Commercial Property Assessed Clean Energy (PACE)

Eligible Renewable Energy System Technologies

Guidance Document

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Summary

New York State's General Municipal Law Article 5L, Municipal Sustainable Energy Loan Program, defines a "renewable energy system" as an energy generating system for the generation of electric or thermal energy by means of solar thermal, solar photovoltaic, wind, geothermal, anaerobic digester gas-to electricity systems, fuel cell technologies or other renewable energy technology approved by the New York State Energy Research and Development Authority (NYSERDA.) In the Commercial Property Assessed Clean Energy (PACE) Guidance Document ("Guidance") https://www.nyserda.ny.gov/All-Programs/Programs/Commercial-Property-Assessed-Clean-Energy, NYSERDA approved air source heat pumps; high efficiency, low emission wood heating systems; and energy storage systems (including electrochemical and thermal energy storage systems) as "renewable energy systems" for the purposes of PACE financing.

This document provides a listing of the eligible technologies, criteria for contractors seeking to perform feasibility studies and the suggested guidelines for performing commercial PACE Renewable Energy Feasibility Studies.

Solar Thermal

To be eligible for PACE financing, solar thermal systems must meet the following criteria:

- Solar thermal collectors must be certified as meeting all applicable standards of the Solar Rating and Certification Corporation. Solar thermal systems may provide domestic hot water and/or space heating.

Individuals performing the Feasibility Study for Solar Hot Water systems should hold a NABCEP Solar Heating Installer Certification. Individuals performing the Feasibility Study for Solar Hot air systems should possess SolarWall or SolarDucts industry training.

The average measure life is assumed to be 20 years.

A Feasibility Study for a Solar Thermal System should include:

- For a residential Solar Hot Water System for Domestic Hot Water (DHW):
  - Assessment of array location inclusive of measurements and roof framing for structural load calculations;
  - Analysis of hot water usage needs of the home (including ACCA Manual J load calculation if to be used for space heating);
  - Solar collector layout and heat production analysis;
  - Plumbing analysis; and
  - Payback analysis.

- For a commercial Installation of a Solar Hot Water System for DHW:
  - Detailed site map including collectors and water tanks, system orientation and tilt angle; point of connection with existing plumbing system, trees or obstructions;
  - Drawing of the proposed installation and one-line diagram;
  - Detailed estimate of annual system production (which shall include but not be limited to displaced electricity (kWh), and/or fuel oil (gallons), propane (British Thermal Units per hour (BTU/h)), and/or natural gas (therms);
  - System loss analysis; and
  - System costs and payback analysis.
- For a Solar Hot Air Heating System:
  - ACCA Manual N calculation of heating load or other appropriate methodology/procedure to perform load calculations; and
  - Site analysis to identify placement and integration.

Solar Photovoltaic (PV)

PV systems eligible for PACE financing must meet the ”System Requirements” as outlined in the “Commercial and Industrial >200 Program Manual” and “Residential/Small Commercial <200kW Solar Electric Systems Program Manual,” which can be found on NYSERDA’s website at https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Contractors/Resources-for-Contractors.

Individuals performing the Feasibility Study for Solar Photovoltaic systems should meet the requirements for becoming a “Participating Contractor” as outlined in the “Commercial and Industrial >200 Program Manual” and “Residential/Small Commercial <200kW Solar Electric Systems Program Manual,” which can be found on NYSERDA’s website at https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Contractors/Resources-for-Contractors

The average measure life is assumed to be 25 years.

A feasibility study for a commercial installation of PV systems should follow the requirements as outlined in the “Commercial and Industrial >200 Program Manual” and “Residential/Small Commercial <200kW Solar Electric Systems Program Manual,” which can be found on NYSERDA’s website at https://www.nyserda.ny.gov/All-Programs/Programs/NY-Sun/Contractors/Resources-for-Contractors

Small Wind

Wind systems eligible for PACE financing must meet the following criteria:

- For turbines with a nameplate rating of less than or equal to 100 kW, be included on the Interstate Turbine Advisory Council (ITAC) Unified List of Wind Turbines (https://www.cesa.org/projects/ITAC/itac-unified-list-of-wind-turbines/.)
- For turbines with a nameplate rating of greater than 100 kW and less than 2MW, demonstrate that an international organization accredited to ISO/IEC Guide 65 or EN45011 has certified that the wind turbine meets the appropriate sections of IEC 61400 for acoustics, durability, safety, and performance standards, or the current version of the AWEA Small Wind Turbine Performance and Safety Standard.
- Inverters and interconnection devices must be listed on the New York State Department of Public Service's list of Certified Interconnection Equipment (http://www3.dps.ny.gov/W/PSCWeb.nsf/All/DCF68EFCA391AD6085257687006F396B?OpenDocument) or the interconnection must be in agreement with the most current version of the Public Service Commission's Standardized Interconnection Requirements.

Individuals performing the Feasibility Study for The Renewable Energy Feasibility Study for Small Wind Turbine Energy Systems should be one of the following:

- Certified Wind Site Assessor who holds a Midwest Renewable Energy Association Small Wind Site Assessment Certificate (https://www.midwestrenew.org/product/wind-electricity/) or similar certification,
- Licensed professional engineer registered to practice in the State of New York who will sign and stamp the study, or
- Other credentialing pre-approved by NYSERDA.

The average measure life is assumed to be 20 years.

A feasibility study should be consistent with the Small Wind Site Assessment Guidelines published by NREL (https://www.nrel.gov/docs/fy15osti/63696.pdf) and include the following:

- Resource Characterization - an evaluation of the wind resource at the potential location of the wind turbine(s) at hub height. This information can be generated by an approved wind resource assessment tool (assessment tool may not be appropriate for building-mounted turbines, short towers typically less than 60 feet tall, tall towers typically greater than 140 feet tall, turbines to be installed in an urban environment, or turbines with a nameplate rating equal to or greater than 100 kW). Include a description of obstructions that could impair the wind resource, such as trees (this assessment should be conducted by considering the mature height of trees), buildings, and land terrain features, within 500-feet of the proposed turbine placement in any direction.

- Turbine and Electric Generator - a description of whether the project will utilize one or multiple turbines and the manufacturer and model of the turbine(s); technical specifications on the wind turbine and inverter, as well as the power curve in graphic and table form from IEC 61400-12-1. Evidence that the turbine and inverter meet the eligibility criteria specified above. Specify the rotor diameter.
- Tower - a description of the tower height, and tower type designed to accommodate the proposed wind turbine. It is recommended that towers be at least 60 feet in height; however, the bottom of the rotor should be at least 30 feet above any obstacle, in any direction, within 500 feet of the turbine. In situations where the local municipality has an ordinance that stipulates the criteria for building-mounted wind turbines, and the intent is to mount a wind turbine on a pre-existing structure such as a building or a pre-existing tower, include a structural analysis assessing whether the structural integrity of the pre-existing structure will be sufficient.
- Footprint and site work - a description of the required physical space(s) (dimensions, location(s) at the project site) where each tower(s) will be placed, and distance between the location of each tower(s) and (i) the location of the site's existing electric infrastructure to which the electric generator will be interconnected, (ii) the nearest property line, (iii) the nearest overhead electric power line, (iv) the nearest human-occupied structure, and (v) other tower(s). Note: best practices for such set-backs are at minimum: a distance between the tower base and a property line or power line equal to the height of the wind energy system, above ground level, including the blades, plus 10%. (i.e., 1.1 times the total height of the wind energy system); a distance between the tower base and any human-occupied building equal to five times the rotor diameter; and a distance between tower bases equal to ten times the rotor diameter. Describe any modification necessary to existing infrastructure at the site. Describe potential issues relating to shadow flicker, and sound.
- Annual Production – a forecast of annual net electric production shall be calculated through a NYSERDA-approved software tool, such as the New York State Small Wind Explorer, or through a bin analysis, and compare to site load profile to ascertain when and by how much surplus electricity be exported from the site.
- Economics - estimates of capital costs (including line-item breakdown of major equipment/component costs), O&M costs (including information on costs of turnkey maintenance, and major maintenance/overhaul items and schedule), other project development costs (including line-item breakdown of things such as engineering, permitting, commissioning, contingencies), electric utility bill savings, other additional costs or credits (e.g., incentives, tradeable emission credits, tax credits). Calculate the return on investment (e.g., simple payback period, internal rate of return). Specify the expectable useful life of the system. Include a sensitivity analysis which assesses how much these estimates might vary because of variations in the modeling assumptions, as well as implications of future changes to site energy load patterns (e.g., load reduction due to energy conservation measures, load growth due to business expansion).

- Authorities Having Jurisdiction – identification of any foreseeable constraints regarding interconnecting with the electric utility grid (e.g., magnitude of utility fees for studying a request for interconnection, for designing an upgrade to the utility infrastructure that the customer would need to pay, and for implementing an upgrade to the utility infrastructure that the customer would need to pay). Identify any other pertinent authorities having jurisdiction and potential impacts on project viability/economics (e.g., building permit, zoning).

Ground Source Heat Pumps

The design and installation of Ground Source Heat Pump systems eligible for PACE financing must meet the criteria outlined in the Ground Source Heat Pump Rebate Manual, which can be found on NYSERDA's website at
https://portal.nyserda.ny.gov/CORE_Solicitation_Document_Page?documentId=a0lt0000000LbC5AAK

Individuals performing the Feasibility Study for Ground Source Heat Pumps should hold one of the following certifications:

- International Ground Source Heat Pump (IGSHPA) Geothermal Inspector;
- IGSHPA Geothermal Installer; or
- Licensed professional engineer registered to practice in the State of New York who will sign and stamp the study.

The average measure life is assumed to be 25 years.

A Feasibility Study for a Ground Source Heat Pump should include the following:

- ACCA Manual N calculation of heating and cooling load or other appropriate methodology/procedure to perform load calculations;
- Site analysis for the loop field based on load calculations; and
- Duct work analysis. ACCA Manual D analysis for duct work is preferred but not required.
- Description of proposed geothermal system (*e.g.* a vertical closed-loop system, a vertical open-loop system, a horizontal closed-loop system, pond/lake loop system, or other appropriate design)
- Description of the process used to evaluate alternative systems and summary of findings, including estimated long-term operational and maintenance costs of each system, estimated payback of each system,
- Test well drilling plan and specifications, criteria for driller selection; and copies of field drilling and test reports including drilling of test wells and performing thermal and hydraulic tests to determine the capacity of the wells to reject heat under various practical design scenarios.

Anaerobic Digester Gas (ADG)

ADG Systems must consist of commercially available technologies, which are defined as technologies that have operated satisfactorily for a minimum of one year at similar scale, with similar inputs and with similar output or which can be otherwise demonstrated as having a proven operating history that is relevant to the proposed project.

Individuals performing the Feasibility Study for the ADG System should meet the following criteria:

- The team must include members with experience in developing and installing similar ADG systems; and
- Licensed professional engineer registered to practice in the State of New York who will sign and stamp the study.

The average measure life is assumed to be 10 years.

The Feasibility Study for an ADG System should include the following information:

- Resource Characterization - organic substrates that will be placed into the digester (e.g., food waste, dairy cow manure, etc.), including type and supply sources, quantity of each type and source, and variability of the relative proportions of types/sources.
- Type of Digester - functional design of the type of digester being used as the basis of the analysis (e.g., continuously-stirred tank reactor, plug flow design).
- Production/Handling of the Biogas - any biogas storage capability or biogas clean-up processes being assessed (e.g., H2S removal, moisture knock-out), and biogas characteristics producible from the organic substrates (quantity, Btu content, contaminant content) both before and after biogas clean-up. Also, a description of the biogas safety flare (maximum biogas destruction capability, minimum continuous fueling requirement).
- Electric Generator - type (e.g., engine, turbine), size (nameplate rating when operating using biogas), and whether capable of operating during a grid outage (so-called “black-start” capable).
- Thermal Systems - equipment for heat recovery and heat discard (sizes of heat exchangers, medium into which recovered heat will be directed such as hot water or steam) and uses and load profiles for the recovered heat.
- Production/Handling of the Biosolids that will exit the digester - any biosolids storage capability being assessed, and biosolids characteristics producible from the organic substrates (production rate in mass and volume, moisture content).
- Production/Handling of the Digestate liquid that will exit the digester - any digestate storage capability being assessed, and digestate characteristics producible from the organic substrates (volumetric production rate, nutrient content).

- Footprint and site work - required physical space(s) (dimensions, location(s) at the project site) where the digester will be placed, where the flare will be placed, where the electric generator will be placed, where recovered thermal energy will be used, where surplus thermal energy will be discarded, and distances between the locations of these components, as well as distance between the location of the electric generator and the location of the site's existing electric infrastructure to which the electric generator will be interconnected. Describe any modification necessary to existing infrastructure at the site.
- Dispatch Scenario - operating scenario (e.g., continuous at full output, overnight stockpiling of biogas for maximized electric production during on-peak hours). Describe the system controls and monitoring.
- Annual Production - forecast of hour-by-hour production for each of the 8,760 hours in a year of net electric production, and comparison to site load profile to ascertain when and by how much will surplus electricity be exported from the site. Forecast of hour-by-hour production for each of the 8,760 hours in a year of beneficial uses of recoverable heat. Calculate the overall annualized efficiency of the system (fuel input, versus electric and beneficially-used heat output, based on higher heating value of the fuel).
- Economics - estimates of capital costs (including line item breakdown of major equipment/component costs), O&M costs (including information on costs of a service contract versus self-maintenance, and major maintenance/overhaul items and schedule), other project development costs (including line item breakdown of things such as engineering, permitting, commissioning, contingencies), electric utility bill savings, financial savings attributable to the beneficially used recoverable heat, revenues from tipping fees, financial savings or expenses attributable to managing the biosolids exiting the digester (e.g., use as animal bedding), financial savings or expenses attributable to managing the digestate liquid exiting the digester (e.g., use as soil amendment/fertilizer), and any monetizable value attributable to black-start resiliency if applicable or other additional costs or credits (e.g., incentives, tradeable emission credits, tax credits.) Calculate the return on investment (e.g., simple payback period, internal rate of return). Specify the expectable useful life of the system. Include a sensitivity analysis which assesses how much these estimates might vary because of variations in the modeling assumptions, as well as implications of future changes to site energy load patterns (e.g., load reduction due to energy conservation measures, load growth due to business expansion).
- Authorities Having Jurisdiction - any foreseeable constraints regarding interconnecting with the electric utility grid (e.g., magnitude of utility fees for studying a request for interconnection, for designing an upgrade to the utility infrastructure that the customer would need to pay, and for implementing an upgrade to the utility infrastructure that the customer would need to pay). Identify any other pertinent authorities having jurisdiction and potential impacts on project viability/economics (e.g., air emissions profile and environmental permitting, Concentrated Animal Feeding Operations [CAFO] regulations, water quality management associated with run-off of land-applied nutrients, building permit, zoning).

Fuel Cells

Fuel cells should be designed for continuous duty stationary power production operation and must provide documentation of certification by a nationally recognized product standard for stationary fuel cell power systems such as: ANSI/CSA America FC1 standard. The fuel cell systems should also be commercially available and warranted for continuous duty.

Individuals performing the Feasibility Study for Fuel Cell Energy Systems must be a licensed professional engineer registered to practice in the State of New York who will sign and stamp the study.

The average measure life is assumed to be 20 years.

A Feasibility Study for a Fuel Cell System should include the following:

- Fuel Availability - availability of fuel (e.g., pipeline natural gas, or other fuel) including quantity/flowrate and delivered pressure.
- Type of Fuel cell - functional design of the fuel cell (e.g., phosphoric acid, solid oxide, molten carbonate, proton exchange membrane), and whether a fuel reformer is needed and/or included.
- Electric Generator - size (nameplate rating), and whether capable of operating during a grid outage (so-called "black-start" capable).
- Thermal Systems - equipment for heat recovery and heat discard (sizes of heat exchangers, medium into which recovered heat will be directed such as hot water or steam) and uses and load profiles for the recovered heat.
- Footprint and site work - required physical space(s) (dimensions, location(s) at the project site) where the fuel cell will be placed, where recovered thermal energy will be used, where surplus thermal energy will be discarded, and distances between the locations of these components, as well as distance between the location of the fuel cell and the location of the site's existing electric infrastructure to which the fuel cell's electric output will be interconnected. Describe any modification necessary to existing infrastructure at the site.
- Dispatch Scenario - operating scenario (e.g., continuous at full output, peak-shaving during on-peak hours). Describe the system controls and monitoring.
- Annual Production - forecast of hour-by-hour production for each of the 8,760 hours in a year of net electric production and compare to site load profile to ascertain when and by how much will surplus electricity be exported from the site. Forecast of hour-by-hour production for each of the 8,760 hours in a year of beneficial uses of recoverable heat. Calculate the overall annualized efficiency of the system (fuel input, versus electric and beneficially-used heat output, based on higher heating value of the fuel).
- Economics - estimates of capital costs (including line item breakdown of major equipment/component costs), O&M costs (including information on costs of turnkey

maintenance, and major maintenance/overhaul items and schedule), other project development costs (including line item breakdown of things such as engineering, permitting, commissioning, contingencies), electric utility bill savings, financial savings attributable to the beneficially used recoverable heat, and any monetizable value attributable to black-start resiliency if applicable or other additional costs or credits (e.g., incentives, tradeable emission credits, tax credits). Calculate the return on investment (e.g., simple payback period, internal rate of return). Specify the expectable useful life of the system. Include a sensitivity analysis which assesses how much these estimates might vary because of variations in the modeling assumptions, as well as implications of future changes to site energy load patterns (e.g., load reduction due to energy conservation measures, load growth due to business expansion).

- Authorities Having Jurisdiction - any foreseeable constraints regarding interconnecting with the electric utility grid (e.g., magnitude of utility fees for studying a request for interconnection, for designing an upgrade to the utility infrastructure that the customer would need to pay, and for implementing an upgrade to the utility infrastructure that the customer would need to pay). Identify any other pertinent authorities having jurisdiction and potential impacts on project viability/economics (e.g., building permit, zoning).

Air Source Heat Pumps

Air source heat pump systems eligible for PACE financing must comply with industry standards developed by the American National Standards Institute (ANSI), the American Society for Testing and Materials (ASTM), the American Society of Heating, Refrigeration, Air Conditioning Engineers (ASHRAE), the Air Conditioning Contractors of America Association (ACCA), and the Air-Conditioning and Refrigeration Institute (ARI) Standard 210/240, Standard for Unitary Air-Conditioning and Air-Source Heat Pump Equipment. Additionally, for systems less than 65,000 BTU, the ASHP(s) must be on the Cold Climate Air-source Heat Pump (ccASHP) specification listing at the time of installation. Developed by the Northeast Energy Efficiency Partnership, ccASHP identifies ASHPs best suited to heat efficiently in cold climates.

Individuals performing the Feasibility Study for Air Source Heat Pumps should hold an HVAC certification that demonstrates training in sizing and the use of ACCA Manual J, such as the Building Performance Institute (BPI) Air Conditioning and Heat Pump certification, BPI Heating, or NATE certifications. A licensed professional engineer registered to practice in the State of New York who will sign and stamp the study also qualifies but must demonstrate experience with the use of ACCA Manual J and/or hold one of the above certifications.

The average measure life is assumed to be 15 years.

A Feasibility Study for an Air Source Heat Pump System should include the following:

- ACCA Manual N calculation of heating and cooling load or other appropriate methodology/procedure to perform load calculations,

- Siting assessment to ensure proper and secure placement of the heat pump, considering structural implications if to be attached to the building wall, snow lines, and other environmental considerations.

Energy Storage

Energy Storage is defined as energy storage being installed in conjunction with a renewable energy system, energy storage for reduction of peak load, energy storage that provides demand response to a utility or grid operator or energy storage integrated with a renewable source that can provide back-up power to a critical system of a facility or to a residence (even partial back-up) to provide a measure of resiliency during an extended grid outage. Battery energy storage, whether considered in conjunction with a renewable energy system or not, must include an inverter/charge controller with a UL 1741 listing and the storage system shall carry a UL 1973 listing or any subsequent more expanded listings including UL 9540. Storage systems must carry a manufacturer's warranty of at least 10 years.

The average measure life is assumed to be 10 years.

Individuals performing the Feasibility Study for Storage Systems, either in conjunction with a renewable energy system or for energy management, would need to demonstrate experience with these types of systems, directly or working in conjunction with another vendor.

The feasibility study should include the following:

- For non-residential applications, the feasibility study should also consider the ability to perform energy management such as peak shaving for demand charge mitigation at the customer's facility by integrating energy storage with or without an on-site renewable resource. The study should indicate the ability of the design to reduce monthly peak loads and allow the building to participate in a distribution utility's and/or the NYISO's demand response program. In addition, for commercial applications, the feasibility study should include load profile or interval meter data analysis and examine one year of historical electric load data for interval metered customers along with projected peak load reduction by time of day and season. If a year of data is not available to fully show seasonal peaks and usage, representative data and supplemental information sufficient to characterize a facility's annual load should be considered. For non-interval metered customers, data logging may be required as a first task in the feasibility study.