Appendix E: C-PACE FINANCING FOR SOLAR PV SYSTEMS AND FUEL CELLS

1. Solar PV Feasibility Study Recommendations
2. Commissioning and Performance Verification Guidelines for Solar PV Systems
3. C-PACE Solar Savings-to-Investment Ratio (SIR) Calculation Guidelines
4. Third Party Ownership & C-PACE

Section 1 - Solar PV Feasibility Study

For installation of a solar PV project, the Green Bank recommends that the feasibility study at the minimum address the following components:

Site Suitability Assessment

A. *Ambient Conditions*
   1. Site location (address, latitude, longitude, azimuth (degrees))
   2. Monthly average temperature (high and low), rain, percent sun, sunrise and sunset, solar insolence (Wh/ft2), irradiance (W/ft2)
   3. Irradiance data file used in projecting future performance (TMY2, SolarAnywhere, etc.)

B. *Building Conditions*
   1. Location for solar energy system (include photographs)
      - Rooftop
      - Ground
      - Parking canopy
   2. Solar energy system support/foundation
      - Rooftop
        - Roof dimensions (identifying usable PV panel space)
        - Roof materials of construction
        - Roof remaining useful life
        - Obstruction/shading analysis
        - Building structural adequacy to support installed solar system
      - Ground
        - Description and condition of area (paved surface vs. open ground)
        - Obstruction/shading analysis
        - Description of necessary work to support solar array rack(s)
      - Parking canopy
        - Description and condition of parking area
        - Obstruction/shading analysis
        - Description of necessary work to support solar array rack(s)

C. *Building characteristics*
    - Property address
    - Property type (office, retail, hotel, multifamily, industrial, etc)
    - Gross square feet

D. *Building historic energy use and cost*
    - Description of electricity metering (number of boxes, location, etc.)
    - Most recent utility electricity rate structure for property
    - Historic electricity use and cost (in accordance with ASTM E2797-15)

<u>PV System</u>

A. Solar module orientation and tilt
B. PV cell specifications, including cell efficiency
C. Module and array description, including module and array efficiency
D. System size (kW) and projected performance - specify model used (e.g., PVSyst, SAM, PVCheck, RETScreen, PV Studio, etc.) including input parameters, assumptions (such as soiling, degradation, etc.)
E. Inverter information (capacity, manufacturer, warranty, etc.) (the inverter must be warranted over the full financing term)
F. PV project site plan (including point of electrical connection)
G. Distance from closest power line hook-up point (electrical run)
H. Building code compliance and permit requirements
I. Identification of Fire Marshall review requirements (e.g., system design compatibility with current fire suppression techniques, sufficient space around PV system location for fire fighters to move around safely - sufficient distance between array and roof edges, ventilation hatches, skylights, etc.)
J. Solar vendor guaranteed performance, including product warranty, decrease of power output warranty
K. Guaranteed useful life
L. Maintenance requirements (for maintaining peak efficiency)

<u>Financial Analysis</u>

M. System total capital cost
N. ZREC credits/sale. If ZREC contract not yet secured, include anticipated ZREC pricing (or range).
O. Potential excess electricity sale back to the grid (if applicable)
P. Annual cost of a maintenance contract with solar contractor, if provided
Q. Cost for roof upgrade (if required)
R. Cost for building structural reinforcement (if required)
S. Energy savings analysis
T. ROI, payback, IRR, NPV and projected cash flow analysis

Commissioning and Measurement and Verification

U. System commissioning plan (in particular, specify metering equipment and how the system will be monitored)
V. Electricity production monitoring including specification of the type of Green Bank-approved monitoring system that will be used (listed on the Green Bank website): http://www.ctcleanenergy.com/YourHome/ResidentialSolarInvestmentProgram/FindanApprovedPerformanceDataProvider/tabid/607/Default.aspx

Section 2 - Commissioning and Performance Verification Guidelines for Solar PV Systems

The commissioning plan and M&V plan for Solar PV systems should consist of four steps: (1) verification of equipment installation and O&M requirements; (2) verification/documentation of the utility interconnect; (3) verification of the system's capability to perform according to its specifications; and (4) system performance tracking. The first three steps need to be addressed in the commissioning plan. The last step needs to be addressed in the M&V plan.

A. Verification of equipment installation and O&M requirements
    - Verification that equipment installed is as specified in the proposal/purchase order (e.g., manufacturer, nameplate rating, numbers of modules, cells, etc.)
    - Installation checklist
    - Verification in writing and signed by the project developer that the installation is complete (preferably via an installation punch list), safe and has all required permits
    - Documentation of "as built" condition (providing "as built" drawings, including array layout/one-line electrical diagram or schematic, and photographs)
    - PE letters or stamped documentation (electrical, structural)
    - Documentation of O&M requirements (and responsibility)
    - Documentation of warranty details

B. Verification/documentation of the utility interconnect
    - Interconnect Agreement
    - Compliance (letter) for ZREC metering requirements (optional)
    - Utility Witness Test Results/Findings (letter)
    - Net metering agreement
    - Final Approval Letter

C. Verification of system performance according to specifications
    - Equipment spec sheets, including monitoring system information
    - Commissioning data sheet
    - PV array test report
    - Miscellaneous system test reports

D. Track system electricity production performance
    - Track PV system electricity production

- Compare Solar PV performance results with projected PV model results.
- Determine energy savings per month (equivalent to electricity production and the applicable value of ZRECs)

Section 3 - C-PACE Solar PV Savings-to-Investment Ratio (SIR) Calculation Guidelines

The Green Bank recommends using the Solar SIR Calculator posted to the C-PACE website.

Determine "Savings" as follows:

A. Add:
   - Avoided annual electricity costs, assuming a maximum of 3% annual escalation of utility electric prices (include both initial price basis and specific annual performance degradation of at least 0.5%)
   - Annual demand charge reduction (if claimed, include the specific model demonstrating how this reduction will be achieved)
   - Annual revenue from excess electricity sales back to the grid at the wholesale rate, if applicable (again, assuming no more than a 3% annual escalator)
   - Annual revenue from sale of renewable energy credits (if necessary to achieve SIR > 1, proof of ZREC contract will be required prior to closing of C-PACE funding)
   - Any other system-related project revenues
   - If the property owner has the ability to monetize the federal Investment Tax Credit and/or MACRS depreciation benefits, include the value of those tax savings for each year in which they will be applied. This should be noted in the form "Documentation of Ability to Monetize Federal Tax Credits Associated with Clean Energy Installations" at the end of the initial application
B. Model annual cash flows from the system over the lifetime of the solar

Determine "Investment" as follows:

Calculate total projected debt service due in respect of the C-PACE financing – including all principal, interest, and any fees over the term of the financing – as well as fixed or variable costs associated with the maintenance or performance of the Energy Improvements over their EUL.

- Up to five years of preventative maintenance costs necessary to maintain system operation at optimum performance can be capitalized into initial financing

SIR = Savings / Investment

KEY NOTES ON SIR CALCULATION GUIDELINES:

- Under C-PACE, the system owner (either the property owner or a third-party owner) is entitled to all tax benefits associated with the system. These tax benefits can be incorporated into the SIR calculation as savings if the property owner has the ability to monetize those tax benefits.