



## Request for Quotation

### City of Salmon Arm Photovoltaic Project

#### RFQ-2019-01

**Issue date:** August 23, 2019

**Closing date and time:** September 13, 2019 at 2:00 p.m. PST

Quotations received after the Closing Date will be rejected.

All queries related to this RFQ should be submitted in writing to the attention of:

Carl Bannister, Chief Administrative Officer, City of Salmon Arm  
Email: [cbannister@salmonarm.ca](mailto:cbannister@salmonarm.ca)

Mail/Courier	Electronic (preferred)
City of Salmon Arm Attention: Carl Bannister 500 - 2 Avenue NE Box 40 Salmon Arm, BC V1E 4N2	Electronic copies of the RFQ may be submitted to: <a href="mailto:cbannister@salmonarm.ca">cbannister@salmonarm.ca</a>  The subject line must contain the following: Response to: RFQ-2019-01 City of Salmon Arm Solar PV Project
<b>Fax responses will not be accepted.</b>	

## **Request for Quotation**

### **Instructions**

#### **Introduction and Bid Instructions**

The City of Salmon Arm conducted a solar feasibility study in 2019 on three municipally owned buildings. The study was completed and Council approved to proceed with a 10.2 kWp solar photovoltaic project at the Salmon Arm Arts Centre.

The City of Salmon Arm is now seeking quotations for a rooftop array solar photovoltaic installation at the Salmon Arm Arts Centre located at 70 Hudson Avenue NE, Salmon Arm, BC. The request for quotation includes the design, supply, installation and commissioning of a 10.2 kWp of Solar PV array on the subject building. The successful proponent will be required to perform the complete supply and installation including, but not limited to: engineered drawings, solar panels, micro inverters, solar panel racks, , all installation hardware and electrical components. The successful proponent will be required to ensure the system is fully operational and producing energy.

Interested contractors should submit quotations on the Quotation Form and provide all submittals asked for in the Solar PV Performance Specifications document. Failure to do so may result in the quotation being put aside and given no further consideration. Failure to complete all fields in the quotation form may result in the contractor's quotation being set aside and given no further consideration. Submissions can be emailed to the contact person, couriered or otherwise dropped off in person at the City of Salmon Arm Municipal Office.

It is the responsibility of each vendor to satisfy itself as to the requirements set out in this RFQ. Inquiries are to be addressed only to the contact person named on the cover page of this RFQ no later than five (5) business days prior to Closing Time. If required, an addendum will be issued to all vendors.

#### **Pricing**

The quotation from each contractor should indicate any time limitations on its pricing.

Prices are to be quoted in Canadian currency and is to include all taxes (excluding GST, except where expressly requested to be included), fees, charges, overhead, profit and other expenses or costs of any kind whatsoever necessary for or incidental to the supply, delivery, and installation of the project.

#### **Withdrawal of Quotation**

The Proponent may withdraw its quotation at any time prior to the Closing Date and time by submitting a written withdrawal letter to the Chief Administrative Officer.

### **Contract**

The City of Salmon Arm currently expects that the result of this RFQ will enter into a contract. The City of Salmon Arm may elect not to enter into any contract as a result of this RFQ, if it deems fit.

### **Delivery of Times or Work Schedules**

On the quotation form, contractors are asked to state the time(s) required from the placement of an order to delivery of goods or completion of work. The City of Salmon Arm may give precedence to contractors who can achieve total completion of the work within three months following award of the contract.

### **Terms of Payment**

It is requested that part of the Quotation indicates the payment terms of the contractor. Contractors should also indicate if there are any discounts for deposits or early payment (ex. NET 15).

### **Evaluation Criteria**

Quotations will be evaluated to determine which are likely to offer the overall best value to the City of Salmon Arm. The City of Salmon Arm expects to take into account factors affecting value, including those concerning quality, service or sustainability, or contractors past work in the area, reputations or experience including qualifications and certifications of staff.

The City of Salmon Arm may also elect to not accept any quotation, and may terminate or amend this RFQ at any time. The City of Salmon Arm may also discuss or negotiate variations from the scope of the RFQ or changes to the scope of supply to be offered by a contractor or the pricing therefor, with any one or more of the contractors responding to the RFQ without having any duty or obligation to advise other contractors or to allow other contractors to vary their quotations as a result of such discussions or negotiations.

### **Site Visit**

An optional site visit will be conducted on September 6, 2019 at 2:00 p.m.

### **Heritage Status**

The subject building is on the Community Heritage Register. The City of Salmon Arm will be responsible for any required approvals; however, the City may require the cooperation of the successful proponent.

### **Evaluation Criteria**

Vendors will be evaluated according to the following criteria:

System Performance Factor	25%
Clarity of Quotation	5%
Scheduling	5%
Warranty	10%
Contractor Experience with Local Government	15%
References	10%
Cost	30%

### **Insurance and Workers' Compensation Coverage**

Each contractor should attach to its quotation a Certificate of Current Insurance. It would be expected that the minimum liability coverage for the contractor would be \$2,000,000. In addition, each vendor must include with its quotation a letter confirming its current WorkSafeBC registration and status.

### **Business Licence**

The successful contractor must be able to obtain a City of Salmon Arm and/or Intercommunity Business Licence.

### **List of Subcontractors and Suppliers**

Contractors should submit with their quotation a list of proposed subcontractors and suppliers, specifying the name and address of, and the portion of the work to be completed by, or the equipment or materials to be supplied by, each proposed subcontractor or supplier. The City of Salmon Arm reserves the right to object to any of the proposed subcontractors or suppliers listed in a quotation. If the City of Salmon Arm objects to a listed subcontractor or supplier, then the City of Salmon arm will permit the contractor to propose a substitute subcontractor or supplier acceptable to the City of Salmon Arm.

## QUOTATION FORM

**Please email, send via mail/courier or deliver your quotation in person to:**

City of Salmon Arm  
500 - 2 Avenue NE  
Box 40  
Salmon Arm, BC V1E 4N2

OR

Email: [cbannister@salmonarm.ca](mailto:cbannister@salmonarm.ca)

**If sending by courier or otherwise delivering in person, address your quotation to the above address and deliver to the above address.**

**Quotations must be marked with the vendor's name and the RFQ title and required appendices or supporting documents must be attached.**

**ATTENTION: Carl Bannister**

**FROM:** \_\_\_\_\_ (Company Name)

\_\_\_\_\_ (Contact Name)

**Subject: City of Salmon Arm Photovoltaic Project**

**Quotation Form**

The undersigned contractor, having carefully read and examined the RFQ and having full knowledge of the requirements described therein, does hereby offer to provide the goods and/or services in accordance with the specifications and terms and conditions set out in the RFQ (except as expressly noted below in this completed Quotation Form) and upon the pricing and other terms and conditions referred to below in this completed Quotation Form.

**A. TABLE OF PRICES**

Item	Description	Total Price
1	Design, supply, installation, and commission photovoltaic system at 70 Hudson Avenue NE, in accordance with the specifications set out in the RFQ. Price to include all labour, materials, equipment, management, professional structural assessment, electrical assessment, kiosk, delivery, and travel.	\$
	<b>G.S.T</b>	\$
	<b>TOTAL</b>	\$

**B. TIME LIMITATIONS ON PRICING**

(Indicate any such limitations in the spaces provided or state that there are none)

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**C. TERMS OF PAYMENT**

(Provide the information requested. Contractors should also indicate if there are any discounts for deposits or early payment.)

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**D. DELIVERY TIMES AND SCHEDULING**

(Provide the information requested. Contractors should indicate an approximate overall project schedule for all work completed for this RFQ.)

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**E. OTHER INFORMATION**

(Please set forth in this section any additional details which may help in the selection process.)

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**F. SUBMITTALS**

(Please attach information requested in part 1.4 located in the City of Salmon Arm Solar PV Performance Specifications - check boxes below)

**Item:**

**Check Box:**

- |  |                          |
|--|--------------------------|
| 1. Schematic Design Package                              | <input type="checkbox"/> |
| 2. Commercial Product Data                               | <input type="checkbox"/> |
| 3. Contractor Experience and References                  | <input type="checkbox"/> |
| 4. Contractor and Professional Engineer Resume           | <input type="checkbox"/> |
| 5. Project Design and Job Specific Construction Schedule | <input type="checkbox"/> |

**G. TERMS AND CONDITIONS**

By signing this form, the contractor acknowledges that: (a) it has read, understands and agrees to the terms and conditions set out in the RFQ's Instructions to Bid Candidates; (b) it has read and understands the information in the City of Salmon Arm PV Performance Specifications of the RFQ; (c), as well as having attached a letter from WorkSafeBC confirming the contractor's current registration, copy of business licence and a letter showing a Certificate of Current Insurance.

Company Name:

\_\_\_\_\_

Signature of Authorized Signing  
Officer:

\_\_\_\_\_

Date:

\_\_\_\_\_

Name of Authorized Signing Officer:

\_\_\_\_\_

Title of Authorized Signing Officer:

\_\_\_\_\_

Mailing Address:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone No.:

\_\_\_\_\_

Fax:

\_\_\_\_\_



## City of Salmon Arm Solar PV Performance Specifications

### 1.0 General

#### 1.1 System Requirements

- .1 The PV contractor will be responsible for the detailed design, supply, installation, manufacture, assembly, coordination and the commissioning of the solar photovoltaic system including:
  - .1 Selection, provision and installation of multiple PV systems, complete with appropriately sized grid tie inverter and targeted size of each solar PV array.
  - .2 Include design calculations and design drawings for the system including models and quantities of main components. System designer to provide:
    - .1 Layout of solar array
    - .2 Details and specifications for solar array racking system
    - .3 Details and specifications for system inverters and balance of system components.
    - .4 Single line diagram for the system.
  - .3 Provide all associated conduit and cabling, electrical protection and controls – inverters, circuit breakers, fuses, fire protection devices and lightning protection and any other items not listed here for the correct installation and operation of the system.
  - .4 Passive protection such as under / over voltage, under / over frequency, Arc Fault protection, overcurrent and short circuit protection.
  - .5 Labelling and signage.
  - .6 Provide Operation and Maintenance Manual for the system which shall include, but are not limited to:
    - .1 List of equipment supplied.
    - .2 Shutdown and isolation procedure for emergency and maintenance
    - .3 Maintenance procedures and timetable
    - .4 Commissioning records and installation checklist
    - .5 Warranty information
    - .6 System configuration diagram / Single line diagram
    - .7 Equipment manufacturer's documentation and handbooks for all equipment
    - .8 PV contractors contact details including after hours contact details

#### 1.2 Assessments and Permits

- .1 A professional structural assessment will be required for the subject building prior to the installation to ensure the building can accommodate the modifications to the roof structure.

- .2 An assessment of the current electrical capacity will be required and service modifications to allow for the PV system.
- .3 The successful proponent will be required to obtain any and all permits required for the project.

### **1.3 Contractor Responsibility**

- .1 The PV contractor will be responsible for all AC and DC wiring, including conduit, solar cabling in between modules, inverter wiring, and AC feed, including tie in breaker.
- .2 Power shutdown shall be minimized and coordinated with the City of Salmon Arm prior to any required power shutdowns.
- .3 All elements of the PV system that are in contact with the roofing system at each location are to be designed so that the current warranty and life expectancy of the roofing system are maintained. It is the responsibility of the PV contractor to ensure compatibility with the current roofing system. Provide any additional protection as required to satisfy these requirements.
- .4 Coordination of roof draining and placement of solar modules.
- .5 Installation shall comply with BC Hydro's Net Metering and Distributed Generation Technical Interconnection Requirements.

### **1.4 Submittals**

Submit the following with the RFQ:

- .1 Schematic design package of the proposed PV system. Submit a complete description of the design, including:
  1. Written narrative of the system
  2. Roof plan layout showing solar module layout
  3. Conceptual single line diagram identifying PV system interconnections, components and point of common coupling
  4. Roof mounting component details
- .2 Commercial Products Data with Performance Charts and Curves. Annotate descriptive data to show the specific model, type, and size of the item. Items for system shall include but not limited to the following:
  1. Solar modules
  2. Solar module mounting system and hardware / racking
  3. Grid tie inverter
- .3 Profiles of four (4) successfully completed solar photovoltaic projects of similar size and complexity. References shall be provided for each of these referenced projects. Contractors with successful installations within other local government jurisdictions will be preferred.
- .4 Contractor and Professional Engineer Resumes
- .5 Proposed project design and construction schedule

## 1.5 Quality Assurance

- .1 The work shall include specific compliance with standards and regulations of the local governing authorities having jurisdiction with regards to installation projects for renewable energy systems; specifically, solar electric grid tie systems. Confirm with and be governed by authorities and standards / regulations including but not limited to:
  - .1 BC Safety Authority
  - .2 BC Hydro Standards
  - .3 Canadian Electrical Code (CEC)
  - .4 CEC Sections 50, 64 and 84
  - .5 ULC 1703 Standard for Flat Plate Photovoltaic Modules and Panels
  - .6 CSA C22.2 No. 107.1-01 General Use Power Supplies
  - .7 CAN CSA C22.2 No. 257-06 Interconnecting Inverter-Based Micro-Distributed Resources to Distributed Systems
  - .8 CAN CSA C22.2 No. 9-08 Interconnection of Distributed Resources and Electrical Supply Systems
  - .9 IEC 61836 Solar Photovoltaic Energy Systems
  - .10 E772-11 Standard Terminology of Solar Energy Conversion
  - .11 IEEE 1547-03 Standard for Interconnecting Distributed Resources with Electric Power Systems
- .2 All components shall be CSA and/or ULC approved, listed, labelled and complying with CSA C22.2-09, all applicable CSA standards, IEEE 929-2000 (recommended Practice for Utility Interface of Photovoltaic Systems), UL 1741 (Standard for Static Inverters and Charge Controller use in Photovoltaic Systems).
- .3 Solar PV Contractors shall demonstrate that they have successfully installed at least four (4) projects that, individually, equal or exceed the size of the proposed project. References shall be provided for each of these referenced projects.
- .4 The system shall have anti-islanding capability thereby incapable of exporting power to the utility distribution system in the absence of utility power.

## 1.6 Guarantee

- .1 All solar photovoltaic system components furnished and installed under this contract shall be guaranteed against defects in design, materials and workmanship for the full warranty period.
- .2 System supplier shall provide warranty of not less than five (5) years on all parts and labour of all aspects of the solar installation including grid tie-in equipment.

## **2.0 Products**

### **2.1 Solar Modules**

- .1 The system supplier is responsible for the selection of CSA/ULC approved solar modules.
- .2 The proposed layout for each system must be illustrated with the layout of arrays indicating the number of arrays and panels per array.
- .3 Details of the manufacturer's warranty must be clearly defined.
- .4 Manufacturer shall be ISO9000 or ISO9001.
- .5 Minimum solar module features to include:
  - .1 Standards: IEC 61215, IEC 61730, IEC 61701, UL 1703
  - .2 Module efficiency: >16%
  - .3 Power Output Tolerance: +5 watts
  - .4 Warranty: Minimum 10 year Product Warranty, 25 year Module Output Warranty

### **2.2 Location and Support Mounting**

- .1 Solar racking for each system will need to be constructed to support the weight of the solar modules, withstand wind loads in relation to the BC Building Code and NBC Structural Commentaries. Framing system warranty and lifespan is expected to match solar module warranty period.
- .2 Racking materials to be aluminum complete with stainless steel hardware and an integrated bonding system.
- .3 Solar modules shall be orientated and angled for maximum annual energy output.
- .4 An industry recognized mounting solution shall be used to ensure adequate weatherproofing of roof penetration.
- .5 The selected mounting shall not damage the existing roof surface.

### **2.3 Inverter**

- .1 The PV contractor shall determine the number and size of the inverters required for system. BC Hydro shall approve the inverters used in its jurisdiction. The chosen model must be approved through the Net Metering application process. Connections and installations shall be done in accordance with CEC Section 84 Interconnection of Electric Power Production Sources.
- .2 The PV contractor shall install the inverter near the main electrical switchgear or in an appropriate location nearby. Based on the proposed design, contractor to confirm space requirements on site and advise if there are any space issues.
- .3 The inverters must be of the grid-interactive type and be of good quality and performance in order to avoid damage to each building's electrical equipment and grid harmonics. The inverter must generate an AC voltage with a pure sine wave form with low harmonic distortion. It is essential that the inverters have an anti islanding mechanism.

- .4 State the inverter manufacturer, model, size, warranty and number of inverters for each location in the quotation.
- .5 Minimum inverter features to include the following:
  - .1 Standards: UL1741, CSA 107.1-01, IEEE 1547, IEEE C62.41.2, IEEE C62.45, IEEE C37.90.1, IEEE C47.90.2, Local Governing Authorities
  - .2 Shall include Maximum Power Point Tracking (MPPT)
  - .3 Isolation means to allow for maintenance and inspection
  - .4 Integrated power output monitoring software or application
  - .5 Anti-Islanding Protection to CSA C22.2 No. 257, CSA C22.2 No. 107.1 and/or UL1741: Inverter to cease energizing the Distribution System within 0.1 seconds upon loss of BC Hydro supply.
  - .6 BC Hydro requires inverter to be certified to the requirements of CSA C22.2 No. 107.1-01 for utility connection.
  - .7 Overcurrent protection: detect and cease to energize the Distribution System for any phase to phase or phase to ground overcurrent fault conditions.
  - .8 Under-Voltage and Over-Voltage Protection
  - .9 Instantaneous Overcurrent Protection
  - .10 Arc Fault Detection and Protection
  - .11 Rapid Shutdown Requirements
  - .12 Timed Overcurrent Protection
  - .13 Under-Frequency and Over-Frequency Protection
- .6 Minimum Inverter Electrical Data:
  - .1 Maximum Array Input Voltage: 600vdc
  - .2 Nominal Output Voltage to match each location service voltage
- .7 PV Contractor to submit design drawings to BC Hydro for their approval. Provide backup protection where BC Hydro considers the inverter protection inadequate.
- .8 Three-phase inverter systems shall cease to energize when any individual phase-to neutral voltage on a grounded-wye system or any individual phase-to-phase voltage on an ungrounded-wye or delta system goes outside an acceptable range. Single-phase inverter DG Systems shall detect the phase-to-neutral voltage if connected to neutral. Single-phase equipment connected line-to-line but not to the neutral conductor shall detect the line-to-line voltage.
- .9 The system shall not attempt to regulate the voltage and shall not adversely affect voltage at the Utility demarcation point. BC Hydro will decide if voltage regulation is expected to be a concern and identify solutions during the technical review.

## 2.4 Kiosk

- .1 The supply and installation of an electronic viewing system within the Salmon Arm Arts Centre to allow public to observe and monitor the data produced by the PV system.

### **3.0 Execution**

#### **3.1 Labelling**

- .1 The PV supplier must supply and install clear and indelible labelling on installation.
- .2 Mark services and equipment to provide a ready means of identification. Provide durable material.
- .3 Combiner boxes and string nameplates will identify the combiner box number and the string as designated on the drawings unless otherwise instructed. Nameplates for disconnect switches will outline their service and source of supply.
- .4 Cables: Label each end to indicate the origin and destination of the cable.
- .5 Operating and maintenance manuals: Provide marking and labelling text identical to the text and terminology used in the Operations and Maintenance manuals.
- .6 Label Isolating switches and outlets to identify the circuit origin.
- .7 Warning labels at revenue meter location and disconnect means.
- .8 Post red warning signs adjacent or on electrical equipment which may be energized by the solar photovoltaic array. Identify "Two Power Sources" on all equipment at point of coupling and all equipment upstream.

#### **3.2 General Electrical Work Testing**

- .1 Provide all testing as required by all codes, including NFPA and standards and all local authorities having jurisdiction
- .2 Upon completion of the installation, system supplier to test all work to ensure there are no leaks, grounds or crosses.
- .3 Ensure all devices are commissioned and operational.

#### **3.3 Installation of PV System**

- .1 Provide system as per design drawings and specifications provided by system designer and all equipment manufacturer's recommendations and instructions. Install the solar photovoltaic system in accordance with the CEC, this section, and the printed instructions of the manufacturer. Prior to system start-up, ensure no copper wire remains exposed with the exception of grounding wire in certain circumstances per manufacturer instructions.
- .2 Wiring Installation: Workers shall be made aware that photovoltaic modules will be live and generating electricity when there is any ambient light source and shall take appropriate precautions. Utilize on site measurements in conjunction with engineering designs to accurately cut wires and layout before making permanent connections. Locate wires out of the way of windows, doors, openings, and other hazards. Ensure wires are free of snags and sharp edges that have the potential to compromise the wire insulation. If the system is roof mounted it shall have direct current ground fault protection according to CEC. Ensure breakers in combiner box are in the off position (or fuses removed) during combiner box wiring.

- .3 Mount rooftop equipment using components for specific applications that will not damage/penetrate roofing system. Ensure components are adequately secured and attached to building structure in manner approved by local authorities.
- .4 Specify, supply and install inverter as per design drawings. Connect for full and complete operation. Program system in accordance with requirements of manufacture to suit specific application. Provide all adjustments required.
- .5 Ensure all raceways are mechanically protected.
- .6 Interconnect system to electrical distribution system.
- .7 Provide all wiring and conduit raceways required.
- .8 Provide all final connections.
- .9 Provide lamacoid nameplates for all equipment.

### **3.4 Grounding and Bonding**

- .1 Perform all required grounding and bonding work in accordance with the requirements of the Canadian Electrical Code (CEC).
- .2 Shall ground according to manufacturer's instructions.
- .3 Provide insulated copper grounding conductors from rooftop equipment and connect to building ground system in main electrical room.
- .4 Ground the system and make all required grounding connections to electrical devices and apparatus. Ground conductors are to be insulated copper wire connected with approved fitting in accordance with CEC.
- .5 Properly ground and bond modules, mounting frames, disconnects, combiner boxes, junction boxes and conduit systems to CEC requirements. Fuse module strings and provide disconnect for each array string.
- .6 The connection to a module or panel shall be arranged so that the removal of a module or panel from a photovoltaic source circuit does not interrupt a bonding conductor to other photovoltaic source equipment.
- .7 Bond PV metal frames to lightning protection system on roof as required.
- .8 DC Ground-Fault Protector:
  - .1 Shall be listed per UL 1703
  - .2 Shall comply with requirements of the CEC to reduce fire hazards
  - .3 Ungrounded DC solar photovoltaic arrays shall comply with the CEC.

### **3.5 Testing and Commissioning**

- .1 Upon completion of the installation, the PV contractor shall start up the system and perform all required site acceptance tests to demonstrate the system meets the functionality and performance requirement of the specification. PV contractor shall also conduct an on-site training to the Owner's designated personnel.
- .2 Inspect installation to ensure compliance with specification manufacturer's requirements and compliance with applicable codes and

- local authorities. Check continuity of conductors including grounding conductors to verify no faults exist.
- .3 The PV contractor will be responsible for testing and commissioning the system prior to handover to the system owner and ensure that it is operating to the tendered specifications and to the satisfaction of client and all authorities having jurisdiction.
  - .4 Obtain PV system designer's / manufacturer's specific electrical output data and design calculations for comparison to measured values. Measure and monitor system voltage, current and power outputs and record in test report. Tabulate result with and compare with designer's / manufacturer's data and design data and where significant differences exist, work with the system supplier and manufacture to perform corrective actions as recommended by supplier.
  - .5 Test PV modules during daytime with the sun shining on the array modules. Record and measure output current of each array string.
  - .6 Make adjustments to the system for the system to produce the maximum possible amount of energy on an annual basis.
  - .7 Field verification of system to be coordinated with BC Hydro as required. Contractor shall coordinate with electrical utility to establish interconnection agreement. Connect the solar array to the electrical utility grid only after receiving prior approval from the utility company.
  - .8 Solar photovoltaic system verification certificate per IEC 62446.
  - .9 For battery equipped devices verify that protection settings are stored in non-volatile memory.
  - .10 For devices relying on battery power to trip, verify design to be fail-safe by disconnecting the battery and verifying the system ceases to energize the distribution system.
  - .11 Confirm all settings (magnitude & delay) are set to the BC Hydro accepted values and protected from changes.
  - .12 Test procedure will include but not be limited to the following:
    - .1 Perform all recommended manufacturer testing
    - .2 Functionally test all protective elements including:
      - .1 Anti-islanding (include time delay to re-energize)
      - .2 Inability to energize dead system
      - .3 Under and over voltage
      - .4 Under and over frequency
      - .5 Overcurrent (if applicable)
      - .6 Synchronizing controls (if applicable)

### **3.6 Operating, Maintenance and Record Manuals**

Prepare operating, maintenance and record manuals as outlined below.

- .1 A front title page shall identify the Project, the Owner, and any and all consultants. In addition, the names of the Photovoltaic Contractor and any and all sub-contractors, with addresses and telephone numbers shall be listed.



- .2 An index shall be provided and the manual shall be divided by index dividers including but not limited to the following major sections:
  1. List of Electrical Design Drawings
  2. Systems Description
    - .1 Details to permit effective start-up operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.
    - .2 Technical data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists.
    - .3 Product data indicating only information pertinent to the specific product.
    - .4 Complete operating instructions and procedures including start-up, break-in and normal operating instructions and sequences. These shall include instructions for summer, winter and any other special operating conditions.
- .3 Maintenance
  - .1 Maintenance schedules including detailed servicing, maintenance and trouble-shooting instructions for each item of equipment including daily, weekly, monthly, semi-annual and annual checks and tasks.
  - .2 Manufacturer's technical literature for each item of equipment installed. Literature shall include: Operating instructions, Maintenance instructions, Wiring Diagrams, Parts list and Installation instructions, Energy considerations, Trouble Shooting Procedure Guide in spreadsheet form with the most likely causes and recommended actions for all foreseeable problems. Trouble Shooting Procedure guides are required for all the major items of equipment.
- .4 Equipment Suppliers
  - .1 Local source of supply for replacement parts for each item of equipment.
- .5 Electrical Distribution
  - .1 Modified single line diagram shall identify all electrical connection points and overcurrent protection sizes.
- .6 Shop Drawings
  - .1 Copies of all final "reviewed" shop drawings. Shop drawings shall be c/w Consultant's review stamp or review form.
- .7 Guarantees, Certificates and Miscellaneous Reports
  - .1 Final Electrical Inspection Report
  - .2 Electrical and Structural Seismic schedules (Letters of Assurance)
  - .3 Commissioning reports/checklists
  - .4 Equipment performance test results

- .5 Warranty certificates
- .8 Record Drawings
  - .1 The Record Drawings shall include, but not be limited to the following changes:
    - .2 All changes in circuiting; show the correct circuit number on the drawings for all devices.
    - .3 Size and routing of all conduits;
    - .4 Number of AWG of conductors (#10 AWG and larger) in raceways and cables;
    - .5 Location of all junction and pullboxes.
    - .6 Location of all electrical equipment, disconnects, inverters, etc.
    - .7 Location of all conduit or duct stubs, installed equipment, devices and fixtures.
    - .8 All changes to electrical installation resulting from addenda, change orders and field instructions.
    - .9 Exact location of all services left for future work.
    - .10 As built panel directories including room number(s).
    - .11 Photovoltaic array arrangement and support structure.
  - 3. Electronic copies of as-built drawings (PDF and AutoCAD formats)
  - 4. Furnish three [3] final copies to the Owner at least ten [10] days prior to the substantial performance inspection date. Provide more than one volume if the overall thickness of a single binder would exceed 100 mm [4"].
  - 5. Printed hard cover manuals shall be supplied in 3 post hard back Acco expansion style "Fliplock" binders, with stamped lettering on the front cover and spine showing the following:
    - .1 Name of Project
    - .2 Name of Manual - "Operating and Maintenance Manual - Photovoltaic System"
  - 6. A complete set of operating instructions for the solar photovoltaic electrical power generation system shall be laminated or mounted under acrylic glass and installed in a frame near the equipment.

### 3.7 Field Training

- .1 Provide a field-training course for operating and maintenance staff members after the system is functionally complete. Include in the training a discussion of the system design and layout and demonstrate routine operation, maintenance and troubleshooting procedures.
- .2 Training session shall be no less than 2 hrs in duration and system owner staff must demonstrate competency and understanding of the system.