FranklinWhiteBridge_BPU_CS_App_SectionsA&B.pdf

FranklinWhiteBridge_BPU_CS_App_SectionC_Signed&Notarized_Applicant&Developer&Project Owner.pdf

FranklinWhiteBridge_BPU_CS_App_SectionC_PropertyOwnerCertification_Signed&Notarized.p df

FranklinWhiteBridge_BPU_CS_App_SectionDAppendix.pdf FranklinWhiteBridge_DelineatedMap.pdf

FranklinWhiteBridge_ProofOfSiteControl_FullyExecuted&Notarized.pdf

FranklinWhiteBridge_NJDEP_PermitReadinessChecklist.pdf

FranklinWhiteBridge_NJDEP_PCER_ConfirmationStatement.pdf

FranklinWhiteBridge_JCP&L_HostingCapacityMap_3672kWAC.pdf

FranklinWhiteBridge_GoodFaithProjectCostEstimate.pdf

FranklinWhiteBridge_[redacted]_AffordableHousingProvider_LetterOfSupport.pdf

ValueOfSolarToNewJerseyAndPennsylvaniz_PerezNorrisHoff2012.pdf

Community Solar Energy Pilot Program Application Form:

Franklin White Bridge Solar 1

Section A: Application Form Requirements, Instructions, Terms and Conditions

The following Application Form is intended only for entities submitting a community solar project for consideration by the New Jersey Board of Public Utilities ("Board" or "BPU"). Projects selected by the Board will be approved for participation in the Community Solar Energy Pilot Program, pursuant to the rules at N.J.A.C. 14:8-9.

This Application Form is valid only for the following Program Year and Application Period:
Program Year 1, Application Period 1
Application Period Opens: April 9, 2019 at 9:00 A.M.
Application Period Closes: September 9, 2019 at 5:00 P.M.

I. Minimum Qualification Requirements

The Community Solar Energy Pilot Program is open to projects that meet the following minimum requirements, and the full requirements defined in N.J.A.C. 14:8-9 (available for reference at the following link: http://njcleanenergy.com/files/file/R_2019%20d_021%20(51%20N_J_R_%20232(a)).pdf).

1. The proposed community solar project must be located in the electric service territory of an Electric Distribution Company ("EDC") in the State of New Jersey.
2. Existing solar projects may not apply to requalify as a community solar project. An existing solar project, as defined in N.J.A.C. 14:8-9.2, means a solar project having begun operation and/or been approved by the Board for connection to the distribution system prior to February 19, 2019. Projects having received a subsection (t) conditional certification from the Board prior to February 19, 2019 should refer to section **B. XIII.** Special Authorizations and Exemptions for additional information.
3. The Board will not consider Applications for EDCs to develop, own, or operate community solar project(s).
4. The Board will not consider Applications for projects sited on preserved farmland, as defined in N.J.A.C. 14:8-9.2.
5. The Board will not consider Applications for projects exceeding the capacity limit for individual community solar projects, set at 5 MW as defined in N.J.A.C. 14:8-9.4(g).

II. Instructions for Completing the Community Solar Energy Pilot Program Application Form

1. Each solar project applying to participate in the Community Solar Energy Pilot Program requires the submission of an individual Application Form. Do not apply for more than one (1) project per Application Form. There is no limit to the number of Application Forms that can be submitted by any one Applicant (see the definition of an "Applicant" in section A. III. Terms and Conditions).

2. Complete sections B and C, and Appendix A in full. All questions are required to be answered, unless explicitly marked as optional. All attachments are required, unless explicitly marked as optional. All attachments must be attached to the end of the Application Form, therefore forming a complete application package. Note that attachments marked as optional will be considered if included, but their absence will not penalize an Application.
3. Original signatures on all forms and certifications of this Application Form are required. The certifications contained in section C must be notarized.
4. Specific exemptions are identified throughout the Application Form which apply only if: 1) the Applicant is a government entity (municipal, county, or state), AND 2) the community solar developer will be selected by the Applicant via a Request for Proposals ("RFP"), Request for Quotations ("RFQ"), or other bidding process. If this is the case, the Applicant must include a letter describing the proposed bidding process, and the Applicant should complete all sections of the Application Form based on the project as it will be designed in the bidding process. The Applicant must further commit to issuing said RFP, RFQ, or other bidding process within 90 days of the proposed project being approved by the Board for participation in the Community Solar Energy Pilot Program (see section B. XIII. Special Authorizations and Exemptions).

III. Terms and Conditions

General Terms and Conditions

1. The "Applicant" is defined as the entity that submits the Community Solar Energy Pilot Program Application Form (for example, an Applicant may be a project developer, project owner, project operator, property owner, contractor, installer, or agent thereof).
2. Prior to completing the Application Form, the Applicant must carefully review the rules at N.J.A.C. 14:8-9, and any other rules, regulations, and codes applicable to the design, construction, and operation of a community solar project in New Jersey. All Applications must be in compliance with all local, state and federal rules, regulations and laws.
   Furthermore, submission of an Application Form does not obviate the need for compliance with all applicable local, state, and federal laws and regulations at any time during the design, construction, operation, and decommissioning of a community solar project including, but not limited to, regulations by commissions such as the New Jersey Highlands Council and the New Jersey Pinelands Commission.
3. By submitting an Application, the Applicant acknowledges notice on behalf of all project participants that the information included in the Application is subject to disclosure under the Open Public Records Act, N.J.S.A. 47:1A-1 et seq. Aggregated information may be used by the Board and/or other state, federal, county, regional or local agencies in reports and evaluations, and the geographic location may be used to update Geographic Information System ("GIS") mapping. Applicants may identify sensitive and trade secret information that they wish to keep confidential by submitting them in accordance with the confidentiality procedures set forth in

N.J.A.C. 14:1-12.3. Furthermore, the Applicant understands that the list of approved community solar projects will be published on the Board of Public Utilities website.

4. Amendments or supplements to the Community Solar Energy Pilot Program Application Form will be made available via the New Jersey Clean Energy Program **("NJCEP")** website at www.njcleanenergy.com. This Application Form may be modified for future Application Periods at any time without prior notification.

Evaluation of Applications and Approval of Projects

5. Only Applications that are administratively complete by the close of the Application Period will be considered for participation in the Community Solar Energy Pilot Program during that Program Year. An application will be deemed administratively complete if: 1) All questions are completed, except those explicitly marked as optional, 2) All required attachments are included (see **Appendix B** for a checklist of required attachments), and 3) All required signatures are included. Applicants will be notified if an Application is deemed administratively incomplete. An incomplete Application may be amended and resubmitted during the following Application Period without advantage or disadvantage.
6. The Applicant may be required to supplement the information provided in the Application Form upon request from the Board or Board Staff.
7. Following the close of the Application Period, each Application will be reviewed and evaluated by a dedicated Evaluation Committee.
8. In reviewing each application, Board Staff may consult with the New Jersey Department of Environmental Protection ("NJDEP"), the New Jersey Department of Agriculture, or other state agencies and consultants as are relevant to the Application. Any information marked and submitted as confidential will be treated as such by the receiving agency, and used for the sole purpose of evaluation.
9. The criteria for evaluation of Applications are presented in **Appendix C** (Evaluation Criteria). Projects must score a minimum 30 points total in order to be considered for participation in the Community Solar Energy Pilot Program. Projects that score above 30 points will be presented to the Board for approval for participation in the Community Solar Energy Pilot Program in order, starting with the highest-scoring project and proceeding to the lowest-scoring project, and until the allocated program capacity for that Program Year is filled.
   The allocated program capacity for Program Year 1 is 75 MW. At least 40% of program capacity (i.e. at least 30 MW) will be allocated to LMI projects.
10. Board Staff may reject Applications that are incomplete at the close of the Application Period, that are not in compliance with the rules and regulations established in N.J.A.C. 14:8-9, or that do not meet a minimum standard for selection, as set forth in this Application Form.

Milestones and Follow-Up for Approved Projects

11. Should the proposed community solar project be approved by the Board for participation in the Community Solar Energy Pilot Program, such approval will be contingent on the project being constructed and operated as was proposed in its Application.
    Furthermore, pursuant to the rules at N.J.A.C. 14:8-9.3(c), approved projects are expected to begin construction within 6 months of their approval by the Board, and are expected to become fully operational within 12 months of their approval by the Board. Extensions may be granted by Board Staff at its discretion, based on its assessment of the specific circumstances of each project approved.
    In order to monitor compliance, approved projects will be required to submit updates to the Board:
    a. Prior to the beginning of construction, the Applicant must provide evidence that commitments in the following categories have been met: project location, community and environmental justice engagement, other benefits.
    b. [illegible] applying for permission to operate ("PTO"), the Applicant must provide evidence that commitments in the following categories have been met: siting (other than location), all permits received.
    c. Prior to applying to the EDC for allocation of bill credits, the Applicant must provide evidence that commitments in the following categories have been met: product offering, subscriber type, geographic limit within EDC service territory.
    If the approved project fails to be completed as proposed in the Application, and the Applicant fails to remediate the failure or provide an equivalent modification within a reasonable timeframe, the project may be penalized up to and including a withdrawal of the permission to operate in the Community Solar Energy Pilot Program.

Special Considerations for Project Siting

12. Unless the proposed community solar facility is located on a rooftop, parking lot, or parking structure, the Applicant must meet with the NJDEP's Office of Permit Coordination and Environmental Review ("PCER") to determine what permits may be required and to identify other potential issues. More information is available at: http://www.nj.gov/dep/pcer. The Applicant must have completed the NJDEP Permit Readiness Checklist and submitted said Checklist to NJDEP PCER prior to submitting the Application to the Board (see section B. VIII. Permits). The Permit Readiness Checklist is available at the following link: https://www.nj.gov/dep/pcer/introcklist.htm.
13. Special attention should be paid when siting a project on a landfill, a brownfield, or an area of historic fill. For reference, NJDEP's *Guidance for Installation of Solar Renewable Energy Systems on Landfills in New Jersey* can be found at the following link: https://www.nj.gov/dep/dshw/swp/solarguidance.pdf.
14. The Applicant should review the environmental compliance history at the proposed site and the various operations that were conducted there. Satisfaction of all outstanding NJDEP regulatory

compliance obligations, if applicable, will be required prior to applying for permission to operate. The Applicant should identify any outstanding compliance and enforcement issues associated with the property on which the proposed project is to be sited and resolve them accordingly before submitting the Post Construction NJDEP Compliance Form, if applicable.

15. If the proposed project is sited on Green Acres preserved open space, as defined in N.J.A.C. 14:8-9.2, or on land owned by NJDEP, the Applicant must receive special approval for the project from NJDEP prior to submitting the Application to the Board, and attach proof of approval to their application package (see section B. VII. Community Solar Facility Siting).

Submitting an Application

Applications must adhere to all of the following instructions for submission. Applications must be received no later than 5:00 P.M. on the date of the close of the Application Period in order to be considered.

Mail or hand-deliver the original complete Application package plus three copies of the complete Application package to:

New Jersey Board of Public Utilities
44 South Clinton Avenue, 7th Floor
Post Office Box 350
Trenton, New Jersey 08625-0350
Attn: Office of Clean Energy
Community Solar Energy Pilot Program Application Package

In addition, submit an electronic version of the complete Application package to both of the following email addresses: communitysolar@njcleanenergy.com and board.secretary@bpu.nj.gov.

Questions and Further Information

Please address all questions pertaining to the Application Form to communitysolar@njcleanenergy.com.

Additional guidance and Frequently Asked Questions will be available on the NJCEP website at: http://njcleanenergy.com/renewable-energy/programs/community-solar.

Section B: Community Solar Energy Project Description

Instructions: Section B must be completed in its entirety. Any attachments should be placed at the end of the Application package.

I. Applicant Contact Information

Applicant Company/Entity Name: Soltage NJ DevCo, LLC

First Name: Zac Last Name: Meyer
Daytime Phone: (201) 992-9200 Email: zmeyer@soltage.com
Applicant Mailing Address: 66 York Street, 5th Floor
Municipality: Jersey City County: Hudson Zip Code: 07302

Applicant is: ✔ Community Solar Project Owner ✔ Community Solar Developer/Facility Installer
☐ Property/Site Owner ☐ Subscriber Organization
☐ Agent (if agent, what role is represented) _____

II. Community Solar Project Owner

Project Owner Company/Entity Name *(complete if known)*: Soltage NJ DevCo, LLC
First Name: Zac Last Name: Meyer
Daytime Phone: (201) 992-9200 Email: zmeyer@soltage.com
Mailing Address: 66 York Street, 5th Floor
Municipality: Jersey City County: Hudson Zip Code: 07302

III. Community Solar Developer

This section, "Community Solar Developer," is optional if: 1) the Applicant is a government entity (municipal, county, or state), AND 2) the community solar developer will be selected by the Applicant via a RFP, RFQ, or other bidding process. In all other cases, this section is required.

Developer Company Name *(optional, complete if applicable)*: Soltage NJ DevCo, LLC
First Name: Zac Last Name: Meyer
Daytime Phone: (201) 992-9200 Email: zmeyer@soltage.com
Mailing Address: 66 York Street, 5th Floor
Municipality: Jersey City County: Hudson Zip Code: 07302

The proposed community solar project will be primarily built by:
✔ a contracted engineering, procurement and construction ("EPC") company
☐ the Developer

If the proposed community solar project will be primarily built by a contracted EPC company, complete the following *(optional, complete if known)*:

If the EPC company information is left blank and the proposed project is approved by the Board for participation in the Community Solar Energy Pilot Program, the Applicant must inform the Board of the information below once the EPC company becomes known.

EPC Company Name *(optional, complete if applicable)*: Not yet determined
First Name:_____ Last Name: _____
Daytime Phone:_____ Email:_____
Mailing Address: _____
Municipality:_____ County:_____ Zip Code: _____

IV. Property/Site Owner Information

[redacted]

V. Community Solar Subscriber Organization *(optional, complete if known)*

If this section, "Community Solar Subscriber Organization," is left blank and the proposed project is approved by the Board for participation in the Community Solar Energy Pilot Program, the Applicant must inform the Board of the information below once the Subscriber Organization becomes known.

Subscriber Organization Company/Entity Name *(optional, complete if applicable)*: Not yet determined
First Name:_____ Last Name: _____
Daytime Phone:_____ Email:_____
Mailing Address: _____
Municipality:_____ County:_____ Zip Code: _____

VI. Proposed Community Solar Facility Characteristics

Community Solar Facility Size (as denominated on the PV panels):

3.67 MW AC 4.6 MW DC

[redacted]

[redacted]

Total Acreage of Community Solar Facility: 20-26 acres

Attach a delineated map of the portion of the property on which the community solar facility will be located. In the electronic submission, two copies of the delineated map should be provided: 1) as a PDF document, and 2) as a design plan in drawing file format (.dwg) or as a shapefile (.shp), in order to facilitate integration with Geographic Information System (GIS) software.

Please find attached PDF and .dwg files

EDC electric service territory in which the proposed community solar facility is located: *(select one)*

☐ Atlantic City Electric
☐ Public Service Electric & Gas
✔ Jersey Central Power & Light
☐ Rockland Electric Co.

Estimated date of project completion* *(The Applicant should provide a good faith estimate of the date of project completion; however, this data is being collected for informational purposes only.)*: October (month) 2020 (year)

Project completion is defined pursuant to the definition at N.J.A.C. 14:8-9.3 as being fully operational, up to and including having subscribers receive bill credits for their subscription to the project.

The proposed community solar facility is an existing project* ..... ☐ Yes ✔ No

If "Yes," the Application will not be considered by the Board. See section B. XIII. for special provisions for projects having received a subsection (t) conditional certification from the Board prior to February 19, 2019.

*Existing project is defined in N.J.A.C. 14:8-9.2 as a solar project having begun operation and/or been approved by the Board for connection to the distribution system prior to February 19, 2019.

VII. Community Solar Facility Siting

1. The proposed community solar project has site control* ..... ✔ Yes ☐ No
   If "Yes," attach proof of site control. See attached Memorandum of Lease
   If "No," the Application will be deemed incomplete.
   *Site control is defined as property ownership or option to purchase, signed lease or option to lease, or signed contract for use as a community solar site or option to contract for use as a community solar site.

2. The proposed community solar facility is located, in part or in whole, on preserved farmland* Yes ✔ No
   If "Yes," the Application will not be considered by the Board. ..... ☐

*Preserved farmland is defined in N.J.A.C. 14:8-9.2 as land from which a permanent development easement was conveyed and a deed of easement was recorded with the county clerk's office pursuant to N.J.S.A. 4:1C-11 et seq.; land subject to a farmland preservation program agreement recorded with the county clerk's office pursuant to N.J.S.A. 4:1C-24; land from which development potential has been transferred pursuant to N.J.S.A. 40:55D-113 et seq. or N.J.S.A. 40:55D-137 et seq.; or land conveyed or dedicated by agricultural restriction pursuant to N.J.S.A. 40:55D-39.1.

3. The proposed community solar facility is located, in part or in whole, on Green Acres preserved open space* or on land owned by the New Jersey Department of Environmental Protection (NJDEP) ..... ☐ Yes ✔ No
   If "Yes," the Applicant must attach special authorization from NJDEP for the site to host a community solar facility. The Board will not consider Applications for projects located, in part or in whole, on Green Acres preserved open space or on land owned by NJDEP, unless the Applicant has received special authorization from NJDEP and includes proof of such special authorization in the Application package.
   *Green Acres preserved open space is defined in N.J.A.C. 14:8-9.2 as land classified as either "funded parkland" or "unfunded parkland" under N.J.A.C. 7:36, or land purchased by the State with "Green Acres funding" (as defined at N.J.A.C. 7:36).

4. The proposed community solar facility is located, in part or in whole, on land located in the New Jersey Highlands Planning Area or Preservation Area ..... ☐ Yes ✔ No

5. The proposed community solar facility is located, in part or in whole, on land located in the New Jersey Pinelands ..... ☐ Yes ✔ No

6. The proposed community solar facility is located, in part or in whole, on land that has been actively devoted to agricultural or horticultural use and that is/has been valued, assessed, and taxed pursuant to the "Farmland Assessment Act of 1964," P.L. 1964, c.48 (C. 54:4-23.1 et seq.) at any time within the ten year period prior to the date of submission of the Application ..... ✔ Yes ☐ No

7. The proposed community solar facility is located, in part or in whole, on a landfill ..... ☐ Yes ✔ No
   If "Yes," provide the name of the landfill, as identified in NJDEP's database of New Jersey landfills, available at www.nj.gov/dep/dshw/lrm/landfill.htm: _____

8. The proposed community solar facility is located, in part or in whole, on a brownfield If "Yes," has a final remediation document been issued for the property? ..... ☐ Yes ✔ No

If "Yes," attach a copy of the Response Action Outcome ("RAO") issued by the LSRP or the No Further Action ("NFA") letter issued by NJDEP.

9. The proposed community solar facility is located, in part or in whole, on an area of historic fill ..... ☐ Yes ✔ No
   If "Yes," have the remedial investigation requirements pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-4.7 been implemented? ..... ☐ Yes ☐ No
   Has the remediation of the historic fill been completed pursuant to the Technical Requirements for Site Remediation, N.J.A.C. 7:26E-5.4? ..... ☐ Yes ☐ No
   If the remediation of the historic fill has been completed, attach a copy of the Response Action Outcome ("RAO") issued by a Licensed Site Remediation Professional ("LSRP") or the No Further Action ("NFA") letter issued by NJDEP.

10. The proposed community solar facility is located on a parking lot ..... ☐ Yes ✔ No

11. The proposed community solar facility is located on a parking deck ..... ☐ Yes ✔ No

12. The proposed community solar facility is located on a rooftop ..... ☐ Yes ✔ No

13. The proposed community solar facility is located on a canopy over an impervious surface (e.g. walkway) ..... ☐ Yes ✔ No

14. The proposed community solar facility is located on the property of an affordable housing building or complex ..... ☐ Yes ✔ No

15. The proposed community solar facility is located on a water reservoir or other water body ("floating solar") ..... ☐ Yes ✔ No

16. The proposed community solar facility is located on an area designated in need of redevelopment ..... Yes ✔ No
    If "Yes," attach proof of the designation of the area as being in need of redevelopment from a municipal, county, or state entity.

17. The proposed community solar facility is located on land or a building that is preserved by a municipal, county, state, or federal entity ..... ☐ Yes ✔ No
    If "Yes," attach proof of the designation of the area as "preserved" from a municipal, county, or state entity.

18. The proposed community solar facility is located, in part or in whole, on forested lands ..... ☐ Yes ✔ No

Construction of the proposed community solar facility will require cutting down one or more trees ..... ☐ Yes ✔No

If "Yes," estimated number of trees required to be cut for construction: _____

19. The proposed community solar facility is located on land or a building owned or controlled by a government entity, including, but not limited to, a municipal, county, state, or federal entity ..... ☐ Yes ✔ No

20. Are there any use restrictions at the site? ..... ☐ Yes ✔ No

If "Yes," explain the use restriction below and provide documentation that the proposed community solar project is not prohibited.

Will the use restriction be required to be modified? ..... ☐Yes ✔No

If "Yes," explain the modification below.

21. The proposed community solar facility has been specifically designed or planned to preserve or enhance the site (e.g. landscaping, land enhancements, pollination support, stormwater management, soil conservation, etc.) ..... ✔Yes ☐ No

If "Yes," explain below, and provide any additional documentation in an attachment.

Soltage always works with local and state regulatory bodies to ensure that we our facilities are designed to meet local needs regarding preservation and enhancement. If, for example, at any point in the permitting process this project is required to provide freshwater wetlands accommodations and/or soil conservation measures to ensure that our facility does not disturb the soil or nearby wetlands, Soltage will design the project accordingly, as Soltage has done for many of the projects we have developed in New Jersey and around the US.

VIII. Permits

1. The Applicant has completed NJDEP Permit Readiness Checklist, and submitted it to NJDEP's PCER ..... ✔Yes ☐ No

If "Yes," attach a copy of the completed Permit Readiness Checklist as it was submitted to NJDEP PCER.

See attached Permit Readiness Checklist

If "No," the Application will be deemed incomplete. Exception: Applications for community solar projects located on a rooftop, parking lot, or parking structure are exempt from this requirement.

2. The Applicant has met with NJDEP's PCER ..... ✔ Yes ☐ No
   If "Yes," attach proof of a meeting with NJDEP PCER. See attached statement from PCER
   If "No," the Application will be deemed incomplete. Exception: Applications for community solar projects located on a rooftop, parking lot, or parking structure are exempt from this requirement.

3. Please list all permits, approvals, or other authorizations that will be needed for the construction and operation of the proposed community solar facility pursuant to local, state and federal laws and regulations. Include permits that have already been received, have been applied for, and that will need to be applied for. The Applicant may extend this table by attaching additional pages if necessary. These include:
   b. Permits, approvals, or other authorizations from NJDEP (i.e. Land Use, Air Quality, New Jersey Pollutant Discharge Elimination System "NJPDES", etc.) for the property.
   c. Permits, approvals, or other authorizations from NJDEP (i.e. Land Use, Air Quality, NJPDES, etc.) directly related to the installation and operation of a solar facility on this property.
   d. Permits, approvals, or other authorizations other than those from NJDEP for the development, construction, or operation of the community solar facility (including local zoning and other local and state permits)

   An Application that does not list all permits, approvals, or other authorizations that will be needed for the construction and operation of the proposed community solar facility will be deemed incomplete.
   If a permit has been received, attach a copy of the permit.

Permit Name & Description	Permitting Agency/Entity	Date Permit Applied for *(if applicable)* / Date Permit Received *(if applicable)*
Freshwater Wetlands Letter of Interpretation: Line Verification or Presence/Absence	NJDEP	Not yet applied
Flood Hazard Area Applicability Determination/Permit-By-Rule	NJDEP	Not yet applied
Local Land Use Board	Franklin Township	Not yet applied
Soil Conservation District	Hunterdon County Soil Conservation District	Not yet applied
County Planning Board	Hunterdon County Planning Board	Not yet applied
5G3 (Stormwater)	NJDEP	Not yet applied

4. The Applicant has consulted the hosting capacity map of the relevant EDC and determined that, based on the capacity hosting map as published at the date of submission of the Application, there is sufficient capacity available at the proposed location to build the proposed community solar facility ..... ✔ Yes ☐ No

   If "Yes," include a screenshot of the capacity hosting map at the proposed location, showing the available capacity.

IX. Community Solar Subscriptions and Subscribers

1. Estimated or Anticipated Number of Subscribers *(please provide a good faith estimate or range)*:

   780

2. Estimated or Anticipated Breakdown of Subscribers *(please provide a good faith estimate or range of the kWh of project allocated to each category)*:

   Residential: 90% Commercial: 10%

   Industrial:_____ Other:_____(define "other":_____)

3. The proposed community solar project is an LMI project* ..... ✔ Yes ☐ No

   *An LMI project is defined pursuant to N.J.A.C. 14:8-9 as a community solar project in which a minimum 51 percent of project capacity is subscribed by LMI subscribers.

4. The proposed community solar project will allocate at least 51% of project capacity to residential customers ..... ✔ Yes ☐ No

5. The proposed community solar project is being developed in partnership with an affordable housing provider: ..... ✔ Yes ☐ No

   If "Yes," attach a letter of support from the affordable housing provider.

   See attached letter of support from [redacted]

6. An affordable housing provider is seeking to qualify as an LMI subscriber for the purposes of the community solar project ..... ☐ Yes ✔ No

   If "Yes," estimated or anticipated percentage of the project capacity for the affordable housing provider's subscription *(provide an estimate or range)*: _____

   If "Yes," what specific, substantial, identifiable, and quantifiablelong-term benefits from the community solar subscription are being passed through to their residents/tenants?

Additionally, the affordable housing provider must attach a signed affidavit that the specific, substantial, identifiable, and quantifiable long-term benefits from the community solar subscription will be passed through to their residents/tenants.

7. This project uses an anchor subscriber *(optional)* .....☐ Yes☐ No
   If "Yes," name of the anchor subscriber *(optional)*: _____
   Estimated or anticipated percentage or range of the project capacity for the anchor subscriber's subscription: _____

8. Is there any expectation that the account holder of a master meter will subscribe to the community solar project on behalf of its tenants? ..... ☐ Yes✔ No
   Not at this time
   If "Yes," what specific, identifiable, sufficient, and quantifiable benefits from the community solar subscription are being passed through to the tenants?

   Additionally, the account holder of the master meter must attach a signed affidavit that the specific, identifiable, sufficient, and quantifiable benefits from the community solar subscription will be passed through to the tenants.

   If "No," please be aware that, if, at any time during the operating life of the community solar project the account holder of a master meter wishes to subscribe to the community solar project on behalf of its tenants, it must submit to the Board a signed affidavit that the specific, identifiable, sufficient, and quantifiable benefits from the community solar subscription will be passed through to its tenants.

   Understood

9. The geographic restriction for distance between project site and subscribers is: *(select one)*
   [redacted]
   Note: The geographic restriction selected here will apply for the lifetime of the project, barring special dispensation from the Board, pursuant to N.J.A.C. 14:8-9.5(a).

10. Product Offering: *(The Applicant must also complete and attach one or more product offering form(s) found in Appendix A. See Appendix A for exemptions.)*

The subscription proposed offers guaranteed or fixed savings to subscribers ..... ✔Yes☐ No

If "Yes," the guaranteed or fixed savings are offered as:

[redacted]

If "Yes," the proposed savings represent:

[redacted]

The subscription proposed offers subscribers ownership or a pathway to ownership of a share of the community solar facility ..... ☐ Yes ✔ No

If "Yes," include proof of a pathway to ownership of a share of the community solar facility offered to the subscribers in Appendix A.

11. The list of approved community solar projects will be published on the Board's website. Additionally, subscriber organizations have the option of indicating, on this list, that the project is currently seeking subscribers.

If this project is approved, the Board should indicate on its website that the project is currently seeking subscribers ..... ✔Yes ☐ No

If "Yes," the contact information indicated on the Board's website should read:

Company/Entity Name: Soltage Contact Name: Zac Meyer
Daytime Phone: (201) 992-9200 Email: zmeyer@soltage.com

Note: it is the responsibility of the project's subscriber organization to notify the Board if/when the project is no longer seeking subscribers, and request that the Board remove the above information on its website.

X. Community Engagement

1. The proposed community solar project is being developed by or in collaboration* with the municipality in which the project is located ..... ☐ Yes ✔ No

If "Yes," explain how and attach a letter of support from the municipality in which the project is located. Soltage is in discussions with Franklin Township, Hunterdon County, who are considering a letter of support.

*Collaboration with the municipality should include, at minimum, one or more meetings with relevant municipal authorities and clear evidence of municipal involvement and approval of the design, development, or operation of the proposed community solar project.

2. The proposed community solar project is being developed in collaboration* with one or more local community organization(s) ..... ☐ Yes ✔No
If "Yes," explain how and attach a letter of support from the local community organization(s).
*Collaboration with a local community organization should include, at minimum, one or more meetings with the relevant local community organization(s) and clear evidence of the local community organization's involvement and approval of the design, development, or operation of the proposed community solar project.

[redacted]

3. The proposed community solar project was developed, at least in part, through a community consultative process* ..... Yes ✔ No
If "Yes," please describe the consultative process.
*A community consultative process should include, at minimum, one or more opportunities for public intervention and outreach to the municipality and/or local community organizations.

[redacted]

XI. Project Cost

1. Provide the following cost estimates and attach substantiating evidence in the form of charts and/or spreadsheet models:

Applicants are expected to provide a good faith estimate of costs associated with the proposed community solar project, as they are known at the time the Application is filed with the Board. This information will not be used in the evaluation of the proposed community solar project.

[redacted]

2. Pursuant to N.J.A.C. 14:8-9.7(q), "community solar projects shall be eligible to apply, via a one-time election prior to the delivery of any energy from the facility, for SRECs or ClassI RECs, as applicable, or to any subsequent compensations as determined by the Board pursuant to the Clean Energy Act."

For indicative purposes only, please indicate all local, state and federal tax incentives which will be applied to if the proposed community solar project is approved for participation in the Community Solar Energy Pilot Program:

NJ SRECs

Investment Tax Credit (ITC, a federal incentive)

Modified Accelerated Cost Recovery System (MACRS, a federal incentive)

NJ Solar Energy Sales Tax Exemption

NJ Property Tax Exemption

XII. Other Benefits

1. The proposed community solar facility is paired with another distributed energy resource:
   a. Micro-grid project ..... ☐ Yes ✔ No
   b. Storage ..... ☐ Yes ✔ No
   c. Other *(identify)*:_____ ..... ☐ Yes ✔ No

2. The proposed community solar facility provides grid benefits (e.g. congestion reduction) ..... ✔ Yes ☐ No

   If "Yes" to any, please explain how and provide supporting documents.

The installation of new distributed photovoltaic capacity often has distribution grid benefits, such as reducing line losses and helping a utility avoid the cost of new distribution infrastructure. This is supported in many studies and reports from established, reputable universities and government institutions; please find one such report attached with this application, "Value of Solar to New Jersey and Pennsylvania" by Perez, Norris, & Hoff, 2012. (In the interest of saving paper, because the report is rather long, I have included a hard copy in only the original Application package, and I have included a PDF file in the digital submission, but not hard copies in the 3 copies of the Application.) As to the exact grid benefits of this specific project, further study would need to be conducted in order to quantify such benefits, but the general benefits explored in the attached report are very much applicable to this proposed project.

[redacted]

If "Yes," identify the entity or entities through which job training is or will be organized (e.g. New Jersey GAINS program, partnership with local school):

[redacted]

XIII. Special Authorizations and Exemptions

1. Is the proposed community solar project co-located with another community solar facility (as defined at N.J.A.C. 14:8-9.2)? ..... ☐ Yes ✔No
   If "Yes," please explain why the co-location can be approved by the Board, consistent with the provisions at N.J.A.C. 14:8-9.

2. Does this project seek an exemption from the 10-subscriber minimum? ..... ☐ Yes ✔No
   If "Yes," please demonstrate below (and attach supporting documents as relevant):
   a. That the project is sited on the property of a multi-family building.
   b. That the project will provide specific, identifiable, and quantifiable benefits to the households residing in said multi-family building.

3. Specific sections throughout the Application Form are identified as optional only if: 1) the Applicant is a government entity (municipal, county, or state), and 2) the community solar developer will be selected by the Applicant via a RFP, RFQ, or other bidding process. Has the Applicant left those specific sections blank? ..... ☐ Yes ✔No
   If "Yes," attach a letter describing the proposed bidding process. The Applicant must further commit to issuing said RFP, RFQ, or other bidding process within 90 days of the proposed project being approved by the Board for participation in the Community Solar Energy Pilot Program. The Applicant will be required to provide the information contained in those optional sections to the Board once it becomes known.

4. Has the proposed community solar project received, in part or in whole, a subsection (t) conditional certification from the Board prior to February 19, 2019? ..... ☐ Yes ✔No

Section C: Certifications

Instructions: Original signatures on all certifications are required. All certifications in this section must be notarized.

Applicant Certification

The undersigned warrants, certifies, and represents that:

1) I, Zachary Meyer am the Manager of Development of the Applicant, Soltage NJ DevCo, LLC and have been authorized to file this Applicant Certification on behalf of my organization; and
2) The information provided in this Application package has been personally examined, is true, accurate, complete, and correct to the best of the undersigned's knowledge, based on personal knowledge or on inquiry of individuals with such knowledge; and
3) The community solar facility proposed in the Application will be constructed, installed, and operated as described in the Application and in accordance with all Board rules and applicable laws; and
4) The system proposed in the Application will be constructed, installed, and operated in accordance with all Board policies and procedures for the SREC Registration Program or subsequent revision to the SREC Registration Program, if applicable; and
5) My organization understands that certain information in this Application is subject to disclosure under the Open Public Records Act, N.J.S.A. 47-1A-1 et seq., and that sensitive and trade secret information that they wish to keep confidential should be submitted in accordance with the confidentiality procedures set forth in N.J.A.C. 14:1-12.3.; and
6) My organization acknowledges that **submission of false information may be grounds for denial of this Application, and if any of the foregoing statements are willfully false, they are subject to punishment to the full extent of the law, including the possibility of fine and imprisonment.**

Signature: _____ Date: 8/27/19

Print Name: Zac Meyer

Title: Manager of Development Company: Soltage NJ DevCo

Signed and sworn to before me on this 27th day of August, 2019

_____

Signature

Adwoa Adjare-Danquah

Name

ADWOA ADJARE-DANQUAH
NOTARY PUBLIC OF NEW JERSEY
Comm. # 2455840
My Commission Expires 11/10/2021

New Jersey's cleanenergy program

Project Developer Certification

This Certification "Project Developer / Installer" is optional if: 1) the Applicant is a government entity (municipal, county, or state), AND 2) the community solar developer will be selected by the Applicant via a Request for Proposals (RFP), Request for Quotations (RFQ), or other bidding process. In all other cases, this Certification is required.

The undersigned warrants, certifies, and represents that:

1) I, Zachary Meyer am the Manager of Development of the Project Developer, Soltage NJ DevCo, LLC and have been authorized to file this Applicant Certification on behalf of my organization; and
2) The information provided in this Application package has been personally examined, is true, accurate, complete, and correct to the best of the undersigned's knowledge, based on personal knowledge or on inquiry of individuals with such knowledge; and
3) The community solar facility proposed in the Application will be constructed, installed, and operated as described in the Application and in accordance with all Board rules and applicable laws; and
4) The system proposed in the Application will be constructed, installed, and operated in accordance with all Board policies and procedures for the SREC Registration Program or subsequent revision to the SREC Registration Program, if applicable; and
5) My organization understands that certain information in this Application is subject to disclosure under the Open Public Records Act, N.J.S.A. 47-1A-1 et seq., and that sensitive and trade secret information that they wish to keep confidential should be submitted in accordance with the confidentiality procedures set forth in N.J.A.C. 14:1-12.3.; and
6) My organization acknowledges that **submission of false information may be grounds for denial of this Application, and if any of the foregoing statements are willfully false, they are subject to punishment to the full extent of the law, including the possibility of fine and imprisonment.**

Signature: _____ Date: 8/27/19

Print Name: Zac Meyer

Title: Manager of Development Company: Soltage NJ DevCo

Signed and sworn to before me on this 27th day of August, 2019

_____

Signature

Adwoa Adjare-Danquah

Name

ADWOA ADJARE-DANQUAH
NOTARY PUBLIC OF NEW JERSEY
Comm. # 2455840
My Commission Expires 11/10/2021

Project Owner Certification

The undersigned warrants, certifies, and represents that:

1) I, Zachary Meyer am the Manager of Development of the Project Owner, Soltage NJ DevCo, LLC and have been authorized to file this Applicant Certification on behalf of my organization; and
2) The information provided in this Application package has been personally examined, is true, accurate, complete, and correct to the best of the undersigned's knowledge, based on personal knowledge or on inquiry of individuals with such knowledge; and
3) The community solar facility proposed in the Application will be constructed, installed, and operated as described in the Application and in accordance with all Board rules and applicable laws; and
4) The system proposed in the Application will be constructed, installed, and operated in accordance with all Board policies and procedures for the SREC Registration Program or subsequent revision to the SREC Registration Program, if applicable; and
5) My organization understands that certain information in this Application is subject to disclosure under the Open Public Records Act, N.J.S.A. 47-1A-1 et seq., and that sensitive and trade secret information that they wish to keep confidential should be submitted in accordance with the confidentiality procedures set forth in N.J.A.C. 14:1-12.3.; and
6) My organization acknowledges that **submission of false information may be grounds for denial of this Application, and if any of the foregoing statements are willfully false, they are subject to punishment to the full extent of the law, including the possibility of fine and imprisonment.**

Signature: _____ Date: 8/27/19

Print Name: Zac Meyer

Title: Manager of Development Company: Soltage NJ DevCo

Signed and sworn to before me on this 27th day of August, 2019

_____

Signature

Adwoa Adjare-Danquah.

Name

ADWOA ADJARE-DANQUAH
NOTARY PUBLIC OF NEW JERSEY
Comm. # 2455840
My Commission Expires 11/10/2021

[redacted]

2) The information provided in this Application package pertaining to siting and location of the proposed community solar project has been personally examined, is true, accurate, complete, and correct to the best of the undersigned's knowledge, based on personal knowledge or on inquiry of individuals with such knowledge; and
3) My organization or I understand that certain information in this Application is subject to disclosure under the Open Public Records Act, N.J.S.A. 47-1A-1 et seq., and that sensitive and trade secret information that they wish to keep confidential should be submitted in accordance with the confidentiality procedures set forth in N.J.A.C. 14:1-12.3.; and
4) My organization acknowledges that **submission of false information may be grounds for denial of this Application, and if any of the foregoing statements are willfully false, they are subject to punishment to the full extent of the law, including the possibility of fine and imprisonment.**

[redacted]

Section D: Appendix

Appendix A: Product Offering Questionnaire

Complete the following Product Offering Questionnaire. If there are multiple different product offerings for the proposed community solar project, please complete and attach one Product Offering Questionnaire per product offering.
Applicants are expected to provide a good faith description of the product offerings developed for the proposed community solar project, as they are known at the time the Application is filed with the Board. If the proposed project is approved by the Board, the Applicant must notify the Board and receive approval from the Board for any modification or addition to a Product Offering Questionnaire.

Exception: This "Product Offering Questionnaire" is optional if: 1) the Applicant is a government entity (municipal, county, or state), AND 2) the community solar developer will be selected by the Applicant via a Request for Proposals (RFP), Request for Quotations (RFQ), or other bidding process.

This Questionnaire is Product Offering number 1 of 1 (total number of product offerings).

1. Community Solar Subscription Type *(examples: kilowatt hours per year, kilowatt size, percentage of community solar facility's nameplate capacity, percentage of subscriber's historical usage, percentage of subscriber's actual usage)*:
   Percentage of community solar facility's nameplate capacity

2. Community Solar Subscription Price: *(check all that apply)*
   ☐ Fixed price per month
   ✔ Variable price per month, variation based on:
   Subscriber % of nameplate capacity * actual facility production * community solar bill credit value * (1 - discount offered to subscriber)
   ☐ The subscription price has an escalator of_____% every_____*(interval)*

3. [redacted]

4. Fees
   ☐ Sign-up fee: none
   ☐ Early Termination or Cancellation fees: none
   ☐ Other fee(s) and frequency: none

5. Does the subscription guarantee or offer fixed savings or specific, quantifiable economic

benefits to the subscriber? ..... ✔ Yes ☐ No

If "Yes," the savings are guaranteed or fixed:

- ☐ As a percentage of monthly utility bill
- ☐ As a fixed guaranteed savings compared to average historicbill
- ✔ As a fixed percentage of bill credits
- ☐ Other: _____

6. Special conditions or considerations:

1. Historical usage of each subscriber will be evaluated to ensure they subscribe to the correct percentage of the facility
2. Subscribers will never be responsible for purchasing electricity beyond what they use

[redacted]

Appendix B: Required Attachments Checklist

Note that this list is for indicative purposes only. Additional attachments may be required, and are identified throughout this Application Form.

Required Attachments for all Applications	Page	Attached?
Delineated map of the portion of the property on which the community solar facility will be located.	p.7	✔ Yes No
For electronic submission only: copy of the delineated map of the portion of the property on which the community solar facility will be located as a PDF and in drawing file format (.dwg) or as a shapefile (.shp).	p.7	Yes
Proof of site control.	p.8	✔ Yes
Copy of the completed Permit Readiness Checklist as it was submitted to NJDEP PCER, if applicable.	p.11	✔ Yes
Proof of a meeting with NJDEP PCER, if applicable.	p.12	✔ Yes
A screenshot of the capacity hosting map at the proposed location, showing the available capacity.	p.12	✔ Yes
Substantiating evidence of project cost in the form of charts and/or spreadsheet models.	p.16	Yes
Certifications in Section C.	p.19-23	✔ Yes
Product Offering Questionnaire(s).	p.24	✔ Yes

Required Attachments for Exemptions	Page	Attached?
The Applicant is a government entity (municipal, county, or state), and the community solar developer will be selected by the Applicant via a Request for Proposals (RFP), Request for Quotations (RFQ), or other bidding process: ⇨ Attach a letter from the Applicant describing the bidding process	p.6, p.19	☐ Yes ☐ No
The proposed community solar project is located, in part or in whole, on Green Acres preserved open space or on land owned by NJDEP. ⇨ Attach special authorization from NJDEP for the site to host a community solar facility.	p.8	☐ Yes ☐ No
The proposed community solar project has received, in part or in whole, a subsection (t) conditional certification from the Board prior to February 19, 2019. ⇨ Attach a signed affidavit that the Applicant will immediately withdraw the applicable subsection (t) conditional certification if the proposed project is approved by the Board for participation in the Community Solar Energy Pilot Program.	p. 19	☐ Yes ☐ No

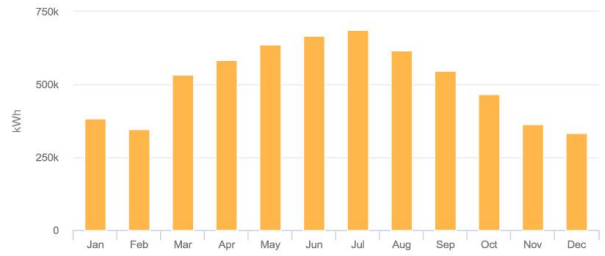
Appendix C: Evaluation Criteria

The Evaluation Criteria chart below lists the various categories that the Board will consider in evaluating project Applications. Projects must score a minimum 30 points total in order to be considered for participation in the Community Solar Energy Pilot Program. Projects that score above 30 points will be awarded program capacity in order, starting with the highest-scoring project and proceeding to the lowest-scoring project.

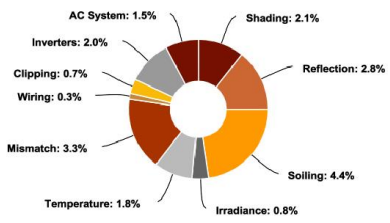
Evaluation Criteria	Max. Points
Low- and Moderate-Income and Environmental Justice Inclusion Higher preference: LMI project	30
Siting Higher preference: landfills, brownfields, areas of historic fill, rooftops, parking lots, parking decks Medium preference: canopies over impervious surfaces (e.g. walkway), areas designated in need of redevelopment No Points: preserved lands, wetlands, forested areas, farmland Bonus points for: landscaping, land enhancement, pollination support, stormwater management, soil conservation	20 Max. possible bonus points: 5
Product Offering Higher preference: guaranteed savings >10%, flexible terms* Medium preference: guaranteed savings >5% No Points: no guaranteed savings, no flexible terms* *Flexible terms may include: no cancellation fee, short-term contract	15
Community and Environmental Justice Engagement Higher preference: partnership with municipality, partnership with local community organization(s), partnership with affordable housing provider Medium preference: letter of support from municipality, project owner is a government and/or public and/or quasi-public entity, project owner is an affordable housing developer	10
Subscribers Higher preference: more than 51% project capacity is allocated to residential subscribers	10
Other Benefits Higher preference: Provides local jobs/job training, demonstrates co-benefits (e.g. paired with storage, micro-grid project, energy audit, EE measures)	10
Geographic Limit within EDC service territory Higher preference: municipality/adjacent municipality Medium preference: county/adjacent county No Points: any geographic location within the EDC service territory.	5

[redacted]

Monthly Production



Sources of System Loss



Annual Production

		Output	
Irradiance (kWh/m²)	Annual Global Horizontal Irradiance	1,470.3	
	POA Irradiance	1,708.2	
	Shaded Irradiance	1,672.6	-2.1%
	Irradiance after Reflection	1,625.8	
	Irradiance after Soiling	1,554.0	-4.4%
	Total Collector Irradiance		
Energy (kWh)	Nameplate	6,837,974.0	
	Output at Irradiance Levels	6,786,599.8	
	Output at Cell Temperature Derate	6,667,189.7	-1.8%
	Output After Mismatch		
	Optimal DC Output	6,429,857.3	
	Constrained DC Output	6,387,573.3	-0.7%
	Inverter Output	6,259,470.0	-2.0%
	Energy to Grid	6,165,580.0	-1.5%
Temperature Metrics			
	Avg. Operating Ambient Temp		
	Avg. Operating Cell Temp		21.5 °C
Simulation Metrics			
		Operating Hours	
		Solved Hours	4683

Condition Set

	Condition Set 1
	TMY, 10km Grid (40.55,-74.95), NREL (prospector)
	Meteo Lat/Lng
	Perez Model
	Sandia Model

Fixed Tilt	-3.56	-0.075	3°C
Flush Mount	-2.81	-0.0455	0°C
East-West	-3.56	-0.075	3°C
Carport	-3.56	-0.075	3°C

10	25	5	2	2	2	2	2	2	2	2	5

	5%
	4° C
	-2.5% to 2.5%
	1.50%

	TSM-DEG14HC(II) 395 (Trina Solar)	Spec Sheet Characterization, PAN
	Sunny Tripower_Core1 33-US-41 (SMA)	Default Characterization

Components

nverters	Sunny Tripower_Core1 33-US-41 (SMA)	110 (3.66 MW)
Strings		
Module	Trina Solar, TSM-DEG14HC(II) 395 (395W)	11,142 (4.40

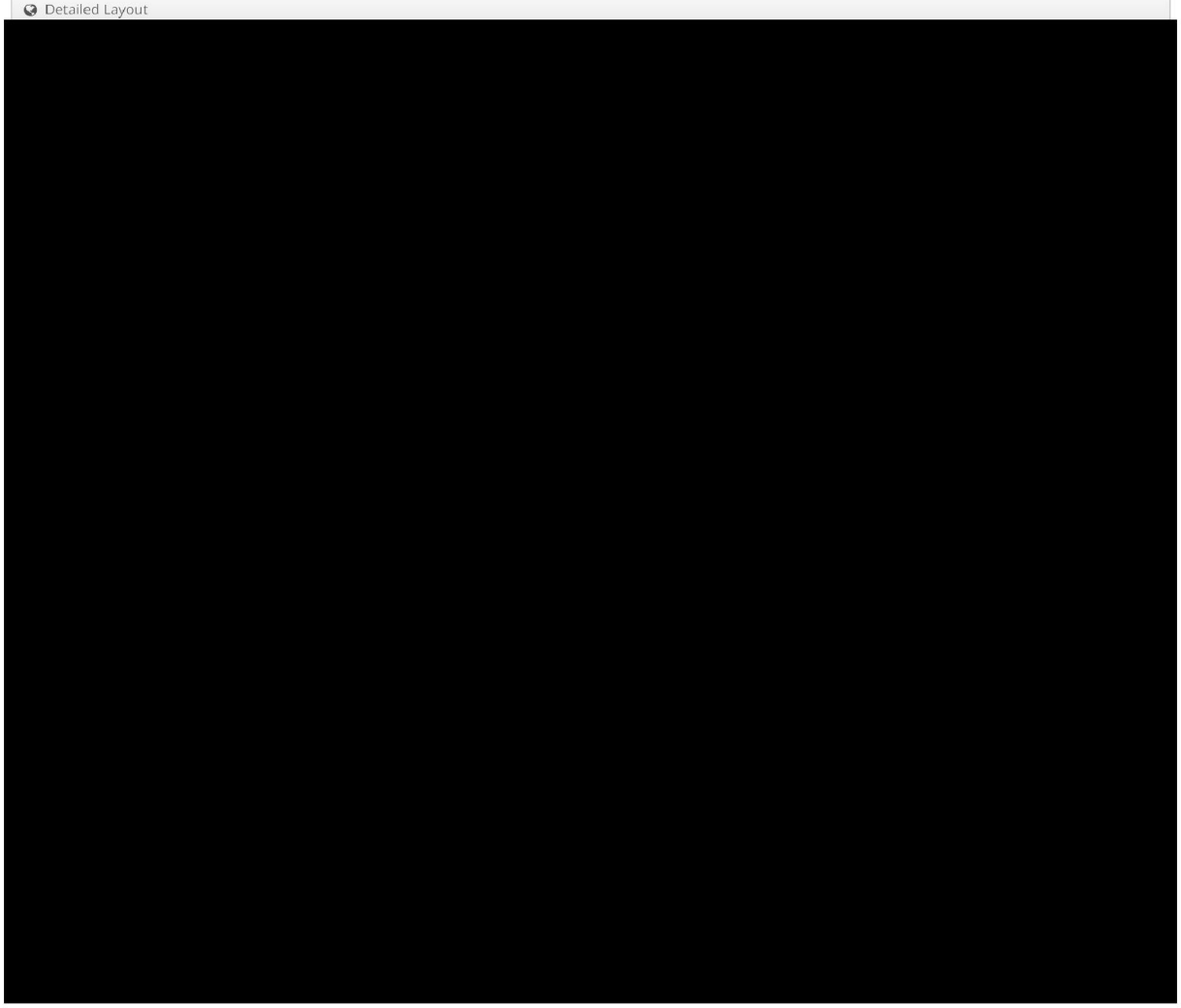
Wiring Zones

Description	Combiner Poles	String Size	Stringing Strategy
Wiring Zone	12	18-18	Along Racking

Field Segments

Description	Racking	Orientation	Tilt	Azimuth	Intrarow Spacing	Frame Size	Frames	Modules	Power
Field Segment 1	Fixed Tilt	Portrait (Vertical)	25°	180°	17.3 ft	2x9	619	11,142	4.40 MW

Detailed Layout



MEMORANDUM OF LEASE

THIS MEMORANDUM OF LEASE ("*Memorandum*") is entered into September 3rd, 2019 between [redacted] and Soltage NJ DevCo, LLC, a Delaware limited liability company ("*Tenant*"), whose address is 66 York Street, 5th Floor, Jersey City, NJ 07302, to provide record notice of that certain Lease Agreement dated 7/23/2019 (the "*Lease*") whereby Landlord leased to Tenant a portion of the real property described in the attached **Exhibit A** ("*Property*"). Specifically, Landlord leased to Tenant that portion of the Property shown in **Exhibit B**, together with all improvements, fixtures, personal property and trade fixtures, and all other appurtenances, tenements, hereditaments, ingress, egress, rights and easements pertaining to the Property (collectively, the "*Leased Premises*"). Landlord and Tenant agree that upon completion of a final site plan and survey delineating the Leased Premises, the parties shall amend **Exhibit B** to more accurately describe the Leased Premises.

The solar photovoltaic power generating facility and all related equipment installed, owned and operated by Tenant and located at the Leased Premises (collectively, the "*Solar Operations*") shall not be deemed a fixture. The Solar Operations are Tenant's personal property and Landlord has no right, title or interest in the Solar Operations. Further, Landlord has waived any and all rights it may have to place a lien on the Solar Operations.

The Effective Date of the Lease is 7/23/2019. The Initial Term of the Lease begins on the Commencement Date (as defined in the Lease) and continues for [redacted] years from the date of commercial operation of the Solar Operations (as defined in the Lease) unless extended or earlier terminated as provided in the Lease. Tenant has the right to extend the Term for up to [redacted] as set forth in the Lease. Additionally, pursuant to the terms of the Lease, Landlord has granted certain easement rights over and across adjacent property as further described on **Exhibit C** (the "*Adjacent Property*"). Reference should be made to the Lease for further particulars.

TENANT: SOLTAGE NJ DEVCO, LLC

By: _____
Name: Sripradha Ilango
Its: Manager
Date: 9/3/2019

WITNESS:

STATE OF NEW JERSEY
COUNTY OF HUDSON

The foregoing Agreement was acknowledged before me this 3rd day of September, 2019, by Sripradha Ilango, as Manager of Soltage NJ DevCo, LLC. ~~He/~~She is personally known to me or has produced _____ as identification.

_____
NOTARY PUBLIC

Print Name:
My Commission Expires:

ADWOA ADJARE-DANQUAH
NOTARY PUBLIC OF NEW JERSEY
Comm. # 2455840
My Commission Expires 11/10/2021

Exhibit A
Property

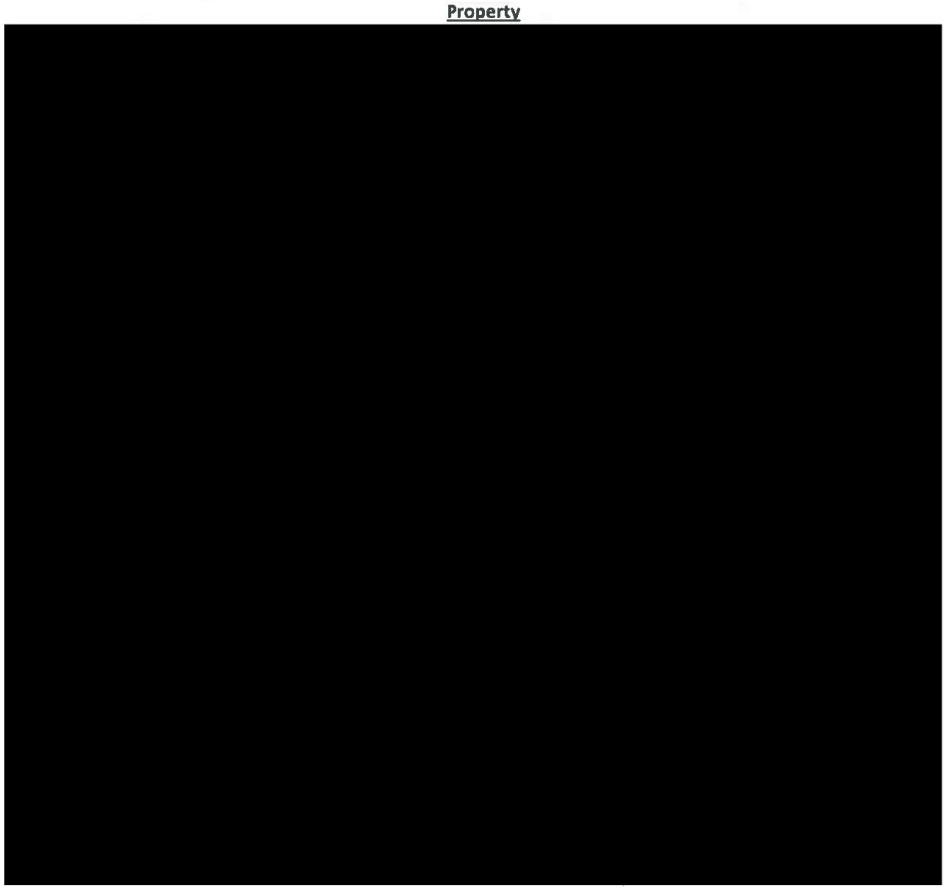


Exhibit B

Leased Premises

The Leased Premises will be determined and mutually agreed upon before the Commencement Date.

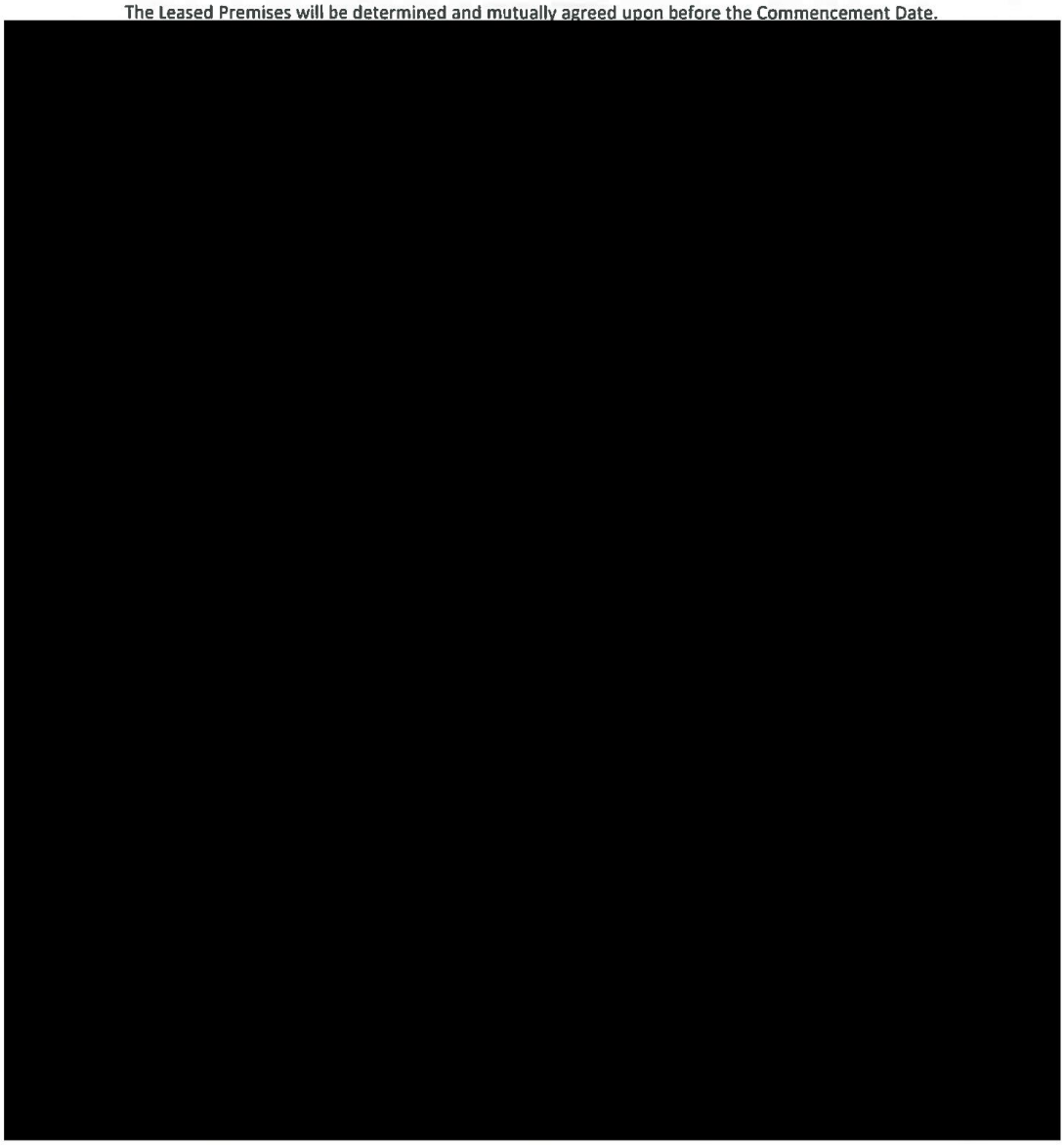


Exhibit C

Adjacent Property

None applicable

Franklin Whitebridge Solar1

Completed Permit Readiness Checklist and Figures

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

OFFICE OF PERMIT COORDINATION AND ENVIRONMENTAL REVIEW

PERMIT READINESS CHECKLIST

FOR PCER OFFICE USE ONLY

DATE RECEIVED____ PRC ID NUMBER ___

Completion of this form will assist the Department in determining what permits might be needed to authorize a project and to insure that all appropriate programs attend a pre-application meeting. Please fill out the below form as completely as possible, noting any areas you are not sure of and including any information about the project and the site that might help the Department determine the permitting needs of the project.[17]

3. Please complete the following questions if applicable and return to the Department with a **1 to 2 page narrative description of project, its function, and its benefits; as well as a site plan, maps, aerial photos, GIS shape files, etc.**

C. GENERAL INFORMATION

7. Name of Proposed Project: Franklin White Bridge Solar 1

[17] Please be advised that this form is not a permit application. To receive authorization, approval, or a permit to conduct regulated activities, a formal application must be filed and a formal permit or authorization issued by the appropriate Bureau within the Department prior to the conduct of regulated activity. This form is used solely for the Department's preliminary review and discussion of this project to determine what permits or authorizations may be needed to conduct the proposed activity. Any guidance offered to the applicant during this process is not binding on the Department or the applicant and a final response can only be rendered through the actual issuance of permits, approvals, or authorizations.

8. Consultant/Contact Information (if any) Weston Solutions, Inc.

9. Name/Address of Prospective Applicant: Soltage, LLC
Address/tel./fax 66 York Street, 5th Floor, Jersey City, NJ 07302

T: 201.992.9200; F: 201-432-1010

4. Does the project have any existing NJDEP ID#s assigned? i.e., Case number, Program Interest (PI)#, Program ID#? N/A

B. PROPOSED PROJECT LOCATION

E. PROPOSED ACTIVITY DESCRIPTION AND SCHEDULE

7. Project Type:___New Construction___Brownfield Redevelop. ___
Alternative Energy X Other (Please describe) Ground mount solar photovoltaic project

a) Estimated Schedule: Date permits needed or desired by, beginning construction date; construction completion, and operation of facility date: Construction start: Q2 2020; Construction completion/operation Q4 2020

b) Funding Source: Is any Federal Funding being used for this project? N/A
State Funding over 1 million dollars? N/A
Is funding secured at this time? Yes, from Soltage's standard investment vehicle Is funding conditional?___No If so, on what?___

c) Is the project contingent on receiving the identified funding? N/A
If yes, explain ___

d) What DEP permits do you think you need for this project? (The Department will confirm this through the PRC process). FWW LOI, FHA

8. For additional guidance on Department permits, please refer to the Permit Identification Form (PIF) which will be forwarded upon request. The PIF does not need to be filled out or submitted to the Department.

e) Which Department(s), Bureau(s), and staff have you contacted regarding your proposed project? OPCER

f) Are there any Department permits that will need to be modified as a result of this project. Please explain and identify the project reviewer of the permit to be modified. No permit modifications are anticipated.

c) Please identify any pre-permit actions or modifications you have applied for or obtained from the Department or other state agencies for this project: NONE

21) Water Quality Management Plan consistency _____

22) Highlands Consistency _____
23) Wetland Delineation (LOI) _____
24) Tidelands Conveyance _____
25) Flood Hazard Jurisdiction or determinations _____
26) Water Allocation _____
27) Site Remediation RAW, Remedial Action Permit – Soil and or Groundwater, NJPDES Discharge to Ground Water, NJPDES Discharge to Surface Water, No Further Action Response Action Outcome _____
28) Landfill Disruption Approval _____
29) Landfill Closure Plan _____
30) Other _____

9. Please submit this Permit Readiness Checklist form, completed to the extent possible, electronically to Ruth.Foster@dep.nj.gov and Megan.Brunatti@dep.nj.gov and one (1) copy via mail[18] with the following items if available:
   (i) The completed Permit Readiness Checklist;
   (j) A description of the proposed project;
   (k) Any overarching regulatory or policy call(s) or guidance that the Department must make or make known prior to the receipt of the application to determine the project's feasibility, regulatory, or review process.
   (l) USGS map(s) with the site of the proposed project site boundaries clearly delineated (including the title of the USGS quadrangle sheet from which it was taken)[19];
   (e) Aerial photos/GIS information regarding the site;
   (f) A site map including any known environmental features (wetlands, streams, buffers, etc[20]);
   (g) Site plans to the extent available;
   (h) Street map indicating the location of the proposed project;
   (i) Any other information that you think may be helpful to the Department in reviewing this project.
   (j) List of any local or regional governments or entities, their historical involvement in this project or site, identification of conflicts with DEP rules; with contact names and information whose attendance/input would be helpful in facilitating this project, ie Soil Conservation Districts, health departments, local zoning officials, etc.

D. The following are questions by Program to guide the Department in its determination of what permits may be needed to authorize this project. If the questions do not apply to the proposed project

---

[18] Submit to: New Jersey Department of Environmental Protection
Office of Permit Coordination and Environmental Review
P.O. Box 420, Mail Code 07J
Trenton, New Jersey 08625
Street Location: 401 East State Street, 7th Floor East Wing
Telephone Number:(609) 292-3600
Fax Number: (609) 292-1921

[19] USGS maps may be purchased from NJDEP, Maps and Publications, P.O. Box 420, Trenton 08625-0420; (609) 777-1038

[20] NJGIS information

please indicate N/A. Please include any other information you think may be helpful for the Department to determine which permits are needed.

WATER AND WASTE WATER INFORMATION

DEP Safe Drinking Water Program (609) 292-5550
http://www.nj.gov/dep/watersupply/

Is the project located within an existing water purveyor service area? If yes, which one? N/A

Will the project affect any land or water controlled by a Water Supply Authority or water purveyor in New Jersey? If so, please identify and explain. N/A

Does the purveyor have adequate firm capacity and allocation to support project demand? N/A

Do water pipes currently extend to the project location? N/A

If not, is it located within a franchise area? N/A

Does the project have an approved Safe Drinking Water main extension permit? N/A

Will the project affect any land or water controlled by a Water Supply Authority or water purveyor in New Jersey? If so, please identify and explain. N/A

DEP Water Allocation Program (609) 292-2957
http://www.nj.gov/dep/watersupply

Is the project seeking a new ground water allocation or modification? If yes, does the project have all necessary well location and safe drinking water permits? N/A

Is the project located within an area of critical water supply concern? N/A

Will this project have the capability to divert more than 100,000 gallons per day from a single source or a combination of surface or groundwater sources? N/A

Will this project draw more than 100,000 gallons per day of ground or surface water for construction or operation? N/A

WATER POLLUTION MANAGEMENT ELEMENT

DIVISION OF WATER QUALITY

Non-Point Pollution Control (609) 292-0407
http://www.nj.gov/dep/dwq/bnpc_home.htm

The **Bureau of Non-Point Pollution Control** (BNPC) is responsible for protecting and preserving the state's groundwater resources through the issuance of NJPDES Discharge to Groundwater Permits and is responsible for permitting industrial facilities and municipalities under NJPDES for discharges of stormwater to waters of the State.

Groundwater Section (609) 292-0407

This Program does not issue NJPDES-DGW permits for remediation operations.

The following definitions should be used to assist in identifying discharge activities:
Subsurface disposal system is any contrivance that introduces wastewater directly to the subsurface environment, such as, but not limited to: septic systems, recharge beds, trench systems, seepage pits, and dry wells.
Injection/recharge wells are constructed such that they are deeper than they are wide, receive effluent via gravity flow or pumping, and include dry wells and seepage pits.
Overland flow is the introduction of wastewater to the ground surface, over which the wastewater travels and eventually percolates or evaporates.
Industrial wastewater is any wastewater or discharge which is not sanitary or domestic in nature, including non-contact or contact cooling water, process wastewater, discharges from floor drains, air conditioner condensate, etc.

1. Will the project/facility have a sanitary wastewater design flow which discharges to groundwater in excess of 2,000 gallons per day? N/A
2. Will the project/facility generate a discharge to groundwater of industrial wastewater in any quantity? N/A
3. Will the project/facility involve the discharge to groundwater by any of the following activities or structures, or include as part of the design any of these activities or structures? N/A

Please indicate which:
Upland CDF (Dredge Spoils) Spray Irrigation _____
Overland Flow Subsurface Disposal System (UIC) _____
Landfill Infiltration/Percolation Lagoon _____
Surface Impoundment _____

Please specify the source of wastewater for every structure identified above (e.g., sanitary wastewater to a subsurface disposal system or non-contact cooling water to a dry well): N/A

Please specify lining materials for each lined structure identified as being used by the proposed project and give its permeability in cm/sec (e.g., 8-inch thick concrete lined evaporation pond at 10-7 cm/sec): N/A

Does your project/facility include an individual subsurface sewage disposal system design for a facility with a design flow less than 2,000 gallons per day which does not strictly conform to the State's standards? N/A

Does your project involve 50 or more realty improvements? N/A

DEP Pretreatment and Residuals program (609) 633-3823

Will the project involve the discharge of industrial/commercial wastewater to a publicly owned treatment works (POTW)? N/A
If yes, name of POTW: _____
Volume of wastewater (gpd):_____

Will/does this project involve the generation, processing, storage, transfer and/or distribution of industrial or domestic residuals (including sewage sludge, potable water treatment residuals and food processing by-products) generated as a result of wastewater treatment. If so, please explain. N/A

Stormwater Program (609) 633-7021
http://www.njstormwater.org/
http://www.state.nj.us/dep/dwq/ispp_home.html

Will your site activity disturb more than one acre? YES

Will any industrial activity be conducted at the site where material is exposed to the rain or other elements? N/A

Does your facility have an existing NJPDES permit for discharge of stormwater to surface groundwater? NO

Is your facility assigned one of the following Standard Industrial Classification (SIC) Codes? N/A
(To determine your SIC Code see the box "Industry Code" on your New Jersey Department of Labor Quarterly Contribution Report.

Surface Water Permitting (609) 292-4860
http://www.nj.gov/dep/dwq/swp.htm

Will this wastewater facility discharge to Surface Water? N/A Yes/No _____

If yes, state the name of the proposed receiving stream N/A

Describe the proposed discharge of wastewater to Surface Water N/A

If no, how is the wastewater proposed to be discharged (e.g., to be conveyed to another STP, Publicly Owned Treatment Works, etc. _____

MUNICIPAL FINANCE AND CONSTRUCTION ELEMENT

Treatment Works Approvals (609) 984-4429
http://www.nj.gov/dep/dwq/twa.htm

Will this project include the construction, expansion or upgrade of a domestic or industrial wastewater treatment facility or an off-site subsurface disposal system that generates more then 2,000 gallons per day? N/A If yes, explain _____

Will the project result in a construction design of more than 8000 gallons of water discharge per day? N/A

Office of Water Resources Management Coordination (609)777-4359
http://www.state.nj.us/dep/wrm

Sewer Service

Is the project in an approved sewer service area for the type of waste water service needed? N/A
If yes, what is the name of the sewer service area? _____

Has this project received endorsement from the appropriate sewer authority with adequate conveyance and capacity? N/A

Do waste water pipes currently extend to the project location? N/A

Is the project consistent with and in an area covered by an up to date Wastewater Management Plan? N/A

Will an amendment to the existing WQMP be required to accommodate this project? N/A

If tying into an offsite treatment plant, is the capacity and conveyance system currently available? N/A

What is the volume of wastewater that will be generated by the project? N/A

DEP Land Use Regulation (609) 777-0454
http://www.nj.gov/dep/landuse

Does the project involve development at or near, or impacts to the following; describe the type and extent of development in regards to location and impacts to regulated features:

Water courses (streams) YES

State Open Waters? N/A

Freshwater Wetlands and/or freshwater wetland transition areas? YES

Flood Hazard areas and/or riparian buffers YES

Waterfront development areas N/A

Tidally Flowed Areas N/A

Bureau of Tidelands Management: N/A http://www.nj.gov/dep/landuse/tl_main.html

The CAFRA Planning Area? N/A http://www.state.nj.us/dep/gis/cafralayers.htm

`DEP NATURAL AND HISTORIC RESOURCES

Green Acres Program (609) 984-0631
http://www.nj.gov/dep/greenacres

Does the project require a diversion of State property or parkland, lease of same, lifting of a Green Acres of Land Use deed restriction, or work within an existing easement? N/A Will any activity occur on State owned lands? N/A If so please describe. _____

Does the project require a diversion of property funded with federal Land and Water Conservation Funding? N/A. If so, please describe__.

Does the project include activities that are under the jurisdiction of the Watershed Property Review Board? If so, please describe. N/A _ Has the Watershed Property Review Board made a jurisdictional determination? N/A

Division of Parks and Forestry: State Park Service 609-292-2772

Is the temporary use of State lands administered by the New Jersey State Park Service required for pre-construction, construction and/or post construction activities? N/A If so, please describe.

Division of Parks and Forestry: State Forestry Services (609) 292-2530
http://www.nj.gov/dep/parksandforests/forest

Forest clearing activities/No Net Loss Reforestation Act
Will construction of the project result in the clearing of ½ acres or more of forested lands owned or maintained by a State entity**?** N/A
If so, how many acres? _____

Division of Parks and Forestry: Office of Natural Lands Management (609) 984-1339
http://www.nj.gov/dep/parksandforests/natural/index.html

Is the project within a State designated natural area as classified in the Natural Areas System Rules at N.J.A.C. 7:5A? N/A
If so, please describe. _____

State Historic Preservation Office – SHPO (609) 292-0061
http://www.state.nj.us/dep/hpo/index.htm

Is the site a Historic Site or district on or eligible for the State or National registry? N/A
Will there be impacts to buildings over 50 years old? N/A
Are there known or mapped archeological resources on the site? N/A

Dam Safety Program (609) 984-0859
http://www.nj.gov/dep/damsafety

Will the project involve construction, repair, or removal of a dam? N/A
If so, please describe _____

Fish and Wildlife (609) 292-2965
http://www.nj.gov/dep/fgw

Will there be any shut off or drawdown of a pond or a stream? N/A

Threatened and Endangered Species Program

Are there records of any Threatened and Endangered species, plant, or animal in this project area? YES

Will the proposed development affect any areas identified as habitat for Threatened or Endangered Species? NO

SITE REMEDIATION PROGRAM (609) 292-1250
http://www.nj.gov/dep/srp/

Office of Brownfield Reuse (609) 292-1251

Is the project located on or adjacent to a known or suspected contaminated site? No
http://www.nj.gov/dep/srp/kcsnj/

Is the project within a designated Brownfield Development Area? N/A
http://www.nj.gov/dep/srp/brownfields/bda/index.html

Has a No Further Action, Response Action Outcome, or Remedial Action Permit been issued for the entire project area? N/A.

If not, what is the current status of remediation activities? Please include remedial phase, media affected and contaminant(s) of concern. N/A

Name of current SRP Case Manager or Licensed Site Remediation Professional and Preferred Identification (PI) Number: N/A

Is the applicant a responsible party for contamination at the property? N/A

Is the project located on a landfill that will be redeveloped for human occupancy? N/A If yes, is there an approved Landfill Closure Plan? _____

Dredging and Sediment Technology (609) 292-1250

Does the project involve dredging or disposing of dredge materials? N/A

SOLID AND HAZARDOUS WASTE MANAGEMENT PROGRAM (609) 633-1418
http://www.nj.gov/dep/dshw/

Does the project receive, utilize, or transport solid or hazardous wastes? N/A

Will the project involve the disposing of hazardous Substances per 40 CFR part 261 and NJAC 7:26? N/A

Will the project include operation of a solid waste facility according to N.J.A.C. 7:26-1-et seq.? N/A

Is the project a solid waste facility or recycling center? N/A

Is the project included in the appropriate county Solid Waste Management Plan? N/A Explain _____

AIR QUALITY PERMITTING PROGRAM
http://www.nj.gov/dep/aqpp

Will activity at the site release substances into the air? N/A

Does the project require Air Preconstruction permits per N.J.A.C. 7.27-8.2©1? N/A

Will your project require Air Operating permits (N.J.A.C. 7:27--22.1)? N/A

Will the project result in a significant increase in emissions of any air contaminant for which the area is nonattainment with the national ambient air quality standards (all of NJ for VOC and NOx; 13 counties for fine particulates), thereby triggering the Emission Offset Rule at NJAC7:27-18? N/A

Will the project emit group 1 or 2 TXS toxic substances listed in NJAC 7:27-17? N/A

Will the project emit hazardous air pollutants above reporting thresholds in NJAC7:27 8, Appendix 1? N/A

Will the project result in stationary diesel engines (such as generators or pumps) or mobile diesel engines (such as bulldozers and forklifts) operating on the site? If so, which?
N/A

RADIATION PROTECTION AND RELEASE PREVENTION (609) 984-5636
www.state.nj.us./dep/rpp

Will the operation receive, store or dispose of radioactive materials? N/A

Will the operation employ any type of x-ray equipment? N/A

DISCHARGE PREVENTION PROGRAM (DPCC) (609) 633-0610
www.nj.gov/dep/rpp

Is this a facility as defined in N.J.A.C. 7:1E in which more than 20,000 gallons of Hazardous substances other then petroleum or greater than 200,000 gallons of petroleum are stored? N/A

TOXIC CATASTROPHE PREVENTION ACT (TCPA) (609) 633-0610

HTTP://WWW.STATE.NJ.US/DEP/RPP/BRP/TCPA/INDEX.HTM

Is this a facility that handles or stores greater than a threshold amount of extraordinarily hazardous substances as defined in N.J.A.C. 7:31? N/A

Bureau of Energy and Sustainability (609)633-0538
http://www.nj.gov/dep/aqes/energy.html
http://www.nj.gov/dep/aqes/sustainability.html

GREEN DESIGN (609) 777-4211

Have you incorporated green design features into this project? Examples of green design features may include: renewable energy, water conservation and use of low impact design for stormwater.

Yes_X_Solar PV Project__ No_____

Will this project be certified by any of the following green building rating systems? N/A

New Jersey Green Building Manual? __
http://greenmanual.rutgers.edu/

US Green Building Council's LEED (Leadership in Energy and Environmental Design)? _____
http://www.usgbc.org/

ASHRAE Standard 189.1? _____
http://www.ashare.org/publications/page/927

National Green Building Standard ICC 700-2008?_____
http://www.nahbgreen.org

USEPA's ENERGY STAR?_____
http://www.energystar.gov/index.cfm?c=business.bus_index

INNOVATIVE TECHNOLOGY (609) 292-0125

Is an environmental and energy innovative technology included in this project? X Y N

Is this technology used for manufacturing alternative fuels? Y X N
- If yes, what is the non-fossil feedstock(s) used for manufacturing the fuels?
Biomass Municipal Solid Waste Other Non-Fossil Feedstocks

-What will be the primary use of the manufactured alternative fuels?
CHP System Micro Turbine Fuel Cells

For other innovative technology type, what is the proposed application?
X Energy Site Remediation Drinking Water Wastewater

For other innovative energy systems, what is the source of energy?
X Solar Wind Tidal/Wave Hydroelectric Geothermal

Is there independent third-party performance data for the technology? X Y N

Has the technology been verified by an independent third-party entity? X Y N

Is this technology in use at any other location at this time? X Y N
- If yes, please provide location _ Other Soltage solar PV installations.

DEP COMPLIANCE AND ENFORCEMENT

Does the applicant have outstanding DEP enforcement violations, and if so, what is the status? N/A

If yes, please identify the case, case manager, program, and phone number. _____

Does the proposed project facilitate compliance where there is a current violation or ACO? N/A

COMMUNITY ENGAGEMENT (609)292-2908

The Department is committed to the principles of meaningful and early community engagement in the project's approval process. The Department has representatives available who could discuss community engagement issues with you and we encourage this communication to take place at the earliest possible time.

(p) What community groups and stakeholders have you identified that may be interested in or impacted by this project? No impacts to community, other than the inherently beneficial attributes associated with renewable energy are expected.

(q) How have you or will you engage community and stakeholders in this project? Please supply individuals or stakeholder groups contacted or who have been identified for community engagement. The Applicant will work with the local Township to ensure all required stakeholders are engaged as part of the development process.

(r) What are the potential impacts of this project on the community? The project will provide clean, renewable power to the local grid and provide power to energy users in NJ.

(s) How do you intend to mitigate these potential impacts? N/A

(t) What are the community concerns or potential concerns about this project? N/A

(u) How do you intend to address these concerns? N/A

(v) As part of this project, do you plan to perform any environmental improvements in this community? NO

Please provide the Department with an additional 1 to 2 page narrative description of the project, focusing on its function and its local/regional environmental, social, and economic benefits and impacts. Also, what sensitive receptors are present and how might they be affected by this project?

GENERAL

Is the project subject to:

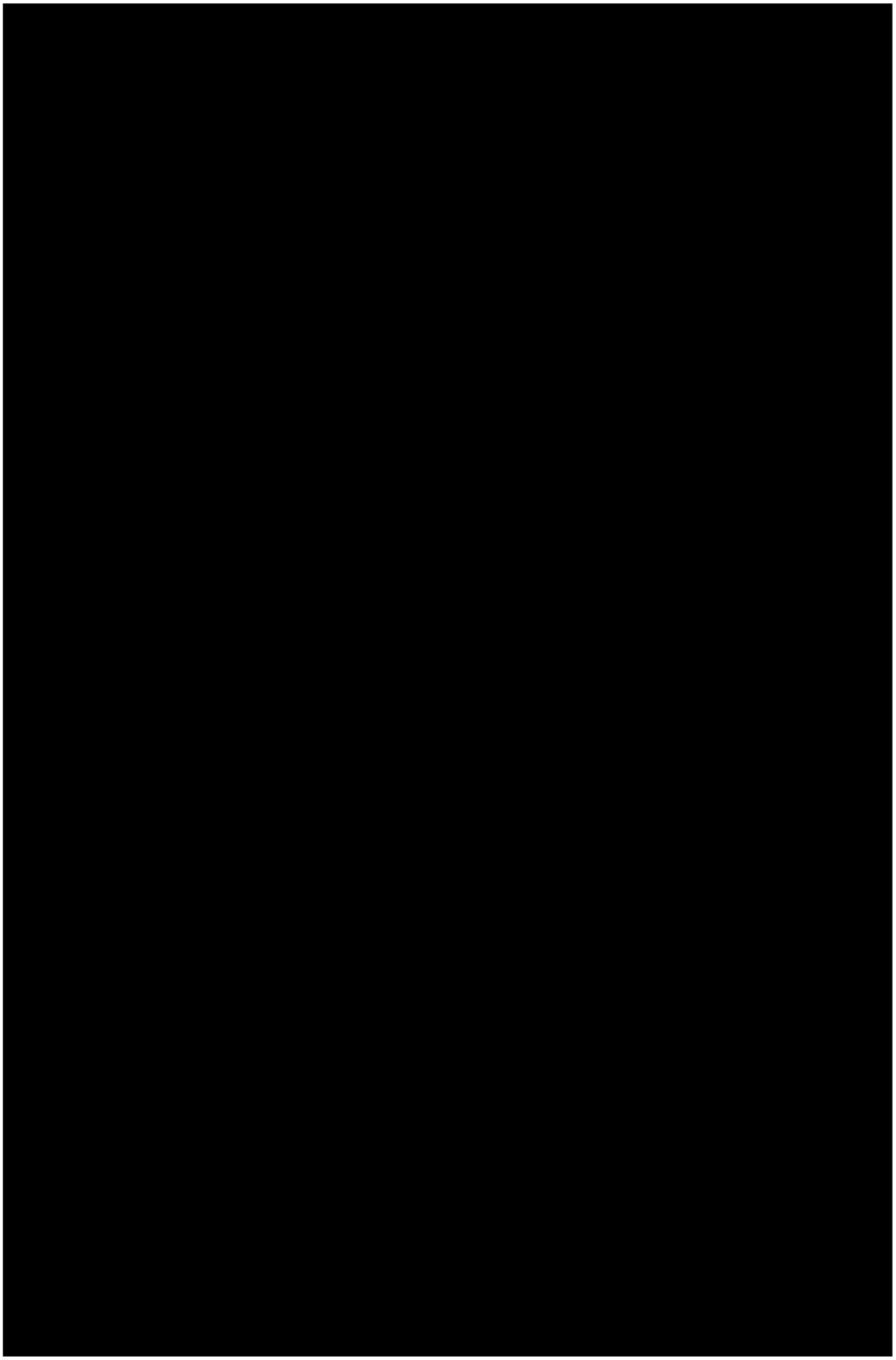
Highlands Regional Master Plan – Planning or Preservation Area? N/A
http://www.nj.gov/dep/highlands/highlands_map.pdf

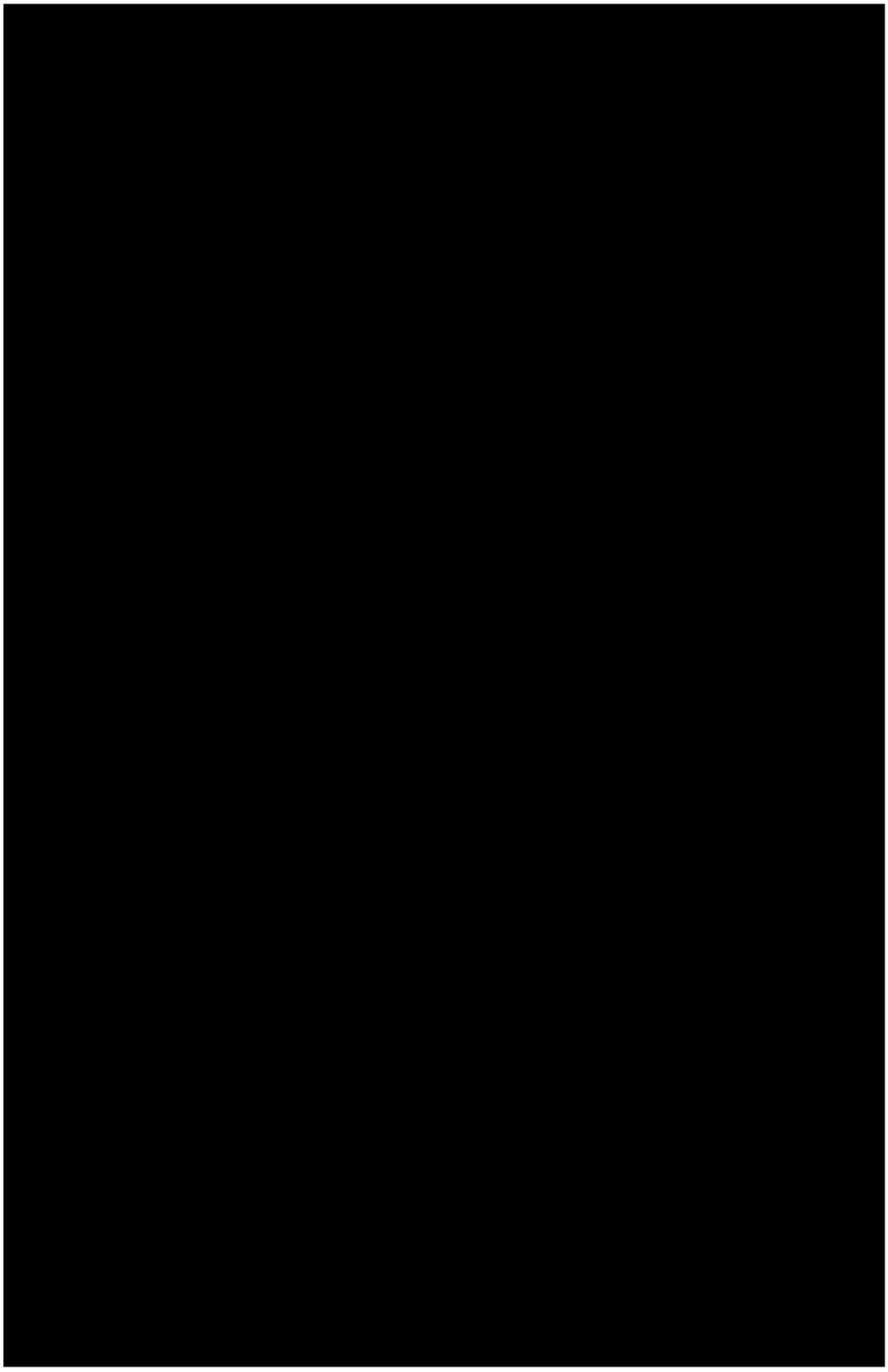
Pinelands Comprehensive Management Plan? N/A
http://www.state.nj.us/pinelands/cmp/

D&R Canal Commission Standards N/A
http://www.dandrcanal.com/drcc/maps.html

Delaware River Basin Commission N/A
(609) 883-9500
http://www.state.nj.us/drbc/

US Army Corp of Engineers review? N/A





Franklin White Bridge Solar 1 – NJDEP PCER Statement that CS Application Requirement is Fulfilled

Franklin Whitebridge Solar1- NJDEP Comments

NK

Nolan, Katherine <Katherine.Nolan@dep.nj.gov>
To Zac Meyer; Jendrasiak, Ryan
Cc Brunatti, Megan; Foster, Ruth; Pepe, David

Reply | Reply All | Forward | ...

Wed 9/4/2019 9:07 AM

Ryan and Zac,

The Office or Permit Coordination and Environmental Review (PCER) distributed project information to various programs within the Department for the proposed Franklin Whitebridge Solar1 Community Solar project located in Franklin Township, Hunterdon County. Below are preliminary comments of possible permits and action items this project may require (but not limited to) based on the information that was submitted on August 8, 2019: *** this is neither a comprehensive nor a technical summary ***

Land Use: Chris Jones: Christopher.Jones@dep.nj.gov

- Freshwater wetlands may be present on the property based upon a review of the information provided and a review of the department's GIS database layer for wetlands. It is recommended that the developer obtain a letter of interpretation presence/absence determination, or a letter of interpretation line verification in the event wetlands are present of the property. Any activities within wetlands and/or transition areas would require approvals pursuant to the Freshwater Wetlands Protection Act prior to conducting any regulated activity.
- Cakepoulin Creek traverses the site and is a Category 1 water. Therefore, Cakepoulin Creek has a 300-foot buffer. Any activities within a flood hazard area or a riparian zones requires authorization pursuant to the Flood Hazard Area Control Act prior to conducting any regulated activity. There is a Permit By Rule under the Flood Hazard Area Control Act Rules that allows for the placement of solar panels and their equipment (N.J.A.C. 7:13-7.30) within a flood hazard area provided the conditions for the PBR are met.

Fish and Wildlife: Joe Corleto: Jospeh.Corleto@dep.nj.gov or (609) 292-9451

- See attached comments.

State Historic Preservation Office: Vincent Maresca or Vincent.Maresca@dep.nj.gov or (609) 633-2395

- Based upon the documentation submitted, there are buildings over 50 years old within the project viewshed. If subject to formal regulatory review, the HPO would recommend assessment for any historic properties within the viewshed of the projects. The project has a low potential for archaeological remains.
- If additional consultation with the HPO is needed for this undertaking, please contact the Historic Preservation Office.

Bureau of Energy and Sustainability (Solar): Erin Hill: Erin.Hill@dep.nj.gov or (609) 633-1120

- The Community Solar Energy Pilot Program Application window opened April 9, 2019 and closes September 9, 2019 https://www.bpu.state.nj.us/bpu/pdf/boardorders/2019/20190329/8E%20-%20Community%20Solar%20Energy%20Pilot%20Program%20Application%20Form.pdf
- The proposed array is located on Agriculture Land which is identified as "not preferred" per the Solar Siting Analysis.
- In the Community Solar Application and Evaluation Criteria, projects on Ag lands will receive zero points under the siting category. Application, page 28.
- Visit the BES solar siting webpage & NJ Community Solar Siting Tool https://www.state.nj.us/dep/aqes/solar-siting.html

Stormwater: Eleanor Krukowski (Eleanor.Krukowski@dep.nj.gov)

- Construction projects that disturb 1 acre or more of land, or less than 1 acre but are part of a larger common plan of development that is greater than 1 acre, are required to obtain coverage under the Stormwater construction general permit (5G3). Applicants must first obtain certification of their soil erosion and sediment control plan (251 plan) form their local soil conservation district office. Upon certification, the district office will provide the applicant with two codes process (SCD certification code and 251 identification code) for use in the DEPonline portal system application. Applicants must then become a registered user for the DEPonline system and complete the application for the Stormwater Construction General Authorization. Upon completion of the application the applicant will receive a temporary authorization which can be used to start construction immediately, if necessary. Within 3-5 business days the permittee contact identified in the application will receive an email including the application summary and final authorization.

Should circumstances or conditions be or become other than as set forth in the information that was recently provided to the NJDEP, the comments and regulatory requirements provided above are subject to change and may no longer hold true. Statements made within this email are not indicative that the NJDEP has made any decisions on whether the proposed project will be permitted.

Please review the comments that were provided. If you would like to work with the programs directly, we just ask that you keep Permit Coordination copied on any correspondence so we may update our records. This email shall serve to satisfy the Community Solar application requirement that the Applicant has met with PCER.

Sincerely,

Katie Nolan

New Jersey Department of Environmental Protection

Office of Permit Coordination & Environmental Review

401 East State Street

Trenton, NJ 08625-0420

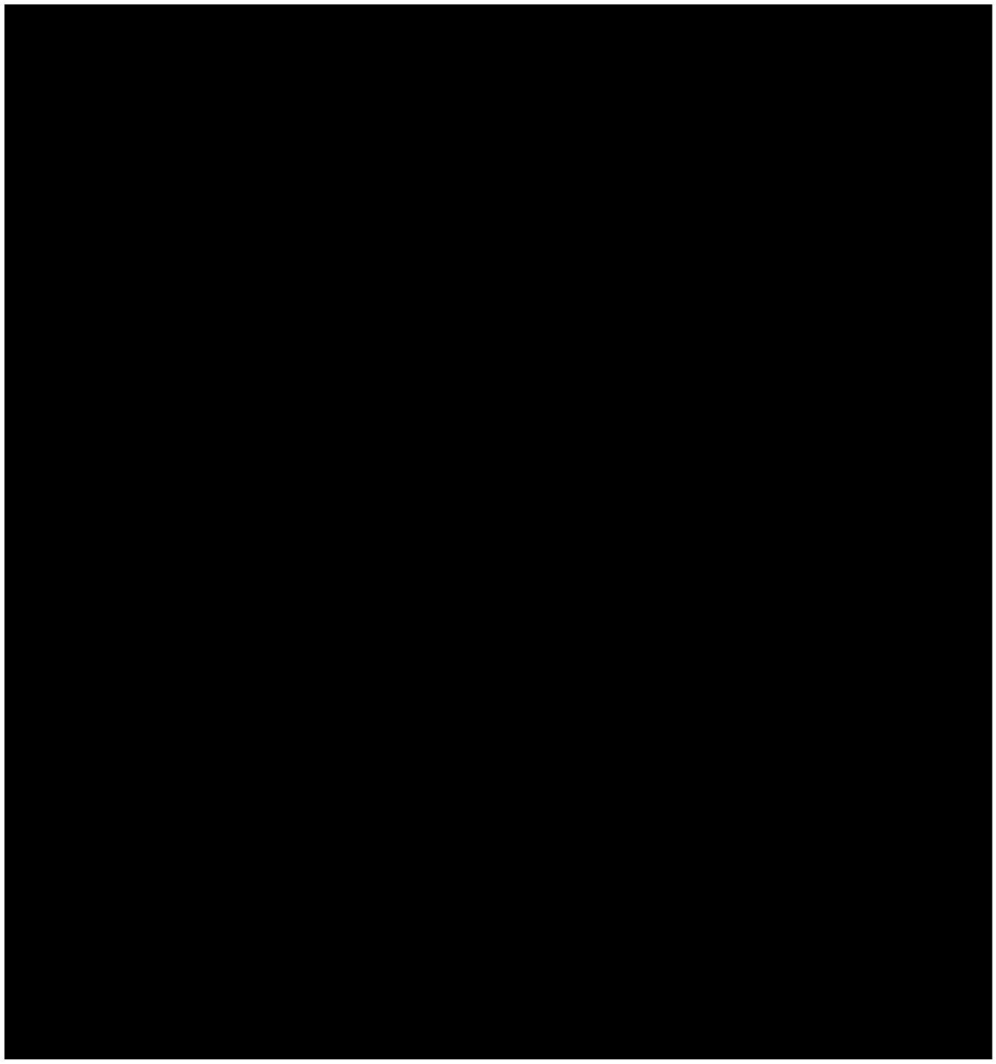
Mailcode: 401-07J

Office #: (609) 272-3600

Direct #: (609) 984-6506

Fax #: (609) 633-1196

Email: Katherine.Nolan@dep.nj.gov



[redacted]

May 15th, 2019

To Whom it May Concern,

[redacted] I am writing to express support for Soltage's plan to develop several community solar projects in New Jersey. [redacted] develops, manages, and provides affordable, conventional, mixed-income, mixed-use and master planned communities, including [redacted]

[redacted] would be proud to be among the leaders in New Jersey pushing towards the State's 50% renewable energy by 2030 goal by supporting these projects. We recognize that not only will this project support the electric grid with clean, renewable energy, but also provide an opportunity for offtakers to secure this energy at discounted rates. That the project will explicitly set aside a large portion of its output for low- and middle-income residents who often face a high energy burden in addition to other economic challenges only serves to enhance the benefits it provides to the community.

We are excited by the opportunity to support Soltage's efforts with these community solar projects, and to support global sustainability at a local level.

Best,

[redacted]

Value of Solar to New Jersey and Pennsylvania

Richard Perez

Benjamin L. Norris

Thomas E. Hoff

October 2012

Prepared for:

Mid-Atlantic Solar Energy Industries Association

Prepared by:

Clean Power Research
1700 Soscol Ave., Suite 22
Napa, CA 94559

Acknowledgements

This report was funded by the following organizations:

- The Reinvestment Fund's Sustainable Development Fund
- Mid Atlantic Solar Energy Industries Association
- Advanced Solar Products
- SMA Americas
- Vote Solar
- Renewable Power

The authors wish to express their gratitude to Rachel Hoff for collecting and analyzing FERC filings from the six utilities, producing the PV fleet simulations, and conducting the peak load day analysis; also to Phil Gruenhagen for researching and preparing the PJM load and pricing data.

Executive Summary

This report presents an analysis of value provided by grid-connected, distributed PV in Pennsylvania and New Jersey. The analysis does not provide policy recommendations except to suggest that each benefit must be understood from the perspective of the beneficiary (utility, ratepayer, or taxpayer).

The study quantified ten value components and one cost component, summarized in Table ES- 1. These components represent the benefits (and costs) that accrue to the utilities, ratepayers, and taxpayers in accepting solar onto the grid. The methodologies for quantifying these values are described further in Appendix 2.

Table ES- 1. Value component definitions.

Value Component	Basis
Fuel Cost Savings	Cost of natural gas fuel that would have to be purchased for a gas turbine (CCGT) plant operating on the margin to meet electric loads and T&D losses.
O&M Cost Savings	Operations and maintenance costs for the CCGT plant.
Security Enhancement Value	Avoided economic impacts of outages associated due to grid reliability of distributed generation.
Long Term Societal Value	Potential value (defined by all other components) if the life of PV is 40 years instead of the assumed 30 years.
Fuel Price Hedge Value	Cost to eliminate natural gas fuel price uncertainty.
Generation Capacity Value	Cost to build CCGT generation capacity.
T&D Capacity Value	Financial savings resulting from deferring T&D capacity additions.
Market Price Reduction	Wholesale market costs incurred by all ratepayers associated with a shift in demand.
Environmental Value	Future cost of mitigating environmental impacts of coal, natural gas, nuclear, and other generation.
Economic Development Value	Enhanced tax revenues associated with net job creation for solar versus conventional power generation.
(Solar Penetration Cost)	Additional cost incurred to accept variable solar generation onto the grid.

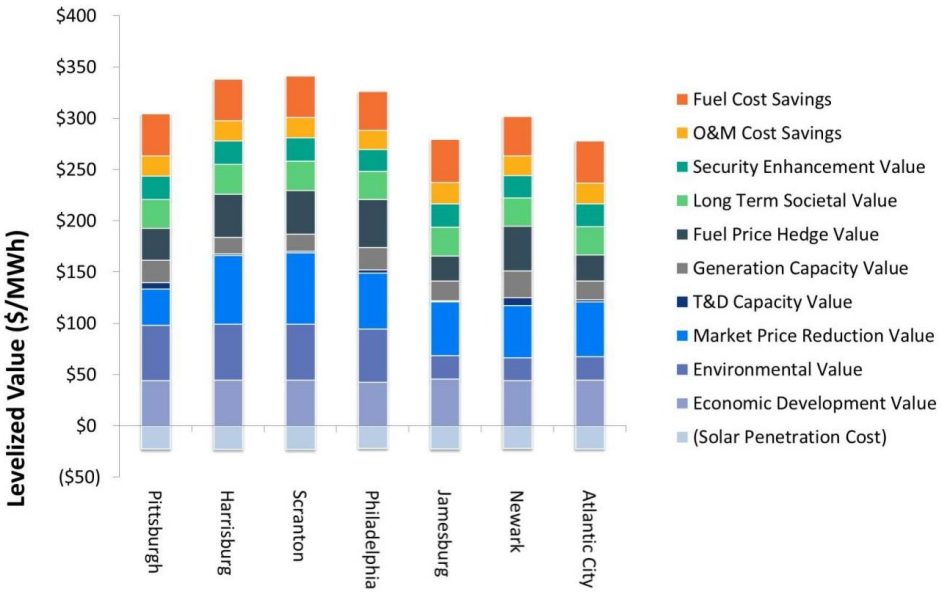
The analysis represents the value of PV for a "fleet" of PV systems (that is, a large set of systems generating into the grid). Four different fleet configurations (e.g., fixed, south-facing, 30-degree tilt

angle) were evaluated at each of seven locations. These locations represent a diversity of geographic and economic assumptions across six utility service territories.

The analysis represented a moderate assumption of penetration: PV was to provide 15% of peak electric load for each study location (higher penetration levels result in lower value). PV was modeled using SolarAnywhere®, a solar resource data set that provides time- and location-correlated PV output with loads. Load data and market pricing was taken from PJM for the six zones, and utility economic inputs were derived from FERC submittals. Additional input data was taken from the EIA and the Bureau of Labor Statistics (producer price indices).

Levelized value results for the seven locations are shown in Figure ES- 1 and Table ES- 2. Detailed results for all scenarios are included in Appendix 3.

Figure ES- 1. Levelized value ($/MWh), by location (South-30).



The following observations and conclusions may be made:

- **Total Value**. The total value ranges from $256 per MWh to $318 per MWh. Of this, the highest value components are the Market Price Reduction (averaging $55 per MWh) and the Economic Development Value (averaging $44 per MWh).
- **Market Price Reduction**. The two locations of highest total value (Harrisburg and Scranton) are noted for their high Market Price Reduction value. This may be the result of a good match between LMP and PV output. By reducing demand during the high priced hours, a cost savings is realized by all consumers. Further investigation of the methods may be warranted in light of two arguments put forth by Felder [32]: that the methodology does address induced increase in demand due to price reductions, and that it only addresses short-run effects (ignoring the impact on capacity markets).
- **Environmental Value**. The state energy mix is a differentiator of environmental value. Pennsylvania (with a large component of coal-fired generation in its mix) leads to higher environmental value in locations in that state relative to New Jersey.
- **T&D Capacity Value**. T&D capacity value is low for all scenarios, with the average value of only $3 per MWh. This may be explained by the conservative method taken for calculating the effective T&D capacity.
- **Fuel Price Hedge**. The cost of eliminating future fuel purchases—through the use of financial hedging instruments—is directly related to the utility's cost of capital. This may be seen by comparing the hedge value in Jamesburg and Atlantic City. At a rate of 5.68%, Jersey Central Power & Light (the utility serving Jamesburg) has the lowest calculated cost of capital among the six utilities included in the study. In contrast, PSE&G (the utility serving Newark) has a calculated discount rate of 8.46%, the highest among the utilities. This is reflected in the relative hedge values of $24 per MWh for Jamesburg and $44 per MWh for Newark, nearly twice the value.
- **Generation Capacity Value**. There is a moderate match between PV output and utility system load. The effective capacity ranges from 28% to 45% of rated output, and this is in line with the assigned PJM value of 38% for solar resources.

Table ES- 2. Levelized Value of Solar ($/MWh), by Location.

	Pittsburgh	Harrisburg	Scranton	Philadelphia	Jamesburg	Newark	Atlantic City
Energy							
Fuel Cost Savings	$41	$41	$41	$38	$42	$39	$41
O&M Cost Savings	$20	$20	$20	$18	$21	$19	$20
Total Energy Value	$61	$60	$60	$56	$63	$58	$61
Strategic							
Security Enhancement Value	$23	$23	$23	$22	$23	$22	$22
Long Term Societal Value	$28	$29	$29	$27	$28	$28	$28
Total Strategic Value	$51	$52	$52	$49	$51	$50	$50
Other							
Fuel Price Hedge Value	$31	$42	$42	$47	$24	$44	$25
Generation Capacity Value	$22	$16	$17	$22	$19	$26	$18
T&D Capacity Value	$6	$1	$1	$3	$1	$8	$2
Market Price Reduction Value	$35	$67	$69	$54	$52	$51	$54
Environmental Value	$54	$55	$55	$52	$23	$22	$23
Economic Development Value	$44	$45	$45	$42	$45	$44	$45
(Solar Penetration Cost)	($23)	($23)	($23)	($22)	($23)	($22)	($22)
Total Other Value	$170	$203	$206	$199	$143	$173	$144
Total Value	**$282**	**$315**	**$318**	**$304**	**$257**	**$280**	**$256**

Contents

Introduction: The Value of PV

This report attempts to quantify the value of distributed solar electricity in Pennsylvania and New Jersey. It uses methodologies and analytical tools that have been developed over several years. The framework supposes that PV is located in the distribution system. PV that is located close to the loads provides the highest value per unit of energy to the utility because line losses are avoided, thereby increasing the value of solar relative to centrally-located resources.

The value of PV may be considered the aggregate of several components, each estimated separately, described below. The methods used to calculate value are described in more detail in the Appendices.

Fuel Cost Savings

Distributed PV generation offsets the cost of power generation. Each kWh generated by PV results in one less unit of energy that the utility needs to purchase or generate. In addition, distributed PV reduces system losses so that the cost of the wholesale generation that would have been lost must also be considered.

Under this study, the value is defined as the cost of natural gas fuel that would otherwise have to be purchased to operate a gas turbine (CCGT) plant and meet electric loads and T&D losses. The study presumes that the energy delivered by PV displaces energy at this plant.

Whether the utility receives the fuel cost savings directly by avoiding fuel purchases, or indirectly by avowing wholesale power purchases, the method of calculating the value is the same.

O&M Cost Savings

Under the same mechanism described for Fuel Cost Savings, the utility realizes a savings in O&M costs due to decreased use of the CCGT plant. The cost savings are assumed to be proportional to the energy avoided, including loss savings.

Security Enhancement Value

The delivery of distributed PV energy correlated with load results in an improvement in overall system reliability. By reducing the risk of power outages and rolling blackouts, economic losses are reduced.

Long Term Societal Value

The study period is taken as 30 years (the nominal life of PV systems), and the calculation of value components includes the benefits provided over this study period. However, it is possible that the life can be longer than 30 years, in which case the full value would not be accounted for. This "long term societal value" is the potential extended benefit of all value components over a 10 year period beyond the study period. In other words, if the assumed life were 40 years instead of 30, the increase in total value is the long term societal value.

Fuel Price Hedge Value

PV generation is insensitive to the volatility of natural gas or other fuel prices, and therefore provides a hedge against price fluctuation. This is quantified by calculating the cost of a risk mitigation investment that would provide price certainty for future fuel purchases.

Generation Capacity Value

In addition to the fuel and O&M cost savings, the total cost of power generation includes capital cost. To the extent that PV displaces the need for generation capacity, it would be valued as the capital cost of displaced generation. The key to valuing this component is to determine the effective load carrying capability (ELCC) of the PV fleet, and this is accomplished through an analysis of hourly PV output relative to overall utility load.

T&D Capacity Value

In addition to capital cost savings for generation, PV potentially provides utilities with capital cost savings on T&D infrastructure. In this case, PV is not assumed to displace capital costs but rather defer the need. This is because local loads continue to grow and eventually necessitate the T&D capital investment. Therefore, the cost savings realized by distributed PV is merely the cost of capital saved in the intervening period between PV installation and the time at which loads again reach the level of effective PV capacity.

Market Price Reduction

PV generation reduces the amount of load on the utility systems, and therefor reduces the amount of energy purchased on the wholesale market. The demand curve shifts to the left, and the market clearing price is reduced. Thus, the presence of PV not only displaces the need for energy, but also reduces the cost of wholesale energy to all consumers. This value is quantified through an analysis of the supply curve and the reduction in demand.

Environmental Value

One of the primary motives for PV and other renewable energy sources is to reduce the environmental impact of power generation. Environmental benefits covered in this analysis represent future savings for mitigating environmental damage (sulfur dioxide emissions, water contamination, soil erosion, etc.).

Economic Development Value

Distributed PV provides local jobs (e.g., installers) at higher rates than conventional generation. These jobs, in turn, translate to tax revenue benefits to all taxpayers.

Solar Penetration Cost

In addition to the value provided by PV, there are costs that must be factored in as necessary to accept variable solar generation onto the grid. Infrastructural and operational expenses will be incurred to manage the flow of non-dispatchable PV resources. These costs are included as a negative value.

Value Perspective

The value of solar accrues either to the electric utility or to society (ratepayers and taxpayers), depending upon component. For example, PV reduces the amount of wholesale energy needed to serve load, resulting in savings to the utility. On the other hand, environmental mitication costs accrue to society.

Approach

Locations

Seven locations were selected to provide broad geographical and utility coverage in the two states of interest (see Table 1). Four locations were selected in Pennsylvania representing three utilities[1] and three locations were selected in New Jersey, each served by a separate utility.

Table 1. Study location summary.

		Location	Utility	2011 Utility Peak Load (MW)	PV Fleet Capacity (MW)
PA	1	Pittsburgh	Duquesne Light Co.	3,164	475
	2	Scranton	PPL Utilities Corp.	7,527	1,129
	3	Harrisburg	PPL Utilities Corp.	7,527	1,129
	4	Philadelphia	PECO Energy Co.	8,984	1,348
NJ	5	Jamesburg	Jersey Central P&L	6,604	991
	6	Newark	PSE&G	10,933	1,640
	7	Atlantic City	Atlantic City Electric	2,956	443

These locations represent a diversity of input assumptions:

- The locations span two states: PA and NJ. These states differ in generation mix (percentage of coal, gas, nuclear, etc.), and this is reflected in different environmental cost assumptions (see Appendix 2).
- The locations differ in solar resource.

[1] Scranton and Harrisburg are both served by PPL Utilities.

- The locations represent six different utility service territories. Each of these utilities differ by cost of capital, hourly loads, T&D loss factors, distribution expansion costs, and growth rate.

Penetration Level

Fleet capacity was set to 15% of the utility peak load. This assumption was intended to represent a moderate long-term penetration level.

The value of solar decreases with increasing penetration for several reasons:

- The match between PV output and loads is reduced. As more PV is added to the resource mix, the peak shifts to non-solar hours, thereby limiting the ability of PV to support the peak.
- Line losses are related to the square of the load. Consequently, the greatest marginal savings provided by PV is achieved with small amounts of PV. By adding larger and larger quantities of PV, the loss savings continue to be gained, but at decreasing rates.
- Similarly, the market prices are non-linear, and PV is most effective in causing market price reduction with small PV capacity.

Based on the above considerations, this study is intended to represent a moderate level of long-term PV penetration. With penetration levels less than 15%, the value of solar would be expected to be higher than the results obtained in this study.

Peak loads for each utility were obtained from hourly load data corresponding to PJM load zones, and these were used to set the fleet capacity as shown in the table.

Fleet Configurations

Four PV system configurations were included in the study:

- South-30 (south-facing, 30-degree tilt, fixed)
- Horizontal (fixed)
- West-30 (west facing, 30-degree tilt, fixed)
- 1-Axis (tracking at 30-degree tilt)

These were selected in order to capture possible variations in value due to the different production profiles. For example, West-facing systems are sometimes found to be the best match with utility loads

and have the potential to provide more capacity benefits. On the other hand, tracking systems deliver more energy per unit of rated output, so they have the potential to offer more energy benefits (e.g., fuel cost savings).

Scenarios and Fleet Modeling

Value was determined for each of 28 scenarios (four fleet configurations at each of seven locations). For modeling purposes, fleets were described by latitude and longitude coordinates, AC rating, a module derate factor (90%), inverter efficiency (95%) and other loss factor (90%). These factors were consistent across all scenarios.

Fleets were modeled for all hours of 2011 using SolarAnywhere® satellite-derived irradiance data and simulation model with a 10 km x 10 km pixel resolution. [2] Under this procedure, the fleet output for each scenario is location- and time-correlated with hourly PJM zonal loads.

[2] http://www.solaranywhere.com.

Results

Utility Analysis

Utility analysis results are shown in Table 2, obtained from an analysis of FERC filings and PJM hourly data using methods developed previously for NYSERDA.[3] These include:

- Utility discount rate
- Utility system loss data
- Distribution expansion costs (present value)
- Distribution load growth rate
- Distribution loss data

Note that actual utility costs are used in this analysis because they are the basis of value. For this reason, the utility cost of capital is required (e.g., an "assumed" or "common" value cannot be used). The results may therefore differ, in part, due to differences in utility discount rate.

PV Technical Analysis

A summary of fleet technical performance results is presented in Table 3. Annual energy production is the modeled output for 2011. Capacity factor is the annual energy production relative to a baseload plant operating at 100% availability with the same rated output. Generation capacity is Effective Load Carrying Capability (ELCC) expressed as a percentage of rated capacity. T&D Capacity is a measure of the direct annual peak-load reduction provided by the PV system expressed as a percentage of rated capacity.

[3] Norris and Hoff, "PV Valuation Tool," Final Report (DRAFT), NYSERDA, May 2012.

Table 2. Utility analysis results.

		Pittsburgh	Scranton	Harrisburg	Philadelphia	Jamesburg	Newark	Atlantic City
Utility		Duquesne Light Co.	PPL Utilities Corp.	PPL Utilities Corp.	PECO Energy Co.	Jersey Central P&L	PSE&G	Atlantic City Electric
UtilityID		DUQ	PPL	PPL	PECO	JCPL	PSEG	AECO
UTILITY DATA								
Economic Factors								
Discount Rate	percent per year	6.63%	8.08%	8.08%	9.00%	5.68%	8.46%	5.88%
Utility System								
Load Loss Condition	MW	1,757	4,786	4,786	4,958	2,893	5,435	1,369
Avg. Losses (at Condition)	percent	5.84%	6.55%	6.55%	4.23%	6.35%	4.86%	5.61%
Distribution								
Distribution Expansion Cost	$ PW	$485,009,880	$423,994,174	$423,994,174	$722,046,118	$446,914,440	$573,820,751	$288,330,547
Distribution Expansion Cost Escalation	percent per year	3.89%	3.89%	3.89%	3.89%	3.89%	3.89%	3.89%
Distribution Load Growth Rate	MW per year	30.9	98.3	98.3	110.7	93.4	91.4	39.5
Load Loss Condition	MW	1,757	4,786	4,786	4,958	2,893	5,435	1,369
Avg. Losses (at Condition)	percent	5.84%	6.55%	6.55%	4.23%	6.35%	4.86%	5.61%

Table 3. Technical results, by location (South-30).

	Pittsburgh	Harrisburg	Scranton	Philadelphia	Jamesburg	Newark	Atlantic City
Fleet Capacity (MWac)	475	1129	1129	1348	991	1640	443
Annual Energy Production (MWh)	716,621	1,809,443	1,698,897	2,339,424	1,675,189	2,677,626	827,924
Capacity Factor (%)	17%	18%	17%	20%	19%	19%	21%
Generation Capacity (% of Fleet Capacity)	41%	28%	28%	38%	45%	45%	46%
T&D Capacity (% of Fleet Capaccity)	31%	14%	14%	21%	29%	56%	36%

Value Analysis

Figure 1 shows the value results in levelized dollars per MWh generated. Figure 2 shows the data in dollars per kW installed. This data is also presented in tabular form in Table 4 and Table 5. Detailed results for individual locations are shown in Appendix 3.

The total value ranges from $256 per MWh to $318 per MWh. Of this, the highest value components are the Market Price Reduction (averaging $55 per MWh) and the Economic Development Value (averaging $44 per MWh).

The differences between Table 4 and Table 5 are due to differences in the cost of capital between the utilities. For example, Atlantic City has the highest value per installed kW, but Atlantic City Electric has one of the lowest calculated discount rates (Table 2). Therefore, when this value is levelized over the 30 year study period, it represents a relatively low value.

Other observations:

- **Market Price Reduction**. The two locations of highest total value (Harrisburg and Scranton) are noted for their high Market Price Reduction value. This may be the result of a good match between LMP and PV output. By reducing demand during the high priced hours, a cost savings is realized by all consumers. Further investigation of the methods may be warranted in light of two arguments put forth by Felder [32]: that the methodology does address induced increase in demand due to price reductions, and that it only addresses short-run effects (ignoring the impact on capacity markets).
- **Environmental Value**. The state energy mix is a differentiator of environmental value. Pennsylvania (with a large component of coal-fired generation in its mix) leads to higher environmental value in locations in that state relative to New Jersey. As described in Appendix 2, the PA generation mix is dominated by coal (48%) compared to NJ (10%).
- **T&D Capacity Value**. T&D capacity value is low for all scenarios, with the average value of only $3 per MWh. This may be explained by the conservative method taken for calculating the effective T&D capacity.
- **Fuel Price Hedge**. The cost of eliminating future fuel purchases—through the use of financial hedging instruments—is directly related to the utility's cost of capital. This may be seen by comparing the hedge value in Jamesburg and Atlantic City. At a rate of 5.68%, Jersey Central Power & Light (the utility serving Jamesburg) has the lowest calculated cost of capital among the

six utilities included in the study. In contrast, PSE&G (the utility serving Newark) has a calculated discount rate of 8.46%, the highest among the utilities. This is reflected in the relative hedge values of $24 per MWh for Jamesburg and $44 per MWh for Newark, nearly twice the value.

Figure 1. Levelized value ($/MWh), by location (South-30).

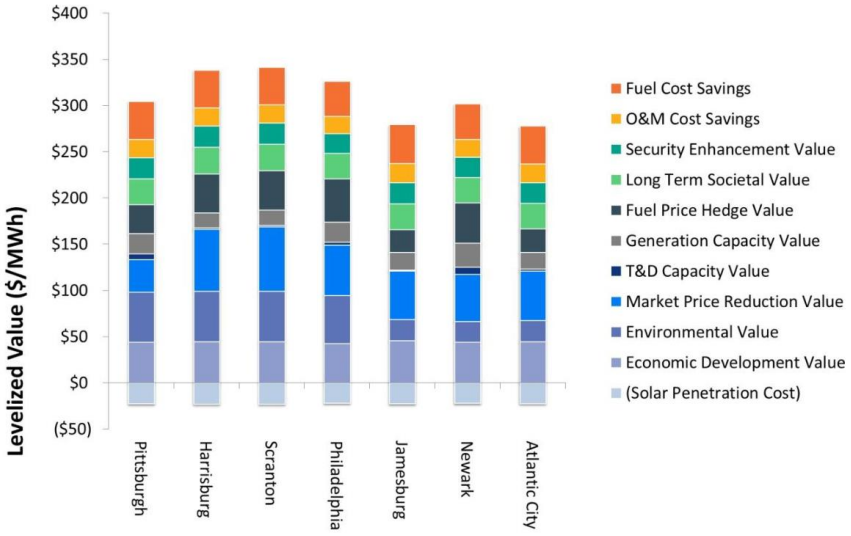


Figure 2. Value ($/kW), by location (South-30).

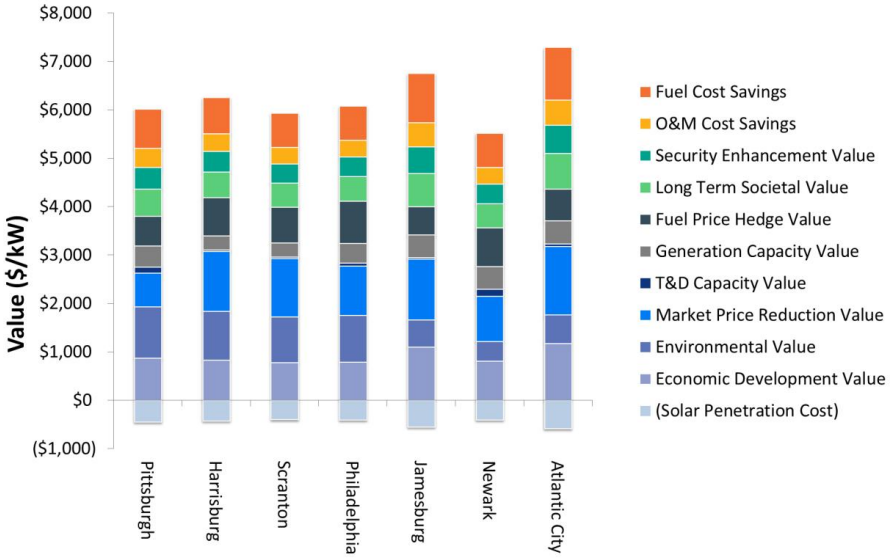


Table 4. Value (levelized $/MWh), by location (South-30).

	Pittsburgh	Harrisburg	Scranton	Philadelphia	Jamesburg	Newark	Atlantic City
Energy							
Fuel Cost Savings	$41	$41	$41	$38	$42	$39	$41
O&M Cost Savings	$20	$20	$20	$18	$21	$19	$20
Total Energy Value	$61	$60	$60	$56	$63	$58	$61
Strategic							
Security Enhancement Value	$23	$23	$23	$22	$23	$22	$22
Long Term Societal Value	$28	$29	$29	$27	$28	$28	$28
Total Strategic Value	$51	$52	$52	$49	$51	$50	$50
Other							
Fuel Price Hedge Value	$31	$42	$42	$47	$24	$44	$25
Generation Capacity Value	$22	$16	$17	$22	$19	$26	$18
T&D Capacity Value	$6	$1	$1	$3	$1	$8	$2
Market Price Reduction Value	$35	$67	$69	$54	$52	$51	$54
Environmental Value	$54	$55	$55	$52	$23	$22	$23
Economic Development Value	$44	$45	$45	$42	$45	$44	$45
(Solar Penetration Cost)	($23)	($23)	($23)	($22)	($23)	($22)	($22)
Total Other Value	$170	$203	$206	$199	$143	$173	$144
Total Value	**$282**	**$315**	**$318**	**$304**	**$257**	**$280**	**$256**

Table 5. Value ($/kW), by location (South-30).

	Pittsburgh	Harrisburg	Scranton	Philadelphia	Jamesburg	Newark	Atlantic City
Energy							
Fuel Cost Savings	$813	$751	$706	$706	$1,020	$709	$1,081
O&M Cost Savings	$396	$366	$344	$344	$497	$345	$527
Total Energy Value	$1,209	$1,117	$1,050	$1,049	$1,517	$1,054	$1,609
Strategic							
Security Enhancement Value	$446	$424	$398	$405	$549	$403	$584
Long Term Societal Value	$557	$530	$498	$507	$686	$504	$730
Total Strategic Value	$1,003	$954	$896	$912	$1,234	$907	$1,314
Other							
Fuel Price Hedge Value	$613	$786	$738	$876	$586	$798	$662
Generation Capacity Value	$432	$297	$290	$401	$468	$470	$478
T&D Capacity Value	$127	$24	$24	$65	$23	$147	$49
Market Price Reduction Value	$696	$1,241	$1,206	$1,013	$1,266	$927	$1,412
Environmental Value	$1,064	$1,011	$950	$967	$560	$411	$596
Economic Development Value	$870	$827	$777	$790	$1,097	$806	$1,168
(Solar Penetration Cost)	($446)	($424)	($398)	($405)	($549)	($403)	($584)
Total Other Value	$3,355	$3,761	$3,586	$3,706	$3,451	$3,156	$3,781
Total Value	**$5,568**	**$5,832**	**$5,532**	**$5,667**	**$6,202**	**$5,117**	**$6,704**

Future Work

In the course of conducting this study, several observations were made that suggest further refinement to these results should be considered:

- The market price reduction estimated as part of the present study will have to be ascertained as PV develops and penetrates the NJ and PA grids. In particular, the impact of PV-induced price reduction on load growth, hence feedback secondary load-growth induced market price increase as suggested by Felder [32] should be quantified. In addition, the feedback of market price reduction on capacity markets will have to be investigated.

- In this study 15% PV capacity penetration was assumed-- amounting to a total PV capacity of 7GW across the seven considered utility hubs. Since both integration cost increases and capacity value diminishes with penetration, it will be worthwhile to investigate other penetration scenarios. This may be particularly useful for PA where the penetration is smaller than NJ. In addition, it may be useful to see the scenarios with penetration above 15%. For these cases, it would be pertinent to establish the cost of displacing (nuclear) baseload generation with solar generation[4] since this question is often brought to the forefront by environmentally-concerned constituents in densely populated areas of NJ and PA.

- Other sensitivities may be important to asses as well. Sensitivities to fuel price assumptions, discount rates, and other factors could be investigated further.

- The T&D values derived for the present analysis are based on utility-wide average loads. Because this value is dependent upon the considered distribution system's characteristics – in particular load growth, customer mix and equipment age – the T&D value may vary considerably from one distribution feeder to another. It would therefore be advisable to take this study one step further and systematically identify the highest value areas. This will require the collaboration of the servicing utilities to provide relevant subsystem data.

[4] Considering integration solutions including storage, wind/PV synergy and gas generation backup.

Appendix 1: Detailed Assumptions

Input assumptions that are common across all of the scenarios are shown in Table 6.

Table 6. Input assumptions and units common to all scenarios.

INPUT ASSUMPTIONS		
PV Characteristics		
PV Degradation	0.50%	per year
PV System Life	30	years
Generation Factors		
Gen Capacity Cost	$1,045	per kW
Gen Heat Rate (First Year)	7050	BTU/kWh
Gen Plant Degradation	0.00%	per year
Gen O&M Cost (First Year)	$12.44	per MWh
Gen O&M Cost Escalation	3.38%	per year
Garver Percentage	5.00%	Pct of Ann Peak
NG Wholesale Market Factors		
End of Term NG Futures Price Escalation	2.33%	per year

PV degradation is assumed to be 0.50% per year indicating that the output of the system will degrade over time. This is a conservative assumption (PV degradation is likely to be less than 0.5% per year). Studies often ignore degradation altogether because the effect is small, but it is included here for completeness.

The study period is taken as 30 years, corresponding to typical PV lifetime assumptions.

PV is assumed to displace power generated from peaking plants fueled by natural gas. Gas turbine capital, O&M, heat rate, and escalation values are taken from the EIA.[5] Plant degradation is assumed to be zero.

[5] Updated Capital Cost Estimates for Electricity Generation Plants, U.S. Energy Information Administration, November 2010, available at http://www.eia.gov/oiaf/beck_plantcosts/pdf/updatedplantcosts.pdf. Taken from Table 1, page 7. Costs are escalated to 2012 dollars.

Costs for generation O&M are assumed to escalate at 3.38%, calculated from the change in Producer Price Index (PPI) for the "Turbine and power transmission equipment manufacturing" industry[6] over the period 2004 to 2011.

Natural gas prices used in the fuel price savings value calculation are obtained from the NYMEX futures prices. These prices, however, are only available for the first 12 years. Ideally, one would have 30 years of futures prices. As a proxy for this value, it is assumed that escalation after year 12 is constant based on historically long term prices to cover the entire 30 years of the PV service life (years 13 to 30). The EIA published natural gas wellhead prices from 1922 to the present.[7] It is assumed that the price of the NG futures escalates at the same rate as the wellhead prices.[8] A 30-year time horizon is selected with 1981 gas prices at $1.98 per thousand cubic feet and 2011 prices at $3.95. This results in a natural gas escalation rate of 2.33%.

[6] PPI data is downloadable from the Bureau industry index selected was taken as the most representative of power generation O&M. BLS does publish an index for "Electric power generation" but this is assumed.

[7] US Natural Gas Prices (Annual), EIA, release date 2/29/2012, available at http://www.eia.gov/dnav/ng/ng_pri_sum_dcu_nus_m.htm.

[8] The exact number could be determined by obtaining over-the-counter NG forward prices.

Appendix 2: Methodologies

Overview

The methodologies used in the present project drew upon studies performed by CPR for other states and utilities. In these studies, the key value components provided by PV were determined by CPR, using utility-provided data and other economic data.

The ability to determine value on a site-specific basis is essential to these studies. For example, the T&D Capacity Value component depends upon the ability of PV to reduce peak loads on the circuits. An analysis of this value, then, requires:

Hour by hour loads on distribution circuits of interest.

- Hourly expected PV outputs corresponding to the location of these circuits and expected PV system designs.
- Local distribution expansion plan costs and load growth projections.

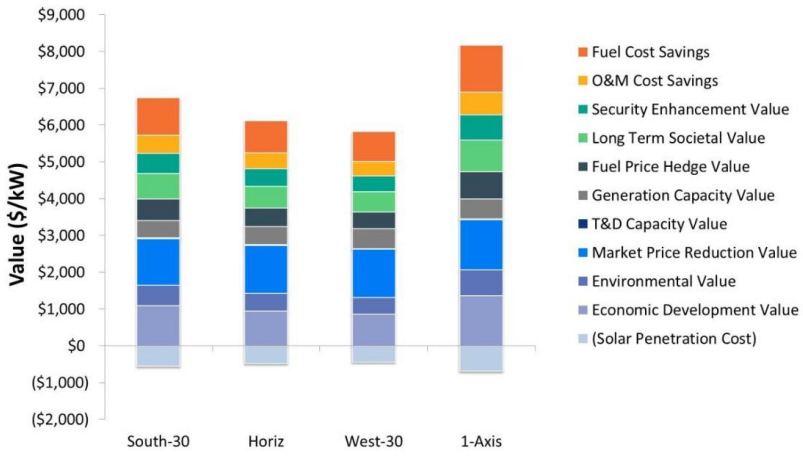
Units of Results

The discounting convention assumed throughout the report is that energy-related values occur at the end of each year and that capacity-related values occur immediately (i.e., no discounting is required).[9]

The Present Value results are converted to per unit value (Present Value $/kW) by dividing by the size of the PV system (kW). An example of this conversion is illustrated in Figure 3 for results from a previous study. The y-axis presents the per unit value and the x-axis presents seven different PV system configurations. The figure illustrates how value components can be significantly affected by PV system configuration. For example, the tracking systems, by virtue of their enhanced energy production capability, provide greater generation benefits.

[9] The effect of this will be most apparent in that the summations of cash flows start with the year equal to 1 rather than 0.

Figure 3. Sample results.



The present value results per unit of capacity ($/kW) are converted to levelized value results per unit of energy ($/MWh) by dividing present value results by the total annual energy produced by the PV system and then multiplying by an economic factor.

PV Production and Loss Savings

PV System Output

An accurate PV value analysis begins with a detailed estimate of PV system output. Some of the energy-based value components may only require the total amount of energy produced per year. Other value components, however, such as the energy loss savings and the capacity-based value components, require hourly PV system output in order to determine the technical match between PV system output and the load. As a result, the PV value analysis requires time-, location-, and configuration-specific PV system output data.

For example, suppose that a utility wants to determine the value of a 1 MW fixed PV system oriented at a 30° tilt facing in the southwest direction located at distribution feeder "A". Detailed PV output data that is time- and location-specific is required over some historical period, such as from Jan. 1, 2001 to Dec. 31, 2010.

Methodology

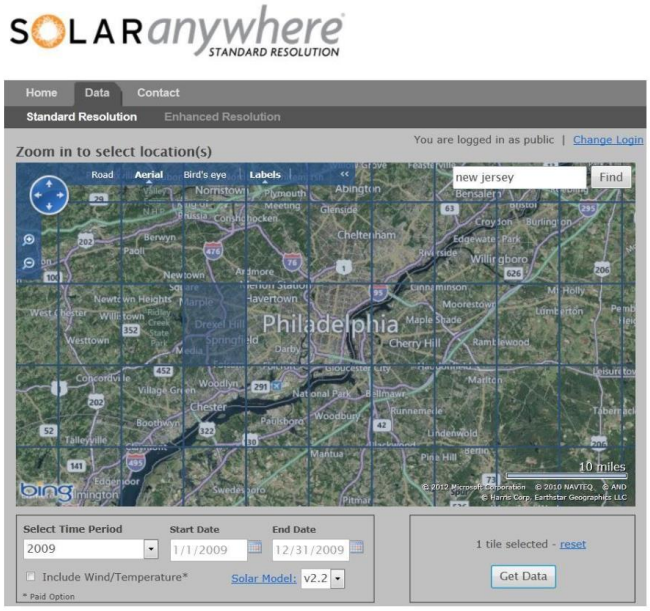
It would be tempting to use a representative year data source such as NREL's Typical Meteorological Year (TMY) data for purposes of performing a PV value analysis. While these data may be representative of long-term conditions, they are, by definition, not time-correlated with actual distribution line loading on an hourly basis and are therefore not usable in hourly side-by-side comparisons of PV and load. Peak substation loads measured, say, during a mid-August five-day heat wave must be analyzed alongside PV data that reflect the same five-day conditions. Consequently, a technical analysis based on anything other than time- and location-correlated solar data may give incorrect results.

CPR's SolarAnywhere® and PVSimulator™ software services will be employed under this project to create time-correlated PV output data. SolarAnywhere is a solar resource database containing almost 14 years of time- and location-specific, hourly insolation data throughout the continental U.S. and Hawaii. PVSimulator, available in the SolarAnywhere Toolkit, is a PV system modeling service that uses this hourly resource data and user-defined physical system attributes in order to simulate configuration-specific PV system output.

The SolarAnywhere data grid web interface is available at www.SolarAnywhere.com (Figure 4). The structure of the data allows the user to perform a detailed technical assessment of the match between PV system output and load data (even down to a specific feeder). Together, these two tools enable the evaluation of the technical match between PV system output and loads for any PV system size and orientation.

Previous PV value analyses were generally limited to a small number of possible PV system configurations due to the difficulty in obtaining time- and location-specific solar resource data. This new value analysis software service, however, will integrate seamlessly with SolarAnywhere and PVSimulator. This will allow users to readily select any PV system configuration. This will allow for the evaluation of a comprehensive set of scenarios with essentially no additional study cost.

Figure 4. SolarAnywhere data selection map.



Loss Savings

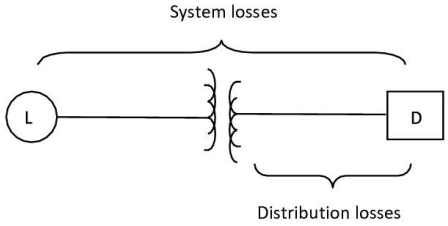
Introduction

Distributed resources reduce system losses because they produce power in the same location that the power is consumed, bypassing the T&D system and avoiding the associated losses.

Loss savings are not treated as a stand-alone benefit under the convention used in this methodology. Rather, the effect of loss savings is included separately for each value component. For example, in the section that covers the calculation of Energy Value, the quantity of energy saved by the utility includes both the energy produced by PV and the amount that would have been lost due to heating in the wires if the load were served from a remote source. The total energy that would have been procured by the utility equals the PV energy plus avoided line losses. Loss savings can be considered a sort of "adder" for each benefit component.

This section describes the methodology for calculating loss savings for each hour. The results of these calculations are then used in subsequent sections. As illustrated in Figure 5, it will be important to note that, while the methodology describes the calculation of an hourly loss result, there are actually two different loss calculations that must be performed: "system" losses, representing the losses incurred on both the transmission and distribution systems (between generation load, L, and end-use demand, D), and "distribution" losses, representing losses specific to distribution system alone.

Figure 5. System losses versus distribution losses.



The two losses are calculated using the same equation, but they are each applicable in different situations. For example, "Energy Value" represents a benefit originating at the point of central generation, so that the total system losses should be included. On the other hand, "T&D Capacity Value" represents a benefit as measured at a distribution substation. Therefore, only the losses saved on the distribution system should be considered.

The selection of "system" versus "distribution" losses is discussed separately for each subsequent benefit section.

Methodology

One approach analysts have used to incorporate losses is to adjust energy- and capacity-related benefits based on the *average* system losses. This approach has been shown to be deficient because it fails to capture the true reduction in losses on a marginal basis. In particular, the approach underestimates the

reduction in losses due to a peaking resource like PV. Results from earlier studies demonstrated that loss savings calculations may be off by more than a factor of two if not performed correctly [6].

For this reason, the present methodology will incorporate a calculation of loss savings on a marginal basis, taking into account the status of the utility grid when the losses occur. Clean Power Research has previously developed methodologies based on the assumption that the distributed PV resource is small relative to the load (e.g., [6], [9]). CPR has recently completed new research that expands this methodology so that loss savings can now be determined for any level of PV penetration.

Fuel Cost Savings and O&M Cost Savings

Introduction

Fuel Cost Savings and O&M Cost Savings are the benefits that utility participants derive from using distributed PV generation to offset wholesale energy purchases or reduce generation costs. Each kWh generated by PV results in one less unit of energy that the utility needs to purchase or generate. In addition, distributed PV reduces system losses so that the cost of the wholesale generation that would have been lost must also be considered. The capacity value of generation is treated in a separate section.

Methodology

These values can be calculated by multiplying PV system output times the cost of the generation on the margin for each hour, summing for all hours over the year, and then discounting the results for each year over the life of the PV system.

There are two approaches to obtaining the marginal cost data. One approach is to obtain the marginal costs based on historical or projected market prices. The second approach is to obtain the marginal costs based on the cost of operating a representative generator that is on the margin.

Initially, it may be appealing to take the approach of using market prices. There are, however, several difficulties with this approach. One difficulty is that these tend to be hourly prices and thus require hourly PV system output data in order to calculate the economic value. This difficulty can be addressed by using historical prices and historical PV system output to evaluate what results would have been in the past and then escalating the results for future projections. A more serious difficulty is that, while hourly market prices could be projected for a few years into the future, the analysis needs to be

performed over a much longer time period (typically 30 years). It is difficult to accurately project hourly market prices 30 years into the future.

A more robust approach is to explicitly specify the marginal generator and then to calculate the cost of the generation from this unit. This is often a Combined Cycle Gas Turbine (CCGT) powered using natural gas (e.g., [6]). This approach includes the assumption that PV output always displaces energy from the same marginal unit. Given the uncertainties and complications in market price projections, the second approach is taken.

Fuel Cost Savings and O&M Cost Savings equals the sum of the discounted fuel cost savings and the discounted O&M cost savings.

Security Enhancement Value

Because solar generation is closely correlated with load in much of the US, including New Jersey and Pennsylvania [26], the injection of solar energy near point of use can deliver effective capacity, and therefore reduce the risk of the power outages and rolling blackouts that are caused by high demand and resulting stresses on the transmission and distribution systems.

The effective capacity value of PV accrues to the ratepayer (see above) both at the transmission and distribution levels. It is thus possible to argue that the reserve margins required by regulators would account for this new capacity, hence that no increased outage risk reduction capability would occur beyond the pre-PV conditions. This is the reason this value item above is not included as one of the directly quantifiable attributes of PV.

On the other hand there is ample evidence that during heat wave-driven extreme conditions, the availability of PV is higher than suggested by the effective capacity (reflecting of all conditions) -- e.g., see [27], [28], on the subject of major western and eastern outages, and [29] on the subject of localized rolling blackouts. In addition, unlike conventional centralized generation injecting electricity (capacity) at specific points on the grid, PV acts as a load modulator that provides immediate stress relief throughout the grid where stress exists due to high-demand conditions. It is therefore possible to argue that, all conditions remaining the same in terms of reserve margins, a load-side dispersed PV resource would mitigate issues leading to high-demand-driven localized and regional outages.

Losses resulting from power outages are generally not a utility's (ratepayers') responsibility: society pays the price, via losses of goods and business, compounded impacts on the economy and taxes, insurance premiums, etc. The total cost of all power outages from all causes to the US economy has been estimated at $100 billion per year (Gellings & Yeager, 2004). Making the conservative assumption that a small fraction of these outages, 5%, are of the high-demand stress type that can be effectively mitigated by dispersed solar generation at a capacity penetration of 15%,[10] it is straightforward to calculate, as shown below, that, nationally, the value of each kWh generated by such a dispersed solar base would be of the order of $20/MWh to the taxpayer.

The US generating capacity is roughly equal to 1000 GW. At 15% capacity penetration, taking a national average of 1500 kWh (slightly higher nationwide than PA and NJ) generated per year per installed kW, PV would generate 225,000 GWh/year. By reducing the risk of outage by 5%, the value of this energy would thus be worth $5 billion, amounting to $20 per PV-generated MWh.

This national value of $20 per MWh was taken for the present study because the underlying estimate of cost was available on a national basis. In reality, there would be state-level differences from this estimate, but these are not available.

Long Term Societal Value

This item is an attempt to place a present-value $/MWh on the generally well accepted argument that solar energy is a good investment for our children and grandchildren's well-being. Considering:

1. The rapid growth of large new world economies and the finite reserves of conventional fuels now powering the world economies, it is likely that fuel prices will continue rise exponentially fast for the long term beyond the 30-year business life cycle considered here.
2. The known very slow degradation of the leading (silicon) PV technology, many PV systems installed today will continue to generate power at costs unaffected by the world fuel markets after their guaranteed lifetimes of 25-30 years

One approach to quantify this type of long-view attribute has been to apply a very low societal discount rate (e.g., 2% or less, see [25]) to mitigate the fact that the present-day importance of long-term expenses/benefits is essentially ignored in business as usual practice. This is because discount rates are

[10] Much less than that would have prevented the 2003 NE blackout. See [30].

used to quantify the present worth of future events and that, and therefore, long-term risks and attributes are largely irrelevant to current decision making.

Here a less controversial approach is proposed by arguing that, on average, PV installation will deliver, on average, a minimum of 10 extra years of essentially free energy production beyond the life cycle considered in this study.

The present value of these extra 10 years, all other assumptions on fuel cost escalation, inflation, discount rate, PV output degradation, etc. remaining the same, amounts to ~ $25/MWh for all the cities/PJM hubs considered in this study.

Fuel Price Hedge Value

Introduction

Solar-based generation is insensitive to the volatility of fuel prices while fossil-based generation is directly tied to fuel prices. Solar generation, therefore, offers a "hedge" against fuel price volatility. One way this has been accounted for is to quantify the value of PV's hedge against fluctuating natural gas prices [6].

Methodology

The key to calculating the Fuel Price Hedge Value is to effectively convert the fossil-based generation investment from one that has substantial fuel price uncertainty to one that has no fuel price uncertainty. This can be accomplished by entering into a binding commitment to purchase a lifetime's worth of fuel to be delivered as needed. The utility could set aside the entire fuel cost obligation up front, investing it in risk-fee securities to be drawn from each year as required to meet the obligation. The approach uses two financial instruments: risk-free, zero-coupon bonds[11] and a set of natural gas futures contracts.

Consider how this might work. Suppose that the CCGT operator wants to lock in a fixed price contract for a sufficient quantity of natural gas to operate the plant for one month, one year in the future. First, the operator would determine how much natural gas will be needed. If E units of electricity are to be generated and the heat rate of the plant is H, $E * H$ BTUs of natural gas will be needed. Second, if the corresponding futures price of this natural gas is $P^{NG\ Futures}$ (in $ per BTU), then the operator will need $E *$

[11] A zero coupon bond does not make any periodic interest payments.

$H * P^{NG\ Futures}$ dollars to purchase the natural gas one year from now. Third, the operator needs to set the money aside in a risk-free investment, typically a risk-free bond (rate-of-return of $r^{risk\text{-}free}$ percent) to guarantee that the money will be available when it is needed one year from now. Therefore, the operator would immediately enter into a futures contract and purchase $E * H * P^{NG\ Futures} / (1+ r^{risk\text{-}free})$ dollars worth of risk-free, zero-coupon bonds in order to guarantee with certainty that the financial commitment (to purchase the fuel at the contract price at the specified time) will be satisfied.[12]

This calculation is repeated over the life of the plant to calculate the Fuel Price Hedge value.

Generation Capacity Value

Introduction

Generation Capacity Value is the benefit from added capacity provided to the generation system by distributed PV. Two different approaches can be taken to evaluating the Generation Capacity Value component. One approach is to obtain the marginal costs based on market prices. The second approach is to estimate the marginal costs based on the cost of operating a representative generator that is on the margin, typically a Combined Cycle Gas Turbine (CCGT) powered by natural gas.

Methodology

The second approach is taken here for purposes of simplicity. Future version of the software service may add a market price option.

Once the cost data for the fully-dispatchable CCGT are obtained, the match between PV system output and utility loads needs to be determined in order to determine the effective value of the non-dispatchable PV resource. CPR developed a methodology to calculate the effective capacity of a PV system to the utility generation system (see [10] and [11]) and Perez advanced this method and called it the Effective Load Carrying Capability (ELCC) [12]. The ELCC method has been identified by the utility industry as one of the preferable methods to evaluate PV capacity [13] and has been applied to a variety of places, including New York City [14].

The ELCC is a statistical measure of effective capacity. The ELCC of a generating unit in a utility grid is defined as the load increase (MW) that the system can carry while maintaining the designated reliability

[12] $[E * H * P^{NG\ Futures} / (1+ r^{risk\text{-}free})] * (1+ r^{risk\text{-}free}) = E * H * P^{NG\ Futures}$

criteria (e.g., constant loss of load probability). The ELCC is obtained by analyzing a statistically significant time series of the unit's output and of the utility's power requirements.

Generation Capacity Value equals the capital cost ($/MW) of the displaced generation unit times the effective capacity provided by the PV.

T&D Capacity Value

Introduction

The benefit that can be most affected by the PV system's location is the T&D Capacity Value. The T&D Capacity Value depends on the existence of location-specific projected expansion plan costs to ensure reliability over the coming years as the loads grow. Capacity-constrained areas where loads are expected to reach critical limits present more favorable locations for PV to the extent that PV will relieve the constraints, providing more value to the utility than those areas where capacity is not constrained.

Distributed PV generation reduces the burden on the distribution system. It appears as a "negative load" during the daylight hours from the perspective of the distribution operator. Distributed PV may be considered equivalent to distribution capacity from the perspective of the distribution planner, provided that PV generation occurs at the time of the local distribution peak.

Distributed PV capacity located in an area of growing loads allows a utility planner to defer capital investments in distribution equipment such as substations and lines. The value is determined by the avoided cost of money due to the capital deferral.

Methodology

It has been demonstrated that the T&D Capacity Value can be quantified in a two-step process. The first step is to perform an economic screening of all areas to determine the expansion plan costs and load growth rates for each planning area. The second step is to perform a technical load-matching analysis for the most promising locations [18].

Market Price Reduction Value

Two cost savings occur when distributed PV generation is deployed in a market that is structured where the last unit of generation sets the price for all generation and the price is an increasing function of load. First, there is the direct savings that occur due to a reduction in load. This is the same as the value of

energy provided at the market price of power. Second, there is the indirect value of market price reduction. Distributed generation reduces market demand and this results in lower prices to all those purchasing power from the market. This section outlines how to calculate the market savings value.

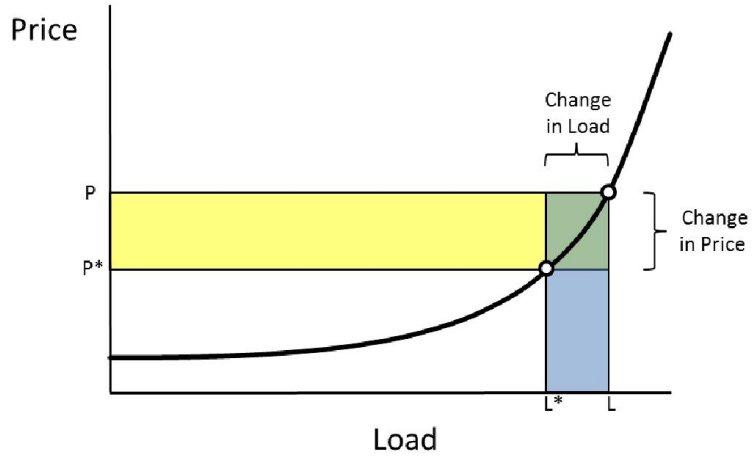
Cost Savings

As illustrated in Figure 6, the total market expenditures at any given point in time are based on the current price of power (P) and the current load (L). The rate of expenditure equals P L. Total market expenditures after PV is deployed equals the new price (P*) times the new load (L*), or P*L*. Cost savings equal the difference between the total before and after expenditures.

(1)

The figure illustrates that the cost savings occur because there is both a change in load and a change in price.

Figure 6. Illustration of price changes that occur in market as result of load changes.



Equation (1) can be expanded by adding and then rearranging the result.

( ) (2)

Let and and substitute into Equation (2). The result is that

(3)

Per unit cost savings is obtained by dividing Equation (3) by .

(4)

Discussion

Equation (4) suggests that there are two cost savings components: direct savings and market price suppression. The direct savings equal the existing market price of power. The market price reduction value is the savings that the entire market realizes as a result of the load reduction. These savings depends on the change in load, change in price, and existing load. It is important to note that the change in load and the existing load can be measured directly while the change in price cannot be measured directly. This means that the change in price must be modeled (rather than measured).

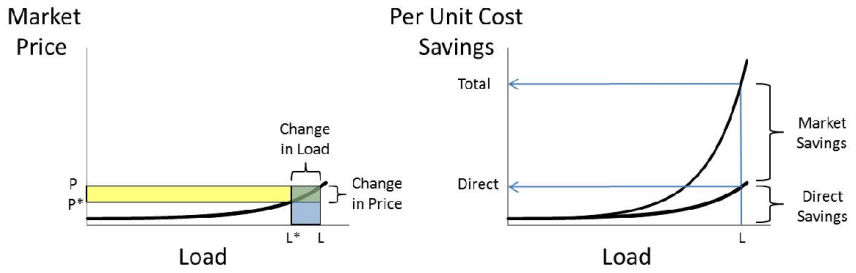
It is useful to provide an interpretation of the market price reduction component and illustrate the potential magnitude. The market price reduction component in Equation (4) has two terms. The first term is the slope of the price curve (i.e., it is the derivative as the change in load goes to zero) times the

existing load. This is the positive benefit that the whole market obtains due to price reductions. The second term is the reduced price associated with the direct savings.

The left side of Figure 7 presents the same information as in Figure 6, but zooms out on the y-axis scale of the chart. The first term corresponds to the yellow area. The second term corresponds to the overlapping areas of the change in price and change in load effects.

The market price curve can be translated to a cost savings curve. The right side of Figure 7 presents the per unit cost savings based on the information from the market price curve (i.e., the left side of the figure). The lower black line is the price vs. load curve. The upper line adds the market price suppression component to the direct savings component. It assumes that there is the same load reduction for all loads as in the left side of the figure. The figure illustrates that no market price suppression exist when the load is low but the market price suppression exceed the direct cost savings when the load is high. The saving is dependent upon the shape of the price curve and the size of the load reduction.

Figure 7. Direct + market price reduction vs. load (assuming constant load reduction).



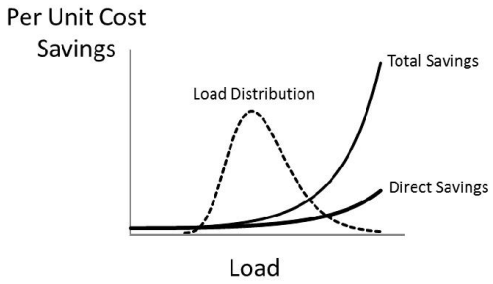
Total Value

The previous sections calculated the cost savings at a specific instant in time. The total cost savings is calculated by summing this result overall all periods in time. The per unit cost savings is calculated by dividing by the total energy. (Note that it is assumed that each unit of time represents 1 unit). The result is that:

$$\frac{\Sigma \; [\,] \; —}{\Sigma} \qquad (5)$$

This result can be viewed graphically as the probability distribution of the load times the associate cost savings curves when there is a constant load reduction. Multiply the load distribution by the total per unit savings to obtain the weighted average per unit cost savings.

Figure 8. Apply load distribution to calculate total savings over time.



Application

As discussed above, all of the parameters required to perform this calculation can be measured directly except for the change in price. Thus, it is crucial to determine how to estimate the change in price.

This is implemented in four steps:

1. Obtain LMP price data and develop a model that reflects this data.
2. Use the LMP price model and Equation (4) to calculate the price suppression benefit. Note that this depends upon the size of the change in load.
3. Obtain time-correlated PV system output and determine the distribution of this output relative to the load.
4. Multiply the PV output distribution times the price suppression benefit to calculate the weighted-average benefit.

Historical LMP and time- and location-correlated PV output data are required to perform the analysis. LMPs are obtained from the market and the PV output data are obtained by simulating time- and location-specific PV output using SolarAnywhere.

Figure 9 illustrates how to perform the calculations using measured prices and simulated PV output for PPL in June 2012. The left side of the figure illustrates that the historical LMPs (black circles) are used to develop a price model (solid black line). The center of the figure illustrates how the price model is used with Equation (4) is used to calculate the price suppression benefit for every load level. Since this benefit depends upon the size of the change in the load, the figure presents a range. The solid blue line is the benefit for a very small PV output. The dashed blue line corresponds to the benefit for a 1,000 MW PV output. The right side of the figure (red line) presents the distribution of the PV energy relative to the load (i.e., the amount of PV energy produced at each load level, so higher values correspond to more frequent weighting). The weighted-average price suppression benefit is calculated by multiply the PV output distribution times the price suppression benefit. Note that in practice, the actual calculation is performed for each hour of the analysis since the price suppression benefit is a function of both the load and the PV output.

Figure 9. Illustration of how to calculate benefit using measured data for June 2011.

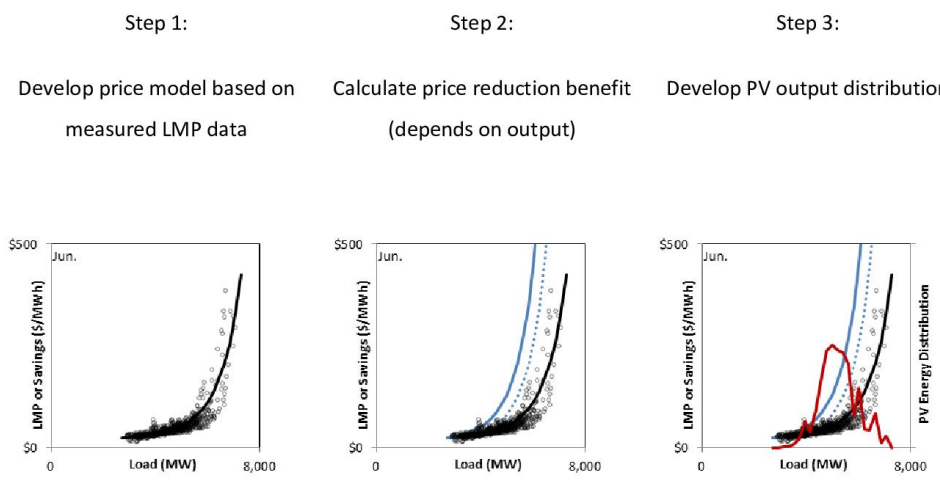
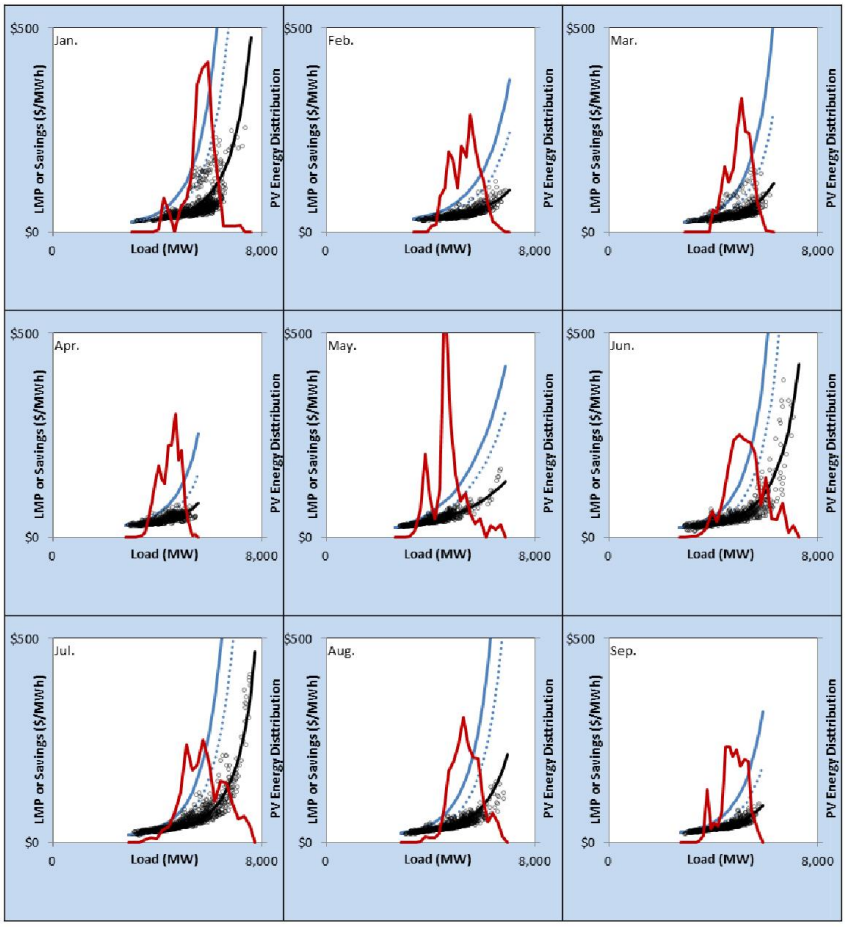
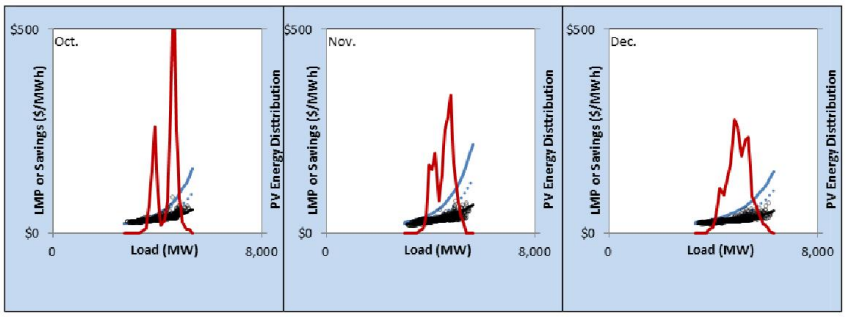


Figure 10 presents the results for the three steps for each month in 2011.

Figure 10. Measured and modeled LMPs (black circles and lines), price suppression benefit (solid blue for small output and dashed blue for 1,000 MW of output) and PV output distribution (PPL 2011).





Results

As illustrated in Table 7 the price reduction benefits are more than double the direct savings for a 100 MW of PV and slightly exceed the direct saving for 1,000 MW PV, for a combined value ranging from $127/MWh to $180/MWh.

Table 7. Market savings illustration.

	100 MW	1,000 MW
Direct Savings	$58	$58
Market Price Reduction	$122	$69
Total	$180	$127

A comparison of direct market savings and energy savings as calculated in this study is shown in Table 8. Fuel cost savings and O&M cost savings are combined because they represent the same costs that are included in market price. Direct savings were calculated for each hour as $P \cdot \Delta L$, summed for the year, and escalated at the same rate each year as natural gas futures beyond the 12 year limit.

Table 8. Direct market savings comparison (Newark, South-30).

	Value ($/kW)	Value ($/MWh)
Fuel Cost Savings	$709	38.8
O&M Cost Savings	$345	18.9
Total Energy Savings	**$1,054**	**57.7**
Direct Market Savings	**$1,470**	**80.4**

The results show that direct market savings are 39% above the energy savings. This discrepancy reflects the fact that the two quantities, while representing the same value components, use entirely different approaches. Fuel cost savings are derived from natural gas futures, discounted at the utility discount rate, and applied against an assumed CCGT heat rate. Direct market savings are based on hourly PJM zonal prices for 2011.

The energy savings achieved by the utility is based on avoided market purchases. However, historical market prices are not necessarily and indicator of future years, especially for 30 years into the future. For this reason, the energy savings methodology used in this analysis is more closely tied to the fundamentals of the cost: fuel and O&M costs that must be recovered by the marketplace for generation to be sustainable in the long run.

Zonal Price Model

To calculate the market price reduction in equation (4), a zonal price model was developed as follows. A function F() may be defined whose value is proportional to market clearing price using the form:

( )

where coefficients A, B, C, and D are evaluated for each utility and for each month using hourly PJM zonal market price data, amounting to a total of 84 individual models.

P is the zonal wholesale clearing price, and P* is given by:

( )
—
( )

The market price reduction (in $/MWh) is calculated using the relevant term in Equation (4) and multiplying by the change in load, including loss savings.

Environmental Value

Introduction

It is well established that the environmental impact of PV is considerably smaller than that of fossil-based generation since PV is able to displace pollution associated with drilling/mining, and power plant emissions [15].

Methodology

There are two general approaches to quantifying the Environmental Value of PV: a regulatory cost-based approach and an environmental/health cost-based approach.

The regulatory cost-based approach values the Environmental Value of PV based on the price of Renewable Energy Credits (RECs) or Solar Renewable Energy Credits (SRECs) that would otherwise have to be purchased to satisfy state Renewable Portfolio Standards (RPS). These costs are a preliminary legislative attempt to quantify external costs. They represent actual business costs faced by utilities in certain states.

An environmental/health cost-based approach quantifies the societal costs resulting from fossil generation. Each solar kWh displaces an otherwise dirty kWh and commensurately mitigates several of the following factors: greenhouse gases, SOx/NOx emissions, mining degradations, ground water contamination, toxic releases and wastes, etc., that are all present or postponed costs to society. Several exhaustive studies have estimated the environmental/health cost of energy generated by fossil-based generation [16], [17]. The results from environmental/health cost-based approach often vary widely and can be controversial.

The environmental/health cost-based approach was used for this study.

The environmental footprint of solar generation is considerably smaller than that of the fossil fuel technologies generating most of our electricity (e.g., [19]). Utilities have to account for this environmental impact to some degree today, but this is still only largely a potential cost to them. Rate-based Solar Renewable Energy Credits (SRECs) markets in New Jersey and Pennsylvania as a means to meet Renewable Portfolio Standards (RPS) are a preliminary embodiment of including external costs,

but they are largely driven more by politically-negotiated processes than by a reflection of inherent physical realities. The intrinsic physical value of displacing pollution is real and quantifiable however: depending on the current generation mix, each solar kWh displaces an otherwise dirty kWh and commensurately mitigates several of the following factors: greenhouse gases, SOx/NOx emissions, mining degradations, ground water contamination, toxic releases and wastes, etc., which are all present or postponed costs to society (i.e., the taxpayers).

The environmental value, EV, of each kWh produced by PV (i.e., not produced by another conventional source) is given by:

$$\Sigma$$

Where EC_i is the environmental cost of the displaced conventional generation technology and x_i is the proportion of this technology in the current energy mix.

Several exhaustive studies emanating from such diverse sources as the nuclear industry or the medical community ([20], [21]) estimate the environmental/health cost of 1 MWh generated by coal at $90-250, while a [non-shale[13]] natural gas MWh has an environmental cost of $30-60.

Considering New Jersey and Pennsylvania's electrical generation mixes (Table 9) and assuming that (1) nuclear energy is not displaced by PV at the assumed penetration level[14] and (2) that all natural gas is conventional, the environmental value of each MWh displaced by PV, hence the taxpayer benefit, is estimated at $48 to $129 in Pennsylvania and $20 to $48 in New Jersey.

We retained a value near the lower range of these estimates for the present analysis.

[13] Shale gas environmental footprint is likely higher both in terms of environment degradation and GHG emissions.

[14] The study therefore ascribes no environmental value related to nuclear generation. Scenarios can certainly be designed in which nuclear generation would be displaced, in which case the environmental cost of nuclear generation would have to be considered. This is a complex and controversial subject that reflects the probability of catastrophic accidents and the environmental footprint of the existing uranium cycle. The fact that the environmental liability is assumed to be zero under the present study may therefore be considered a conservative case.

Table 9. Environmental input calculation.

	Generation Mix		Prorated Environmental Cost ($/MWh)		
Pennsylvania	48%	Coal	43.2	to	120.0
	15%	Natural Gas	4.5	to	9.0
	34%	Nuclear	0.0	to	0.0
	3%	Other	0.0	to	0.0
	Environmental Value for PA		47.7	to	129.0
New Jersey	10%	Coal	9.0	to	25.0
	38%	Natural Gas	11.4	to	22.8
	50%	Nuclear	0.0	to	0.0
	2%	Other	0.0	to	0.0
	Environmental Value for NJ		20.4	to	47.8

Economic Development Value

The German and Ontario experiences as well as the experience in New Jersey, where fast PV growth is occurring, show that solar energy sustains more jobs per unit of energy generated than conventional energy ([21], [22]). Job creation implies value to society in many ways, including increased tax revenues, reduced unemployment, and an increase in general confidence conducive to business development.

In this report, only tax revenue enhancement from the jobs created as a measure of PV-induced economic development value is considered. This metric provides a tangible low estimate of solar energy's likely larger multifaceted economic development value. In Pennsylvania and New Jersey, this low estimate amounts to respectively $39 and $40 per MWh, even under the very conservative, but thus far realistic, assumption that 80% of the PV manufacturing jobs would be either out-of-state or foreign (see methodology section, below).

Methodology

In a previous (New York) study [24], net PV-related job creation numbers were used directly based upon Ontario and Germany's historical numbers. However this assumption does not reflects the rapid changes of the PV industry towards lower prices. In this study a first principle approach is applied based upon

the difference between the installed cost of PV and conventional generation: in essence this approach quantifies the fact that part of the price premium paid for PV vs. conventional generation returns to the local economy in the form of jobs hence taxes.

Therefore, assuming that:

- Turnkey PV costs $3,000 per kW vs. $1,000 per kW for combine cycle gas turbines (CCGT)
- Turnkey PV cost is composed of 1/3 technology (modules & inverter/controls) and 2/3 structure and installation and soft costs.
- 20% of the turnkey PV technology cost and 90% of the other costs are traceable to local jobs, while 50% of the CCGT are assumed to be local jobs, thus:
    - The local jobs-traceable amount spent on PV is equal to: ( )— ——
    - And the local jobs-traceable amount spent on CCGT is equal to:
- PV systems in NJ and PA have a capacity factor of ~ 16%, producing 1,400 kWh per year per kW_{AC} and CCGT have an assumed capacity factor of 50%, producing 4,380 kWh per year, therefore
    - The local jobs-traceable amount spent per PV kWh in year one is: 1,900/1,400 = $1.42
    - The local jobs-traceable amount spent per CCGT kWh in year one is: 500/4,380 = $0.114
- The net local jobs-traceable between PV and CCGT is thus equal to 1.42-0.11 = $1.30
- Assuming that the life span of both PV and CCGT is 30 years, and using a levelizing factor of 8%, the net local jobs-traceable amount per generated PV kWh over its lifetime amounts to:

    ———— 0.116/kWh

- Assuming that locally-traceable O&M costs per kWh for PV are equal to the locally-traceable O&M costs for CCGT, [15] but also assuming that because PV-related T&D benefits displace a commensurate amount of utility jobs assumed to be equal to this benefit (~0.5 cents per kWh), the net lifetime locally-traceable PV-CCGT difference is equal to 0.116-0.005 = $0.111/kWh
- Finally assuming that each PV job is worth $75K/year after standard deductions – hence has a combined State and Federal income tax rate of 22.29% in PA and 22.67% in NJ [16] -- and that each

[15] This includes only a fraction of the fuel costs – the other fraction being imported from out-of-state.

[16] For the considered solar job income level, the effective state rate = 3.07% in PA and 3.54% in NJ and the effective federal rate = 19.83%. The increased federal tax collection is counted as an increase for New Jersey's

new job has an indirect job multiplier of 1.6,[17] it can be argued that each PV MWh represents a net new-job related tax collection increase for NJ equal to a levelized value of

, and a tax collection increase for PA equal to

.

Solar Penetration Cost

It is important to recognize that there is also a cost associated with the deployment of solar generation on the power grid which accrues to the utility and to its ratepayers. This cost represents the infrastructural and operational expense that will be necessary to manage the flow of non-controllable solar energy generation while continuing to reliably meet demand. A recent study by Perez et al. [31] showed that in much of the US, this cost is negligible at low penetration and remains manageable for a solar capacity penetration of 30%. For utilities representative of the demand pattern and solar load synergies found in Pennsylvania, this penetration cost has been found to range from 0 to 5 cents per kWh when PV penetration ranges from 0% to 30% in capacity. Up to this level of penetration, the infrastructural and operational expense would consist of localized load management, [user-sited] storage and/or backup.[18] At the 15% level of penetration considered in this study, the cost of penetration can be estimated from the Perez et al. study[18] at $10-20/MWh.

taxpayer, because it can be reasonably argued that federal taxes are (1) redistributed fairly to the states and (2) that federal expense benefit all states equally.

[17]indirect base multipliers are used to estimate the local jobs not related to the considered job source (here solar energy) but created indirectly by the new revenues emanating from the new [solar] jobs

[18] At the higher penetration levels the two approaches to consider would be regional (or continental) interconnection upgrade and smart coupling with natural gas generation and wind power generation – the cost of these approaches has not been quantified as part of this study.

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Appendix 3: Detailed Results

Pittsburgh

Table A4- 1. Technical results, Pittsburgh.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	475	475	475	475
Annual Energy Production (MWh)	716,621	631,434	595,373	892,905
Capacity Factor (%)	17%	15%	14%	21%
Generation Capacity (% of Fleet Capacity)	41%	43%	45%	48%
T&D Capacity (% of Fleet Capaccity)	31%	32%	32%	32%

Table A4- 2. Value ($/kW), Pittsburgh.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$813	$719	$678	$1,011
O&M Cost Savings	$396	$350	$331	$493
Total Energy Value	$1,209	$1,069	$1,009	$1,503
Strategic				
Security Enhancement Value	$446	$394	$372	$554
Long Term Societal Value	$557	$493	$465	$693
Total Strategic Value	$1,003	$887	$837	$1,247
Other				
Fuel Price Hedge Value	$613	$542	$512	$763
Generation Capacity Value	$432	$446	$468	$505
T&D Capacity Value	$127	$127	$130	$129
Market Price Reduction Value	$696	$718	$715	$740
Environmental Value	$1,064	$940	$888	$1,322
Economic Development Value	$870	$769	$726	$1,081
(Solar Penetration Cost)	($446)	($394)	($372)	($554)
Total Other Value	$3,355	$3,149	$3,067	$3,987
Total Value	**$5,568**	**$5,105**	**$4,913**	**$6,737**

Table A4- 3. Levelized Value ($/MWh), Pittsburgh.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$41	$41	$41	$41
O&M Cost Savings	$20	$20	$20	$20
Total Energy Value	$61	$61	$62	$61
Strategic				
Security Enhancement Value	$23	$23	$23	$23
Long Term Societal Value	$28	$28	$28	$28
Total Strategic Value	$51	$51	$51	$51
Other				
Fuel Price Hedge Value	$31	$31	$31	$31
Generation Capacity Value	$22	$26	$29	$21
T&D Capacity Value	$6	$7	$8	$5
Market Price Reduction Value	$35	$41	$44	$30
Environmental Value	$54	$54	$54	$54
Economic Development Value	$44	$44	$44	$44
(Solar Penetration Cost)	($23)	($23)	($23)	($23)
Total Other Value	$170	$181	$187	$162
Total Value	**$282**	**$293**	**$300**	**$274**

Figure A4- 1. Value ($/kW), Pittsburgh.

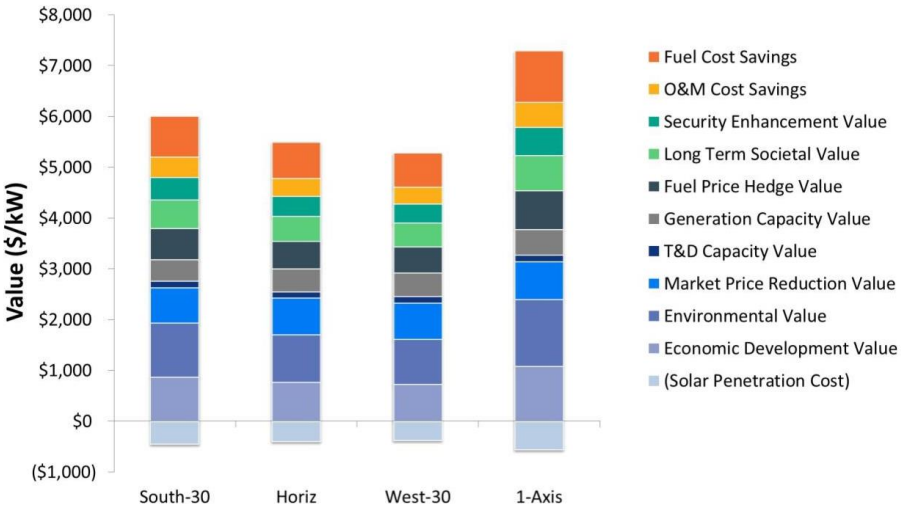
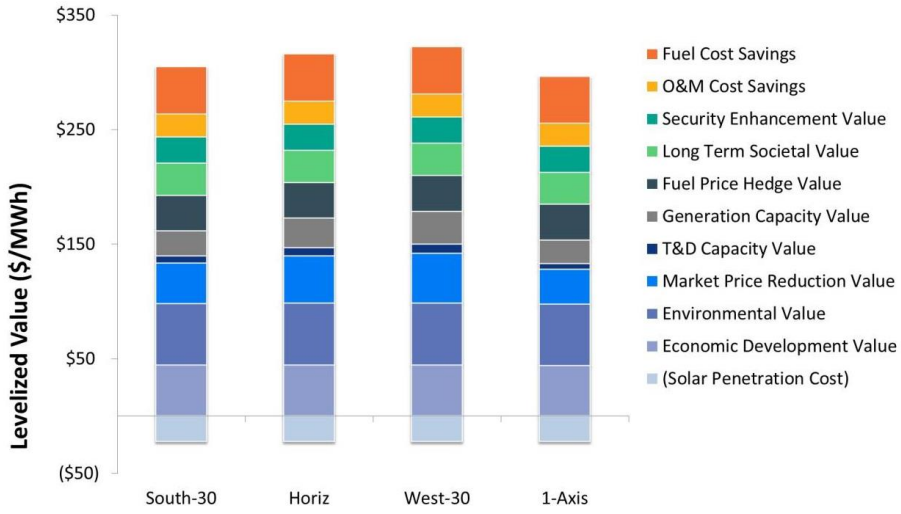


Figure A4- 2. Levelized Value ($/MWh), Pittsburgh.



Harrisburg

Table A4- 4. Technical results, Harrisburg.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	1129	1129	1129	1129
Annual Energy Production (MWh)	1,809,443	1,565,940	1,461,448	2,274,554
Capacity Factor (%)	18%	16%	15%	23%
Generation Capacity (% of Fleet Capacity)	28%	27%	26%	32%
T&D Capacity (% of Fleet Capaccity)	14%	14%	14%	14%

Table A4- 5. Value results ($/kW), Harrisburg.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$751	$652	$608	$942
O&M Cost Savings	$366	$318	$296	$459
Total Energy Value	$1,117	$969	$904	$1,401
Strategic				
Security Enhancement Value	$424	$368	$343	$532
Long Term Societal Value	$530	$460	$429	$665
Total Strategic Value	$954	$827	$772	$1,196
Other				
Fuel Price Hedge Value	$786	$682	$636	$985
Generation Capacity Value	$297	$287	$274	$336
T&D Capacity Value	$24	$24	$24	$24
Market Price Reduction Value	$1,241	$1,224	$1,171	$1,335
Environmental Value	$1,011	$877	$819	$1,268
Economic Development Value	$827	$717	$669	$1,037
(Solar Penetration Cost)	($424)	($368)	($343)	($532)
Total Other Value	$3,761	$3,444	$3,249	$4,454
Total Value	**$5,832**	**$5,240**	**$4,925**	**$7,051**

Table A4- 6. Levelized Value results ($/MWh), Harrisburg.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$41	$41	$41	$40
O&M Cost Savings	$20	$20	$20	$20
Total Energy Value	$60	$61	$60	$60
Strategic				
Security Enhancement Value	$23	$23	$23	$23
Long Term Societal Value	$29	$29	$29	$29
Total Strategic Value	$52	$52	$52	$51
Other				
Fuel Price Hedge Value	$42	$43	$43	$42
Generation Capacity Value	$16	$18	$18	$14
T&D Capacity Value	$1	$1	$2	$1
Market Price Reduction Value	$67	$76	$78	$57
Environmental Value	$55	$55	$55	$55
Economic Development Value	$45	$45	$45	$45
(Solar Penetration Cost)	($23)	($23)	($23)	($23)
Total Other Value	$203	$215	$217	$191
Total Value	**$315**	**$327**	**$330**	**$303**

Figure A4- 3. Value ($/kW), Harrisburg.

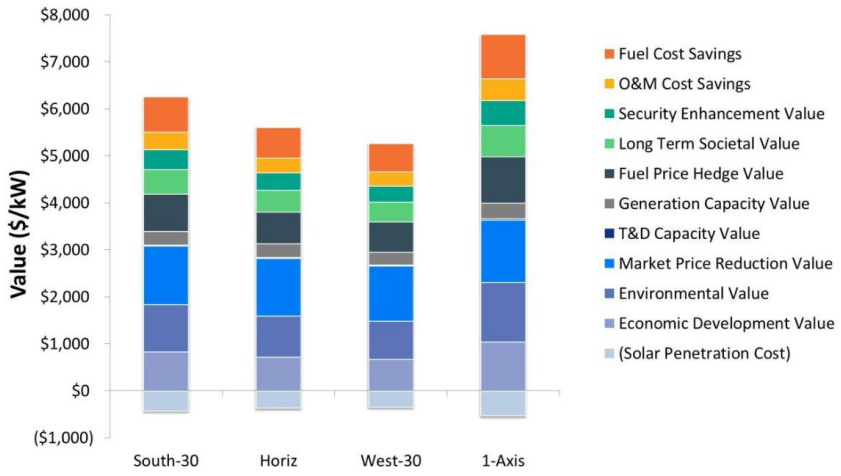
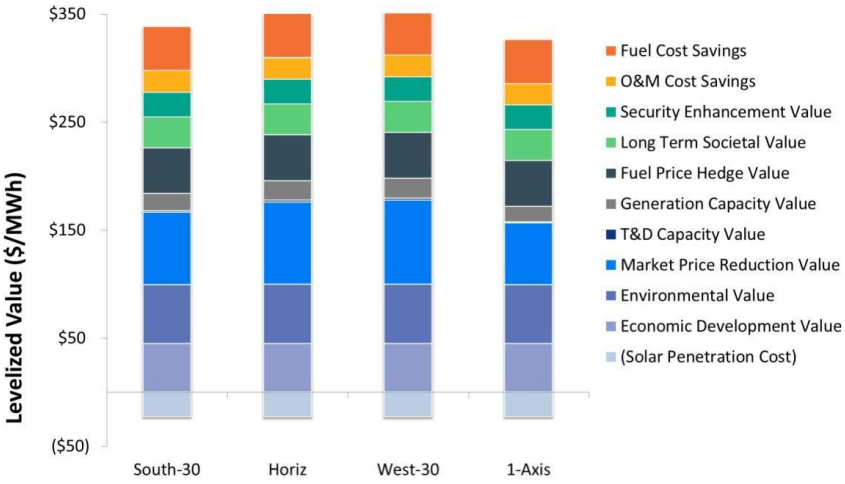


Figure A4- 4. Levelized Value ($/MWh), Harrisburg.



Scranton

Table A4- 7. Technical results, Scranton.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	1129	1129	1129	1129
Annual Energy Production (MWh)	1,698,897	1,479,261	1,386,699	2,123,833
Capacity Factor (%)	17%	15%	14%	21%
Generation Capacity (% of Fleet Capacity)	28%	27%	26%	32%
T&D Capacity (% of Fleet Capaccity)	14%	14%	14%	14%

Table A4- 8. Value ($/kW), Scranton.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$706	$616	$577	$880
O&M Cost Savings	$344	$300	$281	$429
Total Energy Value	$1,050	$916	$859	$1,309
Strategic				
Security Enhancement Value	$398	$348	$326	$497
Long Term Societal Value	$498	$435	$407	$621
Total Strategic Value	$896	$782	$733	$1,118
Other				
Fuel Price Hedge Value	$738	$644	$604	$921
Generation Capacity Value	$290	$283	$276	$336
T&D Capacity Value	$24	$24	$24	$24
Market Price Reduction Value	$1,206	$1,193	$1,157	$1,311
Environmental Value	$950	$829	$777	$1,185
Economic Development Value	$777	$678	$636	$969
(Solar Penetration Cost)	($398)	($348)	($326)	($497)
Total Other Value	$3,586	$3,303	$3,148	$4,249
Total Value	**$5,532**	**$5,001**	**$4,740**	**$6,676**

Table A4- 9. Levelized Value ($/MWh), Scranton.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$41	$41	$41	$41
O&M Cost Savings	$20	$20	$20	$20
Total Energy Value	$60	$61	$61	$60
Strategic				
Security Enhancement Value	$23	$23	$23	$23
Long Term Societal Value	$29	$29	$29	$29
Total Strategic Value	$52	$52	$52	$51
Other				
Fuel Price Hedge Value	$42	$43	$43	$42
Generation Capacity Value	$17	$19	$19	$15
T&D Capacity Value	$1	$2	$2	$1
Market Price Reduction Value	$69	$79	$82	$60
Environmental Value	$55	$55	$55	$55
Economic Development Value	$45	$45	$45	$45
(Solar Penetration Cost)	($23)	($23)	($23)	($23)
Total Other Value	$206	$218	$222	$196
Total Value	**$318**	**$331**	**$334**	**$307**

Figure A4- 5. Value ($/kW), Scranton.

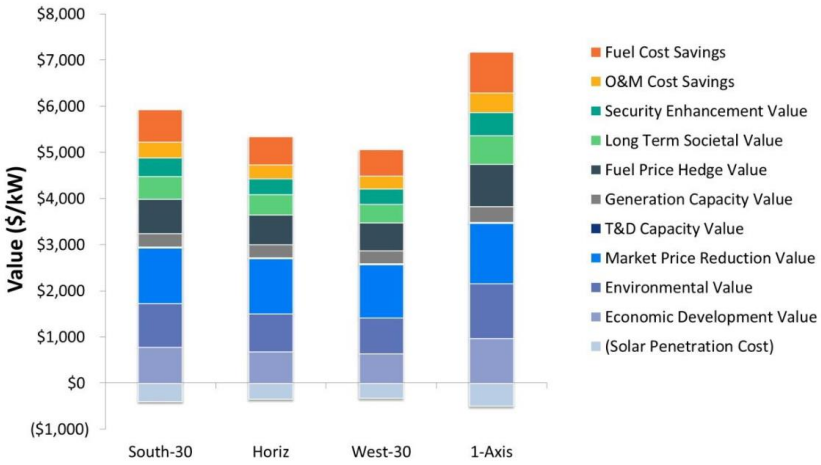
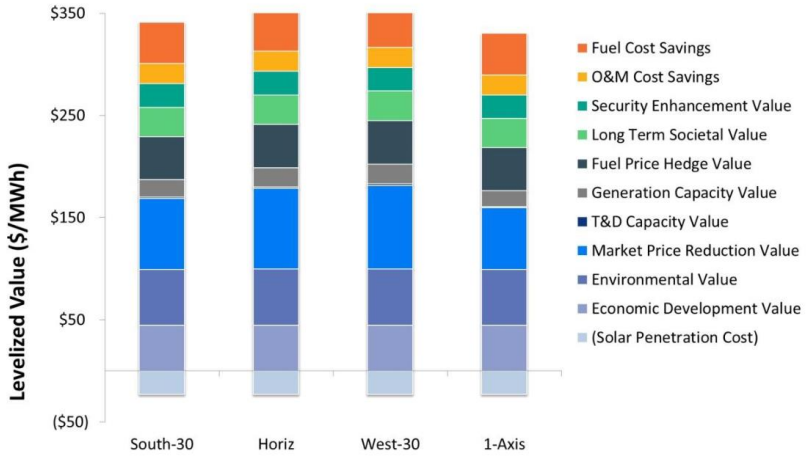


Figure A4- 6. Levelized Value ($/MWh), Scranton.



Philadelphia

Table A4- 10. Technical results, Philadelphia.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	1348	1348	1348	1348
Annual Energy Production (MWh)	2,339,424	1,991,109	1,847,394	2,943,101
Capacity Factor (%)	20%	17%	16%	25%
Generation Capacity (% of Fleet Capacity)	38%	40%	43%	46%
T&D Capacity (% of Fleet Capaccity)	21%	21%	21%	21%

Table A4- 11. Value results ($/kW), Philadelphia.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$706	$602	$559	$886
O&M Cost Savings	$344	$294	$273	$432
Total Energy Value	$1,049	$896	$832	$1,318
Strategic				
Security Enhancement Value	$405	$346	$321	$509
Long Term Societal Value	$507	$432	$402	$636
Total Strategic Value	$912	$778	$723	$1,145
Other				
Fuel Price Hedge Value	$876	$747	$694	$1,100
Generation Capacity Value	$401	$418	$452	$483
T&D Capacity Value	$65	$65	$65	$65
Market Price Reduction Value	$1,013	$1,027	$1,018	$1,103
Environmental Value	$967	$825	$766	$1,214
Economic Development Value	$790	$675	$626	$993
(Solar Penetration Cost)	($405)	($346)	($321)	($509)
Total Other Value	$3,706	$3,412	$3,300	$4,449
Total Value	**$5,667**	**$5,086**	**$4,855**	**$6,912**

Table A4- 12. Levelized Value results ($/MWh), Philadelphia.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$38	$38	$38	$38
O&M Cost Savings	$18	$19	$19	$18
Total Energy Value	$56	$57	$57	$56
Strategic				
Security Enhancement Value	$22	$22	$22	$22
Long Term Societal Value	$27	$27	$27	$27
Total Strategic Value	$49	$49	$49	$49
Other				
Fuel Price Hedge Value	$47	$47	$47	$47
Generation Capacity Value	$22	$26	$31	$21
T&D Capacity Value	$3	$4	$4	$3
Market Price Reduction Value	$54	$65	$69	$47
Environmental Value	$52	$52	$52	$52
Economic Development Value	$42	$43	$43	$42
(Solar Penetration Cost)	($22)	($22)	($22)	($22)
Total Other Value	$199	$215	$224	$190
Total Value	**$304**	**$321**	**$330**	**$295**

Figure A4- 7. Value ($/kW), Philadelphia.

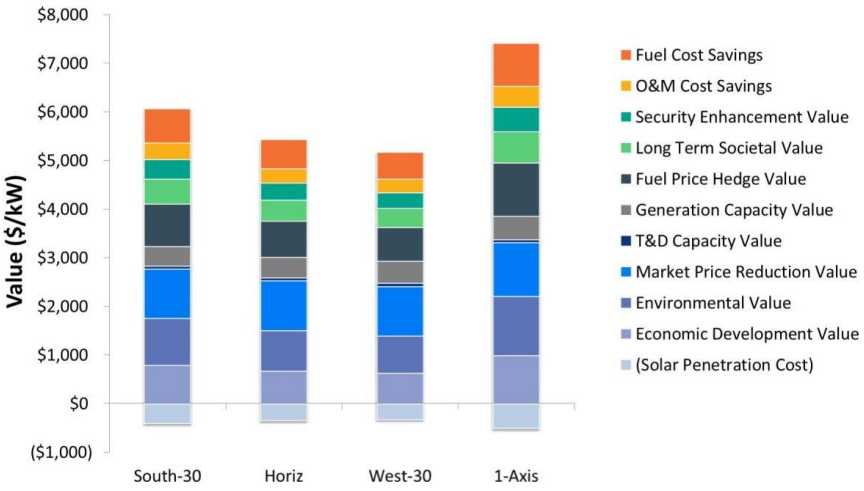
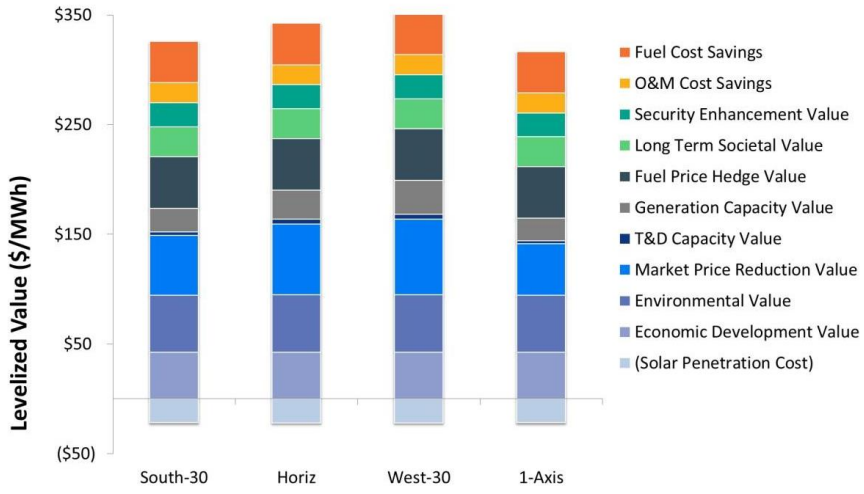


Figure A4- 8. Levelized Value ($/MWh), Philadelphia.



Jamesburg

Table A4- 13. Technical results, Jamesburg.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	991	991	991	991
Annual Energy Production (MWh)	1,675,189	1,431,899	1,315,032	2,102,499
Capacity Factor (%)	19%	16%	15%	24%
Generation Capacity (% of Fleet Capacity)	45%	47%	51%	52%
T&D Capacity (% of Fleet Capaccity)	29%	31%	29%	26%

Table A4- 14. Value results ($/kW), Jamesburg.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$1,020	$878	$808	$1,276
O&M Cost Savings	$497	$428	$394	$622
Total Energy Value	$1,517	$1,306	$1,203	$1,898
Strategic				
Security Enhancement Value	$549	$472	$435	$686
Long Term Societal Value	$686	$590	$544	$858
Total Strategic Value	$1,234	$1,062	$978	$1,544
Other				
Fuel Price Hedge Value	$586	$504	$465	$733
Generation Capacity Value	$468	$496	$531	$546
T&D Capacity Value	$23	$25	$23	$21
Market Price Reduction Value	$1,266	$1,306	$1,315	$1,363
Environmental Value	$560	$482	$444	$700
Economic Development Value	$1,097	$944	$870	$1,373
(Solar Penetration Cost)	($549)	($472)	($435)	($686)
Total Other Value	$3,451	$3,285	$3,212	$4,050
Total Value	**$6,202**	**$5,653**	**$5,393**	**$7,492**

Table A4- 15. Levelized Value results ($/MWh), Jamesburg.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$42	$42	$43	$42
O&M Cost Savings	$21	$21	$21	$21
Total Energy Value	$63	$63	$63	$63
Strategic				
Security Enhancement Value	$23	$23	$23	$23
Long Term Societal Value	$28	$29	$29	$28
Total Strategic Value	$51	$51	$52	$51
Other				
Fuel Price Hedge Value	$24	$24	$24	$24
Generation Capacity Value	$19	$24	$28	$18
T&D Capacity Value	$1	$1	$1	$1
Market Price Reduction Value	$52	$63	$69	$45
Environmental Value	$23	$23	$23	$23
Economic Development Value	$45	$46	$46	$45
(Solar Penetration Cost)	($23)	($23)	($23)	($23)
Total Other Value	$143	$159	$169	$134
Total Value	**$257**	**$274**	**$284**	**$247**

Figure A4- 9. Value ($/kW), Jamesburg.

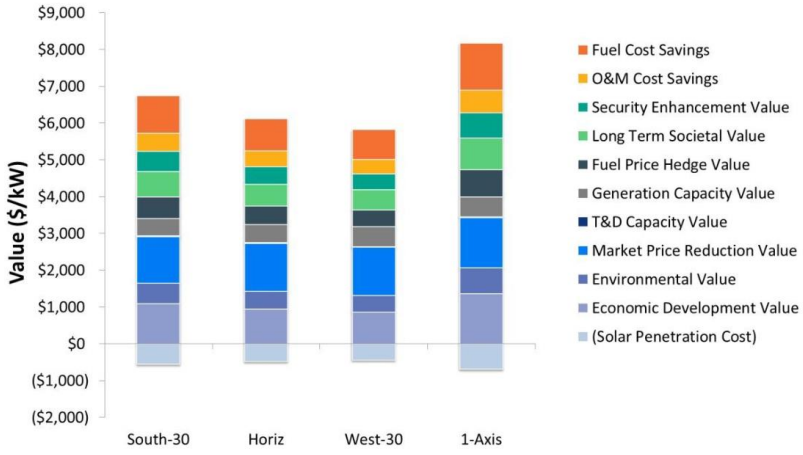
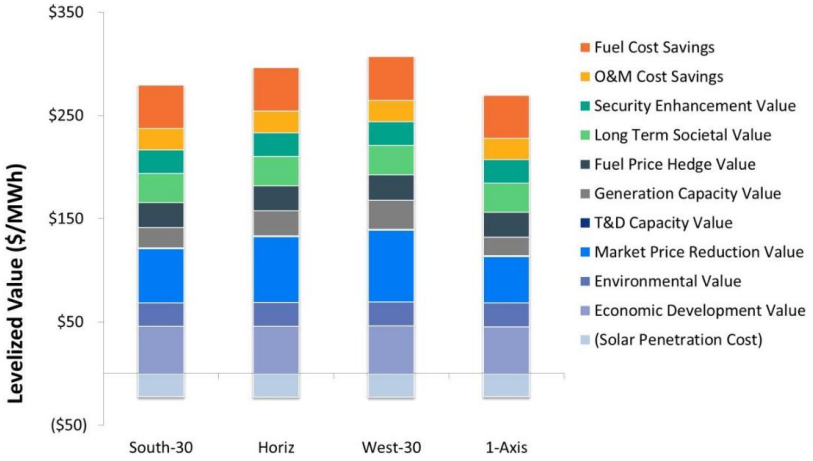


Figure A4- 10. Levelized Value ($/MWh), Jamesburg.



Newark

Table A4- 16. Technical results, Newark.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	1640	1640	1640	1640
Annual Energy Production (MWh)	2,677,626	2,303,173	2,118,149	3,350,313
Capacity Factor (%)	19%	16%	15%	23%
Generation Capacity (% of Fleet Capacity)	45%	47%	51%	54%
T&D Capacity (% of Fleet Capaccity)	56%	57%	57%	57%

Table A4- 17. Value results ($/kW), Newark.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$709	$612	$564	$885
O&M Cost Savings	$345	$298	$275	$431
Total Energy Value	$1,054	$911	$839	$1,317
Strategic				
Security Enhancement Value	$403	$348	$321	$503
Long Term Societal Value	$504	$435	$401	$629
Total Strategic Value	$907	$783	$721	$1,132
Other				
Fuel Price Hedge Value	$798	$689	$635	$996
Generation Capacity Value	$470	$489	$534	$568
T&D Capacity Value	$147	$151	$151	$151
Market Price Reduction Value	$927	$959	$958	$989
Environmental Value	$411	$355	$327	$513
Economic Development Value	$806	$696	$641	$1,007
(Solar Penetration Cost)	($403)	($348)	($321)	($503)
Total Other Value	$3,156	$2,991	$2,926	$3,721
Total Value	**$5,117**	**$4,685**	**$4,486**	**$6,170**

Table A4- 18. Levelized Value results ($/MWh), Newark.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$39	$39	$39	$39
O&M Cost Savings	$19	$19	$19	$19
Total Energy Value	$58	$58	$58	$58
Strategic				
Security Enhancement Value	$22	$22	$22	$22
Long Term Societal Value	$28	$28	$28	$28
Total Strategic Value	$50	$50	$50	$50
Other				
Fuel Price Hedge Value	$44	$44	$44	$44
Generation Capacity Value	$26	$31	$37	$25
T&D Capacity Value	$8	$10	$10	$7
Market Price Reduction Value	$51	$61	$66	$43
Environmental Value	$22	$23	$23	$22
Economic Development Value	$44	$44	$44	$44
(Solar Penetration Cost)	($22)	($22)	($22)	($22)
Total Other Value	$173	$190	$202	$163
Total Value	**$280**	**$298**	**$310**	**$270**

Figure A4- 11. Value ($/kW), Newark.

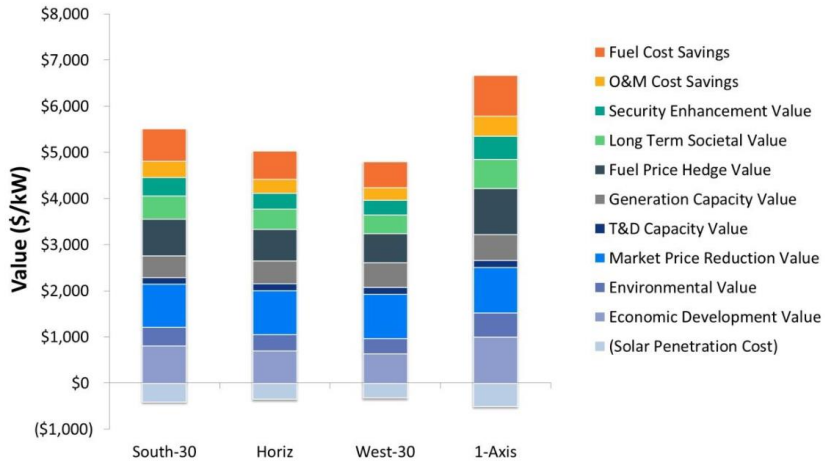
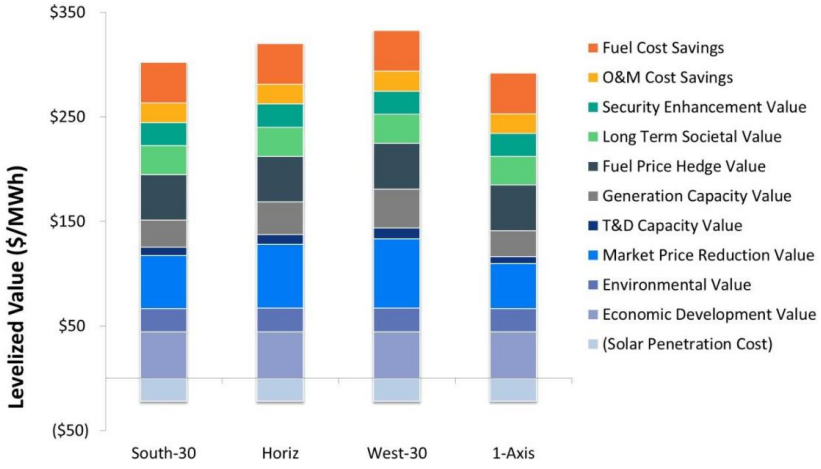


Figure A4- 12. Levelized Value ($/MWh), Newark.



Atlantic City

Table A4- 19. Technical results, Atlantic City.

	South-30	Horiz	West-30	1-Axis
Fleet Capacity (MWac)	443	443	443	443
Annual Energy Production (MWh)	827,924	705,374	654,811	1,039,217
Capacity Factor (%)	21%	18%	17%	27%
Generation Capacity (% of Fleet Capacity)	46%	48%	54%	57%
T&D Capacity (% of Fleet Capaccity)	36%	37%	38%	36%

Table A4- 20. Value results ($/kW), Atlantic City.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$1,081	$927	$863	$1,354
O&M Cost Savings	$527	$452	$421	$660
Total Energy Value	$1,609	$1,380	$1,283	$2,015
Strategic				
Security Enhancement Value	$584	$501	$466	$732
Long Term Societal Value	$730	$626	$582	$914
Total Strategic Value	$1,314	$1,127	$1,048	$1,646
Other				
Fuel Price Hedge Value	$662	$567	$528	$828
Generation Capacity Value	$478	$503	$569	$600
T&D Capacity Value	$49	$51	$52	$49
Market Price Reduction Value	$1,412	$1,485	$1,508	$1,503
Environmental Value	$596	$511	$475	$746
Economic Development Value	$1,168	$1,002	$932	$1,463
(Solar Penetration Cost)	($584)	($501)	($466)	($732)
Total Other Value	$3,781	$3,618	$3,598	$4,458
Total Value	**$6,704**	**$6,125**	**$5,929**	**$8,119**

Table A4- 21. Levelized Value results ($/MWh), Atlantic City.

	South-30	Horiz	West-30	1-Axis
Energy				
Fuel Cost Savings	$41	$42	$42	$41
O&M Cost Savings	$20	$20	$20	$20
Total Energy Value	$61	$62	$62	$61
Strategic				
Security Enhancement Value	$22	$22	$22	$22
Long Term Societal Value	$28	$28	$28	$28
Total Strategic Value	$50	$50	$51	$50
Other				
Fuel Price Hedge Value	$25	$25	$25	$25
Generation Capacity Value	$18	$23	$27	$18
T&D Capacity Value	$2	$2	$2	$1
Market Price Reduction Value	$54	$66	$73	$46
Environmental Value	$23	$23	$23	$23
Economic Development Value	$45	$45	$45	$44
(Solar Penetration Cost)	($22)	($22)	($22)	($22)
Total Other Value	$144	$162	$174	$135
Total Value	**$256**	**$274**	**$286**	**$247**

Figure A4- 13. Value ($/kW), Atlantic City.

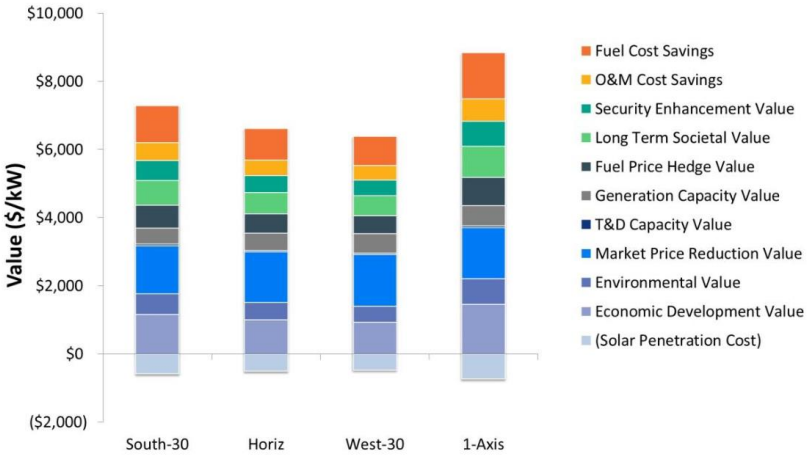


Figure A4- 14. Levelized Value ($/MWh), Atlantic City.