

**Solar Design Associates, LLC.**  
**Solar System Service and Repair Agreement**

**Service and Repair Agreement for Harvard Community Solar Garden-1**

Solar Design Associates, LLC. (SDA) offers an annual service agreement as described below for the 294 kWp dc solar photovoltaic (PV) plant located at 285 Ayer Road, Harvard, MA renewable annually by mutual agreement for a period of up to 5 years from the date of system acceptance.

**SUMMARY OF SERVICES UNDER THE SERVICE AGREEMENT:**

Regular Data Acquisition System (DAS) observation

- Confirm proper operation of PV system and DAS

Annual scheduled system re-commissioning by qualified solar engineers, including:

- Visual inspection of array and complete system
- Testing of the PV arrays
- Inspection of wiring and connections
- Inspection of all BoS components
- Confirmation of system power output and operational modes
- Verification of proper system grounding

While on site for the annual inspection, SDA will correct any discovered issues that can be addressed during SDA's scheduled annual re-commissioning.

Trouble shooting and repair for issues that cannot be corrected during the annual scheduled inspection and re-commissioning and are not covered under warranty shall be provided on a time and materials basis as described below under *Unscheduled Maintenance*.

Repairs for issues caused by Acts of God (including but not limited to lightning strikes or near-strike transients), Natural events (including but not limited to bird droppings) and Vandalism (including but not limited to theft, breakage, and graffiti) will be addressed on a time and materials basis.

**DETAILED DESCRIPTION OF SERVICES UNDER THE SERVICE AGREEMENT:**

Under this agreement, SDA shall provide the following Operations and Maintenance services:

**PV SYSTEM MONITORING**

1. Regularly view the logged data from the DAS system web page to verify PV array output. If the PV system is not functioning properly an unscheduled site visit may be necessary on a time and materials basis to diagnose and correct the problem(s).

**ANNUAL SYSTEM RECOMMISSIONING**

Once annually, SDA will provide a comprehensive recommissioning of the PV plant and assess the system's operation as defined below:

1. Full recommissioning of the system and reporting to ensure that the PV system remains fully functional and in a neat and orderly condition consistent with industry practice and operational requirements.
  - a. A photo-record of the installation and major components, including PV's, inverters, transformers, source circuit combiners and other BoS components will be made, including photos showing connections within all installed enclosures.
  - b. A copy of the photo record shall be added to the system Operation and Maintenance Manual.
2. Verification that all components remain properly installed.
  - a. Check whether mounting system components remain properly fitted.
  - b. Check for any unusual positioning of the PV modules or mounting system.
  - c. Check for any unusual positioning of the PV system conduits or combiners.

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3. Inspection of outdoor components to confirm they remain weatherproof and capable of functioning intact under the site environmental conditions.
  - a. Confirm that all outdoor enclosures remain configured to alleviate condensation.
  - b. Confirm that all doors, covers, panels, and cable exits remain gasketed or otherwise designed to limit the entrance of dirt and moisture.
  - c. Inspect the PV module surfaces for damage or discolorations.
  - d. Note and report any build-up of unwelcome plant growth and other debris especially under and around the array mounting system and inverters. Mowing and other site vegetation management tasks to be performed by others.
4. Testing of PV array
  - a. Test each source circuit string for Voc and Isc. Obtain source circuit string testing instructions and tables of expected values for measurement of individual source circuit Voc and Isc from the PV manufacturer. Follow the instructions and refer to these tables when testing source circuits. Each source circuit is to be tested for Voc and Isc under good, clear weather conditions. Ambient temperature and solar irradiance in the plane of the array are to be measured and recorded. The measurements are to be recorded and compared to the values in the tables. The instructions will provide a guide of suggested actions in the event the measurements are out of the expected ranges in the table. A copy of the measurements is to be included in the PV system Operation and Maintenance Manual.
  - b. Test each source circuit string for resistance to ground with a meg-ohm meter. Source circuits with an insulation resistance which are below 1M $\Omega$  at 500Vdc will be considered defective and will need to be repaired.
5. Confirmation that all wiring is in good condition and continuous for each wiring run.
  - a. Inspect all wiring for mechanical damage and/or corrosion.
  - b. Inspect all conduit runs and electrical enclosures.
  - c. Verify that all wiring is supported as required and that proper strain relief is correctly installed.
  - d. Confirm that wires have identifying labels or markings on both ends and that the labels or markings are permanent and durable. Labels or markings on exposed wiring should be of type that is rated for withstanding the outdoor environment.
  - e. Confirm that wiring not in conduit remains bundled, laced and otherwise laid in an orderly manner and is free from abrasion damage.
6. Inspect all balance-of-system electrical components.
  - a. Test the inverters as outlined in the inverter Operations and Maintenance manual.
    - i. Test and record the AC line voltage at the inverter to insure that it is within the proper limits as stated by the manufacturer.
    - ii. Test that the phase sequencing is correct as applicable.
    - iii. Check the continuity of all fuses.
    - iv. Check that the DC open-circuit array voltage is within the manufacturer's recommended range at the DC disconnect.
    - v. Ensure that the inverter enclosure and the DC and AC disconnect switches are properly secured.
    - vi. After manufacturer's specified start up time (~five minutes), confirm that each inverter is operating properly by recording the DC operating voltage and currents, AC phase voltages and phase currents and inverter power.
    - vii. Confirm System Wake-Up and Sleep Separations with inverter manufactures specs.

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- viii. Check system response to Loss of Utility and Loss of Array.
  - ix. Look for, listen for, make notation of, find the cause, and if possible within the scheduled visit, remedy anything unusual observed from the PV array or BoS components.
  - b. Confirm that all lightning arrestors and surge suppressors are properly installed and not been damaged by near-strike transients.
7. Inspection of accessible electrical connections to confirm they are tight. This will require that the field engineers open all enclosures and check for proper torque of all fasteners. Consult the component O&M manuals for proper settings.
  8. Verification that non-current-carrying metal parts are solidly grounded and all equipment and PV system grounding is functional per NEC 250.

**UNSCHEDULED TROUBLE SHOOTING AND REPAIRS**

1. While on site for the annual re-commissioning, SDA will correct any discovered issues that can be addressed in the time available during the scheduled inspection.
2. SDA will address system trouble shooting and repair requirements on a time and materials basis for issues that cannot be corrected during the scheduled annual re-commissioning and are not covered under warranty.
3. SDA shall provide rapid-response "on-call" support to address critical system malfunctions.
4. SDA will act as a liaison with the individual component suppliers / manufacturers on behalf of HSG-1 to address warranty issues that might arise with their hardware.
5. Repairs for issues caused by Natural Events (including but not limited to bird droppings), Acts of God (including but not limited to lightning strikes and near-strike transients), and Vandalism (including but not limited to theft, breakage, and graffiti) are not covered by warranty or this service agreement and shall be addressed on a time and materials basis.

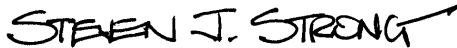
Fee: The base cost of for the first year of this agreement is \$3,750 payable at the beginning of the one-year period commencing on initial operation of the system. This fee includes the following: Regular review of system output data, the annual re-commissioning effort, liaison with suppliers and manufacturers and, being "on-call" to address unscheduled field maintenance requirements.

SDA fees for field engineering time for system trouble shooting and unscheduled maintenance / repair is \$125 / hr. Reimbursable expenses for such items as any materials needed that are not covered under warranty and shipping fees for components and material are in addition to services and will be billed at cost. If additional provisions are added to this agreement, we reserve the right to increase our fees to cover them.

Payments shall be made within 30 days of receipt of invoice from Solar Design Associates, LLC. Overdue payments shall incur interest at 1.5% per month.

Submitted by:

Accepted by:



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Steven J. Strong, President  
Solar Design Associates, LLC.  
December 7, 2012

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for Harvard Solar Garden 1

By: \_\_\_\_\_

Date: \_\_\_\_\_