17211 will be upgraded to a three-phase device to facilitate the proposed interconnection.
- The project inverters must operate in accordance with the NY standard volt-var curve for UL1741-SB certified smart inverters.
- (2) 600 kvar switched capacitor banks shall be installed at the overhead conductor closest to the substation to account for power factor impacts due to the project consuming vars.
- Relocate distribution line regulator 196162, to a location downstream of the project POI.
- Replace fuse N43392 upstream of the proposed project.
- Install an electronic recloser at the site to enable SCADA reporting to the Utility.
- The customer shall install a three-phase voltage transformer on the primary side of the interconnection between the customer air-break disconnect switch and customer transformer, which will be considered the reference point of applicability (RPA) and act as the voltage reference point for the plant controller which will dictate the UL 1741 SB inverter Volt-VAR function. The plant controller shall monitor phase-to-ground voltage independently for each phase and provide the inverters with the most extreme voltage value, furthest away from the Volt-VAR curve (VVC) deadband (highest value of overvoltage or lowest value of undervoltage), to determine the VVC control point. The customer shall provide an updated Three Line Diagram (System Diagram), via the IOAP, when the change is made.
- Please note that the customer will be responsible for opening a new service account at this site. Please contact Central Hudson's New Business Department for further details.

This study was conducted based upon this facility being served by the interconnecting circuit during normal utility operating conditions. The terms, conditions, notification requirements, and other obligations of both the Company and the facility pertaining to disconnection of the facility are set forth in the applicable section(s) of the NYSSIR and the Interconnection Agreement that will be executed for the project(s) that were studied in this CESIR. Any change in system size and/or design is subject to the requirements of the NYSSIR, as well as supplemental documents developed by the Interconnection Technical Working Group and Interconnection Policy Working Group.

7.0 CONCEPTUAL COST ESTIMATE

The following items are a good faith estimate for the scope and work required to interconnect the project estimated under rates and schedules in effect at the time of this study in accordance with the most recent version of the New York State Standardized Interconnection Requirements ("SIR").

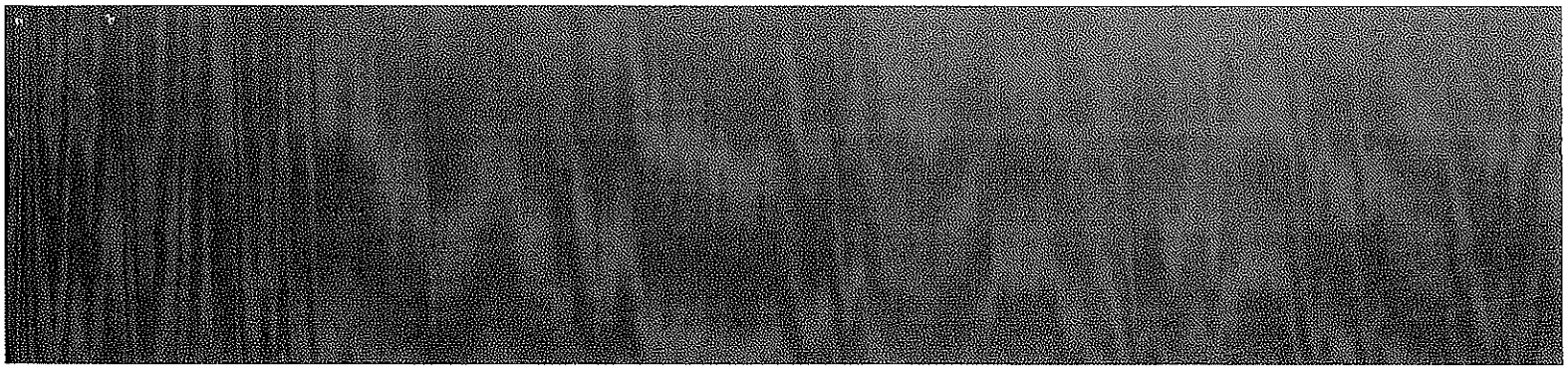


- Adverse field conditions such as weather and interconnection customer equipment obstructions
- Extended construction hours to minimize outage time or company's public duty to serve
- The cost of any temporary construction service
- Any required permits

Cost adders estimated for overtime would be based on 1.5- and 2-times labor rates if required for work beyond normal business hours. Per Diems are also extra costs potentially incurred for overtime labor.

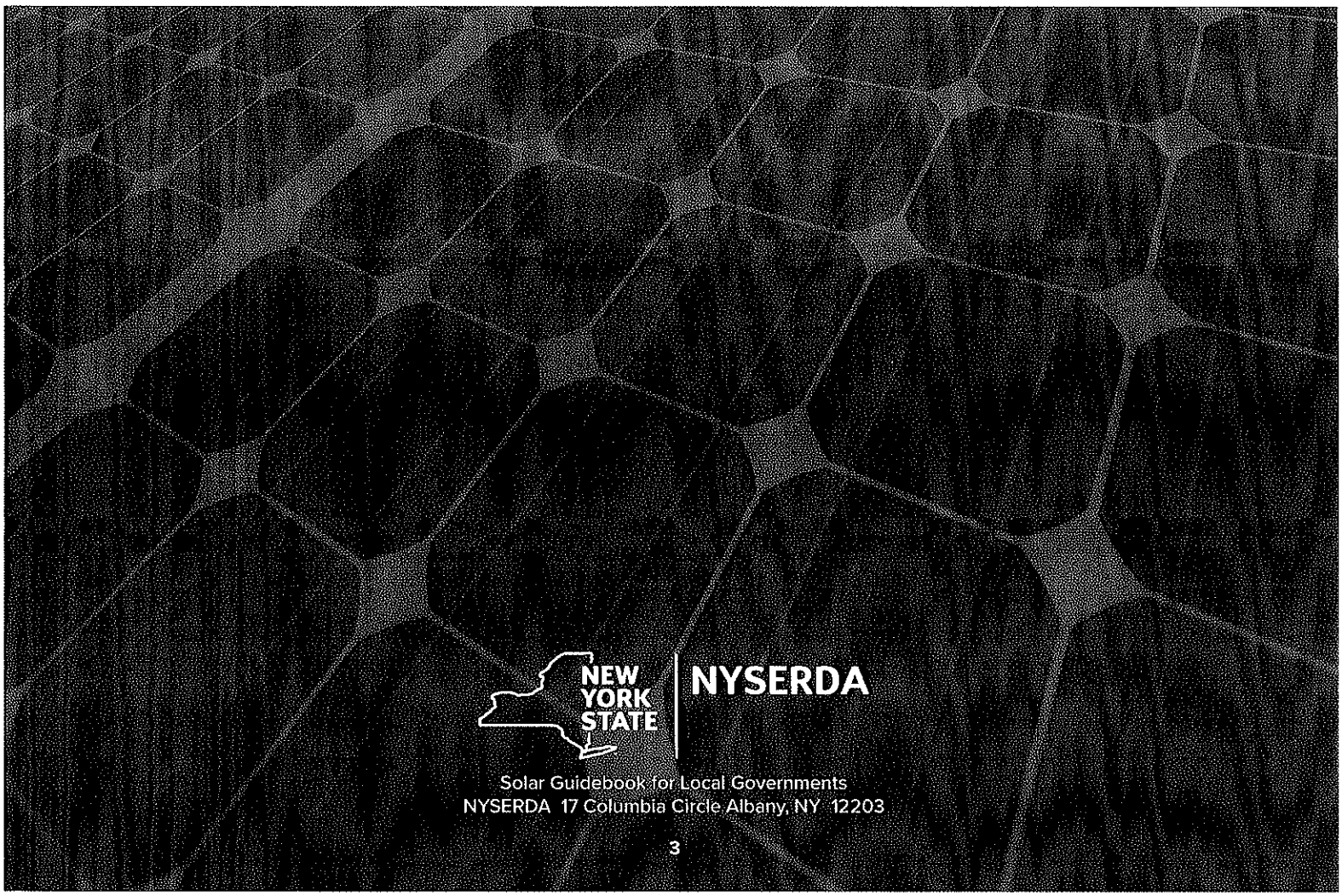
8.0 REVISION HISTORY

Version	Date	Description of Revision
1.0	07/10/2023	Initial Report
2.0	07/27/2023	Final Report



Solar Basics and Frequently Asked Questions

Understanding the basics of solar energy technology, equipment, and terminology.

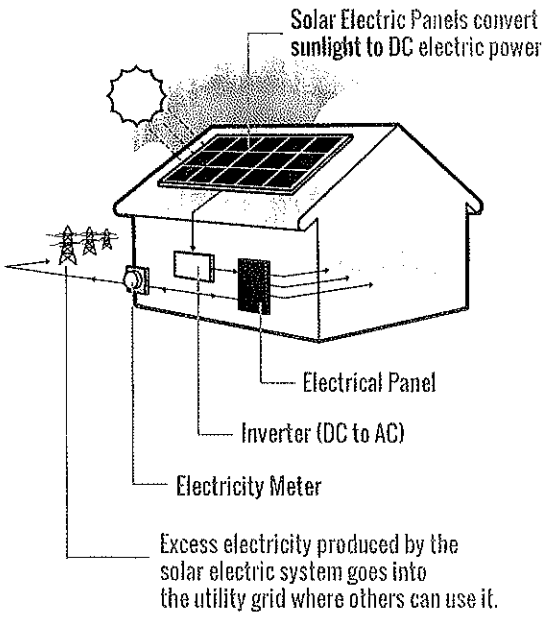


Section Contents

1. Solar Basics

An introduction to the common equipment and terminology used in solar technology. Topics of discussion include solar PV systems, solar terms, system components, net metering and financial considerations with regards to solar development.

1.1 Solar PV Systems



Solar electric systems convert the energy in sunlight into electrical current, which can power electric loads, be fed back to the electric grid, or be stored in batteries. All solar electric systems consist of the same basic components but vary widely in terms of size and complexity. This tool focuses on utility grid-tied residential solar PV systems under 25 kW in size. Solar electric systems should not be confused with solar thermal systems, which are a separate technology that captures the sun's thermal energy to heat water and air.

When sunlight strikes a solar electric array, electrons in the array are agitated into motion, creating direct current (DC). The electrical current flows along conductors from the array to an inverter. The inverter transforms the DC into alternating current (AC), which powers most common electrical appliances. The AC flows through conductors to the site's electric service panel, and then to individual branch circuits and loads. If the solar PV system is grid-tied (connected to the electric grid) and produces more electricity than is used at the site, the excess current is pushed back into the utility grid. This basic description of a solar electric system applies to most installations.

Most of New York's solar PV installations are residential, utility grid-tied, and do not include battery storage. They are typically roof-mounted and range from 4 to 10 kW. New York State's Standardized Interconnection Requirements (SIR; www3.dps.ny.gov/W/PSCWeb.nsf/All/DCF68EFCA391AD6085257687006F396B) allow residential solar PV systems up to 25 kW.

1.2 Solar Terms

The following terms are frequently used when discussing solar energy and associated technologies.

Alternating current: AC describes one type of electric charge flow. The AC stream of charges periodically reverses itself, whereas direct current (DC) describes a stream of electrons that moves in one direction only. AC is the standard electric current for power grids worldwide. Solar electric cells capture particles of light and convert them into DC electricity. An inverter translates DC into AC for consumers to use in their homes and businesses.

Ampere: Abbreviated as amp, this unit is used to measure electric current.

Balance-of-system: BOS costs refer to the costs of all aspects of a solar PV installation, except the cost of the modules and inverters. BOS costs include all wiring and miscellaneous materials, along with soft costs, such as time and administrative costs associated with selling and signing a contract, system design and permitting, installation labor costs, inspections, travel to and from the installation site, and other costs of doing business. These costs account for as much as 50 percent of the total solar PV system installation. New York State has focused on reducing BOS costs to reach its goal of installing 6 gigawatts of solar by 2025.

Direct current: DC describes the direct, constant flow of electricity. Unlike AC, DC does not periodically reverse direction. A solar PV system comes equipped with an inverter that converts DC into AC, the standard electric current for power grids in the United States.

Energy payback: Gauges how long it will take to recover the energy originally required to manufacture a solar PV system. Because most solar PV systems last 20 – 25 years, there is a pronounced net environmental benefit over the system's life span. The U.S. Department of Energy estimates an energy payback of 1-4 years for rooftop solar PV systems. The original energy used is often referred to as embedded energy.

Feed-in tariff: FITs are long-term generation contracts that have favorable terms designed to encourage the production of renewable energy by individuals and businesses. FITs are typically offered for long periods of time, such as 10, 15, or 20 years.

Inverter: A key component of any solar PV system that converts direct current (DC) electricity into alternating current (AC) electricity, which is the standard current in the United States.

Kilowatt: kW is a unit of measure that equals 1,000 Watts and is the main mechanism for measuring the size or capacity of a solar PV system. The Watt is named after Scottish inventor and mechanical engineer James Watt (1736 – 1819).

Kilowatt-hour: 1 kWh is equivalent to the electricity generated or consumed at a rate of 1,000 Watts over the period of one hour.

Net metering: A common feature of grid-connected solar PV systems whereby excess electricity produced by a solar array is fed back into the utility grid. System owners can earn credits on future energy bills for the excess electricity their systems generate. The credits can then be used later when homeowners need power from the local utility, such as at night or on cloudy days.

Power purchase agreement: PPAs are becoming a popular way for homeowners to take advantage of solar power without the financial responsibility associated with installation costs. Under the agreement, a third party installs the solar PV system and the homeowner agrees to buy the electricity (kWh) it generates, typically at a rate lower than what the utility offers.

Photovoltaic: PV technology converts solar energy into direct current electricity. The technology uses semiconducting materials that exhibit the photovoltaic effect, a naturally occurring phenomenon in which photons of light emitted from the sun knock electrons off their valence shell into a higher state of energy, creating electricity. A solar PV system uses solar panels, which are composed of a number of solar (PV) cells, to convert sunlight directly into electricity.

Photovoltaic cells: PV cells are thin layers of semiconducting material that are usually made of silicon. When the silicon is exposed to light, an electrical charge is generated. Solar (PV) cells form the basis of a solar PV panel, which together make up a solar PV system.

Remote net metering: A variation on net metering whereby a solar PV system's production is credited to an electricity consumer(s) located at a different physical site.

Solar photovoltaic (PV) systems: A technology that converts sunlight directly into electricity. A PV system is made up of solar modules (panels), which are made up of solar cells.

Solar thermal systems: A technology that uses sunlight to heat water or air. In contrast to a solar PV system, a solar thermal system uses mirrors to concentrate sunlight to produce heat.

1.3 System Components

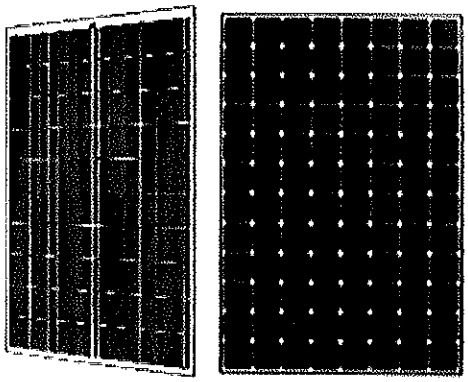
1.3.1 Modules

A solar PV module or "solar panel" is an electrical generation device that produces DC current when exposed to sunlight. Most modules consist of 60-72 small, conjoined solar cells, an aluminum frame, and a tempered glass front piece. Modules are roughly three feet by five feet and are mounted in either a portrait (a vertical rectangle) or landscape orientation (a horizontal rectangle). In monocrystalline modules, individual cells are made from single pieces of silicon. Polycrystalline modules feature cells made from multiple pieces of silicon.

Installers wire together multiple modules to combine their voltage. Multiple strings of modules can be combined to add their current (amperage).

The size of solar PV systems is typically given in rated DC capacity at standard test conditions (STC). For example, a system with 10 modules rated at 300 Watts each is a 3,000-Watt (3 kilowatt) system. Most solar PV modules come with a manufacturer's production warranty of 25 years and are expected to have a useful life of approximately 30 years.

A SolarWorld Polycrystalline module (left) and a SunPower Monocrystalline module (right)
Source: SolarWorld and SunPower



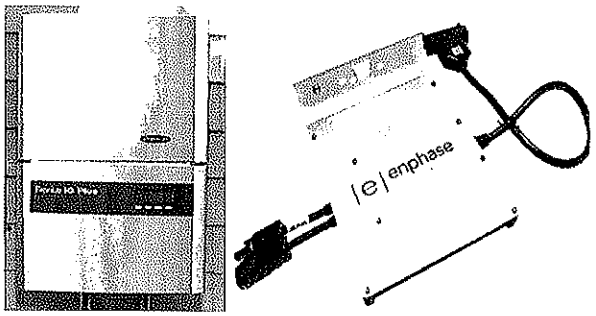
1.3.2 Inverter

All utility grid-tied solar PV systems have at least one inverter, which converts DC to AC. Most residential solar PV systems have one or two string inverters, which are connected to one or more strings of modules. Inverters are generally mounted vertically on basement, garage, or exterior walls, and can be located indoors or outdoors.

Microinverters are a special type of inverter that are mounted on the underside of individual solar PV modules. Unlike string inverters, each microinverter services only 1-2 modules, which permits greater flexibility in system design.

Most solar PV professionals describe system size in terms of module capacity (kilowatts DC), whereas most electric utilities refer to system size by inverter capacity (kilowatts AC).

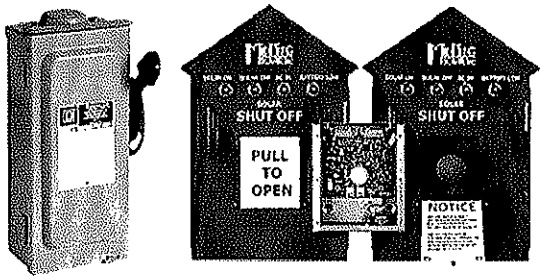
A Fronius String Inverter (left) and an Enphase Microinverter (right)
Source: Fronius and Enphase



1.3.3 Balance of System Components

"Balance of system" (BOS) generally refers to all equipment in a solar PV installation except the modules and inverter. (Occasionally, inverters are included in the term.) BOS components include racking, conductors, conduit, disconnects, fuses, mounting hardware, combiner boxes, and occasionally batteries.

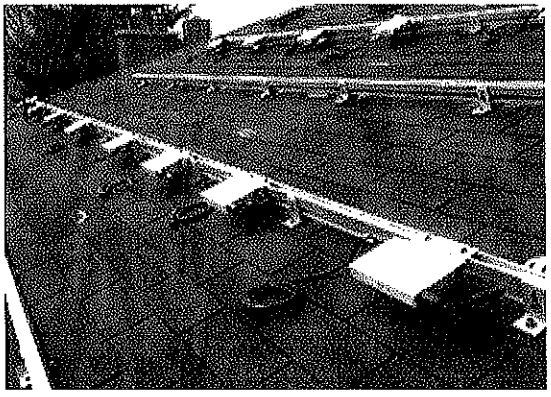
BOS Components: A Square D Fusible AC Disconnect (left) and a MidNite Solar Rapid Shutdown Device (right)
Source: Square D and MidNite Solar



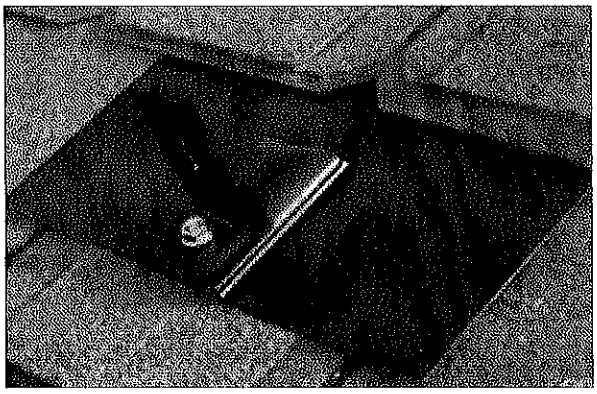
1.3.4 Racking

Most solar PV arrays are mounted to roofs using specially-designed aluminum racking systems. Typically, L-shaped brackets are connected to the roofing members of a house with lag bolts. Long aluminum rails are bolted onto the L-feet, and individual modules are attached to the rails with clamps. All roof penetrations must be flashed to prevent leaks and roof damage[1], and the system designer must ensure that the roof is structurally strong enough for the additional load of a PV system. Any necessary replacement or repair work on a roof must be done prior to the installation of the solar PV system.

A Solar Electric Racking System



Detail of an L-Foot with a SnapNrack Flashing



System designers may choose to use a ballast mounting system on flat roofs. Instead of using lag bolts to anchor the racking to the building's structural members, heavy concrete blocks weigh down the array. Ballasted systems are less likely to create leaks in the roof membrane but add substantial weight and may be too heavy for some roofs.

Solar electric arrays are also commonly ground-mounted. Arrays can be mounted on racking directly on the ground, or atop a metal pole. As with roof mounts, metallic racking must be bonded (made electrically continuous to provide a path for fault currents). When designing a ground-mounted system, the designer must account for soil conditions. Voltage drop is a concern for ground mounted systems, which often have long conductor runs.

Ground-mounted solar PV arrays sometimes include tracking equipment, which rotates the array throughout the day to follow the sun's trajectory. Tracking may occur along one or two axes. The additional energy produced by these systems must be weighed against their additional cost, complexity, and maintenance.

[1] Section 1503.2 of the International Building Code, Section 903.2 of the International Residential Code.

1.3.5 Conductors

Conductors (wire) coming from the modules are typically factory-assembled "PV Wire" with a factory-formed termination (see NEC 690.31). These factory leads are labeled "PV Wire" or "Type USE-2" and are rated to withstand all weather conditions. They are then spliced with standard building wire, using appropriate connectors and enclosures. The standard building wire is installed in raceway (conduit) to its next point of connection. Under certain conditions, conductors may be direct burial or part of a cable assembly. NEC 690.32 and NEC 310 provide guidance on allowable conductor types and methods.

The maximum allowable voltage for residential solar PV systems is 600 volts DC, but nonresidential systems may run up to 1,000 volts DC (NEC690.7(C)). Conductors must be protected from accidental contact. When exposed, they must be installed in raceway (such as conduit), or otherwise rendered inaccessible. For example, the exposed conductors on the back side of a ground-mounted array must be guarded or located at least eight feet above ground.

1.3.6 Raceway (Conduit)

Raceway includes conduit, boxes, fittings, and enclosures that provide a pathway and protection for individual conductors. All raceway systems must be suitable for the environment in which they are installed. All metal raceways must be bonded to form part of the equipment grounding conductor.

All DC conductors that enter a structure must be installed in a metal raceway NEC 690.31(G) or MC cable that meets NEC 250.118(10). Flexible and nonmetallic conduits may be permitted under certain conditions. In addition to NEC 690, refer to Chapter 3 of the NEC for types of permitted conduits and uses.

1.3.7 Battery Backup

Most residential solar PV systems are utility grid-tied, but do not include a battery backup system. In the event of a blackout or grid failure, such solar PV systems de-energize and do not function until grid power is restored, as required by NYS' Standardized Interconnection Requirements (SIR; www3.dps.ny.gov/W/PSCWeb.nsf/All/DCF68EFCA391AD6085257687006F396B).

Off-grid ("stand-alone") solar PV systems are not connected to the grid. Solar PV output is stored in a battery bank, which provides power to the site's electric loads. In addition to a battery bank, these systems include one or more charge controllers, which determine the amount and rate of power that can be stored and drawn from the battery bank.

Battery-backup solar PV systems are utility grid-tied and include a battery system that is used in the event of grid failure. Due to the high cost and additional complexity, battery backup on solar PV systems is currently rare. Section 690.71 of the NEC contains additional requirements for solar PV systems with batteries.

1.4 Net Metering

Solar electric systems are a distributed generation (DG) technology that currently qualifies for net metering in New York State. Any power produced by a solar PV system that isn't consumed on-site is pushed into the utility grid. The solar PV system owner receives a credit for this production on their monthly utility bill. Utilities typically install a meter at solar PV sites, which tracks the amount of electricity taken from and fed into the grid. The site owner is billed for only the net electricity consumed. Nonresidential solar PV systems can credit their production to off-site electric accounts through remote net metering, but this type of arrangement is outside the scope of this document.

1.5 Financial Considerations

Most homeowners view the installation of a solar PV system as a financial investment. Over time, the power it produces generates savings on their electric bills.

1.5.1 Incentives

Although the costs of residential solar PV systems have fallen significantly in recent years, they still typically cost tens of thousands of dollars. The project cost includes the modules, inverters, balance of system components, and "soft costs," such as installation and administrative labor, customer acquisition, and engineering.

Several incentives make projects more affordable for homeowners. NYSERDA's NY-Sun Incentive Program administers a step-down megawatt block incentive program.[2] Visit the NY-Sun Program Site for the most up-to-date information regarding available incentives. For information regarding tax credits, we encourage you to speak with a tax accountant.

Other incentives may exist at the local level, including real property tax exemptions, and a real property tax abatement program in New York City. Unlike most residential home improvements, most solar PV installations in New York State do not increase the taxable value of a home.[3] However, local governments can opt out of this exemption. One excellent resource to navigate incentives is www.dsireusa.org. Customers should consult a tax advisor to determine their eligibility for tax credits.

1.5.2 Purchase Types

Many homeowners choose to buy a solar PV system with cash, or by taking out a loan. As the system owners, they can apply for all applicable tax credits. Installation companies typically offer a 5 to 10-year warranty, and some manufacturers offer extended warranties. An increasing variety of loans are available to help customers finance the purchase of solar PV systems.

Leasing a solar PV system is another common option. With this model, a third-party company (often the installation contractor) is responsible for installing, operating and maintaining a solar PV system at the customer's site. Customers sign long-term leases (typically 20 years) and make monthly payments to the company that owns the solar PV system. In return, customers receive all electricity produced by the system. At the end of the lease term, the homeowner typically has the option of renewing the lease, purchasing the equipment at fair market value, or having the system owner remove the equipment. The company that owns the solar PV system receives most of the tax benefits.

A third option is a power purchase agreement (PPA). It is similar to a lease, but instead of paying a flat monthly fee, customers pay for the amount of electricity actually produced by the solar PV system.

2. Frequently Asked Questions

2.1 Project Revenue

2.1.1 What is the difference between a "Large-Scale Renewable" project and a "Distributed Energy Resource" project?

Solar energy projects in New York State are divided into two general categories; large-scale renewables (LSR) and distributed energy resources (DER). LSR projects, also known as "utility-scale solar," are typically larger than 5 MW_{ac}, and are built with the primary purpose of supplying wholesale electricity to the grid. A DER project is typically 5 MW_{ac} or less and must have a customer(s), known as the "offtaker," to purchase the electricity. Most DER projects are community solar projects, residential/ commercial rooftop solar projects, or small ground mounted solar.

[2] http://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun
[3] https://www.tax.ny.gov/research/property/assess/manuals/vol4/pt1/sec4_01/sec487.htm

2.1.2 What are Renewable Energy Certificates? Do All Projects Qualify?

A renewable energy certificate (REC) is a certificate created by a tracking system, such as the New York Generation Attribute Tracking System (NYGATS), that represents the environmental attributes of one megawatt hour of electricity generated from a renewable source like solar or wind. A typical New York household requires about seven megawatt hours of electricity to be powered for a full year. RECs are used to substantiate environmental claims related to renewable energy use, such as for compliance with a State-mandated renewable compliance program, or for voluntary claims such as a climate action pledge. As such, RECs provide a tradable, traceable means for claiming the benefits of renewable electricity generation. In New York, under the Order Adopting the Clean Energy Standard, only eligible large-scale renewable facilities are able to generate Tier 1 RECs.[1] DER projects are compensated for environmental attributes under a separate compensation mechanism known as the environmental or "E" component of the VDER value stack.

2.1.3 How do large-scale solar projects make money?

Large-scale solar projects rely on two main streams of income to generate revenue and continue operations: 1. the sale of electricity generated by the renewable generator, typically either sold in the NYISO market (wholesale) or sold to an offtaker under a contract called a power purchase agreement, which compensate projects based on the power they generate, and 2. the sale of RECs to NYSERDA or another offtaker, which provides compensation for the project's environmental attributes. Through annual Renewable Energy Standard solicitations, NYSERDA seeks to purchase eligible RECs from renewable energy projects under long-term contracts to provide these projects with a predictable revenue stream via selling their RECs. Once a project is operational and transfers RECs to NYSERDA, they can then be sold to Load-Serving Entities, such as utilities, for compliance under the Clean Energy Standard. By providing a contract to renewable energy developers to purchase RECs from the projects they have built or plan to build, developers are granted financial security for their projects and, once operational, the RECs can be used by utilities to comply with environmental standards. It is important to note that projects do not receive payments from NYSERDA until they are operational and producing energy.[2]

2.1.4 What is the Investment Tax Credit?

Initially implemented in 2005, the Investment Tax Credit (ITC) is an important federal policy mechanism that has propelled the growth of solar across the United States. Section 48 of the Internal Revenue Code of 2006 (as amended) allows project owners or investors to be eligible for the federal business energy ITC for installing designated renewable energy generation equipment. The ITC allows project owners to apply a percentage of the project's engineering, procurement, and construction costs (such as the panels, inverters, and racking equipment) as a credit towards their income taxes. The ITC is a one-time dollar-for-dollar reduction, and does not cover interconnection or some other "soft" development and financing costs. The current ITC rate is set at 26% in 2020 and is scheduled to step down to 22% in 2021 and 10% in 2022. The ITC has been subject to frequent changes as energy policies have evolved. It is possible that the ITC may be modified or extended.

2.2 Local Benefits

2.2.1 What is RPTL §487?

New York State Real Property Tax Law (RPTL) Section §487 provides a 15-year exemption from real property taxation for renewable energy systems, including solar. This statute only applies to the value that a solar electric system adds to the overall value of the property; landowners with an installed renewable energy system continue to pay property tax on their homes and land. Property owners must also continue to pay special district taxes (such as a fire district tax payment, but could also include a library, sewer, water, or ambulance tax). The exemption has been a cornerstone of the State's efforts to meet its clean energy goals, providing essential economic incentives for solar. Local taxing jurisdictions do have the option to opt out of RPTL §487 and make the system fully taxable; however, projects may not be financially viable at full taxation. If a jurisdiction opts out of RPTL §487, it must opt out for systems of all sizes, not just large-scale, and must file copies of the local law opting out of RPTL §487 with both the New York Department of Taxation and Finance and NYSERDA.

[1] http://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId=%7B44C5D588-14C3-4F32-8399-F5487D6D8FE8%7D
[2] https://www.nyserda.ny.gov/All-Programs/Programs/Clean-Energy-Standard/REC-and-ZEC-Purchasers

2.2.2 What are PILOTs and Host Community Agreements?

If a taxing jurisdiction does not opt out of RPTL §487, it may enter into a payment-in-lieu-of-taxes (PILOT) agreement – an annual payment which replaces a portion of the property tax revenue a project would have otherwise generated. A PILOT cannot exceed the value of taxes that would be paid without the exemption. In order to negotiate a PILOT agreement, taxing jurisdictions must notify solar developers of their intent to require a PILOT within 60-days after being notified of the developer's intent to construct a project in their community. PILOT payments can also be paired with Host Community Agreements (HCAs), which provide certain benefits directly to the municipality hosting the project, and can be uniquely adapted for each municipality. Unlike PILOTs, which are typically distributed with constraints similar to tax revenue, HCAs are flexible and can be allocated as the host community sees fit.

2.2.3 Why should solar projects receive tax breaks?

Even while receiving an exemption under RPTL 487, a solar project can generate economic benefits in a community by growing the tax base, creating jobs, and generating supplemental income for farmers and landowners. Solar development can take place on existing or abandoned commercial sites, brownfields, landfills, agricultural lands, former industrial sites, and otherwise underutilized sites. Often, this land is generating minimal or no income for the municipality. By choosing to develop solar on this land, municipalities can turn underutilized sites into valuable and revenue-generating land, with the flexibility to direct PILOT payments or HCAs where the need is greatest. Full taxation typically discourages solar project development, and would cause communities to miss out on opportunities to fund local infrastructure and public services. Once installed, renewable energy systems do not create significant increased demands on municipal services or infrastructure, so PILOT payments usually provide a net benefit to the host community.

2.2.4 Is solar a good use of farmland?

While local governments can implement zoning laws to protect their most productive farmland, solar can be developed on farmland in a way that maintains the current economic benefits to the community and preserves prime farmland. In addition, solar projects can be designed with co-use in mind, as developers are more proactively designing project layouts that include fencing and water access for sheep, pollinator friendly landscaping for honey production, and compatible native vegetation for soil and water erosion prevention. When solar is developed on farmland, it often supplies the landowner with significantly higher income than they would have received without solar on the land, and can support the continuation of agricultural practices on farms with distressed economics, including ensuring that farms retain local ownership. As such, the local community benefits from PILOTs, HCAs, and land lease payments. These lease payments can provide farmers with 20 years or more of guaranteed financial security, diversifying their income while preserving the land for future use. Unlike alternative types of development, such as residential construction, after decommissioning at the end of a solar energy system's useful life, agricultural land can be returned to its original state and farming may resume.

In many instances, even while supporting solar, the land can continue to be used for agricultural operations such as livestock grazing, beekeeping, cultivation of certain crops, or planting of pollinator-friendly vegetation under and around the panels. New York has seen an emergence of solar projects that incorporate wildflowers and native plants to support bees, hummingbirds, and insects, and which may increase the future productivity of soil. Increasing the habitat for pollinators supports agricultural production and is great for New York's food supply.[3] Other options include planting shade-tolerant crops and elevating solar panels to allow farm equipment to pass safely underneath.[4]

2.2.5 My region is often overcast or cloudy. Does solar really make sense in New York?

Yes! It is a common misconception that solar only works well in climates where there is abundant sunshine. Solar panels do not require perfectly sunny weather to generate electricity, and modern solar resource datasets allow developers to accurately estimate the amount of sunshine at a given location. Solar photovoltaic (PV) technology continues to become more efficient, enabling solar projects to generate in the absence of strong, direct sunlight, and increasing the viability of project locations throughout New York. Additionally, the cooler temperatures in New York actually make panels more efficient. Combined with the strong demand for renewable energy throughout New York, availability of suitable land, and supportive policies, solar makes sense in most areas of New York State.[5]

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[3] "New York State's First Pollinator-Friendly Solar Farm." Cypress Creek Renewables, ccrenew.com/news/jefferson-solar-ribbon-cutting/.
[4] "Overview of Opportunities for Co-Location of Solar Energy Technologies and Vegetation." National Renewable Energy Laboratory, www.nrel.gov/docs/fy14osti/60240.pdf.
[5] Bobby Magill Follow "Rooftops in Cloudy Places Could Be Solar Gold Mines." Climate Central, 15 Apr. 2016, http://www.climatecentral.org/news/cloudy-places-could-be-solar-gold-mines-20253.

2.3 Safety

2.3.1 Are solar panels toxic?

Solar panels largely consist of widely-used and non-toxic components, including an aluminum frame, tempered glass, and various common plastics. The most common type of solar panel consists of crystalline silicon PV cells which generate electricity when exposed to light. These non-toxic crystalline silicon cells consist almost entirely of silicon, one of the most common elements in the Earth's crust.[6]

Cadmium-based thin-film solar panels are the second most common type of panel (accounting for less than 15% worldwide), however NYSERDA is not aware of any of these installations currently in New York.[7,8] While cadmium is toxic, the form of cadmium used in these types of solar panels is cadmium telluride (CdTe), which has 1/100th the toxicity of elemental cadmium. When a CdTe panel is exposed to fire, the glass panels absorb the cadmium such that more than 99.9% of the cadmium is stored in the glass itself and not released into the environment. CdTe panels have also passed the EPA's Toxic Characteristic Leaching Procedure test, which tests the potential for crushed panels in a landfill to leach hazardous substances into groundwater.

Some minor system components, including solder, may contain toxic chemicals at extremely low concentrations. Analysis performed by the North Carolina Clean Energy Technology Center did not find a potential toxicity threat from leaching, even in worst case scenarios (hurricane, fire, tornado, etc.), indicating an insignificant threat to human health and the environment.

Release of toxic chemicals from other solar system equipment including inverters, racking, and cabling is also unlikely as solar installations must conform to state fire safety and electric codes, and they pose little or no risk of contaminating the soil or ground water.

2.3.2 Can solar panels break and release toxic materials?

The most common solar panel failure modes include glass breakage and various failures of internal electrical connections, neither of which would typically result in the release of any materials to the environment. Solar panels are constructed primarily of silicon or cadmium telluride, tempered glass, and metals. Similar to a car windshield, when solar panels experience a catastrophic event, the panels typically stay fully intact, thus not releasing any materials into the environment.

Additionally, reputable solar panel manufacturers will ensure that their equipment is certified to applicable performance and safety standards including those established by the International Electrotechnical Commission (IEC) and Underwriters Laboratory (UL).

2.3.3 Do solar panels affect water runoff at the site?

Federal, state, and local rules are in place to ensure that solar arrays are installed in ways that protect public water supplies, wetlands, and other water resources. Rooftop solar systems have little to no effects on the direction or flow of water. Ground-mounted systems will be designed to manage runoff using deep-rooted vegetation such as "pollinator-friendly" grasses and wildflowers, pervious pavement, or topographical features such as berms, swales, or retention ponds, which can provide a net water quality benefit.

Various state agencies also maintain requirements and relevant guidance on this topic:

- The Department of Environmental Conservation's State Pollutant Discharge Elimination System (SPDES) website details permit requirements for stormwater discharge.[9]
- The Department of Agriculture and Markets' Guidelines for Solar Energy Projects includes guidance related to drainage for solar installations on agricultural lands.[10]

[6] "Health and Safety Impacts of Solar Photovoltaics." NC Clean Energy Technology Center, May 2017, ncsolarcen-prod.s3.amazonaws.com/wp-content/uploads/2017/10/Health-and-Safety-Impacts-of-Solar-Photovoltaics-2017_white-paper-1.pdf.
[7] https://data.ny.gov/Energy-Environment/Solar-Electric-Programs-Reported-by-NYSERDA-Beginn/3x8r-34rs
[8] "Crystalline Silicon Photovoltaics Research." Energy.gov, https://www.energy.gov/eere/solar/crystalline-silicon-photovoltaics-research
[9] State Pollutant Discharge Elimination System (SPDES) website https://www.dec.ny.gov/chemical/43133.html
[10] https://agriculture.ny.gov/system/files/documents/2019/10/solar_energy_guidelines.pdf

2.3.4 Should we be worried about electromagnetic fields (EMF) associated with solar?

There are two kinds of EMF; "ionizing fields," which are high level and harmful, and "non-ionizing," which are low-level and generally harmless. Non-ionizing radiation comes from computers, appliances, cell phones, and wireless routers, whereas ionizing radiation comes from harmful sources such as UV lights or X-rays. EMF from solar systems are non-ionizing, similar to that of your household appliances. Studies show that the exposure level within the array or at the fenced boundary of a system falls well below recommended exposure limits. This exposure level decreases even more as you move away from the system, and is nonexistent at night when the system is not producing energy. Ultimately, EMF from solar systems is extremely insignificant and cannot be associated with a health effect.[11]

2.3.5 Do solar panels create glare? I'm worried about the visual impacts for my town and aviation.

Solar panels are designed to be dark colors, usually black or blue, that absorb the sunlight to create electricity. If panels were reflecting the sun, or creating glare, they would not be effective. PV panels are designed with anti-reflective coating to increase panel efficiency and keep the level of reflected light around 2% - less than the reflectivity of water. Airports around the world have been installing PV arrays to provide onsite generation, and studies show that glare from the solar arrays is a negligible issue.[12]

2.3.6 Do solar panels create high ambient temperatures in their surroundings?

The theory that a functioning solar PV array increases the ambient temperature of its surroundings is known as the "heat island" effect. The "heat island" effect proposes that solar panels create a darker landscape that reflects less light, and therefore creates a localized area of increased heat. Few studies have been conducted on the subject, but it has been generally concluded that the area surrounding a large-scale solar array is unlikely to experience a net heating change from the panels. It is, however, possible to see some heating occur under the panels themselves. This can be mitigated with proper implementation of vegetative cover instead of gravel.[13] With any PV array, the significance of the heating depends on the location of the array, time of the year, and surrounding environment.[14, 15]

2.3.7 Does the fire department need special equipment to handle solar panel fires?

No special equipment is needed to handle solar panel fires, just proper training. Solar panels, like any electrical device, can be a fire hazard themselves or act as a physical barrier that hinders the ability of firefighters to put out an unrelated fire. Project developers and municipalities must ensure the local fire department is aware of the installation and informed about the procedures for de-electrifying the system and responding to incidents. In addition, the New York State Fire Code directly addresses solar PV installations, requiring clear labeling, instructions, setbacks, and safety features.

2.3.8 Are solar panels recyclable?

Solar panel recycling and disposal is not yet a major consideration in New York State, as most installations are newly operational and have a minimum 25-year expected useful life. It is, however, important to plan for the disposal of solar systems at the end of their useful life. Currently, there are no regulations requiring the recycling of solar panels in New York State, but it is best practice to reuse or recycle system components. Solar panels are classified as "general waste," which means that they can be placed in a landfill. Solar panels can contain small amounts of toxic materials, but research shows that they generally do not pose a threat in landfills.[16]

Some solar energy system components, such as metal racking, can readily be reused or salvaged. Solar PV recycling is still in its infancy, though the ultimate goal is to recycle solar panels and recover any materials that may be reused or sold. At present, this is costly, but the industry is advancing; a 2016 study by the International Renewable Energy Agency (IRENA) estimates that recyclable materials in old solar modules will be worth $15 billion in recoverable assets by the year 2050.[17] Some examples of recycling opportunities in the United States include: Cascade Eco Minerals, Cleanlites, Echo Environmental, and First Solar.

2.3.9 Do solar PV systems generate noise?

Solar panels are noise-free, and residential solar inverters are quieter than a refrigerator. Large-scale, ground-mounted systems may have minor noise associated with the transformers and inverters within the array as well as the electrical equipment used as required for utility interconnection. Any system noise is typically at background levels at a distance of 50 to 150 feet from the site boundary.

2.3.10 How are endangered species protected?

Endangered species are accounted for and protected throughout the life of a large-scale solar project. First, solar projects must conduct an initial screening with the U.S. Fish and Wildlife Service to identify if endangered species are present in the area. In consultation with the New York State Department of Environmental Conservation (DEC) and U.S. Fish and Wildlife, developers must identify potential impacts to endangered or threatened species from facility construction, operation, or maintenance, and work with the DEC to mitigate impacts. Issues related to direct and indirect habitat loss, mortality, breeding, and wintering and migration patterns of bird and bats are all addressed during the process through which solar projects obtain their permits to construct, and inform the final design of the project and mitigation measures. Examples of potential mitigation measures include construction buffers around known bald eagle nests, avoiding disturbing sensitive habitat, and developing conservation funds to offset any unavoidable impacts.

2.3.11 Do solar panels contribute to bird loss?

The misconception that solar projects are a major contributor to bird loss has stemmed from issues with "concentrated solar thermal." This type of solar system, which constitutes a small percentage of US solar capacity and is located almost exclusively in the Southwest, uses mirrors to focus solar energy in order to power a steam generator. Bird loss in this situation occurs when birds fly through concentrated light reflection. Solar projects in New York, which use solar panels to convert sunlight into energy, do not reflect light or act as a mirrors. Due to this major design difference, there is a minimal impact on avian species.[19]

Questions?

If you have any questions regarding solar basics, please email questions to cleanenergyhelp@nyserda.ny.gov or request free technical assistance at nyserda.ny.gov/SolarGuidebook. The NYSERDA team looks forward to partnering with communities across the state to help them meet their solar energy goals.

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