blueprints
Energy Efficiency & Conservation Block Grant Program

Blueprint 3A How-To Guide: Solar + Storage – Power Purchase Agreements and Direct Ownership

Introduction

The Energy Efficiency and Conservation Block Grant (EECBG) Program Blueprints provide ideas and inspiration to utilize EECBG funding in the areas of energy planning, energy efficiency, renewable energy, transportation electrification, clean energy finance, and workforce development, including several high-level key activities. These key activities are suggested steps EECBG Program awardees can take to begin or make progress within their selected blueprint.

The Blueprint How-To Guides, in contrast, provide additional detail to help practitioners get going. Awardees can reference these more granular steps, recommendations, and resources within each key activity as they get started implementing their EECBG projects and programs. By using these documents, awardees can quickly identify where they need to start, where they need to go next to make progress, and how they can leverage existing resources to get ahead.

KEY ACTIVITY CHECKLIST: BLUEPRINT 3A

1. Site Assessment

- ☑ Establish a list of potential sites
- ☑ Eliminate sites with significant constraints for solar and storage
- ☑ Size and prioritize remaining sites

2. Project Savings Assessment

- ☑ Estimate lifetime project cost savings

3. Procurement and Legal Support

- ☑ Select the sites and contract structure for procurement based on the prior analysis
- ☑ Administer the procurement with legal/specialized support as needed

4. Installation of Solar Panels and Battery Storage

- ☑ Follow an efficient and predictable timeline

Key Activities

KEY ACTIVITY 1: SITE ASSESSMENT

- **Goal: Identify locations that are good geographical candidates for solar or combined solar + storage projects.**

SCEP
STATE & COMMUNITY ENERGY PROGRAMS

Step 1: Establish a list of potential sites

How? Follow the checklist:

- ❑ **Map out your solar sites.** List all potential solar project sites (building rooftops, parking lots, and unused ground parcels, including brownfields) that are expected to remain in operation and be in your real estate portfolio for at least 15 years. **Note:** The checklist items below only apply to sites passing the 15-year duration filter.
- ❑ **Gather planned roof replacement years for all rooftop sites.** Collect information on roof condition, if readily available, as well.
- ❑ **Account for shade & obstructions.** Gather basic information on whether the site is shaded by trees or other buildings and has obstructions such as rooftop air handlers.
- ❑ **Check for electricity.** Determine if you have on-site electricity consumption at all sites.
- ❑ **Check for ventilation.** For sites with on-site consumption, determine whether there is nearby, well-ventilated space for a potential battery storage project.
- ❑ **Owned vs. Leased.** Distinguish sites that you own from sites that you lease.

What to consider:

- **Focus on sites with readily available data.** If you have a large portfolio of potential sites or if collecting information on certain sites will be difficult, focus solar assessments on a subset of your largest sites with the most readily available data, or simply on a sample of sites.
- **Ensure you have long-term control over your site.** Solar projects can have long operating lives (30 years+) and longer investment payback periods than some energy efficiency measures. It is not recommended to install solar on sites that you do not control for long periods (typically 15+ years).
- **Consider third-party owned sites.** Solar can be hosted on buildings that you do not own, and you can receive the economic and environmental benefits of such solar projects (depending on leases and building owner preferences), but there is usually additional complexity involved compared to agency-owned properties.

KEY TERMS IN THIS DOCUMENT

- **Demand charge:** A charge on an energy utility bill that is based on maximum demand (kW) during a given period, e.g., each month.
- **Interconnection review**: Utilities review and approve customer power generation projects.
- **Interconnection standards**: A set of requirements and procedures for utilities and customers that mandate how renewable energy systems connect to the electric grid.
- **Net metering**: Policy that allows electricity customers with their own generation capacity to be financially compensated for the energy they produce.
- **Power purchase agreement (PPA)**: A contract allowing the customer to avoid making upfront capital investments for the project and operating responsibilities. A PPA uses third-party organizations to site and host the solar project, and an outside firm of engineers, finances, installs, owns, and operates the project. The customer pays each month for the project's solar power ($/kWh).
- **Solar + storage**: A project with co-located solar panels and battery storage, with the solar electricity output able to charge the battery system. Including storage may increase the economic and/or resilience (against utility power outage) benefits of a solar project.
- **Time-of-use charge:** Demand charge based on the site's maximum demand only during specified hours.
  - Can have multiple time-of-use periods (e.g., a rate may have both an on-peak demand charge during the middle of the day, and a separate part-peak demand charge later in the day when less energy is used).
  - Can vary by season (e.g., summer on-peak demand charges may be higher than winter on-peak demand charges, or winter on-peak demand charges may be non-existent).

Step 2: Eliminate sites with significant constraints from your list

How? Follow the checklist:

- ❑ **Avoid shady sites.** For any site with moderate to high amounts of shading, consider eliminating the site from the list or at least reducing its solar-ready space to the unshaded portions.
- ❑ **Avoid sites with poor rooftops.** For a site with a rooftop in moderate to poor condition or with concerns about the ability to accommodate a solar array, consider eliminating it. Ideally, also avoid installing solar on a roof scheduled to be replaced in the next 15 years.
- ❑ **Avoid uncertain commitments.** If a ground site either cannot be committed for at least 15 years to solar or has competing reuse opportunities, consider eliminating it.
- ❑ **Avoid sites without electricity or ventilation.** If there is no on-site electricity use or there is no nearby, well-ventilated space, remove the site from consideration for solar + storage systems. This is because there would likely be no ready opportunity for utility bill savings, resilience benefits, and/or safe operation from the storage project.

What to consider:

- **Check utility maps.** Some utilities publish interconnection guidance maps highlighting where new projects are more likely to encounter interconnection challenges. It is best to avoid such locations.

Step 3: Size and prioritize remaining sites on your list

How? Follow the checklist:

- ❑ **Determine the size of your project.** Estimate the size of a solar project, i.e., capacity in kilowatts (kW), that might be installed at each site and the associated annual solar electricity output in kilowatt-hours (kWh). Use the National Renewable Energy Laboratory's (NREL's) PVWatts® Calculator (including the "Rooftop Size Estimator," see Figure 1) or another tool to produce this information. Downsize the solar capacity, as needed, to better match on-site electricity use. Install energy efficiency measures first or include them as part of your project and in your downsizing calculations. **Tip:** This helps comply with utility net metering[1] limits that typically exist on solar projects. If your utility has aggregate or virtual net metering programs, you may be able to allocate excess solar production from one of your sites to others.
- ❑ **Gather stakeholder input.** Engage local stakeholders that may have preferences and opinions on the potential sites. This will help prioritize sites, build local partnerships, and provide insight into potential opposition.

KEY ACTIVITY 1 RESOURCES

PVWatts® Calculator (NREL)

REopt® tool (NREL)

Solar Site Selection Guide and Workbook (HUD)

Community Engagement and Equity in Renewable Energy Projects (NREL)

Solar Power in Your Community (DOE)

[1] Net Metering: In Brief (Congressional Research Service): https://crsreports.congress.gov/product/pdf/R/R46010

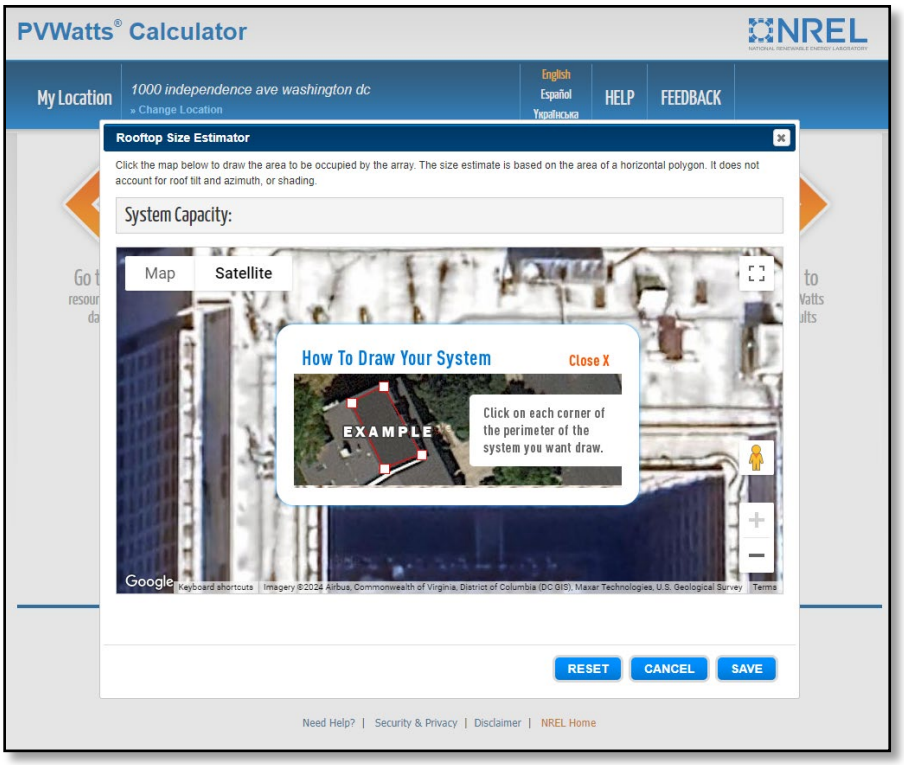

Figure 1. The Rooftop Size Estimator tool, part of the NREL PVWatts® Calculator.

- ❑ **Narrow down your site list.** Prioritize sites for solar based on factors including:
  - Estimated solar output. Larger projects tend to have economies-of-scale.
  - Compass orientation of rooftops. South-facing roofs will produce the most solar electricity per square foot; and north-facing roofs will produce the least.
  - Agency site ownership because leased sites may have more transaction complexity.
  - Local community preferences learned through stakeholder engagement.
- ❑ **Consider solar + storage priorities.** Prioritize sites for solar + storage if they have "critical electricity loads" that have significant health, safety, or economic impacts if they are interrupted (during grid outages) and insufficient back-up power on-site. Examples include fire and police stations, hospitals.

What to consider:

- **Pair solar with energy efficiency.** Install energy efficiency measures first or include them with your solar project. Energy efficiency can lower electricity demand and reduce the size (and cost) of the solar system capacity needed to meet your energy needs. The Energy Star **Checklists of Energy-Saving Measures**[2] lists various operations and maintenance steps that can be taken to reduce energy use in buildings and facilities.
- **Make do with your available sites.** If you have a limited number of potential sites, be more flexible in advancing sites to the next key activity. The ideal site list will have several site options to provide potential developers. That way, developers can provide a few project implementation options.

[2] Checklists of Energy-Saving Measures (Energy Star):
https://www.energystar.gov/buildings/save_energy_commercial_buildings/ways_save/checklists

- **Estimate battery storage size.** Estimating the appropriate size for battery storage to pair with solar can be complex. Using an external analytical tool like REopt® (NREL)[3] can be very helpful.
- **Streamline your site assessment efforts.** The purpose of this step is to reduce the burden on the government agency, so it only conducts project savings assessments for its most favorable sites. **Energy expertise is not necessary, but it can be helpful.** The steps in this key activity can be performed by a person without energy industry background. As an alternative, the government agency could hire an energy expert to conduct more detailed analyses.

KEY ACTIVITY 2: PROJECT SAVINGS ASSESSMENT

➢ **Goal: Estimate project costs and benefits on prioritized sites.**

Step 1: Complete an economic analysis by comparing project costs to ongoing savings

How? Follow the checklist:

- ❑ **Calculate electricity cost offsets from solar.** This economic analysis can be done via a tool such as REopt®[4] or via a do-it-yourself spreadsheet. The calculation involves comparing project (i) capital costs (reduced by incentives) and operations and maintenance (O&M) costs to (ii) savings (usually by multiplying solar output by $/kWh utility costs, providing electricity costs offset by solar, and adding any battery storage savings). Remember to consider an "electricity cost escalation rate" for the duration of the project, which can be selected under "Financial" in the REopt tool. Economic analyses that involve leases or PPAs will involve additional data points and calculations.
- ❑ **Follow an example.** For instance, according to Tracking the Sun[5] from Larence Berkeley National Laboratory (LBNL), small commercial solar projects of 100kW or less cost an average of $3.2/W. So, if the fictional town of Townsville, USA wants to install a 100kW system at City Hall, the capital cost, factoring in the 30% Investment Tax Credit (ITC), would be:

$$\$3.2/W \times 100kW = \$320{,}000 - (30\% \times \$320{,}000) = \$\mathbf{224{,}000}\ \boldsymbol{total\ capital\ cost}$$

Then, say that the EIA Electric Power Monthly[6] data shows the average price of electricity to customers in Townsville as $0.15/kWh, and PVWatts® estimates the annual solar output of the system as 150,000 kWh. The calculated energy savings would be:

$$\$0.15/kwh \times 150{,}000kwh = \$\mathbf{22{,}500}\ \boldsymbol{savings\ per\ year}$$

- ❑ **Use available calculation tools.** Calculation inputs can be obtained from the Key Activity 2 Resources, and technical assistance is available for EECBG Program grantees.

[3] REopt tool (NREL): https://reopt.nrel.gov/
[4] REopt tool (NREL): https://reopt.nrel.gov/
[5] Tracking the Sun (LBNL): https://emp.lbl.gov/tracking-the-sun
[6] Electric Power Monthly (EIA): https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a

What to consider:

- **Request technical assistance if needed.** This is an activity that would be extremely useful to have an energy expert help with. EECBG participants can get assistance from the National Renewable Energy Lab by emailing them at EECS_TA@nrel.gov.
- **Get familiar with the policy landscape.** Understanding the solar energy and clean energy policy landscape (e.g., solar renewable energy credits, net metering, federal/state/local solar incentives) would be useful for this activity. See Key Activity 2 Resources for helpful policy information.
- **Determine how solar will impact your electric bill.** It is critical to distinguish parts of your electric bill that will be affected by solar. For example, fixed monthly charges are unaffected by adding solar.
- **Explore IRA tax credits.** The Inflation Reduction Act (IRA) modified and extended the ITC for Energy Property, now making it available to non-taxable entities like local governments. The IRA added tax credit bonuses for various project characteristics, included those located in defined **energy communities**[7] and **low-income communities**[8], which if stacked together could *reduce overall project costs by up to 70%*.
- **Understand units of performance.** The capacity of battery storage systems is expressed in both power (kW) and energy (kWh) terms. System costs may also be expressed in power, energy, or a hybrid manner.
- **Consider the economic benefits of battery storage.** The economic benefits of battery storage systems are generally higher for customers with high peak demand charges and/or with time-of-use energy charges that vary significantly.
- **Understand solar power use claims.** If the agency sells the solar renewable energy credits associated with its project (to improve economics), it cannot claim to be purchasing green power from the project. See the U.S. Environmental Protection Agency's (EPA's) **Solar Power Use Claims**[9].

KEY ACTVITY 2 RESOURCES

Tracking the Sun (LBNL) report for historical capital and O&M costs

Annual Technology Baseline (NREL) for capital and O&M cost projections

Federal Solar Tax Credits for Businesses (DOE)

Database of State Incentives for Renewables & Efficiency®

Annual Energy Outlook (DOE) to assist in projecting future electricity prices

Electric Power Monthly (EIA) for average monthly electricity costs for consumers, by state

[7] Energy Community Tax Credit Bonus: https://energycommunities.gov/energy-community-tax-credit-bonus/#:~:text=As%20defined%20in%20the%20Inflation%20Reduction%20Act%20%28IRA%29%2C,projects%2C%20facilities%2C%20and%20technologies%20located%20in%20energy%20communities

[8] Low-Income Communities Bonus Credit Program: https://www.energy.gov/justice/low-income-communities-bonus-credit-program

[9] Solar Power Use Claims (EPA): https://www.epa.gov/green-power-markets/solar-power-use-claims

KEY ACTIVITY 3: PROCUREMENT AND LEGAL SUPPORT

➢ **Goal: Administer a procurement to obtain qualified project offers after selecting the best sites and contract structure.**

Step 1: Select sites and contract structure

How? Follow the checklist:

- ❑ **Select your site(s).** Based on prior site and project savings assessments (if conducted), select the sites with the best electricity production and economic prospects for inclusion in a procurement.
- ❑ **Determine project ownership.** Decide whether the agency will own the projects or have a PPA or lease with an external project owner.
- ❑ **Choose whether to include storage.** Decide whether to include solar + storage projects in a procurement based on storage benefits for addressing energy cost savings and/or resilience use cases at specific sites.

What to consider:

- **Size may impact offers.** Larger capacity solar or solar + storage projects are more likely to receive attractive offers due to economies-of-scale.
- **Consider third-party ownership.** PPAs and leases are best for agencies seeking to avoid capital investments and operational burdens and for agencies comfortable with externally owned property on their sites for 15-25 years. For more information, refer to EPA's webpage on Understanding Third-Party Ownership Financing Structures for Renewable Energy[10].
- **Explore IRA direct pay options.** The ITC provides 30% off the installation costs of eligible solar, wind and storage systems. The IRA made this tax credit available through elective pay, also known as direct pay, where tax-exempt and governmental entities can receive a reimbursement payment equal to the full value of the tax credit for building qualifying clean energy projects. This may make direct ownership more accessible to states, local governments, and tribes.[11]

KEY ACTIVITY 3 RESOURCES

Steps to a Successful Solar RFP (DOE SunShot)

Solar RFP Template (NREL)

Step 2: Administer procurement process

How? Follow the checklist:

- ❑ **Choose your procurement process.** Select whether to use a two-part procurement, with a Request for Qualifications (RFQ) to select eligible solar vendors followed by a Request for Proposals (RFP) to those vendors, or to issue only an RFP. **Tip:** RFQs tend to be most useful if the agency anticipates issuing multiple solar RFPs over future years.

[10] Understanding Third-Party Ownership Financing Structures for Renewable Energy (EPA): https://www.epa.gov/greenpower/understanding-third-party-ownership-financing-structures-renewable-energy
[11] Direct Pay Through the Inflation Reduction Act (The White House): https://www.whitehouse.gov/cleanenergy/directpay/

- ❑ **Draft your RFQ and/or RFP.** Tailor a solar RFQ and/or RFP template to your local needs (refer to the RFP guidance under Key Activity 3 Resources).
- ❑ **Engage internal stakeholders.** Formally involve all parts of your agency that will be significantly affected by the renewable energy transaction in the review of qualified offers (this includes Law, Labor, and any department with clean energy goals).
- ❑ **Consider outside support.** Decide if your agency requires outside technical and/or legal assistance to administer the procurement and negotiate the resulting contract(s). **Tip:** Transactions with battery storage, leases and PPAs warrant more specialized support than direct ownership solar transactions.

What to consider:

- **Competitive RFPs may be required.** Best practice, and often a government legal requirement, is to use competitive RFPs for any solar or solar + storage contract.
- **EECBG review may be expedited for projects limited to Key Activities 1-3.** If EECBG solar or solar + storage activities are limited to stakeholder engagement or the prior key activities in this blueprint, grantees can expect an expedited application review.

KEY ACTIVITY 4: INSTALLATION OF SOLAR PANELS AND BATTERY STORAGE

➢ **Goal: Establish an efficient and predictable schedule for project installation.**

How? Follow the checklist:

- ❑ **Understand EECBG requirements.** If EECBG funds are to be used on physical project construction, understand EECBG Program Formula Grant Application Instructions on Limitations on Expedited Reviews (page 39).
- ❑ **Secure a construction plan.** Obtain a construction plan for the project with key milestones and designate a staff member as central point of contact for monitoring construction progress.
- ❑ **Ensure insurance coverage.** Make sure that the project is properly covered by the agency's insurance policies before construction begins, including integrating any rooftop solar with the roof warranty.

KEY ACTIVITY 4 RESOURCES

Solar Project Development Pathway (EPA)

Local Government Guide for Solar Deployment (DOE)

What to consider:

- **Construction can be delayed due to grid and permitting factors.** The timing of interconnection and permit (e.g., electrical, building, and environmental) reviews can delay completion of project construction.
- **Check that electric bills are accurate.** After construction and commissioning, it is a best practice to regularly monitor solar output and battery storage operation via electronic access and check that it is recorded accurately on utility bills. Review your bills to calculate actual savings!