Illinois Solar For All

Quality Assurance and Quality Control for Project Installations

Onsite Inspection and Photo Review Processes

March 26, 2019

Agenda

- Introduction
- Quality Assurance(QA)and Quality Control(QC) Requirements
- Site Suitability
- Desktop Reviews
- Onsite Inspections
- Tracking Deficiencies and Remedial Processes

Administration Team

Elevate Energy
is a non-profit dedicated to bringing the benefits of the clean energy economy to those who need it most. Our community-focused, and data-driven approach to energy program design and implementation brings many voices and innovation into everything we do.

- Program Administration

AECOM
is a global network of engineers, project managers and technical experts working with clients, communities, and colleagues to develop and implement innovative solutions to the world's most complex challenges.

- Quality Assurance and Inspections
- Vendor Support

GRID Alternatives
is the largest non-profit solar developer in the country. We have pioneered the integration of low-income solar and workforce development into successful solar programs and have installed over 10,000 systems across the country.

- Job Training Coordination
- Technical Support

Shelton Solutions
is a community-based energy services firm with a deep understanding of data and data management. We have served low-income communities in Illinois by providing critical technical services to innovative energy programs statewide.

- Income Verification
- Environmental Justice Community Self-Designation

Organizations on the administrative team are not developing solar projects within Illinois

QA/QC and Inspection Process Development

- Elevate Energy and AECOM teams include electrical, mechanical, structural, and energy engineers
- Elevate Energy and AECOM teams have demonstrated experience in solar installation management, solar installer training, and solar program administration
- Protocols and requirements were developed leveraging this experience and national industry best practices, with a focus on the unique issues associated with low-income communities
- Protocols were also informed by regulating agencies such as the U.S. Environmental Protection Agency and the U.S. Department of Energy regarding photovoltaic installation

Quality Assurance and Quality Control Requirements

Requirements from Long-Term Renewable Resources Procurement Plan

- Illinois Solar for All (ILSFA) Program Administrator will develop and implement a process for quality assurance, including:
  - Thorough photo documentation process of all projects while under construction
  - Desktop review of submitted application materials
  - On-site inspection of random sample of installations
- If installations are found to have deficiencies, the ILSFA Approved Vendor will be responsible for repairs, alterations, or additions to remedy deficiencies and cannot pass associated costs for this remediation onto participants
- ILSFA Approved Vendors who persistently install deficient systems after remediation guidance may lose eligibility to continue to participate in the ILSFA program

Proposed High-Level Requirements

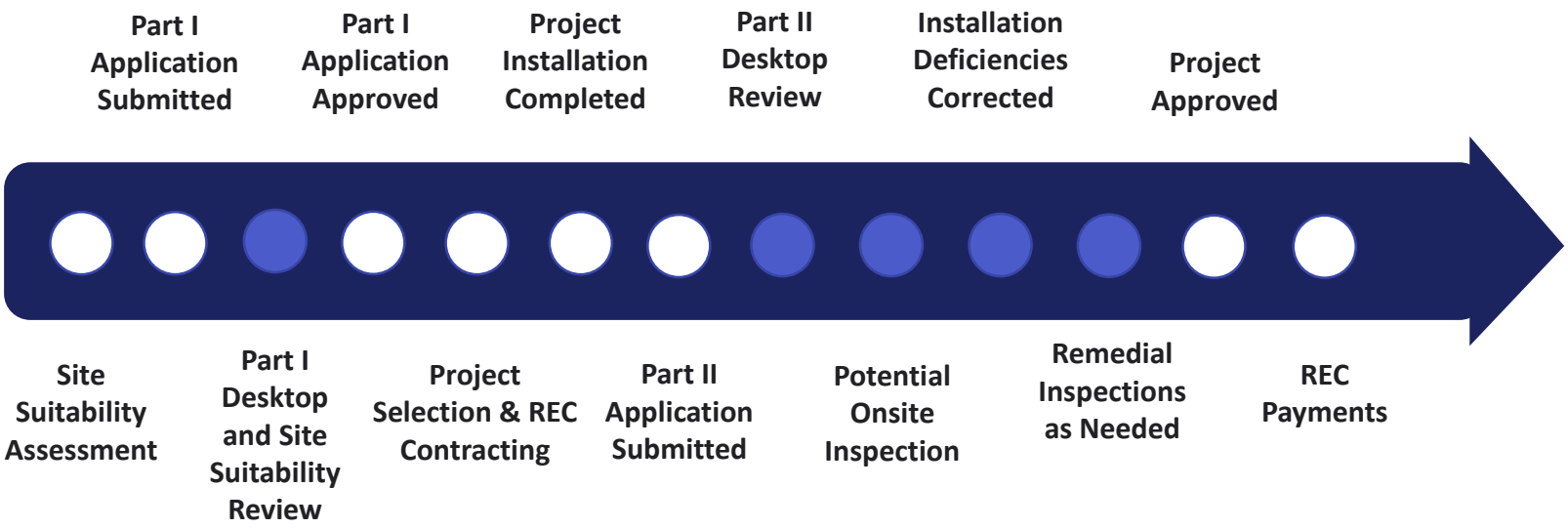
- ILSFA projects comply with local codes, utility requirements, and industry best practices
- Photo documentation and desk review at Part I and Part II project approval stages
- All sites meet minimum suitability requirements before Part I approval
- Onsite inspections for a portion of all Approved Vendor projects
- Compliance with workplace safety requirements and standards, such as OSHA and NFPA 70E to protect workers

Proposed Approved Vendor Inspection Schedules

The following schedule applies to each Approved Vendor or Designee:

- 100% of projects will be assessed via Part I desktop review
- 100% of projects will be assessed via Part II desktop review
- 100% of community solar installations will be inspected
- For all other project types:
  - 100% of first five installations will be inspected onsite
  - 30% of next ten installations will be inspected onsite
  - 20% of all ongoing installations will be inspected onsite
  - Remedial inspections will be conducted as needed and can impact this schedule

Proposed QA/QC Process



- *Portion of projects will undergo onsite inspection; all other QA/QC steps are mandatory for all projects*
- *The sequence will differ for projects submitted after installation is complete.*

Project Approval & Development Steps

Quality Assurance and Quality Control Steps

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Site Suitability Requirements

Site Suitability

- Identifies site conditions that would be considered barriers to installation
- Approved Vendors and designees will be required to ensure that rooftop and ground-mount installations meet minimum site suitability requirements
- Approved Vendors and designees will submit a Site Suitability Report for each project at the Part I application phase

Categories of Site Suitability Evaluation

Evaluation of site suitability will be conducted both through documentation provided as well as onsite inspections

- Roofing and Structural
- Ground-mount Site Evaluation
- Electrical
- Health and Safety
- Space and Accessibility

Roofing Evaluation

Assess Roof Covering

Critical Concerns:

- Weather-sealing ability
- Roof degradation
- Asphalt shingles (brittleness, loss of coating, warping, curling)
- Slate, clay, concrete tiles (cracks, misalignment, missing tiles, flaking)
- Metal roofing (rusting, corrosion, pitting)
- Built-up, membrane, and gravel roofs (membrane brittleness, cracking, bubbling, ponding, water penetration)

Requirements:

- Comply with all local codes
- Reasonable expected life remaining
- Weather-sealed
- Repairs and modifications do not void existing warranties and themselves be warrantied against failure
- Findings shared with building owner and program administrator
- Concerns addressed through repair or replacement by licensed professionals

Structural Evaluation

Roof surfaces and structures able to withstand loads from PV arrays

Critical Concerns:

- Significant decay, dry rot, or insect damage of components
- Unaddressed fire or water damage
- Added roof loads
- Multiple-layer roof (three or more layers)
- Removed web members
- Rafter holes, notches, and truss/roof framing modifications

Requirements:

- Roof must comply with all current local structural code requirements
- Must be able to support additional loading of PV system (changes to dead, wind, snow, rain loading)
- Repairs must not void existing warranties
- All findings must be shared with building owner and program administrator
- All concerns must be addressed through repair or replacement by licensed professionals

Ground Mount Evaluation

Assessing reporting requirements from the Civil Plan

Requirements:

Civil Assessment must be presented, stamped, and submitted by a civil engineer licensed to practice in the State of Illinois, including:

- A completed Geotechnical Report
- A completed Structural Report
- Flood Insurance Rate Map (FIRM) review through the Federal Emergency Management Agency; If FIRM is not available for site, provide the flood risk report through External Data Request report
- Confirm ground-mounted system does not intrude on protected wetlands; provide report from Fish and Wildlife Service online mapping tool
- Completed Ecological Compliance Technical Tool Report (EcoCAT)

Electrical Evaluation

Ensure electrical wiring can be installed according to current codes

Critical Concerns:

- Uncovered electrical boxes
- Improperly insulated or exposed wires
- Unsecured electrical connections
- Inadequate panelboard space for interconnection of PV system
- Inadequate busbar capacity to handle back-fed power
- Active knob and tube wiring
- Fused panelboards

Requirements:

- Upon completion, site complies with all local electrical code requirements
- Panelboard consists of circuit breakers and not Edison base fuses
- Panelboard has space for adding necessary overcurrent protection devices for PV system
- Busbar of existing panelboard has enough capacity to handle additional back-fed load from PV system
- Panelboard does not present hazardous electrical conditions (e.g., missing front cover, exposed wires, loose breakers, etc.)
- Electrical system does not contain active knob and tube wiring
- All findings must be shared with building owner and program administrator
- All concerns must be addressed by licensed professionals

Accessibility and Space; Health and Safety

Visual Inspection:

- Confirm work areas are clear of hazardous materials
- Do not disturb areas with suspected asbestos or suspected vermiculite
- Ensure no pest contamination of site
- Work cannot be conducted in unsafe or unhygienic conditions

Site Suitability Photo Requirements

- Photos will be required to verify the site suitability findings.

Location	Roof & Structural	Electrical
• General photos of installation location • Array installation area • Any areas that will be modified during installation • Available space for balance of system	• Roof • Supporting structure	• Electrical system tie-in location, overcurrent protection • Existing electrical panel

Questions?

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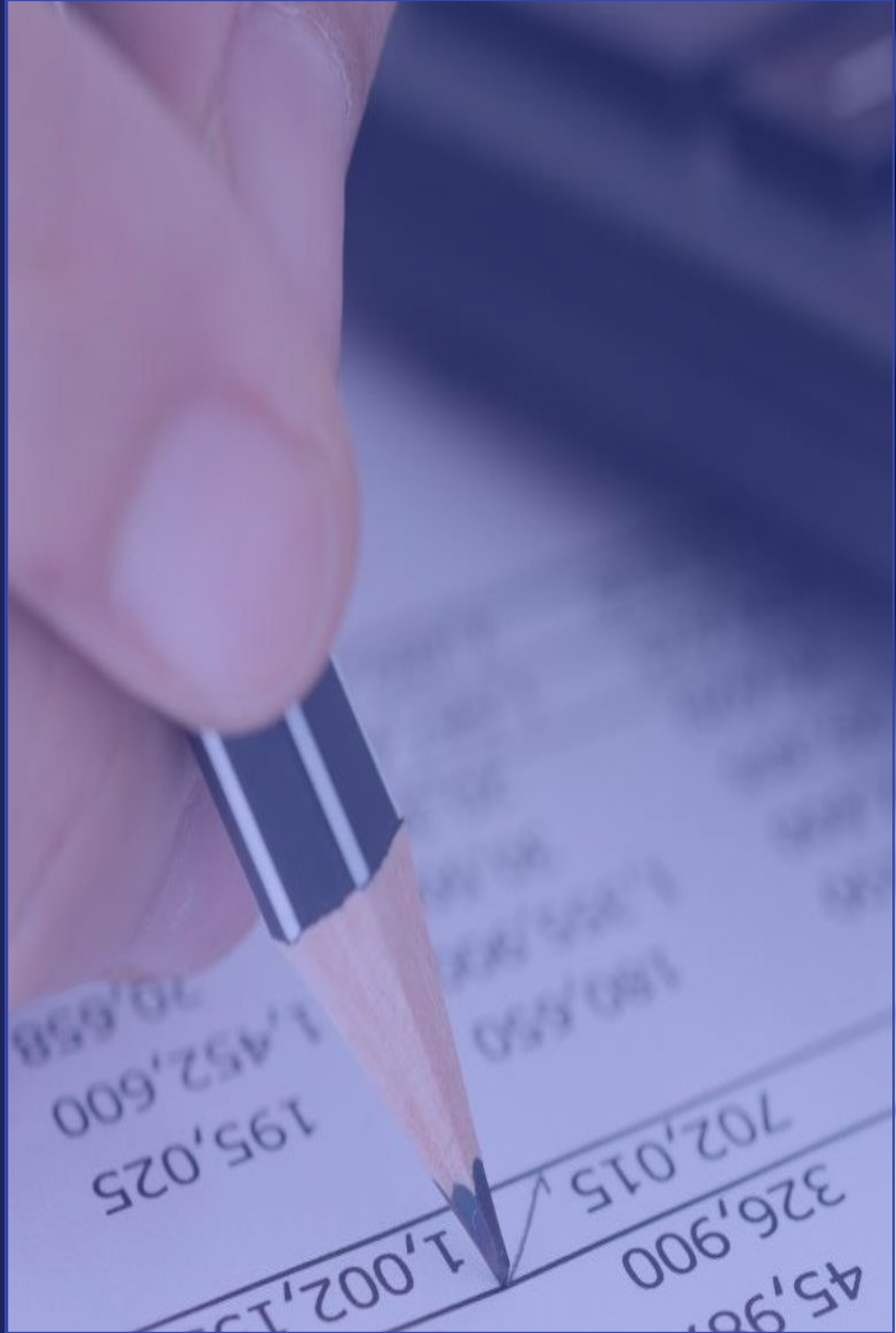
Desktop Review for Project Approval Part II Stage



Summary of Part I Project Approval

- Part I project approval processes will mirror the Adjustable Block Program requirements:
  - Standard disclosures
  - System design requirements and input
  - Shading, site control and plot diagram
  - Requirements for systems of 25 kW or larger
- With the addition of ILSFA specific requirement steps:
  - Income and eligibility validation
  - Consumer protections validation
  - Community Engagement validation (community solar)

Summary of Part II Project Approval

- Part II project approval processes will mirror the Adjustable Block Program requirements:
  - Final system details and changes from design
  - REC production estimates
  - Qualified Person verification and attestations
  - Net metering, interconnection documentation
  - Photo documentation review
- With the addition of ILSFA specific requirement steps:
  - Job Training requirements tracking
  - Subscriber documentation and income verification for community solar projects

Part II Photo Requirements: Electrical

- In addition to standard Part II project approval processes, photos will be required for all projects to ensure systems are installed properly and meet program requirements.

String Inverter	Module Level Power Electronics	General Electrical
• Inverter (1 Photo) • DC Disconnect (1 Photo) • DC Combiner Box (1 Photo if installed) • Load Side Connection (3 Photos) • Supply Side Connection (2 Photos) • Battery Storage (3 Photos if installed)	• Inverter (1 Photo) • Load Side Connection (3 Photos) • Supply Side Connection (2 Photos) • Battery Storage (3 Photos if installed)	• Grounding (1 Photo) • Wire Management (1 Photo)

Part II Photo Requirements: Structural

- Additional photos are required for specific inspection types.

Angled Roof	Flat Roof	Ground Mount	General Structural
• Mounting System Anchoring (1 photo) • Flashing Techniques (1 Photo)	• Mounting System Anchoring (1 Photo if needed) • Flashing Techniques (1 Photo if needed) • Tilt angle (1 photo)	• Tilt angle (1 photo)	• Mounting System (1 Photo) • Solar Modules (2 Photos)

Desktop Review Assessment of Photo Documentation

- In addition to Part II Project Approval processes, a desktop review of photo documentation of the completed installation will be conducted.
- The assessment of photo documentation is Pass/Fail.
- All required photos must be submitted, clearly showing the requested installation aspects or components.
- Missing or unclear photos will need to be resubmitted.
- Any failure identified during review of photo documentation may trigger an onsite inspection. Certain failures, such as missing safety labels, may be resolved through resubmission of photo documentation.

Questions?

Onsite Inspections

Purpose of Onsite Inspections

- Ensure safe operation of ILSFA PV systems
- Ensure quality of ILSFA PV systems
- Protect funding and Illinois ratepayers
- Strengthen and protect solar industry in Illinois
- Satisfy consumer protection requirements

Onsite Inspection Process

- Inspector will perform visual inspections to verify information submitted during site suitability, application, and desktop review phases, including:
  - Installation and equipment follows designs/drawings submitted in application
  - Compliance with electrical codes applicable to project
  - Ensuring roof condition and structural supports are as described and provided in designs and any calculations
  - Verification of REC production metering

Types of Onsite Inspections

- Inspection will vary based on type of system installed
  - Community solar or distributed generation systems
  - Systems with site suitability concerns or repairs
  - Systems with battery storage
  - Rooftop or ground-mounted systems
  - Angled or flat roofs
  - Tracking or fixed systems
  - Ballasted or penetrating anchor systems

Categories and Areas of Inspections

Inverter Inspection
String Inverter
DC Disconnect
DC/DC Converters
PV Source Circuit Combining
Load Side Connection
Supply Side Connection
Battery Storage
Rapid Shutdown Equipment

Module Inspection
Microinverters and ACMs
Load Side Interconnection
Supply Side Interconnection
Battery Storage

Electrical Inspection
PV Array Configuration
Grounding
Wire Management
Conductors
Over Current Protection Devices
Electrical Connections
Signs and Labels
REC Production Metering

General Structural Inspection
Design requirements
Components and equipment

Angled Roof Inspection
Ballast Mount
Rail Mount
Rail-Less Mount

Flat Roof Inspection
Ballast Mount
Rail Mount
Rail-Less Mount

Ground Mount Inspection
Ballast Mount
Tracking Mount

Questions?

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Tracking Deficiencies and Remedial Processes

Identifying Deficiencies

- All categories of inspection will be assessed based on a Pass/Fail review
- All identified issues must be resolved before project completion and approval for payment
- Each deficiency identified will be designated as a minor, moderate or major issue based on the impact of that aspect on safety and system performance.

Tracking Severity of Deficiencies

- For example, for the Rapid Shutdown Equipment inspection category, the following deficiencies will be looked for in the following way:

Rapid Shutdown Equipment		
Cause of Inspection Failure	**Severity of Failure**	**Steps for Approval**
The rapid shutdown equipment has not been installed per the manufacturer, NEC and local AHJ requirements.	Moderate	Final system approval will not be granted until the contractor properly installs the rapid shutdown equipment according to the manufacturer, NEC, and the local AHJ and provides photos showing the proper installation.
The rapid shutdown equipment is not the same as the Part II plan or the information has not been submitted.	Major	Final system approval will not be granted until one of the following happens: 1. Remove the incorrect Rapid Shut Down equipment and install the correct equipment 2. Provide reasoning why the Rapid Shutdown equipment does not match the Part II plans. Resubmit a satisfactory design that incorporates the installed Rapid Shutdown Equipment.
The proper rapid shutdown labels have not been included according to NEC and the local AHJ requirements.	Minor	System can be energized but final approval will be pending until contractor provides photos showing proper labels have been added for the rapid shutdown equipment.

Using Inspection Data

These failure designations are tracked to:

1. Categorize remediation requirements; for example:
   - Major issue: Requires remedial onsite inspection
   - Minor issue: Requires remedial photo documentation
   - Moderate issue: May require either or both
2. Track frequency and severity of found deficiencies to inform Approved Vendor performance management
3. Track frequency and severity of found deficiencies to inform program guidelines and learning across Approved Vendor organizations

Tracking Deficiencies Over Time

- The frequency and severity of deficiencies will be tracked on an ongoing basis and attributed to Approved Vendors, installer/contractors, Aggregators, and Designees
- A greater frequency or severity of deficiencies will trigger performance actions and can effect Approved Vendor status
- The Program Administrator will assign a single point of contact for all Approved Vendors who will provide guidance and ongoing support on all QA/QC requirements and issues
- Details on inspector protocols, as well as detailed deficiency tracking will be made available in the Approved Vendor manual prior to program launch

Questions?

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