

The Community Solar Playbook was created by the National Rural Electric Cooperative Association (NRECA) in collaboration with the Clean Energy Collective and support from the Meister Consultants Group and the National Consulting Group.

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The Community Solar Playbook builds on the knowledge and experiences developed in the Department of Energy SunShot Initiative’s Solar Utility Network Deployment Accelerator (SUNDA). The SUNDA Team includes the following:

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**Foreword: The Community Solar Playbook**

America’s Electric Cooperatives have been at the forefront of community solar photovoltaic (PV) development. In keeping with the spirit of the network, a number of cooperatives and NRECA are working together and with other partners to share their combined knowledge. NRECA’s Community Solar Playbook is a comprehensive guide that combines the experience of America’s electric cooperatives and the knowledge of the solar vendor community with the tools and resources developed at NRECA to help other cooperatives save time and resources in the design and development of community solar programs.

The Community Solar Playbook is the latest entry in a series of resources that your cooperative can use as templates as you go through the process of evaluating and potentially deploying a community solar project. The full set of resources provides objective information about PV technology through fact sheets, courses, and case studies. These resources also capture practical design, implementation, and operational practices for large-scale PV systems (the SUNDA Cooperative PV Field Manual and the Community Solar Playbook).

In the near future, there will be tools that provide templates for other consumer-centric programs for solar offerings and beyond. Look for the technical overviews, uses, and templates for offerings such as residential rooftop programs; C&I programs; and combined PV, energy efficiency, and battery system offerings.

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Module 5 Section 1: Project Management and Planning

## About this Guide

Cooperatives have been early leaders in community solar photovoltaic (PV) development. At the same time, community solar program (CSP) designs remain dynamic and opportunities exist for early adopters to benefit from emerging innovations. To help other cooperatives save time and resources, this Playbook provides community solar decision tools that share experiences and facilitate peer learning. These tools include resources to support (a) community solar program design and (b) community solar program implementation.

**This Project Management and Planning Module is one of 5 modules developed by NRECA, collectively forming the Community Solar Playbook. Each module is focused on the actions required from a particular division of a cooperative utility to establish a community solar program**, **including the following**:

1. Executive Management

* Board of Directors Guide

1. Marketing, Member-Consumer Services, and Communications
2. Information Technology to Support Marketing and Program Administration
3. Business, Finance, and Program Administration
4. **Section 1: Project Management and Planning (this document)**

Section 2: PV System Engineering, Commissioning, and Operations

**Section 1 of the Project Management and Planning Module** focuses on the planning for a community solar program. **Section 2, PV System Engineering, Commissioning, and Operations Module,** based on the SUNDA Project Manager’s PV Quick Start Guide, focuses on the Project Manager’s role in designing and deploying a 1-MW (AC) PV system.

# Introduction: Project Management and Planning

This module has been developed for project managers tasked with planning and implementing a CSP. Module 5 Section 1 focuses on planning requirements and strategies, and compiles all of the project planning requirements assigned to various job functions. In addition, it provides Project Manager-specific checklists associated with system planning, site selection, and permitting.

Module 5 Section 2 provides a high-level checklist of the tasks associated with implementation duties, such as system procurement, site preparation, commissioning, operation, and maintenance.

The sections of this module include the following:

* Project Manager’s Planning Checklist
* Project Management Planning for Community Solar
  + Project Manager Business Case Contribution and Planning Overview
  + Business Case Template
* Business Case Planning Documents
  + Value Proposition Document
  + Engineering Design and System Configuration Plan
    - *SUNDA Reference Designs*
  + Siting Options Document
  + Recommendation of Community Solar Business and Financing Model
    - *Economic and Financial Evaluation*
    - *Key Financial Data*
  + Marketing and Communications Plan
    - *Market Analysis and Segmentation*
  + Information Technology System Integration Plan
    - *IT System Options Assessment*
  + Risk Mitigation Plan
* Other Useful Planning Documents
  + System Planning Documentation Checklist
  + Sales Onboarding Document
  + Legal and Regulatory Checklist
  + Overview of the Planning and Implementation Decisions
  + Consolidated Staff Planning Task List

# Project Manager’s Planning Checklist

Many community solar programs require a full-time project manager during the planning of the CSP, as well as during the procurement and construction phases. It is the role of the Project Manager to compile the planning material developed by staff. Additionally, the Project Manager is responsible for coordinating staff during the planning phase and leading the design, procurement, and commissioning of the PV system itself. These tasks are covered in Module 5 Section 2 in the Implementation Checklists.

Table 1: Project Manager’s Planning Checklist

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Management Planning** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Develop Engineering Design and System Configuration Plan** |  |  |  |  |  |  |  |
| 🞎 | **Develop the Siting Options Document** |  |  |  |  |  |  |  |
| 🞎 | **Ensure the following planning documents have been submitted to CEO for review/approval:** |  |  |  |  |  |  |  |
|  | 🞎 **Value Proposition Document** |  |  |  |  |  |  |  |
|  | 🞎 **Engineering Design and System Configuration Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Siting Options Document** |  |  |  |  |  |  |  |
|  | 🞎 **Recommendation of Community Solar Business and Financial Model** |  |  |  |  |  |  |  |
|  | 🞎 **Marketing and Communications Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Information Technology System Integration Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Financial Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Risk Mitigation Plan** |  |  |  |  |  |  |  |
| 🞎 | **Consolidate and produce community solar business case that includes the following:**   * **Strategic rationale** * **Program goals, overall value proposition, and success factors** * **Proposed scope, scale, and technology infrastructure** * **Proposed software strategy** * **Proposed financing strategy** * **Proposed marketing strategy** * **Consumer value proposition, pricing, participation, and care** * **Regulatory and legal overview** * **Next steps** |  |  |  |  |  |  |  |

# Project Management Planning for Community Solar

Many programs require a full-time Project Manager during the planning of the community solar program (CSP) as well as during the procurement and construction phases. In planning, the primary role of the Project Manager is to collect material from internal staff or contracted resources to create the business case to be provided for the CEO for approval.

### Project Manager Business Case Contribution and Planning Overview

The business case itself will be compiled by the Project Manager, with contributions from internal staff or external consultants. The approach used in this document uses two phases in the business case development process. The first phase centers on the exploration of options (business models, software needs, marketing tactics), with suggested approaches for CEO approval. The second phase integrates the selected program structures into a single integrated program plan for Board approval. In practice, the business case development process is likely to be far more iterative.

The end result of this business case methodology will enable the Project Manager and CEO to characterize the entire CSP.

**A suggested outline may include the following:**

* Strategic rationale
* Program goals, overall value proposition, and success factors
* Proposed scope, scale, and technology infrastructure
* Proposed software strategy
* Proposed financing strategy
* Proposed marketing strategy
* Pricing, member-consumer participation, and member-consumer care
* Regulatory and legal overview
* Next steps

**Before finalizing the business case, the Project Manager will need to oversee the development of the following documents by various staff for CEO review and approval:**

See Sections **“Business Case Planning Documents”** and “**Other Useful Planning Documents**” for descriptions and templates.

* Value Proposition Document (Marketing Manager)
* Engineering Design and System Configuration Plan (Project Manager)
* Siting Options Document (Project Manager)
* Marketing and Communications Plan (Marketing Manager)
* Information Technology System Integration Plan (IT Manager)
* Risk Mitigation Plan (Staff)
* Recommendation of CSP Model (Business and Finance Manager and staff)

In practice, the Project Manager would likely contribute to all of the above documents in some capacity, providing input on the potential system size, configuration, cost, and output developed in the Engineering Design and System Configuration Plan. It should be noted that the Siting Options Document is purely in the Project Manager’s track. Experience has shown that siting can be the most disruptive component in launching a program; it is worth extra time and consideration.

In addition to siting options, the Project Manager should work with the CEO on the development of the staffing scope of work. Experiences from cooperatives have shown that the Project Manager’s duties alone will be a full-time effort for at least a year for a cooperative’s first project. This is especially true during the construction, procurement, and commissioning of the PV system, which will require significant oversight by the Project Manager and during which program infrastructure will be established (setting up billing systems, launching marketing campaigns, securing financing). Included in this guide is an overview of the different job functions and the associated “to-do” lists. Still, it would behoove the Project Manager to review all of the modules to gain an understanding of what needs to be done and to take on an active role in the planning/exploration phase to ensure a successful launch. **More information on staffing can be found in the Executive Management Module.**

# Business Case Template

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|  | **Assignment** | | | | | |
| **Step 1. Do Your Research** | **CEO** | **BOD** | **PM** | **IT** | **MKT** | **FIN** |
| **LEG** |

Take the time to scan and understand the PV basics, industry trends, technology, general economics, market opportunities, and other critical factors for successful community solar programs. It is important to understand the demand for renewable options within your proposed program area, including the current market and other external factors that may influence consumer demand. Resource materials, use cases, and guides can be found on the NRECA Business & Technology Strategies site on Cooperative.com.

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| **Step 2. Define the strategic business drivers and rationale** | **CEO** |  | **PM** |  | **MKT** |  |

Describe the potential strategic advantages and related business drivers when considering a community solar program. A program should have a clear rationale aligned with the cooperative’s strategic direction. Possible business drivers may include responding to member-consumer demand by offering competitive renewable energy source options, increasing the cooperative’s bond with its consumers, enhancing economic development, addressing regulatory requirements, gaining experience in renewable technology, and improving public perception of the cooperative.

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| **Step 3. Consider the member-consumer market** |  |  | **PM** |  | **MKT** |  |

Develop the value proposition for consumers. Determine member-consumers’ interests, needs, and motivations for participating in a community solar program. Leverage existing research or initiate targeted market surveys or focus groups. It is important to assess, by member-consumer segments, the potential demand and participation factors for a community solar program offering. Prospective questions to answer include the following:

* What does the existing research indicate about technology choice and consumer trends?
* What are the levels of awareness for solar programs within the co-op’s service territory?
* Who is likely to participate?
* What motivates them to participate?
* How much are they willing to pay?
* What are the service needs and expectations for a solar program?
* What is the competition doing (offerings, cost, sales pitch)?
* What are the market segments to target?
* How can the cooperative differentiate itself from the competition?
* What opposition to the program might arise, and from what entities?

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| **Step 4. Define and map stakeholders** | **CEO** |  | **PM** |  |  |  |

Map the roles, motivations, responsibilities, and degree of involvement of key stakeholders, such as the Board and its role in the program evaluation process; the G&T’s role, guidance, and involvement; and any relevant member-consumer advisory groups with which the cooperative may be engaged. Define the roles of any third parties that may be involved in, or could potentially influence, the CSP. Conducting stakeholder mapping early in the project development process can better position the cooperative to achieve the necessary buy-in for the program.

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| **Step 5. Outline conceptual business model and options** |  |  | **PM** |  | **MKT** | **FIN** |
| **LEG** |

As a starting point to the evaluation, determine the possible program elements and options that would be considered in the evaluation process. These include the following:

|  |  |
| --- | --- |
| **Target Segment** | Residential  Commercial and Industrial (C&I)  Mixed use |
| **Project Scale** | Capacity size of the solar infrastructure |
| **Ownership** | Cooperative-owned (G&T or D-Coop)  Purchase power agreement (PPA) |
| **Electrical Grid** | Substation and Technical Issues |
| **Financing** | Non-Taxable Cooperative:   * Conventional loan * NCREBs (New Clean Renewable Energy Bonds) * REAP grants * Tax-equity flip * Taxable subsidiary   Taxable Cooperative:   * Lease buy-out * NCREBs * Consumer ownership * Tax-based flip   Conduct legal review of options |
| **Member-Consumer Program Offering** | * Lease/sell panel model * Subscription model * Energy block sales * Direct energy purchase * Green energy bill credits   Potential cross-subsidy issues – conduct legal review of options |

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| **Step 6. Gather data and relevant technical and financial information** |  |  | **PM** | **IT** |  | **FIN** |
| **LEG** |

Before doing a detailed economic and financial evaluation, gather and confirm the necessary data. These include the following:

* System configuration
  + Energy output projections, based on scale and location
  + Array and module type and size
  + Capacity factor and related dependent variables impacting capacity
  + Inverter ratings
  + Required land size
  + System life
  + Substation, available capacity, and interconnection requirements
  + Power flow, system protections, voltage regulation, intermittency, harmonics, and islanding
* Capital infrastructure investment
  + Engineering design, hardware, site preparation, construction, installation, and interconnections
  + Land cost
  + Interest during construction
* Operating and maintenance costs
  + Costs for managing, maintaining, and operating the system
  + Member-consumer support and care
  + Replacement and repair
* Marketing costs
  + Time, resources, and materials
  + Software costs
  + Consumer receptivity
* Software costs
  + To support marketing (CIS/CMS systems)
  + To support program administration (billing and record keeping)
  + Costs to integrate and maintain project IT needs into cooperative systems
* Internal costs to outsource discrete work activities
* Possible incentives, including investment tax credits (state and federal), accelerated depreciation, property tax exemptions, renewable energy credits (RECs) (if available), grants and rebates, etc. Have legal counsel review incentive opportunities.
* Information on financing alternatives and PPA scenarios

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| **Step 7. Complete an economic and financial evaluation** |  |  | **PM** |  |  | **FIN** |

Outline the related business assumptions, including land availability, capital expenditures (CAPEX) and operating expenditures (OPEX), wholesale power cost, operating management staffing costs, regulatory environment, required internal capital rate of return, escalation rates, etc.

* Ensure involvement of the right personnel to guide, participate, and validate the various analyses.
* Model and analyze the financials and economics. Possible analyses include the following:
  + Perform an initial financial screening to assess and compare the composite unit cost per generation for various financing options (reference: SUNDA Solar Costing Financial Screening Tool, PV Solar, etc.)
  + Perform an economic analysis (pro forma) over the project life to determine net present value, internal rate of return, and payback years
  + Integrate the financial forecast with community solar financials to determine the impacts on key financial ratios
* Model various “what if” case scenarios to assess how key cost drivers and options impact economics. Example use-case scenarios include the following:
  + Economics of the varying scale options for the project
  + Changes in equipment price and related revenue requirements
  + Model of financial impact of varying levels of subscriptions, including a low-level subscription scenario and identifying a break-even subscription point (optimize for both co-op and consumer)
  + Impacts of renewable credits recovery
  + Sensitivity to land costs
* Summarize the key conclusions from the analysis:
  + What are the financial options and factors that optimize financial results for the cooperative?
  + What are the non-economic benefits such a political goodwill, member-consumer engagement, and others?
  + What are the optimum technology and economy-of-scale options?

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| **Step 8. Assess the related risks and outline mitigation strategies** | **CEO** |  | **PM** | **IT** | **MKT** | **FIN** |
| **LEG** |

Analyze the key risk factors and outline possible strategies or attention areas. Assess both the likelihood and impacts. Outline those approaches that minimize or address the most important risk areas.

Examples:

|  |  |
| --- | --- |
| **Possible Risk Area** | **Mitigation** |
| Risk of doing nothing | * Comprehensive scan of the market, competitive environment, trends, and drivers for community solar, and evaluation of appropriate responses to meet member-consumer demand, if needed |
| Financial risk | * Careful modeling and analysis of the financial options and drivers that will impact financial results |
| Lack of participation or underperforming subscriptions | * Clearly describe the overall value proposition * Ensure a comprehensive marketing and communications plan * Model worst-case scenarios * Make adjustments in project scale |
| Solar system underperformance | * Strong vetting process of the selected solar infrastructure design, technology selection, and installation team * Performance guarantees from vendors |
| Land availability and acquisition costs | * Negotiate land acquisition options * Understand advantages/disadvantages of property siting options * Clearly understand siting zoning regulations |
| Environmental, permitting, siting, and decommissioning risks | * Anticipate and consider all related elements, including federal, state, and local requirements; environmental impacts; decommissioning, etc. * Design system to minimize decommissioning costs |
| Cyber security and software interoperability risks | * Identify data that require confidential management * DOE cyber security procurement language * Cyber security risk insurance * MultiSpeak compatibility * Software documentation * Vendor selection, with IT criteria |
| Hidden costs | * Research and learn from other installed systems * Anticipate sources of hidden costs * Ensure comprehensive review of internal resource impacts * Engage subject matter experts to assess the cost elements |
| Project delays | * Establish clear project roles * Ensure comprehensive project and schedule with effective project management controls * Incorporate contingency into schedule |
| Legal and regulatory risks | * Seek legal counsel or CPA firm (as appropriate) with expertise on enabling statutes, bylaws, applicable Federal and state environmental, renewable, zoning and land-use regulations, tax law, SEC regulations, existing funding requirements of entities such as RUS, and utility regulations * Collaborate or contract with third parties that have expertise While third-party expertise can be valuable, it is not a substitute for legal counsel. |
| Staffing risk | * Ensure that assigned Project Manager and other key staff have the right skills, capabilities, and bandwidth * Cost-benefit analysis of insourcing vs. outsourcing various duties |
| Political risk | * Coordinate with political and legal counsel * Contact political stakeholders for insights |

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| **Step 9. Confirm the program objective, value proposition, goals, and success factors** | **CEO** |  | **PM** |  | **MKT** | **FIN** |

Describe the overall purpose (why do this?) and value proposition (a clear and concise statement outlining the value contribution to the member-consumership) of the proposed program.

* Define 2‒4 measured goals for the program. Examples include the following areas:
  + Member-consumer participation
  + Energy output
  + Economic impact on cooperative and consumers
  + Consumer satisfaction with the program offering
  + Mitigating the potential of future regulatory or political risks

Outline the related success factors – what are the elements that will demonstrate success for the program?

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| **Step 10. Define member-consumer participation and communications strategy and plan** |  |  | **PM** |  | **MKT** |  |
| **LEG** |

Considering the program goals, outline various approaches to market and communicate the solar program. Possible areas include the following:

* Formulate a messaging approach consistent with the overall value proposition statement
* Decide on the name and develop a branding plan for the offering
* Assess the target member-consumer segments
* Distill a clear communication brief on how member-consumers can participate
* Outline various communication channels to reach consumers
* Draft a formal plan and schedule
* Have marketing messaging reviewed by legal counsel

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| **Step 11. Finalize and describe the details of community solar program elements** | **CEO** |  | **PM** |  |  |  |

Building on the research, evaluation, and analysis, refine and describe the details of the proposed community solar program. An outline of the community solar program elements may include the following:

* Strategic rationale
* Program goals, overall value proposition, and success factors
* Proposed scope, scale, and technology infrastructure
* Proposed software strategy
* Proposed financing strategy
* Proposed marketing strategy
* Consumer value proposition, pricing, member-consumer participation and member-consumer care
* Estimated project size
* Regulatory and legal overview undertaken in conjunction with each of the elements listed above.
* Next steps

# Business Case Planning Documents

The overall goal of the Project Manager is to coordinate with the CEO, Marketing Manager, Business and Finance Manager, and IT Manager in the planning phase to develop and deliver to the CEO the following 7 documents:

1. Value Proposition Document (Marketing Manager)
2. Engineering Design and System Configuration Plan (Project Manager)
3. Siting Options Document (Project Manager)
4. Recommendation of Community Solar Business and Financing Model (Business and Finance Manager and staff)
5. Marketing and Communications Plan (Marketing Manager)
6. Information Technology System Integration Plan (IT Manager)
7. Risk Mitigation Plan (Staff)

The information contained within these documents will enable the CEO to decide on the best course of action and develop the business case for Board approval. The individual planning documents will provide a roadmap for the successful implementation of the program.

**Note on Cost Savings and Environmental Benefit Claims:**

**Cost Savings:** FTC green guide requires that marketers qualify these types of claims to prevent deception about the nature of the environmental benefit being asserted.

**Environmental Benefits:** It can be claimed that community solar allows consumers to participate in the production of renewable energy and it may or may not involve the consumption of renewable energy. Any cooperative pursuing community solar should retain and use legal counsel. In addition to legal counsel, cooperatives may work with a community solar vendor that has REC knowledge to develop marketing guidelines and/or review claims about renewable attributes.

All environmental and cost saving representations should be reviewed and approved by legal counsel.

### Value Proposition Document

The Marketing Manager will craft the Value Proposition Document, which will clearly state why a consumer should be interested in the CSP. The value proposition needs to be clearly understood by everyone who will interface with member-consumers and the public. Cooperatives should establish clear internal guidelines for all communications regarding the solar initiative at an early stage.

**The four main takeaways of the Value Proposition Document should be the following:**

1. There will be no solar panels on your roof
2. You may save money on your electric bill (assuming this is appropriate under FTC Green Guidelines)
3. It is good for the environment
4. It is easy; there is no maintenance

The list above is drawn from years of experience and direct feedback on what works. The items on the following list have proven to hinder the execution and success of a CSP.

**Things to Avoid:**

1. Being overly optimistic regarding subscriber interest

It is important to create realistic expectations, both internally and with the public. Unrealistic expectations can lead to embarrassment for the co-op, or worse.

1. Cost discussion

Any discussion of cost and savings must be within the context of the real effect on the member-consumer’s monthly electric bill. Savings, even minor ones, will generate a positive effect on the program. Unrealized promises of savings will generate a negative effect.

1. Overemphasis on environmental benefits  
   Those consumers seeking environmental benefits as a priority will continue to do so, regardless of a marketing effort. Those lacking that priority will still feel good about making an environmentally sound decision based on savings.

### Engineering Design and System Configuration plan

The Project Manager will develop and maintain the Engineering Design and System Configuration Plan. It requires decisions on the system design and size, the use of external experts, equipment procurement considerations, and the documentation required for project implementation. The Project Manager’s PV Quick Start Guide ([http://www.nreca.coop/wp-content/uploads/2016/02/Project-Managers-PV-Quick-Start-Guide.pdf](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-green.pdf)) is a great resource to help plan and design a PV system. Below is a summary of what needs to be included in the plan.

**The Engineering Design and System Configuration Plan should include the following elements:**

1. **PV System Size**

The system size is based on the available site size and funding but can be constrained by the load on the feeder/substation. As a rule of thumb, the system size should not be larger than the minimum daytime load on a feeder/substation.

1. **System Location**

When identifying site options, co-ops should consider such factors as the solar resource, access (roads and driveways), proximity to a feeder, substation loads, community visibility, and structural loads.

1. **Orientation**

In the Northern Hemisphere, south-facing panels are generally ideal; however, this situation can change somewhat, depending on geographic location, site conditions, etc.

1. **Array Tilt**

The rule of thumb is to set the angle of the array at roughly the degree of latitude for the location, though this can be affected by local site conditions as well as staff capacity (adjusting the array angle in the spring as well as the fall can increase productivity), or whether the co-op plans to purchase tracking racks and software.

1. **Array Heights**

Heights are largely determined by local needs and/or conditions as well as the type of mounting structure in which the co-op plans to invest. For instance, if the site has low trees or shrubs that might shade the panels, or there is a need for reasonable clearance for a small tractor or other vehicle, panels should be mounted higher than at a site where those factors are not a concern.

1. **Azimuth Angle**
2. **PV System Components**
3. Photovoltaic module sources
4. Made in the U.S.
5. Tier 1 Chinese
6. Imported non-Chinese
7. Typical Mounting Structures
8. “Driven pier”
9. Screw anchor
10. Self-ballasted racking
11. Racking Types
12. Fixed
13. Tracking (single or dual axis)
14. DC-AC inverter(s)
15. Central
16. String
17. Wiring, Combiner Boxes, and Other Balance-of-System Equipment
18. Interconnection Transformer and Switchgear
19. Monitoring Systems
20. **Inverters:** Record both the DC inputs (sub-array voltage, current, and power) and AC output (voltage, current, power, frequency, and power factor), and report them either to a web browser or the cooperative’s SCADA system. Inverters also record and display numerous error codes for fault conditions associated with problems in both the DC and AC circuits.
21. **Revenue-Grade Meters:** Provide a single calibrated measurement of the system output (voltage, current, power, frequency, and power factor), which can be compared with the information provided by the individual inverters.
22. **Meteorological Data Acquisition System (DAS)**: This system measures solar irradiance, ambient and PV module temperature, and wind speed. The information can be used to calculate the expected performance of the array, which can be compared with actual system output.
23. **Expected Output**
24. **DC-AC Ratio**
25. **Load-Flow Impact Study**
26. **Division of Labor**
27. Turnkey: Use an EPC firm, which is responsible for delivering a complete facility
28. Multiple Prime (piecemeal): Use one or more companies to handle various project activities (e.g., site work, engineering, installation) while performing other activities (e.g., procurement, O&M) in house
29. In house: Use in-house resources for all aspects of project deployment while using external firms for specialized functions, such as system engineering or land surveying

### SUNDA Reference Designs

The SUNDA 1-MW reference design includes a drawing sheet list, six site plans (layouts, trenching, and grounding), single-line diagrams, schedules, labels, partial plans for the inverter pad, conduit details, and stringing plans for arrays. The 1-MW design can be accessed at [http://www.nreca.coop/wp-](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-kit-carson.pdf)[content/uploads/2015/09/nreca\_sunda\_standard\_design\_1000kw\_1000v\_20150818.pdf](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-great-river.pdf).

**The SUNDA design incorporates several criteria and attributes, including the following:**

• 1.39 DC/AC ratio, to optimize cost-effective energy production

• Maximum ground coverage ratio, expandable symmetric block

• Fixed, non-tracking design for cost-effective construction and low O&M costs

• Optimized combiner box locations to reduce DC conductors

• Centrally located equipment pad to help reduce DC wiring cost

• Use of medium-voltage switch as site AC disconnect, reducing pad footprint

• Modular racking with integrated wire management and accessible height for rapid, simplified installation

• Electrical equipment pad designed to provide easy service access, minimize use of concrete, and optimize feeder stub-ups

This work, authored by the National Rural Electric Cooperative Association, was funded in whole or in part by the Department of Energy under U.S. Government contract DE-EE-0006333.

### Siting Options Document

The Project Manager will be responsible for creating the Siting Options Document. Experience has shown that siting can be the most disruptive component in launching a program; it is worth extra time and consideration.

A 1-MW AC PV system typically requires 6 to 10 acres, depending on such factors as parcel shape, latitude, slope, and shading. When identifying site options, co-ops should consider such factors as the solar resource, access (roads and driveways), proximity to a feeder, substation loads, community visibility, and structural loads.

**The Siting Options Document is a list of suitable sites. For each suitable site it should do the following:**

* Identify ownership of land options
* Identify current land use
* Address authority having jurisdiction (AHJ) land use restrictions and permitting requirements
* Assess solar resource (primarily shading issues)
* Identify topographic characteristics
* Assess grid connection costs and substation load and interconnection capability
* Determine availability of water supply if panel cleaning will be needed
* Assess potential access routes to site and local infrastructure needed for construction
* Complete geotechnical survey to determine load-bearing properties of the soil and pull-out parameters for driven-pier structures

**The document should, if possible, address the following:**

* Does the site require major work – e.g., removal of buildings, trees?
* Is the site in a special taxation or zoning category that limits development?
* Is the land unincorporated?
* Is the land prime agricultural land?
* Are the project boundaries well defined?
* Will residents in the area be supportive or antagonistic to the project?
* Is a wall or living screen – trees, brush – around the system required by the AHJ?
* Are there any post-installation landscaping or aesthetic requirements?

### Recommendation of Community Solar Business and Financing Model

The primary planning role of the Business and Finance Manager is to assess potential business model options for a CSP to provide an economic evaluation for inclusion in the business case. The Business and Finance Manager also will need to develop and compare conceptual business models, and provide staff with relevant financial data to support their contributions.

**Business and Financing Model Recommendations should include the following:**

|  |  |
| --- | --- |
| **Target Segment** | * Residential * C&I * Mixed use |
| **Project Scale** | * Capacity size of the solar infrastructure |
| **Ownership/Organization** | * Cooperative-owned (D-Co-op or G&T) * Purchase power agreement (PPA) |
| **Financing** | * Non-taxable entity:   + Conventional loan   + NCREBs   + Tax-equity flip * Taxable entity:   + Lease buy-out   + Taxable subsidiary |
| **Member-Consumer Program Offering** | * Lease/sell panel model * Subscription model * Energy block sales * Direct energy purchase * Green energy bill credits * Renewable Energy Credits (RECs) |

The recommendation is the result of the financial and economic evaluation performed by the Business and Finance Manager.

#### Economic and Financial Evaluation

**This evaluation should include the following:**

* An outline of the related business assumptions, including land availability, wholesale power cost, operating management, regulatory environment, internal capital rate of return, escalation rate, etc.
* Analysis of financials and economics, including the following examples:
  + Initial financial screening to assess and compare the composite cost per unit of generation (i.e., $/MWH) for various financing options (reference: SUNDA Solar Costing Financial Screening Tool)
  + An economic analysis over the project life to determine net present value, internal rate of return, and payback years
  + A financial forecast integrated with community solar financials to determine the impacts to key financial ratios and financial statements
* Case scenarios to assess how key cost drivers and options impact economics. Example case scenarios include the following:
  + Sensitivity analysis on the economics with the varying scale of the project
  + Variability in net capacity factor ‒ seasonally, annually, and with project age
  + Projected seasonal and on/off-peak market value of solar energy
  + Changes in equipment prices and related revenue requirements
  + Model financial impact of subscriptions, including a low-level subscription scenario and identification of a break-even subscription point
  + Impacts of renewable credits recovery
  + Variability in land costs
* Summary of the key conclusions from the analysis

#### Key Financial Data

**To conduct an informed economic evaluation and structure a model recommendation, relevant financial data will need to be collected. These data should include the following:**

* Capital infrastructure investment (with Project Manager)
  + Engineering design, hardware, site preparation, construction, installation, and interconnections
  + Land cost
  + CIS/billing interface modifications
* Operating and maintenance costs (with Project Manager)
  + Costs for managing and operating/maintaining the system
  + Member-consumer support and care
* Internal and/or outsourcing resource costs (with CEO)
* Possible incentives, including ITCs (state and federal), accelerated depreciation, property tax exemptions, RECs (if available), grants, and rebates, etc. (with legal counsel)
* Information on financing alternatives and PPA scenarios

**Additional financial information also is needed, including the following:**

* Discount rate
* Cost-of-service study (with legal counsel)
* Financial impact of various participation options; goals/benchmarks
* Program pricing (with marketing), value to member-consumers, ROI
* Utility ROI and hurdle rate
* Break-even subscription point, sustainable level of subscriptions, impact of canceled subscriptions
* Plans for changing rates in the future if co-op installs another project (how do you—or should you—compensate the first round of consumers should prices decrease?)
* Financial viability of qualifying vendors or EPCs
* Requirements for record keeping and billing (with IT Manager)
* Cost of required software (with IT Manager)
* Sales onboarding process (with IT and Marketing Managers)

The data should enable an economic and financial evaluation that identifies key financial options and factors that optimize the economics for the cooperative and participants.

### Marketing and Communications Plan

The Marketing Manager will develop a Marketing and Communications Plan for inclusion in the business case.

**This document should include the following:**

* Member-consumer value proposition
* Name or brand of the offering
* Communications strategy:
  + Messaging approach consistent with the overall value proposition statement
  + Assessment of the target member-consumer segment
  + Suggested consumer management tools, “self-serve” automation, and data collection service (with IT Manager)
  + Consumer service and sales training program
* Advertising plan/timeline
* Sales Onboarding Document
* Marketing budget
* Personnel time/material requirements

### Market Analysis and Segmentation

In developing a Marketing and Communications Plan, it is important that the Marketing Manager oversee the market analysis and segmentation for community solar among the member-consumership. The goal is to determine consumers’ interests, needs, and motivations for participating in a CSP. This can be done by leveraging existing research or initiating targeted market surveys or focus groups. Additionally, becoming informed about third-party sales pitches may help the Marketing Manager better understand the market. It is also important to assess by member-consumer segments the potential demand and participation factors for the CSP offering.

**Prospective questions to answer include the following:**

* What does the existing research say about technology choice and consumer trends?
* What are the levels of awareness for solar programs within the co-op’s service territory?
* Who is likely to participate?
* What motivates them to participate?
* How much are they willing to pay?
* What are the service needs and expectations for a solar program?
* What is the competition doing (offerings, cost, sales pitch)?
* What, if any, negative perceptions regarding the cooperative need to be addressed?

### Information Technology System Integration Plan

The primary role of the IT Manager in developing the business case is to provide an IT System Integration Plan that includes an assessment of software products to support marketing and administrative efforts such as CIS/billing modification requirements and options, consumer management tools, “self-serve” automation, and data collection service.

**The IT integration plan includes the following:**

* Recommended software approach
* Business case for automated billing, consumer acquisition, and consumer management
* Cyber security analysis of software options that includes a description of the security risks/benefits associated with each option
* Interoperability analysis
* Budget and staffing requirements

**Before an IT plan can be recommended, three preliminary documents will need to be developed:**

1. A Sales Onboarding Document outlining the application and enrollment process (with the Marketing and Business Managers) (See section below, Sales Onboarding Document)
2. Requirements for program record keeping (with the Business Manager and legal counsel)
3. An IT System Options Assessment

### IT System Options Assessment

This document includes the following:

|  |  |
| --- | --- |
| Scope of Work/Problem Statement | * 1. Problem Statement   2. Assessment Objectives   3. Core Process Options (Examples)      1. Recording System Production      2. PV System Monitoring      3. Automated Billing and Other Record Keeping      4. Sales and Marketing Automation/Support      5. Member-Consumer Acquisition Support      6. Online Web Portal/Interface |
| Stakeholders | 1. Key staff involved in procurement process    1. IT Manager    2. Project Manager    3. Marketing Manager    4. Business and Finance Manager |
| Assessment Scope | 1. Business vision 2. Timing and scope |
| Inventory of Systems Evaluated | 1. RFI results |
| Suggested Software Approach(es) | Approach(es) 1, 2, 3, etc.:  a. Software and hardware requirements  b. Benefits  c. Estimated cost and resource requirements  d. Overview of software customization requirements  e. Process semantics   * 1. Data inputs   2. Data output   f. Software testing requirements  g. Timeline |
| Cyber Security Risks/Mitigation | Identify the key cyber security risks:   1. Personally Identifiable Information (PII), such as name, date of birth, social security number, medical information, etc. 2. Payment and billing information, such as credit card data, banking account data, and PCI solution 3. Consumer usage data 4. Sensitive business data 5. Third-party data acquisition/controls/protection |
| Alternatives | Core process, costs, benefits, and risk profile |
| Financial Analysis | 1. Summary and methodology 2. Current or (estimated) operating costs 3. Future investment options 4. ROI |
| Recommendations | Include next steps and action items |

### Risk Mitigation Plan

The creation of this document will be a team effort; the depth and format will be determined by the CEO. The goal is to analyze the key risk factors and outline possible strategies or attention areas. Below are examples of some risk and mitigation factors that the co-op should consider.

|  |  |
| --- | --- |
| **Possible Risk Area** | **Mitigation** |
| Risk of doing nothing | * Comprehensive scan of the competitive environment, trends, and drivers for community solar |
| Financial risk | * Careful modeling and analysis of the financial options and drivers that will impact financial results |
| Lack of participation or underperforming subscriptions | * Clearly describe the overall value proposition * Ensure a comprehensive marketing and communications plan * Model worst-case scenarios |
| Solar system underperformance | * Strong vetting process of the selected solar infrastructure design, technology selection, and installation team |
| Increased land availability and acquisition costs | * Understand advantages/disadvantages of property siting options * Clearly understand the siting zoning regulations |
| Environmental, permitting, siting, and decommissioning risks | * Anticipate and consider all related elements, including federal, state, and local requirements; environmental impacts; decommissioning, etc. |
| Cyber security and software interoperability risks | * Identify data that require confidential management * DOE cyber security procurement language * Cyber security risk insurance * MultiSpeak compatibility * Software documentation |
| Hidden costs | * Research and learn from other installed systems * Anticipate sources of hidden costs * Ensure comprehensive review of internal resource impacts * Engage subject matter experts to assess the cost elements |
| Project delays | * Establish clear project roles * Ensure comprehensive project and schedule with effective project management controls |
| Legal and regulatory risks | * Seek legal and tax counsel with expertise on the relevant legal and regulatory requirements, including tax law, enabling statutes and bylaws, SEC regulations, state zoning, land-use, renewable and environmental regulations, utility regulations, and existing requirements under current financial contracts, such as RUS loans * While consulting legal counsel is imperative, cooperatives may decide to get additional information by collaborating or partnering with third parties that have expertise |
| Staffing risk | * Ensure that assigned Project Manager and other key staff have the right skills, capabilities, and bandwidth * Cost-benefit analysis of insourcing vs. outsourcing various duties |
| Political risk | * Coordinate with political counsel and legal counsel | |

## Other Useful Planning Documents

### System Planning Documentation Checklist

Throughout the planning and deployment process, the Project Manager should develop a detailed list of all of the documents needed during the planning, permitting, installation, commissioning, and O&M phases of a PV project.

**These documents include the following:**

* Site survey study
* Site permits
* System design and equipment specifications
* Electrical and mechanical drawings with connections requirements
* SCADA mapping
* Site layout and equipment locations
* Civil plan (including access roads, water retention basins, storm water runoff)
* Environmental compliance plans, if required in the area
* Vegetation management plan
* Installation and commissioning procedures
* Quality assurance (QA)/quality control (QC) plan (responsibilities, documents control, construction process control, inspections and testing for in-process and completed work, recording of quality information)
* O&M procedures
* Site-specific safety procedures
* Contracts for all external contractors, including engineering, procurement, and construction (EPC) and other consultants
* Project schedule

### Sales Onboarding Document

Typically, the sales onboarding process will document the entire consumer acquisition life cycle, from pitching the product to receiving payment. It will ensure an understanding of how the process works, so that when a potential candidate is located by way of in-person communications, newsletters and other media, or online “self-service,” the sales team can close the deal quickly. Automation can play a key role in this process.

The onboarding document should be used to compare the speed and value of automation versus manual processing.

The document should capture the following:

|  |  |
| --- | --- |
|  | How the consumer can communicate interest to the co-op |
| ✓ | The documentation required for subscribing |
| ✓ | Where the documents reside |
| ✓ | How the consumer is charged/how the subscription information is integrated into billing |
| ✓ | How consumers receive information regarding their pro-rated share of community solar benefits |
| ✓ | How consumers can ask questions and change subscriptions |
| ✓ | What information is considered PII, payment information, or consumer usage data that would be sensitive if released to the public, and how confidentiality for that subset of information will be managed |

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### Legal and Regulatory Checklist

A number of legal and regulatory issues must be addressed to ensure that a CSP is compliant with all relevant legal and regulatory requirements, including regulations promulgated by FERC and the SEC, as well as issues associated with REC characterization and net metering. In addition, key program design decisions can impact whether the cooperative is able to take advantage of tax (e.g., ITC) and depreciation benefits (e.g., MACRS). Although this Playbook has identified discrete issues on which knowledgeable vendors may be helpful, such as with establishing REC models, they do not take the place of legal counsel. Cooperatives are urged to consult legal counsel on all of these issues. Relevant legal and regulatory requirements include the following, among others (not an exhaustive list):

* FERC regulations
* G&T affiliation and other contractual agreements between cooperatives
* IRS and tax implications
* SEC oversight
* REC characterization
* Other federal approvals, if applicable
* State approvals, if applicable, such as RPS, environmental requirements, and zoning and land-use requirements
* Local jurisdiction approvals
* Clean power plan, if applicable
* Cost-of-service options and restrictions for the delivery of program benefits to consumers

### Overview of the Planning and Implementation Decisions

### Consolidated Staff Planning Task List

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **CHIEF EXECUTIVE OFFICER** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Set goals for the community solar program** |  |  |  |  |  |  |  |
| 🞎 | **Approve Value Proposition Document** |  |  |  |  |  |  |  |
| 🞎 | **Oversee coordination with G&T, statewide, and other affiliated cooperatives** |  |  |  |  |  |  |  |
| 🞎 | **Develop a Risk Mitigation Document** |  |  |  |  |  |  |  |
| 🞎 | **Develop a staffing plan** |  |  |  |  |  |  |  |
| 🞎 | **Select a community solar business model** |  |  |  |  |  |  |  |
| 🞎 | **Approve Marketing and Communications Plan** |  |  |  |  |  |  |  |
| 🞎 | **Select/approve Information Technology System Integration Plan** |  |  |  |  |  |  |  |
| 🞎 | **Approve financial plan** |  |  |  |  |  |  |  |
| 🞎 | **Ensure compliance with applicable federal and state regulatory requirements** |  |  |  |  |  |  |  |
| 🞎 | **Review siting options** |  |  |  |  |  |  |  |
| 🞎 | **Propose business case to Board** |  |  |  |  |  |  |  |
| 🞎 | **Develop PV and community solar policies for Board approval** |  |  |  |  |  |  |  |

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| **LEGAL, TAX, & REGULATORY** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Advise regarding applicable legal and regulatory requirements and issues** |  |  |  |  |  |  |  |
| 🞎 | **Review available incentive options and identify those most applicable to your project** |  |  |  |  |  |  |  |
| 🞎 | **Review and assist in the development of the Risk Mitigation Plan** |  |  |  |  |  |  |  |
| 🞎 | **As appropriate, review data and record-keeping requirements** |  |  |  |  |  |  |  |
| 🞎 | **As appropriate, review cost-of-service options and restrictions** |  |  |  |  |  |  |  |
| 🞎 | **Review marketing materials** |  |  |  |  |  |  |  |

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| **BOARD OF DIRECTORS** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Educate themselves on the elements of a solar policy and the key decision factors** |  |  |  |  |  |  |  |
| 🞎 | **Review business case and value statement developed by staff; ensure alignment with cooperative strategic goals** |  |  |  |  |  |  |  |
| 🞎 | **Consider adopting community solar policy** |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **MARKETING & MEMBER-CONSUMER SERVICES** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Conduct market research and demand analysis** |  |  |  |  |  |  |  |
| 🞎 | **Develop communications planning timeline** |  |  |  |  |  |  |  |
| 🞎 | **Develop the Value Proposition Document** |  |  |  |  |  |  |  |
| 🞎 | **Create the Sales Onboarding Document, including establishing the application process and enrollment options** |  |  |  |  |  |  |  |
| 🞎 | **Assess the value of online consumer management tools** |  |  |  |  |  |  |  |
| 🞎 | **Develop a detailed Marketing and Communications Plan for CEO approval that includes:**   * **Member-consumer value proposition** * **Market analysis** * **Communications strategy** * **Advertising plan/timeline** * **Personnel time/material requirements** * **Consumer service and sales training program** * **Consumer “self-serve” automation and data collection service** * **Marketing budget** |  |  |  |  |  |  |  |
| 🞎 | **Develop marketing collateral – Ads, online tools, pitch book** |  |  |  |  |  |  |  |
| 🞎 | **Ensure that marketing materials are reviewed by legal counsel** |  |  |  |  |  |  |  |
| 🞎 | **Oversee staff training, including consumer service call center** |  |  |  |  |  |  |  |
| 🞎 | **Execute marketing campaign** |  |  |  |  |  |  |  |
| 🞎 | **Monitor and evaluate effectiveness** |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **INFORMATION TECHNOLOGY** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Determine process of recording production of array and information allocation to bills** |  |  |  |  |  |  |  |
| 🞎 | **Develop requirements for billing and record keeping** |  |  |  |  |  |  |  |
| 🞎 | **Assess the value of online consumer management tools and automated billing** |  |  |  |  |  |  |  |
| 🞎 | **Create the Sales Onboarding Document, application process, enrollment options, data requirements, and record-keeping requirements** |  |  |  |  |  |  |  |
| 🞎 | **Perform a cyber security impact assessment** |  |  |  |  |  |  |  |
| 🞎 | **Perform a software integration/interoperability analysis** |  |  |  |  |  |  |  |
| 🞎 | **Develop an IT system option assessment and suggested integration plan that includes budget and staffing requirements** |  |  |  |  |  |  |  |
| 🞎 | **Oversee software integration and testing** |  |  |  |  |  |  |  |

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| **FINANCE, ACCOUNTING, & BILLING** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Consider available incentive options and identify those most applicable to your project** |  |  |  |  |  |  |  |
| 🞎 | **Determine process of recording production of array and information allocation to bills** |  |  |  |  |  |  |  |
| 🞎 | **Develop requirements for billing and record keeping** |  |  |  |  |  |  |  |
| 🞎 | **Identify the value of online consumer management tools and automated billing** |  |  |  |  |  |  |  |
| 🞎 | **Develop a Risk Mitigation Plan, including financial impact scenarios** |  |  |  |  |  |  |  |
| 🞎 | **Create the Sales Onboarding Document, application process, enrollment options, data requirements, and record-keeping requirements** |  |  |  |  |  |  |  |
| 🞎 | **Provide financial analysis for IT system assessment and a suggested integration plan** |  |  |  |  |  |  |  |
| 🞎 | **Develop a Community Solar Financial Planning Document that includes the following:**   * **Cost-of-service study (with legal counsel or other consultants) and discount rate** * **Financial impact assessment of ownership models** * **Applicability of ITCs, MACRS, or renewable energy grants** * **Financial impact of consumer participation options** * **Determination of utility return on investment (ROI)** * **Plan for future rate changes in the event of additional installations** * **Determination if the contact contains a lease** |  |  |  |  |  |  |  |
| 🞎 | **Develop Community Solar Business Model to assess the following:**   * **Build or buy** * **Organizational choice** * **Ownership choice** * **Financing choice** * **Participation choice, including pricing options** * **Administrative requirements (accounting and billing) that include staffing requirements and technology needs** |  |  |  |  |  |  |  |
| 🞎 | **Develop Recommendation of Community Solar Business and Financial Model** |  |  |  |  |  |  |  |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Project Management Planning** | | **CEO** | **LEG** | **BOD** | **MKT** | **IT** | **FIN** | **PM** |
| 🞎 | **Develop Engineering Design and System Configuration Plan** |  |  |  |  |  |  |  |
| 🞎 | **Develop the Siting Options Document** |  |  |  |  |  |  |  |
| 🞎 | **Ensure the following planning documents have been submitted to CEO for review/approval:** |  |  |  |  |  |  |  |
|  | 🞎 **Value Proposition Document** |  |  |  |  |  |  |  |
|  | 🞎 **Engineering Design and System Configuration Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Siting Options Document** |  |  |  |  |  |  |  |
|  | 🞎 **Recommendation of Community Solar Business and Financial Model** |  |  |  |  |  |  |  |
|  | 🞎 **Marketing and Communications Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Information Technology System Integration Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Financial Plan** |  |  |  |  |  |  |  |
|  | 🞎 **Risk Mitigation Plan** |  |  |  |  |  |  |  |
| 🞎 | **Consolidate and produce community solar business case that includes the following:**   * **Strategic rationale** * **Program goals, overall value proposition, and success factors** * **Proposed scope, scale, and technology infrastructure** * **Proposed software strategy** * **Proposed financing strategy** * **Proposed marketing strategy** * **Consumer value proposition, pricing, participation, and care** * **Regulatory and legal overview** * **Next steps** |  |  |  |  |  |  |  |

Module 5 Section 2: PV System Engineering, Commissioning, and Operations

## About this Guide

**Section 1** focuses on the planning for a CSP. **Section 2,** based on the SUNDA Project Manager’s PV Quick Start Guide, focuses on the Project Manager’s role in designing and deploying a 1-MW (AC) PV system. This document provides only a high-level view, mainly in the form of checklists enabling the cooperative Project Manager to oversee and monitor the key steps in system deployment.

For more information, please refer to the Project Manager’s PV Quick Start Guide, as well as Volumes II and III of NRECA's Cooperative Utility PV Manual, at [www.nreca.coop/solar](mailto:Henry.Cano@nreca.coop).

**This PV System Engineering, Commissioning, and Operations Module is one of 5 modules developed by NRECA, collectively forming the Community Solar Playbook. Each module is focused on the actions required from a particular division of a cooperative utility to establish a CSP**, **including the following**:

1. Executive Management
   * Board of Directors Guide
2. Marketing, Member-Consumer Services, and Communications
3. Information Technology to Support Marketing and Program Administration
4. Business, Finance, and Program Administration
5. Section 1: Project Management and Planning

**Section 2: PV System Engineering, Commissioning, and Operations (this document)**

## Implementation Checklists

**Included are the following checklists:**

1. Site Selection
2. Permitting
3. System Design and Procurement
4. Site Preparation and Installation
5. Commissioning

The checklists include common tasks intended to help readers gain a better understanding of the solar deployment process, but the checklists should not be considered exhaustive. For more information and context around the various tasks within these checklists, please review the Project Manager’s PV Quick Start Guide as well as the SUNDA technical volumes. These documents can all be found at [www.nreca.coop/SUNDA](http://www.nreca.coop/SUNDA). (Not an exhaustive list; Project Managers should adapt as needed.)

|  |  |
| --- | --- |
|  | Tasks: Site Selection |
| 🞎 | Identify suitable sites |
| 🞎 | Determine land ownership |
| 🞎 | Identify current land use |
| 🞎 | Ask relevant administration having jurisdiction (AHJ) about land use restrictions and permitting requirements |
| 🞎 | Assess solar resource (primarily shading issues) |
| 🞎 | Identify topographic characteristics, including load-bearing properties of soil |
| 🞎 | Assess grid connection and substation load |
| 🞎 | Determine availability of water supply |
|  | Tasks: Permitting |
| 🞎 | Survey of land: elevation, grade, ground water management |
| 🞎 | Fire code compliance |
| 🞎 | Compliance with zoning, land use regulations |
| 🞎 | Geotechnical study |
| 🞎 | Soil studies (disturbance, sedimentation, erosion control) |
| 🞎 | Environmental studies (wetlands, endangered and threatened species) |
| 🞎 | Archaeological study |
| 🞎 | Tree shading and vegetation control |
| 🞎 | Conditional use permit |
| 🞎 | FAA ocular impact study |
|  | Tasks: System Design and Procurement |
| 🞎 | Review decision on division of labor, make any needed changes |
| 🞎 | Identify output goal: maximum power or peak matching |
| 🞎 | Select array tilt angle based on PV system latitude, orientation, and shading conditions |
| 🞎 | Select orientation based on production goal |
| 🞎 | Determine azimuth angle optimal for site |
| 🞎 | Determine height of array to minimize vegetation and other obstructions |
| 🞎 | Evaluate extent of shading using commercially available tools |
| 🞎 | Identify options for eliminating obstructions or offset arrays |
| 🞎 | Assess impact of mounting system on array operating temperatures |
| 🞎 | Identify options for maximizing air flow around arrays |
| 🞎 | Determine AC-DC ratio |
| 🞎 | Estimate energy production of PV system using a tool |
| 🞎 | Conduct costing and economic analyses |
| 🞎 | Consider the impact of clouding and seasonal variations on annual variability in PV output |
| 🞎 | Examine impact of permitting process on design |
| 🞎 | Review the PV system design during and after permitting |
| 🞎 | Select/procure equipment |
| 🞎 | Evaluate module suppliers |
| 🞎 | Coordinate equipment delivery and confirm that equipment meets contract specification upon delivery or shortly thereafter |
| 🞎 | Source balance-of-system equipment |
| 🞎 | Oversee site design modifications |
|  | Tasks: Site Preparation/Installation |
| 🞎 | Level/grade the land |
| 🞎 | Improve access roads (if necessary) |
| 🞎 | Improve drainage (if necessary) |
| 🞎 | Trim vegetation (as needed) |
| 🞎 | Install perimeter fencing |
| 🞎 | Install site surveillance/security system |
| 🞎 | Install support foundation |
| 🞎 | Install racking structures |
| 🞎 | Install conduits for wiring from combiner boxes to inverter DC switchgear |
| 🞎 | Prepare inverter pad |
| 🞎 | Install grounding system for metal structure and inverter pad |
| 🞎 | Install modules on racking |
| 🞎 | Install combiner boxes on racking structures |
| 🞎 | Install weather/monitoring station to verify proper operation of system |
| 🞎 | Install inverter(s), lightning protection/surge arrestors, and associated DC and AC switchgear |
| 🞎 | Wire modules into series strings and connect to combiner boxes |
| 🞎 | Run DC wires from combiner boxes to inverter DC switchgear |
| 🞎 | Run DC wires from DC switchgear to inverter |
| 🞎 | Connect inverter(s) to interconnection transformer and associated switchgear |
| 🞎 | Connect structure and combiner boxes to grounding |
| 🞎 | Connect inverter and associated equipment to grounding system and protection equipment |
| 🞎 | Install metering cabinet and associated telecommunications |
| 🞎 | Connect monitoring system to co-op’s SCADA system |
| 🞎 | Connect system to electric grid |
|  | Tasks: Commissioning |
| 🞎 | Complete final installation details |
| 🞎 | Complete visual inspections |
| 🞎 | Verify compliance with NEC requirements |
| 🞎 | Conduct electrical verification tests |
| 🞎 | Verify system functionality, including start-up, operations, shut-down, and emergency procedures |
| 🞎 | Verify that system power output and energy production meet performance expectations |
| 🞎 | Complete system documentation, including changes for as-built drawings |
| 🞎 | Conduct user orientation and training on system operation and safety |
| 🞎 | Conduct hazard assessment and safety training |
| 🞎 | Verify through thermal imaging that all cabinet connections are appropriately tightened |
| 🞎 | Conduct final inspection |
| 🞎 | Installation contractors completes final checkout |
| 🞎 | AHJ completes final inspection |
| 🞎 | Perform operations and maintenance (O&M) tasks |
| 🞎 | Verify output and performance |
| 🞎 | Confirm system availability and performance on a regular basis |
| 🞎 | Match to predicted performance |
| 🞎 | Institute project-specific maintenance plan, schedules, and responsibilities |
| 🞎 | Inspect components and wiring systems |
| 🞎 | Clean modules |
| 🞎 | Conduct electrical tests, performance verification |
| 🞎 | Conduct visual inspections |
| 🞎 | Perform thermal imaging |
| 🞎 | Inspect for water infiltration |
| 🞎 | Inspect for site erosion |
| 🞎 | Perform calibrations |
| 🞎 | Make repairs |
| 🞎 | Conduct hazard assessment, safety training |
| 🞎 | Create schedule of routine or preventative maintenance, including vegetation management |
| 🞎 | Perform unscheduled maintenance |
| 🞎 | Replace failed component(s) |
| 🞎 | Respond to emergencies or natural disasters |
| 🞎 | Respond to security breaches |

# Site Selection, Acquisition, and Permitting

A 1-MW AC PV system typically requires 6 to 10 acres, depending on such factors as parcel shape, latitude, slope, and shading. When identifying site options, co-ops should consider such factors as the solar resource, access (roads and driveways), proximity to a feeder, substation loads, community visibility, and structural loads.

**Steps in the site selection process include the following:**

* Identify suitable sites
* Determine ownership of land
* Identify current land use
* Ask the AHJ about land use restrictions and permitting requirements
* Assess solar resource (primarily shading issues)
* Identify topographic characteristics, including load-bearing properties of soil
* Assess grid connection and substation load
* Determine availability of water supply if cleaning will be needed
* Assess potential access routes to site
* Complete geotechnical survey to determine load-bearing properties of the soil and pull-out parameters for driven-pier structures

**In selecting a site, a co-op should consider several issues, such as the following:**

* Does the site require major work – e.g., removal of buildings, trees?
* Is the site in a special taxation category that limits development?
* Is the land unincorporated?
* Are the project boundaries well defined?
* Is a wall or living screen – trees, brush – around the system required?
* Will residents in the area be supportive or antagonistic to the project?
* Are there any post-installation landscaping or aesthetic requirements?

A co-op may be well advised to employ a land broker or other expert to help assess the site options and select a site. For details, see NRECA’s white paper, Solar Project Land Acquisition and Permitting: A Case Study of Four Cooperatives Participating in the Solar Utility Network Deployment Acceleration Project, available at: [http://www.nreca.coop/wpcontent/uploads/2014/09/sunda\_whitepaper\_on\_land\_permitting\_and\_acquisition\_\_7\_5\_15.pdf](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-tri-county.pdf).

### Site Acquisition

The site selected must be acquired and then permitted through the AHJ. It can be helpful to meet with the relevant AHJ to identify the supporting documentation required when the co-op submits a permitting application. An AHJ is defined in Section 100 of the National Electric Code (NEC) as “An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.”

### Site Acquisition/Permitting Schedule

If a co-op does not own the selected site, it may want to use a land broker or other expert to assist in buying the land. Co-ops should develop a timeline for buying the land and acquiring all necessary permits. Typical time requirements are as follows:

* Land acquisition: 3 to 9 months
* Permitting: 1 to 3 months
* Obtaining special-use permits and rezoning land (if necessary): 2 to 4 months

If a co-op owns the land or has access to it, the lead times may be shorter, but the land may still need to be rezoned in some instances. In other cases, special considerations may extend the permitting time considerably (*in some cases involving opposition, permitting can take 2 to 3 years*).

### Permitting Requirements

Permitting a site involves a number of considerations. Among them are the following:

* Survey of the land: elevation, grade, ground water management
* Fire code compliance
* Compliance with zoning, land use regulations
* Geotechnical study
* Verify acreage of potential PV parcel
* Consider other site factors, such as the solar resource, access, proximity to a feeder, substation loads, community visibility, and infrastructure impacts (i.e., roads during construction)

# System Design and Procurement

### Division-of-Labor Review

Co-ops should review their decisions on the division of labor for the project and determine whether any changes are needed before signing all relevant contracts.

### Design Considerations

Co-ops will need to decide whether they want their PV system to produce maximum power or be used for peak matching. This decision will determine such factors as array tilt and azimuth angle (east-west orientation).

**Key elements to consider include the following:**

* Array tilt
* Azimuth angle
* Tracking

**Other design considerations include the following:**

* Array height
* Shading
* Thermal considerations
* AC-DC ratio

### Calculating Energy Output

Co-ops can estimate the energy production of a PV system using the SUNDA Solar Costing and Financing Screening Tool, available at: [http://www.nreca.coop/what-we-do/bts/solar-utility-network-deployment-acceleration-project/business-and-financial-models/](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-smeco.pdf).

This tool uses PVWatts, an online calculator developed by the National Renewable Energy Laboratory (available at: http://pvwatts.nrel.gov/). The calculator estimates monthly and annual electricity production using an hour-by-hour simulation over a typical 1-year period, based on historical solar radiation and climate data. A number of derating factors are considered in estimating the AC production, based on a given size PV array and site conditions. Accurate estimates of these factors are required to produce verifiable results. Output from a system will vary on a daily, monthly, and annual basis.

**Other tools include the following:**

1. System Advisory Model, which combines PVWatts with economic analysis to provide a more detailed look at system performance (available at: https://sam.nrel.gov/)
2. PVSyst, a commercial stand-alone software package that provides a deeper level of analysis and design tools than PVWatts (available at: http://www.pvsyst.com/en/), Cooperative Utility PV Field Manual Project Manager’s PV Quick Start Guide
3. HelioScope by Folsom Labs, a commercial web-based software service that provides a deeper level of analysis and design tools than PVWatts (available at: [http://www.folsomlabs.com/](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-san-miguel.pdf))

NRECA does not endorse or recommend the use of particular products, including those products named in this Playbook.

### Procurement Tips

If a co-op chooses to do all of the procurement for its PV system, it will want to consider several issues, including the following:

* Financial stability of suppliers
* Material and labor warranties
* Coordination of equipment delivery
* Sourcing of “balance-of-system” equipment, such as wires, fuses/circuit breakers, and grounding rods

# Site Preparation and Installation

### Site Preparation

Site preparation includes surfacing, such as general leveling of the land; improving access roads and drainage as needed, such as adding or improving gravel access roads; and vegetation management, such as trimming specified vegetation that may cause shading or interfere with equipment installation. The perimeter fence usually can be installed when the site grading is completed. Co-ops may want to rely on the services of several outside consultants for site preparation – including surveyors, civil engineers, security contractors, or earth-moving companies.

### Installation

Once the site is prepared, installing a 1-MW PV system typically takes approximately 6 weeks and involves both mechanical and electrical construction activities.

**The mechanical activities include the following:**

* Installing support foundation (pouring concrete pads or driving piles)
* Installing racking structures
* Installing conduits for wiring from combiner boxes to inverter DC switchgear
* Preparing inverter pad
* Installing grounding system for metal structure and inverter pad
* Installing modules on racking
* Installing combiner boxes on racking structures
* Installing weather/monitoring station to verify proper operation of system
* Installing inverter(s), lightning protection/surge arrestors, and associated DC and AC switchgear

**The electrical activities include the following:**

* Wiring modules into series strings and connecting to combiner boxes
* Running DC wires from combiner boxes to inverter DC switchgear
* Running DC wires from DC switchgear to inverter
* Connecting inverter(s) to interconnection transformer and associated switchgear
* Connecting structure and combiner boxes to grounding system
* Connecting inverter and associated equipment to grounding system and protection equipment
* Installing metering cabinet and associated telecommunications
* Connecting monitoring system to co-op’s SCADA system
* Connecting system to electric grid

# Commissioning

Commissioning verifies that installation has been completed satisfactorily and safely according to the plans and applicable codes.

**Key tasks include the following:**

* Complete final installation details
* Complete visual inspections
* Verify compliance with NEC requirements
* Conduct electrical verification tests
* Verify system functionality, including start-up, operations, shut-down, and emergency procedures
* Verify that system power output and energy production meet performance expectations
* Complete system documentation, including changes for as-built drawings
* Conduct user orientation and training on system operation and safety
* Conduct hazard assessment and safety training

## Final Inspection

A final checkout confirms that the installation is complete before conducting any testing or beginning system operations. The checkout typically is performed by the installation contractor before the final inspection by the AHJ. With the exception of PV arrays, all circuits should be de-energized whenever possible in preparation for system testing. In addition to a test of the system, component-by-component testing is recommended.

### Initial Testing

PV systems should be tested thoroughly at the time of commissioning and then periodically over their lifetimes to ensure proper performance and safe operation. Baseline measurements at the time of system commissioning are compared to the system ratings and expectations for acceptance, and serve as a baseline for comparison with future measurements.

System functional testing verifies proper system operation, including start-up, shut-down, and nominal operating conditions. These tests confirm that system operating parameters are within expected and nominal limits but are not intended to verify system ratings in accordance with specifications or warranty provisions. Additional detailed testing, using additional measurements and normalizing data, is required to verify performance with system ratings.

# Operations and Maintenance (O&M)

The party or parties responsible for O&M should confirm system availability and performance on a regular basis. System performance can be estimated using array-sizing parameters and the specific meteorological data from the site. A mismatch of system output with predicted performance indicates some problem with the system. The problem can be further isolated by examining data from the inverter DC input circuits and then examining parameters at each of the system’s combiner boxes.

### Project-Specific Maintenance Plan, Schedules, and Responsibilities

**Maintenance activities include the following:**

* Inspection of components and wiring systems
* Module cleaning
* Electrical tests, performance verification
* Visual inspections
* Thermal imaging of electrical cabinets and even PV subarrays, if necessary
* Water infiltration
* Site erosion
* Calibrations
* Repairs
* Hazard assessment, safety training

Co-ops should review and verify responsibility for maintenance as identified during the project's planning stage. The PV system maintenance plan should include a schedule of routine or preventative maintenance. In addition to preventative maintenance, co-ops need to be prepared to address events such as component failures, natural disasters, and any breaches in security that will require unscheduled maintenance. Information on test equipment is available in NRECA’s Cooperative Utility PV Manual, Volume III: Operations, Maintenance, and Monitoring, available at: [http://www.nreca.coop/wp-content/uploads/2015/02/NRECA-Cooperative-Utility-PV-FieldManual-Volume-III-Final.pdf](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-okanogan.pdf).

## Tips and Advice from Co-op Project Managers

**General Advice:**

* Don’t assume it will be easy or quick to obtain a piece of land.
* Keep a steady pace through the project timeline – don’t rush.
* Build strong relationships with your vendors, contractors, crews, and team throughout the project. A great project manager will successfully wear many hats throughout this process.
* Don’t assume you will always have good weather – be on your guard.
* Provide security solutions for your site.
* Take your time when commissioning, and be thorough.
* Don’t try to sell your solar project to the member-consumers all in one day – be creative and be flexible.

**Specific Advice:**

* **Monthly output can vary throughout the year**, which is important so you can properly communicate expectations to consumer-subscribers. (Some subscribers may expect that their subscriptions will erase their monthly bill – which is not the case for a several reasons – but some subscribers have also been surprised at how low their winter monthly credit has been. Better communication regarding seasonal variation could avoid these faulty expectations.)
* **Significant staff and resources are needed** to execute a CSP and continue to own and maintain the array after commercial operation. Some projects have utilized nearly every department of the co-op to execute; also, may be a misconception about solar ownership needs such as the belief that once a CSP is installed you can walk away. Developing a proper maintenance plan and arranging qualified personnel to maintain your PV system is a good idea before starting PV development.
* For procurement and installation, **the solar industry is still both dynamic and new**. Many vendors and contractors are in the market, ranging from small businesses of <10 people to large, vertically integrated national developers. Small and even large companies regularly go out of business or significantly change ownership, so choosing vendors who will be around for the life of the asset and uphold their warranty can be a difficult challenge. For small- to medium-sized community solar arrays, deciding on qualified contractors can be difficult: small business installers may have better pricing and more experience with smaller arrays than the national developers, but they also present a higher risk. Large developers may have higher rates and may not even bid on small/medium projects, but may be more stable. Vetting out new and small companies that may actually end up doing a great job and saving the co-op money can be difficult, but worth it.
* **For permitting solar development, cities and counties will vary**. There is significant variation from county to county, each having its own requirements and understanding of PV development. Early action and engagement with local permitting bodies will help avoid schedule delays, bad PR, or permitting roadblocks.
* **It can be tricky to meter small-scale solar installations**. Balancing low-cost metering solutions with standard utility metering practices can be a potential challenge. It is important to ensure that proper data are recorded while remaining within a budget that does not significantly increase subscription costs. There may also be a need to coordinate metering solutions between the G&T and the distribution co-op, depending on the project size, interconnection location, metering system, and requirements of the G&T.

## Resources for Project Managers

## Tools and Resources from NRECA

National Consulting Group Policy Development Services for Community-Based Solar Projects

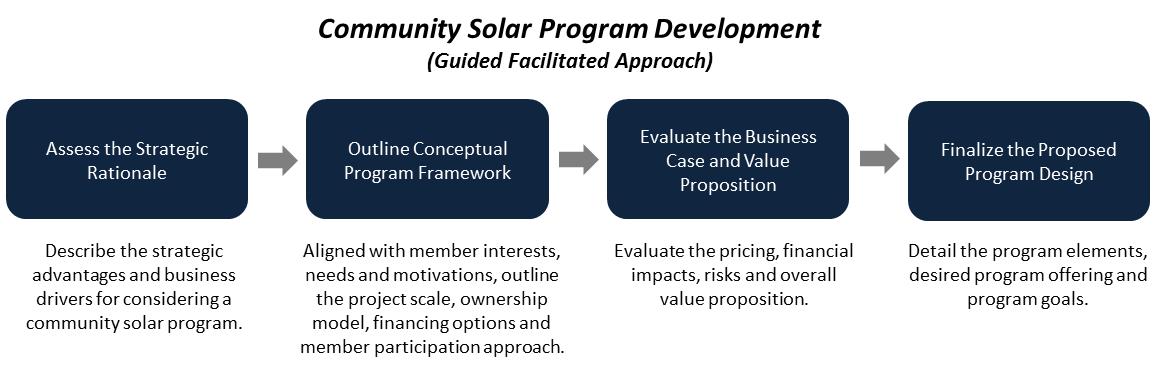
As interest in solar energy grows and the cost of deploying photovoltaic arrays becomes less prohibitive, many electric cooperatives are evaluating the feasibility of establishing CSPs. To assist with that process, NRECA is offering a suite of consulting services designed to help its co-op members deploy and operate solar generation projects.



Through its National Consulting Group (NCG), and in collaboration with the association’s Business and Technology Strategies (BTS), NRECA is providing a resource to help mitigate cooperatives’ risks and costs – and increase the value of successful CSPs. NRECA’s consultants work alongside cooperatives’ personnel to evaluate and plan for the strategic, business, financial, and resource requirements of solar projects.

Our strategic consultants bring third-party value to the planning and development process, including assessment and creation of the strategic rationale for community solar. This process ensures that member co-ops and their consumers clearly understand the advantages and business drivers of proposed projects. Every co-op is unique, so we strive to provide a range of options that provide the best solution to each.

The overall principle for performing these services is one of guided facilitation:



Contact: [Henry.Cano@nreca.coop](http://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-systems-energy-efficiency), 602-621-3905.

#### Solar Utility Network Deployment Acceleration (SUNDA)

NRECA created certain tools and resources pursuant to a DOE-funded project, the Solar Utility Network Deployment Acceleration (SUNDA). The purpose of the project was to enhance the ability of co-ops to design, deploy, and operate utility-scale, utility-owned solar PV systems at their facilities. Co-op project utilities installed more than 20 MW of utility-scale, utility-owned solar. SUNDA publications include the following:

* 1. **Cooperative Utility PV Field Manual** ‒ NRECA’s Cooperative Utility PV Field Manual is a three-volume series designed to support electric cooperatives as they explore utility-scale solar PV:
  2. Volume I: Business Models and Financing Options
  3. Volume II: Planning, Design, Installation/Interconnection, and Commissioning
  4. Volume III: Operations, Maintenance, and Monitoring

1. **SUNDA Reference Designs** – Templates to design for 250-kW (single inverter and string inverter design), 500-kW, and 1-MW utility-scale PV solar projects
2. **Project Managers Quick Start Guide** – Summary and checklist of Project Manager tasks and documentation requirements
3. **Cost and Financing Screening Tool for Utility-Scale Solar Projects** – Open and editable spreadsheet for project financial examination
4. **Solar Communications Planning Guide** – Guide to creating a communications plan for a solar project launch and marketing for increased participation

Available at: [www.nreca.coop/SUNDA](mailto:eluesebrink@socoreenergy.com)

This work, authored by the National Rural Electric Cooperative Association, was funded in whole or in part by the Department of Energy under U.S. Government contract DE-EE-0006333.

#### Cooperative Solar Case Studies

**The following eight case studies illustrate innovative ways cooperatives are satisfying member-consumers’ demand for solar-derived electricity:**

* [Tri-County Electric Cooperative](mailto:ryan.cook@mc-group.com)
* [Southern Maryland Electric Cooperative](mailto:kjb@msuc.net)
* [San Miguel Power Association](mailto:jlee@bchain.com)
* [Okanogan County Electric Cooperative](http://www.nreca.coop/solar)
* [Green Power Electric Membership Cooperative](http://www.nrucfc.coop)
* [Cherryland Electric Cooperative](mailto:mark.wilkerson@easycleanenergy.com)
* [Kit Carson Electric Cooperative](mailto:jbridges@crossdiscipline.com)
* [Great River Energy](http://livewire.nreca.org/sites/mas_bpe_project/projectsandcollaboration/EandTEventSetup/Shared%20Documents/VendorMeetingEachBusinessGroupsNumber1s.xlsx)

Also available at: [http://www.nreca.coop/solar-case-studies/](http://www.nreca.coop/SUNDA)

#### Comprehensive Web-Based Courses

NRECA offers this series of online webinars to help cooperatives address and evaluate community solar options. Topics include the following:

1. **Strategic Business Options**
2. **Financing Options and Cost Estimates**
3. **Technical Project Management**
4. **Communications Best Practices**
5. **Case Studies from Electric Co-ops**

Available at: [http://www.nreca.coop/what-we-do/bts/solar-utility-network-deployment-acceleration-project/comprehensive-course/](http://www.cio.com/article/2442514/it-strategy/5-security-questions-to-ask-your-software-vendor.html)

#### Distributed Generation (DG) Toolkit

NRECA created this DG toolkit to help electric co-ops address the legal, economic and technical issues raised by consumer-owned generation. These materials provide models and guidance that each co-op can adapt to its unique needs after consultation with management, legal counsel and system engineers. We suggest beginning with the “Business and Contract Guide for Interconnection” that will guide you through the process and provide you descriptions for each of the documents. With this toolkit, each co-op should be able to independently draft the rules, policies, tariffs, contract documents and retail rates required to respond to member requests for interconnection.

Available at: [http://www.nreca.coop/nreca-on-the-issues/energy-operations/distributed-generation/](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-green.pdf)

### Additional Online Training Courses

#### State of Renewable Impact Analysis Software

This live 75-minute web conference presented by NRECA's Cooperative Research Network (CRN) provides co-ops with the basic technical guidance they will need to stay informed and on the leading edge of DG.

Available at: [https://www.cooperative.com/conferences-education/web-conferences/pages/state-of-renewable-impact-analysis-software.aspx](http://www.cio.com/article/2442514/it-strategy/5-security-questions-to-ask-your-software-vendor.html)

#### MultiSpeak Integrator Training

Learn the advantages of implementing MultiSpeak® specification and how it works during this in-depth training session for co-op staff, consultants, and software integrators. The workshop covers Version 3.0, which has been implemented at utilities since 2005.

Available at: [https://www.cooperative.com/conferences-education/courses/multispeak/Pages/default.aspx](http://www.greentechmedia.com/articles/read/IRS-Guidance-Finds-Individual-Community-Solar-Investor-Qualifies-for-the-Fe)

#### [Developing a Cyber Security and Risk Mitigation Plan](https://www.pcicomplianceguide.org?ID=2&Title=(175.1)+Developing+a+Cyber+Security+and+Risk+Mitigation+Plan?ID=2&Title=(175.1)+Developing+a+Cyber+Security+and+Risk+Mitigation+Plan)

NRECA’s CRN made news when it made available to the public the Guide to Developing a Cyber Security and Risk Mitigation Plan. Written for electric cooperatives, the Guide can be used by any co-op to start immediately strengthening its security posture and charting a path of continuous improvement. This one-day, 8-hour workshop introduces the Guide and its related documents, and walks participants through the process of developing their own cyber security plans. The workshop covers risks posed by people, processes, and technology, and also looks at NERC CIP compliance. After taking this class, co-op staff will be ready to create their own cyber security plans.

Available at: [https://www.cooperative.com/conferences-education/Lists/Courses/DispForm.aspx?ID=2&Title=(175.1)+Developing+a+Cyber+Security+and+Risk+Mitigation+Plan](http://pec.coop/Home/Energy_Services/altenergy/solartour.aspx?ID=2&Title=(175.1)+Developing+a+Cyber+Security+and+Risk+Mitigation+Plan)

This work, authored by the National Rural Electric Cooperative Association, was funded in whole or in part by the Department of Energy under U.S. Government contract DE-OE-OE0000222.

#### Enhancing IT Effectiveness: Managing and Planning the IT Function

This 2-day course covers the management techniques, current practices, tools, and resources crucial for effective IT planning, decision making, and leadership. The program also introduces a step-by-step approach to developing a strategic IT plan and guides participants in creating the foundation of an IT plan that can be taken back to their cooperatives.

Available at: [https://www.cooperative.com/conferences-education/Lists/Courses/DispForm.aspx?ID=23&Title=(781.2)+Enhancing+IT+Effectiveness:+Managing+and+Planning+the+IT+Function](http://www.nreca.coop/SUNDA?ID=23&Title=(781.2)+Enhancing+IT+Effectiveness:+Managing+and+Planning+the+IT+Function)

#### Solar Tools: Getting Co-ops Up to Speed on Their Solar Options

NRECA has pulled together tools and resources to answer questions and help you make informed decisions when exploring the installation of your own solar arrays or participating in cooperative solar development, like community solar. This webinar updates our online toolkit, which incorporates the experience and input from experts and consultants across the country.

Available at: [https://www.cooperative.com/conferences-education/web-conferences/Pages/Solar-Tools-Getting-Co-ops-Up-to-Speed-on-Their-Solar-Options.aspx](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-kit-carson.pdf)

## ENTITIES Providing Community Solar Services

### Executive Management, Governance, and Regulatory

**Vermont Energy Investment Corporation (VEIC)**

For three decades, the Vermont Energy Investment Corporation (VEIC) has provided energy services guided by our commitment to environmental and social justice, innovation, and results. VEIC provides utilities with program implementation and consulting services in energy efficiency, renewable energy, and transportation efficiency. VEIC specializes in policy and regulatory leadership, energy planning, financing and program design and review, grounded in our real-world experience delivering the awarding-winning programs Efficiency Vermont, the DC Sustainable Energy Utility (DCSEU), and Efficiency Smart. VEIC has consulted in Vermont and the District of Columbia to develop community solar regulations and creative models that include low-to-moderate income resident participation and employee/employer ownership.

Contact: Joananne Bachmann, Business Development & Sales Manager

Email: [jbachmann@veic.org](http://www.nreca.coop/what-we-do/bts/solar-utility-network-deployment-acceleration-project/comprehensive-course/)

Phone: +1.802.540.7838

**Clean Energy Collective (CEC)**

CEC utilizes its extensive experience to offer everything from turnkey CSPs to a comprehensive menu of products, software, and services to make each individual aspect of community solar a seamless process. CIC focuses on handling indemnity on securities and tax issues (SEC and IRS) as well as properly handling the ITCs, RECs and green claims for our partners. CEC’s policy team is a leader in the industry, active in virtually every interested state in driving toward positive CSPs and educating regulators, legislators, and stakeholders about the benefits of supporting such programs in communities.

Contact: Mark W. Wilkerson, VP Strategic Partnerships

Email: [mark.wilkerson@easycleanenergy.com](http://www.nreca.coop/solar-case-studies/)

Phone: +1.815.549.6051

**Meister Consultants Group (MCG)**

Meister Consultants Group provides expert technical and program assistance to rural electric cooperatives on a variety of clean energy programs including community solar projects. MCG works with cooperative leadership to understand, prioritize, and select community solar program design options, with an emphasis on developing community solar projects that are effective, financially sound, and in line with a cooperative’s organizational goals and principles. MCG provides targeted financial analysis that projects the financial impacts of programs on cooperatives and their members and supports rural electric cooperatives with member engagement and stakeholder education. MCG has worked with leading rural electric cooperative nationwide on community solar issues, and is a member of the White House Community Solar Partnership.

Contact: Ryan Cook, Consultant

Email: [ryan.cook@mc-group.com](mailto:Mark.Wilkerson@easycleanenergy.com)

Phone: +1.617.209.1990

### Marketing, Member-Consumer Services, and Communications

**Clean Energy Collective**

CEC has more experience in lead generation, sales conversion, and ongoing consumer engagement than anyone in the industry. CEC can offer everything from market research and consulting to a complete marketing suite, using consumer targeting and tactics that have been tested and refined in markets across the U.S. with multiple co-op partners. CEC continues to engage co-op member-consumers via production and credit tracking for the life of a project, as well as providing a custom portal through which consumers can view these numbers themselves on a computer or mobile or tablet device. CEC manages operations and maintenance of the array for the life of a project so that co-ops do not need to worry about them.

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### Information Technology

**Clean Energy Collective**

Through its proprietary software platform, as well as experience in working with numerous co-ops, CEC can ensure compliance with a wide range of billing systems. CEC provides automated reconciliation and application of solar panel production onto participating member-consumers’ accounts; an online credit check with adverse action letter (legal requirement); and e-commerce that allows for a quick, easy sign-up – all of which is entirely member-consumer driven and significantly eases the workload of a co-op’s employees in signing up member-consumers manually. CEC also provides multiple encryption options and secure consumer data-handling procedures.

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**Federated Rural Electric Insurance Exchange**

Federated Rural Electric Insurance Exchange (Federated) is the leading provider of property and casualty insurance for rural electric cooperatives in 43 states. Federated is the only property/casualty insurer owned by the rural electric cooperatives. Its primary goal is to offer its co-ops the best insurance value while maintaining a stable, secure insurance market. Since Federated was formed, it has returned $322.6 million in cash and equity to its rural electric member co-ops.

Contact: Bill West

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**National Information Solutions Cooperative (NISC)**

National Information Solutions Cooperative (NISC) is a member-owned information technology cooperative that provides software and services to more than 750 community-based utility and telecommunication providers located in 49 states, Canada, American Samoa, and Palau.

Based on iVUE, its enterprise software solution, NISC offers accounting, consumer care solutions, and a suite of Smarter Grid solutions, which include meter data management systems (MDMS); prepaid metering; web-based and mobile consumer presentment, reporting, and payment tools; mobile workforce automation; mapping; outage management; and distribution analytics solutions. Additional information can be found at [www.nisc.coop](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-okanogan.pdf).

Contact: Susan Imm

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**N-Dimension Solutions**

N-Dimension Solutions is a market-leading managed security service provider offering innovative solutions tailored to protect smart energy networks from cyber threats and vulnerabilities; improve system reliability; and safeguard critical infrastructures, data, and assets. Its services can protect operations and enterprise networks from internal and external cyber risks, providing a key element of a defense-in-depth security strategy.

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**MultiSpeak**

The MultiSpeak® Initiative is a collaboration of NRECA, utility software vendors, and electric distribution utilities worldwide. MultiSpeak® is the leading standard for enterprise-level software interoperability. It allows for information sharing between systems in a cost-effective and standardized way. MultiSpeak® enables the Smart Grid and saves both vendors and utilities by simplifying software integration and minimizing expenses for custom interface solutions. It strengthens software applications and adds value to IT investments. For example, an advanced metering infrastructure (AMI) system automatically reporting power outages to an independent outage management system (OMS) via MultiSpeak adds tremendous value to both investments.

The MultiSpeak specification is the most widely applied de facto standard in North America pertaining to distribution utilities and all portions of vertically integrated utilities except generation and power marketing. It is the only interoperability standard of its type listed in the National Institute of Standards and Technology Smart Grid Interoperability Panel (NIST-SGIP) Catalog of Standards. It is used in real-time operations at more than 725 electric cooperatives, investor-owned utilities, municipals, and public power districts in at least 20 different countries worldwide. For more information, please visit www.multispeak.org.

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### Finance and Program Administration

**Clean Energy Collective**

If a co-op selects CEC’s turnkey community solar option, CEC will finance the array and assume the risk. CEC assists with monetizing the 30% federal investment tax credit via tax-equity partners; resulting savings are passed through to member-consumers, allowing all consumer types to be eligible (residential, commercial, non-profit). CEC always performs extensive due diligence and ensures ongoing compliance with loan terms. CEC assists in finding financing for an array, which can greatly benefit co-ops; even those with a for-profit division will find that the costs, complications, and legal requirements are major hurdles and time requirements—all of which CEC can help the co-op avoid.

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**CoBank**

CoBank is a national cooperative bank serving vital industries across rural America. CoBank supports rural communities and agriculture with reliable, consistent credit and financial services in all 50 states—today and in the future. CoBank is a member of the Farm Credit System, a nationwide network of banks and retail lending associations chartered to support the borrowing needs of U.S. agriculture and the nation's rural economy. In addition to serving its direct retail borrowers, the bank also provides wholesale loans and other financial services to affiliated Farm Credit associations serving approximately 70,000 farmers, ranchers, and other rural borrowers around the country. More information is available at [www.farmcreditnetwork.com](http://www.nreca.coop/wp-content/uploads/2015/10/solar-case-study-great-river.pdf).

Contact: Tamra Reynolds, Regional Vice President, Southern Region, Electric Distribution

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Phone: +1.303.740.4034

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Federated Rural Electric Insurance Exchange (Federated) is the leading provider of property and casualty insurance for rural electric cooperatives in 43 states. Federated is the only property/casualty insurer owned by rural electric cooperatives. Its primary goal is to offer its members the best insurance value while maintaining a stable, secure insurance market. Since Federated was formed, it has returned $322.6 million in cash and equity to its rural electric member co-ops.

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Phone: +1.617.209.1990

N**ational Rural Utilities Cooperative Finance Corporation (CFC)**

The National Rural Utilities Cooperative Finance Corporation (CFC) is a nonprofit finance cooperative created and owned by America’s electric cooperative network. With more than $22 billion in assets, CFC is committed to providing unparalleled industry expertise, flexibility, and responsiveness to serve the needs of its member-owners. CFC is an equal opportunity provider and employer. More information is available at [www.nrucfc.coop](http://www.nreca.coop/what-we-do/bts/solar-utility-network-deployment-acceleration-project/comprehensive-course/).

Contact: Krishna Murthy, CFC, Vice President, Energy and Industry Analysis

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**RUS Electric Program**

Under the authority of the Rural Electrification Act of 1936, the RUS Electric Program makes direct loans and loan guarantees to electric co-ops (wholesale and retail providers of electricity) that serve member-consumers in rural areas. The Electric Program helps nearly 700 borrowers in 46 states finance safe, modern, and efficient infrastructure. The resulting loan portfolio of approximately $46 billion is managed by the Electric Program. RUS-financed electrical systems provide service to more than 90% of the nation’s counties identified as suffering from persistent poverty, out-migration, or other economic hardships. The Electric Program also provides financial assistance through its High Energy Cost Grants to rural communities with extremely high energy costs to help them acquire, construct, extend, upgrade, and otherwise improve energy generation, transmission, or distribution facilities.

Contact: Victor Vu, RUS, Deputy Assistant Administrator, Portfolio Management and Risk Assessment

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### Project Management Planning

**Clean Energy Collective**

CEC’s capabilities in project management, engineering, commissioning, and operations are unmatched in the industry. CEC has extensive solar array construction management experience, which includes program design, supervising the process from start to end, site-specific permitting, land acquisition, and securing necessary permitting and approvals. CEC’s in-house engineering team has expertise in modeling arrays and determining accurate production figures for multiple co-op partner arrays. CEC also provides in-house O&M services, including remote troubleshooting and service dispatch capabilities.

Contact: Mark W. Wilkerson, VP Strategic Partnerships

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**Cross-Discipline Technology Limited**

Cross-Discipline Technology Limited (Cross-Discipline) can provide project management support to help guide the beginning of project conceptualization through final construction, including providing on-site construction observation/support. Cross-Discipline currently is contracted with Western Farmers Electric Cooperative (WFEC) to handle the engineering and project management required to interconnect 13 new solar farm sites to WFEC’s member cooperatives’ distribution systems. Its team has years of experience in providing project management, design/engineering, and procurement support, including full EPC services for multiple substations, transmission lines, and distribution lines. Cross-Discipline builds on that experience by teaming several strategic affiliates in the solar industry, and can provide project management support for a wide variety of solar projects.

Contact: Jerimiah Bridges, P.E.

Email: [jbridges@crossdiscipline.com](https://www.cooperative.com/conferences-education/web-conferences/pages/state-of-renewable-impact-analysis-software.aspx)

Contact: Chad Beardslee, P.E.

Email: [cbeardslee@crossdiscipline.com](https://www.cooperative.com/conferences-education/courses/multispeak/Pages/default.aspx)

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**SoCore Energy**

SoCore Energy ([www.SoCoreEnergy.com](https://www.cooperative.com/conferences-education/Lists/Courses/DispForm.aspx)) is a market leader in cooperative, commercial and industrial solar portfolio development. With hundreds of solar solutions designed and installed across dozens of states, SoCore offers cooperatives, multisite retailers, REITs and industrial companies portfolio-wide solar and energy storage solutions that provide energy cost savings and carbon reduction opportunities. As a wholly owned indirect subsidiary of Edison International, SoCore combines Edison's Fortune 500 stability with entrepreneurial creativity in order to provide energy solutions that their customers genuinely want and need.

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Phone: +1.773.897.5782

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**Mid-South Utility Consultants, Chain Electric Company, and Irby Utilities**

Mid-South Utility Consultants, Chain Electric Company, and Irby Utilities have developed a relationship to pursue EPC opportunities with investor-owned and public power utilities. Their expertise in each aspect of the process is well known to co-ops across the mid-South and greater Southeast United States. They are anxious to develop a program that will provide a broad spectrum of resources to rural utilities and support them as they develop their CSPs.

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Email: [jlee@bchain.com](mailto:Henry.Cano@nreca.coop)

Contact: Irby Utilities, Eddie Moak

Email: [moak@irby.com](http://www.farmcreditnetwork.com)

**National Renewables Cooperative Organization (NRCO)**

Cooperatives across the country formed the National Renewables Cooperative Organization (NRCO) to promote and facilitate the development of renewable energy resources for its members. NRCO’s main purposes are to facilitate the cost-effective joint development of renewable resources nationwide for its cooperative owners, helping them meet the requirements of voluntary and mandatory renewable energy standards. For more information, please visit [www.nrco.coop](mailto:mark.wilkerson@easycleanenergy.com).

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**NRECA National Consulting Group**

Through its National Consulting Group (NCG), and in collaboration with its Business and Technology Strategies (BTS), NRECA is providing a resource to mitigate cooperatives’ risks and costs – and increase the value of successful CSPs. NRECA’s consultants work alongside cooperatives’ personnel to evaluate and plan for the strategic, business, financial, and resource requirements of solar projects. This work includes financial evaluation and business case development services, project planning and management, RFP development and analysis, and safety and technical compliance reviews.

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**Renewable Energy Integration**

Nanogrids by Renewable Energy Integration provide solutions to solar and storage, giving the cooperative complete control of the power. As a turn­key solution, its Nanogrid Program is designed with no money out ­of pocket for the cooperative, benefits for the member-consumers, and a business/finance model that generates new revenue streams, mitigates stress on aging assets, and pays for itself month in and month out.

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**Silicon Ranch Corporation**

Silicon Ranch Corporation (Silicon Ranch) is one of the nation’s leading developers, owners, and operators of solar energy plants. It understands the value that not-for-profit rural electric cooperatives and public power districts bring to their member-consumers across the country. Silicon Ranch is proud to have established positive and productive relationships with prominent local co-ops throughout the United States.

As the partner of choice for a diverse set of forward-thinking companies, Silicon Ranch brings all of the benefits of utility-scale solar energy together in a turnkey model that requires no capital investment from our stakeholders.

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**SunEdison**

SunEdison develops, finances, installs, and operates distributed solar power systems, delivering cost-effective electricity and services to educational, residential, commercial, utility, and government consumers. SunEdison’s 4.0-GW global portfolio spans 23 countries and 28 states, and has generated more than 9,000 GWh.  
  
SunEdison is pleased to offer turnkey community solar options for electric co-ops. SunEdison understands that each NRECA co-op member has its own priorities, competencies, and limits. As such, it is happy to work with co-ops to structure the optimal community solar program based on their executive and member-consumer preferences. SunEdison’s approach is premised upon a low-cost, economy-of-scale model that is simple to implement and tailored to co-ops’ individual needs.  
  
The challenge for co-ops lies in how to offer community solar at the least cost and with maximum benefits to the co-op and its member-consumers. SunEdison works as a partner to design and implement the most effective and efficient full-service community solar solution.

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**Power System Engineering, Inc. (PSE)**

Power System Engineering Inc. (PSE) is a full-service consulting firm for electric utilities. The professionals at PSE include engineers, IT experts, utility strategy experts, economists, and financial analysts. PSE’s team has extensive experience in all facets of the utility industry. PSE services include communications (fixed and mobile), technology work plans, strategic plans, construction work plans, long-range plans, sectionalizing studies, load forecasting, line design, rates and financial planning, substation automation, and many others. For a full list of services, visit the PSE website at www.powersystem.org.

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