

Appendix J

Operations and Maintenance Schedule

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Project Operations and Maintenance Tasks and Frequency			
Equipment	Short Description	Long Description	
SITE	Primary Site Inspection	Visual inspection of general site conditions, including solar arrays, balance of plant, fencing, shading, vegetation, animal damage, erosion, roads, drainage systems and other civil infrastructure, signs of corrosion. Clear debris within the fence perimeter as needed.	Quarterly (4x)
	Primary Site Inspection	Visual inspection of spare parts containers, communication cabinets, shelters, and any other enclosures on site for signs of secure and intact doors/windows, signs of forced entry or vandalism, animal nesting, damage, roof integrity, erosion that may compromise any part, obstruction to any ventilation.	Quarterly (4x)
	Primary Site Inspection	Inspect all switches, fuses, and disconnects.	Annually (1x)
PV MODULES	Primary DC Field Inspection	Visual inspection of modules for cracks, discoloration, environmental seal deterioration, frame damage, backsheets damage, junction box problems, excessive soiling, cord-plate separation/arching, position movement, animal damage/nesting and vegetation overgrowth causing shading.	Annually (1x)
	IR SCAN	Perform aerial IR scans on 100 percent (100%) of the modules to identify string outages, faulty modules, and any other string/module related issues.	Annually (1x)
MODULE SUPPORT STRUCTURES	Primary DC Field Inspection	Visual inspection of posts, sub-structure frames, mounting systems, module clips, removed/damaged modules, grounding system, and other relevant equipment.	Annually (1x)
TRACKER/ RACKING SYSTEM (IF APPLICABLE)	Primary DC Field Inspection	Inspect tracking/racking system for proper positioning, loose/worn joints/couplings/bushings, signs of cracked/damaged drive components, obstructions to normal travel/movement, proper operation and mounting of any sensors and masts, rust and corrosion, grounding systems. Visual inspections of all piles/foundations and other steel.	Annually (1x)
	Maintenance	Lubricate slew gears.	Every 2 years
	Maintenance	Perform preventive maintenance per manufacturer's warranty requirements and recommended operations and maintenance manual.	Annually (1x)
	Maintenance	Inspect module table for proper alignment and check a sample of module rail fasteners for proper connection.	Annually (1x)
	Maintenance	Test wind stow functionality. Repeat for snow or flood sensors if installed.	Annually (1x)

Project Operations and Maintenance Tasks and Frequency			
Equipment	Short Description	Long Description	
	Maintenance	Inspect bearing housing assemblies for misalignment due to settling of piers and adjust position if necessary.	Annually (1x)
	Maintenance	Inspect all electrical enclosures for cracking, pests, water or other damage.	Annually (1x)
	Maintenance	Check a sample of torque tube adapter torqued connections for proper torque value.	Annually (1x)
DC HARNESS, CABLE AND WIRING	Primary DC Field Inspection	Visual inspection of all string level wiring (from modules through combiner box) and wire management and DC harnesses, including looking for fuse issues, compromised cable, stained, exposed or melted wiring, disconnected/separated connectors, crimped wire radii, unsecured wire harnesses/clips, animal damage/nesting, and grounding. Inspect the system for loose electrical connections.	Annually (1x)
	Primary DC Field Inspection	Perform short circuit current (Isc) and open circuit voltage (Voc) testing of strings (10%).	Annually (1x)
COMBINER BOX	Primary DC Field Inspection	Perform IR scans on 100 percent (100%) of combiner boxes, recombiner boxes, string boxes, and tighten connections. Provide reporting on observed issues and address corrective maintenance items.	Annually (1x)
	Primary Site Inspection	Visual inspection of exterior for obstruction to ventilation, corrosion and environmental seals.	Quarterly (4x)
	Primary DC Field Inspection	Physical inspection of internal filters, wire terminations for torque mark alignment, exposed wires, pull tests, and any other checks recommended by OEM. Includes power blocks, terminal strips, DIN rails, grounding bus and systems, back panel, fuses, etc. Clean any dirt/debris.	Annually (1x)
METEOROLOGICAL STATION	Maintenance	Weekly pyranometer cleanings and visual inspection of sensor alignment.	Weekly (52x)
	Maintenance	Weekly soiling station cleaning of 1 module or reference cell.	Weekly (52x)
	Primary Site Inspection	Full visual and operational inspection of weather stations, including pyranometers, BOM temperature sensors, temp/RH/wind/precip sensors, enclosures, tower, foundation, grounding and wiring. Clean any dirt/debris.	Quarterly (4x)
	Primary DC Field Inspection	Desiccant pack replacement at meteo and soiling station enclosures.	Annually (1x)
	Maintenance	Support pyranometer recalibration effort managed by Owner or 3rd party (receive sensors, perform physical swap, perform SCADA system updates as necessary, ship sensors back, documentation of all items).	Every 2 years

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	Primary Site Inspection	Full visual and operational inspection of soiling station equipment, including cabling, data logger, etc.	Quarterly (4x)
PCS ENCLOSURE	Maintenance	Check protective cover, torques and contact resistors of the low-voltage connections between inverter and MV block.	Annually (1x)
	Maintenance	Check labels on Tracker Auxiliary Rack, check function of the TAR disconnect switches.	Every 2 years
	Primary Site Inspection	Perform visual check of all equipment, enclosures, conduit for integrity, exhaust fans, louvers, actuators, general PCS inspection. Includes grounding system. Clean any dirt/debris.	Quarterly (4x)
HVAC	Maintenance	Inspection and check of site HVAC systems, including fans, compressors, filters, thermostats, timers, power and control wiring. Clean any dirt/debris. May be included in monthly substation maintenance.	Monthly (12x)
INVERTER	Primary DC Field Inspection	Perform 100 percent (100%) inverter thermal imaging on connections, terminations, and other relevant areas.	Annually (1x)
	Primary Site Inspection	Visual inspection of exterior cabinet for: obstruction to ventilation, corrosion and environmental seals. Clean any dirt/debris.	Quarterly (4x)
	Maintenance	Physical inspection of internal filters, capacitors for bulging, leaking or discoloration), wire terminations for torque mark alignment, exposed wires, pull tests, grounding systems and any other checks recommended by OEM. Clean any dirt/debris.	Semi-Annual (2x)
	Maintenance	Annual "heavy" physical inspection of internal filters, capacitors for bulging, leaking or discoloration), wire terminations for torque mark alignment, exposed wires, pull tests, grounding systems and any other checks recommended by OEM.	Annually (1x)
	Maintenance	Enclosure status.	Annually (1x)
		Doors and locks are in good state and close/seal properly. All keys and handles present.	
		Internal general cleanliness.	
		Change inverter air filters per manufacturer's warranty requirements and recommended operations and maintenance manual.	
		Change inverter heat sincks per manufacturer's warranty requirements and recommended operations and maintenance manual.	
		Check torque marks and re-tightening appropriate wiring connections.	

Project Operations and Maintenance Tasks and Frequency			
Equipment	Short Description	Long Description	
		AC wires and bolts status. Control connections.	
		LCL filter capacitance.	
		MV connectors in MV switchgear in good state.	
		SF6 pressure visual inspection (MV switchgear).	
		GFDI hardware trigger.	
	Maintenance	DC sources in proper range.	Semi-Annual (2x)
		DC leakage detector.	
		Surge protection devices feedback.	
		GFDI feedback.	
		Signaling elements. LEDs and display work.	
		Main temperatures in range.	
		Verify meter power readings from the inverter against the SCADA data.	
MEDIUM-VOLTAGE TRANSFORMER	Primary Site Inspection	Visually inspect exterior for obstruction to heat-sink fins, corrosion, leaking, and ensure the oil gauges are functioning properly, elbows, gauges, drain, test valves, grounding systems. Clean any dirt/debris. Check meters, oil gauge, and temperature gauge. Verify transformer temperatures in acceptable range.	Quarterly (4x)
	Maintenance	Perform DGA on 100 percent (100%) of units.	Annually (1x)
	Maintenance	Check labels for integrity.	Annually (1x)
	Maintenance	Check the bolted connection of the low-voltage connection.	Annually (1x)
	Maintenance	Adjust the MV transformer tank pressure.	Annually (1x)
	Primary DC Field Inspection	Perform 100 percent (100%) thermal imaging.	Annually (1x)
GROUNDING SYSTEM	Maintenance	Including all site grounding wires, test wells, lightning protection and grounding plates. Maintenance included in inverter, tracker, module support structures, transformer, PCS enclosure, combiner box and substation items.	Annually (1x)
PHOTOVOLTAIC INTERCONNECTION SWITCHGEAR (PVIS)	Primary DC Field Inspection	Includes bus work, exposures, circuit breaker and switches. Clean any dirt/debris.	Annually (1x)
	Primary DC Field Inspection	Perform 100 percent (100%) thermal imaging.	Annually (1x)
FIRE ALARMS/SAFETY	Maintenance	Inspection and check of site fire and security alarm systems, including wiring and associated devices. Testing of all alarms and related equipment. Inspection and general maintenance of eyewash station.	Monthly (12x)

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Equipment	Short Description	Long Description	
AC CABLE AND WIRING	Maintenance	Physical inspection of all wire terminations for torque mark alignment, exposed wires and pull tests of clamped wire ends before and after seasonal temperature swings. Includes AC cables and wires from inverters to MV transformers, to the switchgear/substation, and any AC cables serving ancillary equipment and power panels. Inspect the system for loose electrical connections.	Annually (1x)
	Maintenance	Visual inspections of Gentie for loose connections, structural issues and grounding matters.	Annually (1x)
	Primary DC Field Inspection	Perform 100 percent (100%) thermal imaging, including any overhead AC system lines.	Annually (1x)
SCADA SYSTEM	Maintenance	Visual inspection and cleaning of all SCADA system equipment. Includes power and control wiring, SCADA panels and enclosures, structural and support components, power supply, interfaces, logic and controller devices, monitoring devices.	Annually (1x)
	Maintenance	Technical/cyber inspection and cleanup, maintenance of SCADA systems.	Annually (1x)
	Maintenance	IT maintenance includes VPN account management and manufacturer required maintenance on Servers, Network Switches and Firewalls.	Monthly (12x)
	Maintenance	Performance scheduled maintenance on SCADA and data acquisition systems, in accordance with manufacturer's instructions. Perform software updates within 30 days of software update release.	Monthly (12x)
	Maintenance	SCADA system functional testing of batteries, validation of data and server maintenance.	Annually (1x)
HIGH VOLTAGE STEP-UP TRANSFORMER (IF APPLICABLE)	Maintenance	5-year major routine maintenance (outage).	Every 5 years
	Maintenance	Annual substation routine maintenance (outage).	Annually (1x)
	Maintenance	Perform DGA on GSU.	Annually (1x)
	Maintenance	Perform 100 percent (100%) thermal imaging.	Annually (1x)
SUBSTATION	Maintenance	5-year major substation routine maintenance (outage).	Every 5 years
	Maintenance	Annual substation routine maintenance (outage).	Annually (1x)
	Maintenance	Annual substation and collector system IR scan.	Annually (1x)
	Maintenance	Monthly substation and interconnection/gen-tie inspection (fencing, grounding, roads, debris,	Monthly (12x)

Project Operations and Maintenance Tasks and Frequency			
Equipment	Short Description	Long Description	
		veg, corrosion, leaks, enclosures & all equipment, etc.). Includes inspection of GSU oil containment structures and for leaks.	
	Maintenance	Substation battery and backup systems maintenance, including measurements of float cell voltage, pilot cell voltage, electrolyte temperature of pilot cell, specific gravity as required.	Monthly (12x)
	Maintenance	Perform DGA on GSU (IF APPLICABLE).	Annually (1x)
	Maintenance	Control building – integrity inspection, cleaning of dust/water from interior and exterior areas and all equipment, inspection and operating check of HVAC systems, fire alarms, security systems, etc. Clean any dirt/debris. Includes HVAC line above.	Monthly (12x)
METERS	Maintenance	Perform annual meter calibrations and other maintenance per manufacturer recommendations. Includes site energy meters, telecom equipment and meters, relaying and other electronic equipment houses within the control building. Clean any dirt/debris.	Annually (1x)
TRANSMISSION LINE	Maintenance	Gopher State Solar will generally inspect the transmission lines annually as part of normal practices. These inspections will be limited to the right-of-way and to areas where obstructions or terrain may require off-right-of-way access. If issues are identified during inspection, repairs will be performed, and damage restored.	Annually (1x)