AMENDMENT NO. 1 TO THE AGREEMENT FOR DISTRIBUTED CONTROL SYSTEM UPGRADE/REPLACEMENT PROJECT BETWEEN THE CITY OF SANTA CLARA, CALIFORNIA, AND EMERSON PROCESS MANAGEMENT POWER & WATER SOLUTIONS, INC.

PREAMBLE

This agreement ("Amendment No. 1") is entered into between the City of Santa Clara, California, a chartered California municipal corporation ("City") and Emerson Process Management Power & Water Solutions, Inc., a Delaware corporation ("Contractor") registered to conduct business in the State of California. City and Contractor may be referred to individually as a "Party" or collectively as the "Parties" or the "Parties to this Agreement."

RECITALS

A. The Parties previously entered into an agreement entitled, "Agreement for Distributed Control System Upgrade/Replacement Project Between the City of Santa Clara, California, and Emerson Process Management Power & Water Solutions, Inc.", dated on or about July 22, 2019 (Agreement);

B. The Parties entered into the Agreement for the purpose of having Contractor provide all equipment, materials, and labor to upgrade the Distributed Control System ("System" or "DCS") at the Donald Von Raesfeld Power Plant and the Parties now wish to amend the Agreement to add the Ovation Excitation Module.

C. The Agreement and its amendments are collectively referred to herein as the "Agreement as Amended"; and

NOW, THEREFORE, the Parties agree as follows:

AMENDMENT TERMS AND CONDITIONS

1. Section 11 of the Agreement "COMPENSATON AND PAYMENT" is hereby deleted and replaced with: "The maximum compensation of this Agreement is Three Million Seven Hundred Twenty Five Thousand Dollars ($3,725,000), subject to budget appropriations, which includes all payments that may be authorized under this Agreement. The terms, rate, and schedule of payment are set forth in the attached Exhibit B, entitled "Compensation and Payment Schedule." All work performed or materials provided in excess of the maximum compensation shall be at Contractor's expense. Contractor shall not be entitled to any payment above the maximum compensation without a mutually executed Amendment."

2. Exhibit A – Scope of Services is hereby deleted and replaced with the attached Exhibit A – Scope of Services - Amended October 27, 2020.

3. Exhibit B – Schedule of Fees is hereby deleted and replaced with the attached Exhibit B – Compensation and Fee Schedule - Amended October 27, 2020.

4. Exhibit F – Sample Work Authorization Form is hereby added.

5. Except as set forth herein, all other terms and conditions of the Agreement as Amended shall remain in full force and effect. In case of a conflict in the terms of the Agreement and this Amendment No. 1, the provisions of this Amendment No. 1 shall control.

The Parties acknowledge and accept the terms and conditions of this Amendment No. 1 as evidenced by the following signatures of their duly authorized representatives.

CITY OF SANTA CLARA, CALIFORNIA
a chartered California municipal corporation

Approved as to Form: Dated: _____

BRIAN DOYLE
City Attorney

DEANNA J. SANTANA
City Manager
1500 Warburton Avenue
Santa Clara, CA 95050
Telephone: (408) 615-2210
Fax: (408) 241-6771

"CITY"

EMERSON PROCESS MANAGEMENT POWER & WATER SOLUTIONS, INC.
a Delaware corporation

Dated: _____
By (Signature): _____
Name: _____
Title: _____
Principal Place of Business Address: _____
Email Address: _____
Telephone: ( ) _____
Fax: ( ) _____

"CONTRACTOR"

EXHIBIT A

SCOPE OF SERVICES – AMENDED OCTOBER 27, 2020

1. GENERAL

1.1. This Scope of Services covers the replacement of all major plant control systems and interfaces to various auxiliary systems at the Donald Von Raesfeld ("DVR") (collectively, the "Project"). This Scope of Services defines the requirements for the design, engineering, manufacture, staging, factory test, demonstration, documentation, delivery, installation, certification, field testing and startup of the Distributed Control System ("System" or "DCS") and the addition of the Emerson Ovation Excitation System (Excitation).

1.2. This Project is on a turnkey basis whereby Contractor is responsible for installation and commissioning for the scope of supply covered under this Scope of Services.

1.3. Contractor is responsible for all system design and implementation. Contractor shall be responsible for reviewing all system and original equipment manufacturer (OEM) documentation, including all current logic and wiring diagrams, and incorporate all currently controlled and connected equipment.

1.4. City will not perform any design or engineering for the project and expects that Contractor has experience and capability to fully engineer the replacement System, Excitation, and execute the project successfully. The City will design and implement a new server room and interlocation networking with guidance from the Contractor. The City may review Contractor's submittals and make comments but this does not remove the responsibility of the Contractor for system design.

1.5. The DVR plant consists of the following.

1.5.1. Two (2) General Electric LM6000 PC sprint combustion turbine generators (CTG) single fuel gas with water injection to control NOx and air inlet chilling.

1.5.2. Two (2) ATS Express dual pressure heat recovery steam generators (HRSG) with duct burners and selective catalytic reduction (SCR) and CO catalyst to control emissions.

1.5.3. One (1) Mitsubishi Heavy Industries induction condensing steam turbine generator (STG).

1.5.4. Balance of plant (BOP), a deaerating surface condenser, a mechanical draft, plume-abated cooling tower, and various associated support equipment.

1.6. The System shall be a fully engineered system, designed and executed as a fully functional replacement for the existing gas turbines, steam turbine, generator excitation, heat recovery steam generators, and balance of plant systems. Contractor shall meet or exceed all OEM control specifications, sequencing, protection, operational limits, and interlocks. The System shall provide automatic control that maintains operational process limits and time curves for warmup/cooldown requirements. Special attention must be made to both the combustion/steam turbines and generators protection systems, ensuring all processes critical inputs are evaluated and acted upon within OEM and industry standard time specifications. Examples of critical protection are speed detection, monitoring, and over speed trip system. The System shall be open architecture with no hidden logic or sections of code inaccessible to City.

1.7. To the extent not inconsistent with this Agreement between the City and Contractor including this Scope of Services, the City's Request for Proposal (RFP) 18-19-16 (including subsequent updates), Contractor's proposal response dated March 18, 2019, Contractor's system demonstrations materials dated April 11, 2019, and Contractor's Best and Final Offer (BAFO) response dated April 16, 2019 are hereby incorporated by reference herein, and shall supplement this Scope of Services and be subject to the terms and conditions of the Agreement.

2. DOCUMENTS

2.1. This Exhibit contains the following Appendices:

2.2. Appendix A-: I/O Counts

2.3. Appendix A-2: Steam Turbine Control Block Diagram

2.4. Appendix A-3: Turbine Data

2.5. Appendix A-4: OT & EWS Stations

2.6. Appendix A-5: Preliminary Project Implementation Schedule

2.7. Appendix A-6: Final System Acceptance Certificate

2.8. Appendix A-7: SureService Customer Service Support Program

2.9. Appendix A-8: Excitation Control System Proposal

2.10. Appendix A-9: Excitation Project Preliminary Schedule

3. CURRENT SYSTEM DESCRIPTION

3.1. Existing Control System

The hardware locations, as well as the scope of the interfaces between the control systems and ancillary devices, will mimic the current installation. The current control systems to be replaced are outlined as follows.

3.1.1. Combustion Turbine Generators (CTG), each turbine has its own independent control system

3.1.1.1. Control: GE Millennium Mark VI, one (1) for each CTG.

3.1.1.2. Engineering Work Station: GE Control System Toolbox and Logicmaster PLC. Mark VI configuration tool installed on local Supervisory Control and Data Acquisition Human Resource Interface (SCADA/HMI).

3.1.1.3. SCADA/HMI: Wonderware, one (1) local and one (1) remote station for each CTG.

3.1.2. Steam Turbine

3.1.2.1. Control: Mitsubishi Heavy Industries (MHI) Turbine Control Panel with a Woodward 505 governor.

3.1.2.2. Control (Supervisory): ABB (Harmony) DCS, one (1) Process Control Unit (PCU).

3.1.2.3. Engineering Work Station: ABB Composer, common to all systems except the CTG's.

3.1.2.4. SCADA/HMI: ABB Conductor NT, common to all systems except the CTG's.

3.1.3. HRSG's

3.1.3.1. Control: ABB (Harmony) DCS, one (1) PCU for each HRSG.

3.1.3.2. Engineering Work Station: ABB Composer, common to all systems.

3.1.3.3. SCADA/HMI: ABB Conductor NT, common to all systems except the CTG's.

3.1.4. Balance of Plant

3.1.4.1. Control: ABB (Harmony) DCS, two (2) PCU's for BOP.

3.1.4.2. Engineering Work Station: ABB Composer, common to all systems.

3.1.4.3. SCADA/HMI: ABB Conductor NT, common to all systems except the CTG's.

3.1.5. Gas Compressor

3.1.5.1. Control (Supervisory): ABB (Harmony) DCS, one (1) PCU.

3.1.5.2. Engineering Work Station: ABB Composer, common to all systems.

3.1.5.3. SCADA/HMI: ABB Conductor NT, common to all systems except the CTG's.

3.1.6. Switch Yard

3.1.6.1. Control (Supervisory): ABB (Harmony) DCS, one (1) PCU.

3.1.6.2. Engineering Work Station: ABB Composer, common to all systems.

3.1.6.3. SCADA/HMI: ABB Conductor NT, common to all systems except the CTG's.

3.2. ABB (Harmony) DCS System

3.2.1. The ABB (Harmony) DCS and Conductor NT SCADA/HMI system to be replaced consist of seven (7) independent process control units (PCU), each with one or two pairs of redundant control processors. With an additional six (6) processors used as foreign device interface units (FDI) to communicate with auxiliary systems. The SCADA stations are common to all control units except the CTG's and are all located in the plant control room. There are currently six (6) dual screen operator SCADA/HMI systems, one (1) Open Platform Communications (OPC Data server (OSI PI Interface) and two (2) engineering work stations (EWS). The first EWS is located in the control room and the second EWS located in the Instrumentation Control (I&C) office.

3.2.2. The ABB (Harmony) DCS system consist of the following process control units. Contractor shall provide the necessary equipment (i.e. fiber optic modems, Ethernet switches) to communicate between all PCU's and all SCADA/HMI, EWS and all other work stations. The existing fiber optic, Ethernet and data highway cabling between panels (locations) shall be utilized when possible. Inter-panel fiber optic, Ethernet and data highway cabling shall be replaced.

3.2.2.1. PCU 1: Unit #1 HRSG Control & CTG Interface & Supervisory Control.

3.2.2.2. Location: Auxiliary Power Enclosure.

3.2.2.3. Cabinets: Four (4), one (1) Processors & Modules, three (3) Input/output (I/O) Terminations.

3.2.2.4. Processor's Control: Two (2) sets of redundant pairs.

3.2.2.5. Processor's FDI: One (1) interface with the Burner Management System (BMS) control.

3.2.2.6. PCU 2: Unit #2 HRSG Control & CTG Interface & Supervisory Control.

3.2.2.6.1. Location: Auxiliary Power Enclosure.

3.2.2.6.2. Cabinets: Four (4), one (1) Processors & Modules, three (3) I/O Terminations.

3.2.2.6.3. Processor's Control: Two (2) sets of redundant pairs.

3.2.2.6.4. Processor's FDI: One (1) interface with the Burner Management System (BMS) control.

3.2.2.7. PCU 3: BOP Control.

3.2.2.7.1. Location: Auxiliary Power Enclosure.

3.2.2.7.2. Cabinets: Two (2), one (1) Processors & Modules, one (1) I/O Terminations.

3.2.2.7.3. Processor's Control: One (1) set of redundant pairs.

3.2.2.8. PCU 4: Steam Turbine, Interface & Supervisory Control.

3.2.2.8.1. Location: Electrical Room.

3.2.2.8.2. Cabinets: Four (4), one (1) Processors & Modules, three (3) I/O Terminations.

3.2.2.8.3. Processor's Control: One (1) set of redundant pairs.

3.2.2.9. PCU 5: BOP Control

3.2.2.9.1. Location: Electrical Room

3.2.2.9.2. Cabinets: Four (4), one (1) Processors & Modules, three (3) I/O Terminations.

3.2.2.9.3. Processor's Control: Two (2) sets of redundant pairs.

3.2.2.9.4. Processor's FDI: Two (2) separate interfaces with the plant RIG and RTU.

3.2.2.10. PCU 6: Gas Compressor’s, Interface & Supervisory Control.

3.2.2.10.1. Location: Gas Compressor Building.

3.2.2.10.2. Cabinets: Two (2), one (1) Processors & Modules, one (1) I/O Terminations.

3.2.2.10.3. Processor's Control: One (1) set of redundant pairs.

3.2.2.10.4. Processor's FDI: One (1) interface with the Gas Compressor control system.

3.2.2.11. PCU 7: Switchyard, Interface & Supervisory Control.

3.2.2.11.1. Location: Duane Substation Switchyard, Relay House.

3.2.2.11.2. Cabinets: Two (2), one (1) Processors & Modules, one (1) I/O Terminations.

3.2.2.11.3. Processor's Control: One (1) set of redundant pairs.

3.2.2.11.4. Processor's FDI: One (1) interface with the substation.

3.2.3. All cabinets are dual access (front/back) 2200 mm tall x 600 mm wide. Existing cabinets shall be utilized modifying as necessary to accommodate new system. Contractor shall provide all hardware necessary to modify the cabinets to integrate the new control system into the existing enclosures.

3.2.4. The existing field wiring shall be utilized. It will be the Contractor's responsibility to design the I/O termination points to accommodate the existing cable locations and lengths. No cable splicing shall be permitted. All field wiring shall be terminated at terminal blocks. All I/O modules shall be pre-wired to terminal blocks/termination units (TU), preferably with pre-manufactured cabling designed for the modules. All module points including spares shall be pre-wired to the TU's. Contractor shall verify existing voltage and amperage for all I/O points and ensure they are compatible with the new system. See Appendix A-1 for a detailed I/O count.

3.3. GE Millennium Control System

3.3.1. The GE Millennium Controller consists of a Mark VI microprocessor based digital fuel controller and a GE Fanuc 90/70 PLC sequencer. The current engine core version is S5 with enhanced sprint, water injection for NOx control and inlet air chiller system (chiller not included in this Project).

3.3.2. The engine core version may be upgraded to S6 or S7.

3.3.3. There are two (2) independent Millennium control systems, one for each gas turbine generator system. Each system has one local (panel mounted at TCP) and one remote (main control room) Wonderware InTouch SCADA/HMI station.

3.3.4. Located on each local SCADA/HMI station is the GE Control System Toolbox software for the Mark VI configuration, testing and calibration. The 90-70 Logicmaster PLC software is located on a single laptop.

3.3.5. The GE Millennium control system consists of the following. Contractor shall provide the necessary equipment (i.e. fiber optic modems, Ethernet switches) to communicate between all controllers and all SCADA/HMI, EWS and all other work stations. The existing fiber optic, Ethernet and data highway cabling between panels (locations) shall be utilized when possible. Internal panel fiber optic, Ethernet and data highway cabling shall be replaced.

3.3.6. CTG-1/2: Millennium Mark VI control systems, the following list is for one unit. The scope shall be for both units.

3.3.6.1. Location: Auxiliary Power Enclosure.

3.3.6.2. Turbine Control Panel: Two (2), one (1) Processors & Modules, one (1) I/O Terminations. The TCP contains both local (Mark VI) and remote (90-70) I/O.

3.3.6.3. Remote I/O: Genius Bus I/O.

3.3.6.3.1. Turbine Control Panel (TCP)

3.3.6.3.2. Main Turbine Terminal Box (MTTB).

3.3.6.3.3. Main Generator Terminal Box (MGTB)

3.3.6.4. Two (2) Woodward EM Digital Drivers, 4-20mA control. Drivers shall be replaced with the latest Woodward models.

3.3.6.4.1. One (1) Driver for fuel control, valve not included in upgrade.

3.3.6.4.2. One (1) Driver for water injection control, valve not included in upgrade.

3.3.6.5. Modbus Master: Serial RS485 data link.

3.3.6.5.1. One (1) Slave: Bently Nevada 3500, Hardwire trip, Modbus Slave, RS485 data link for SCADA/HMI.

3.3.6.5.2. One (1) Slave: Digital Meter Multi-Function (DMMF), Generator Data, Modbus Slave, RS485 data link.

3.3.6.6. Woodward DSM Synchronizer, not included in upgrade.

3.3.6.7. Bently Nevada 3500: Integrate only, (Option to replace).

3.3.6.8. The Brush Prismic A30 AVR shall be replaced with the Emerson Ovation Excitation System as outlined in Appendix A-8.

3.3.6.9. Beckwith M-3425 Generator Protection (Redundant): Integrate only, not included in upgrade.

3.3.7. There are three existing cabinets for each CTG to be utilized, modifying as necessary to accommodate new system. This is a typical GE design and it is expected that Contractor has experience fitting the new controls, communications and I/O into the TCP, MTTB and MGTB panels. Contractor shall provide all hardware necessary to modify the cabinets to integrate the new control system into the existing enclosures.

3.3.8. The existing field wiring shall be utilized. It will be the Contractor's responsibility to design the I/O termination points to accommodate the existing cable locations and lengths. No cable splicing shall be permitted. All field wiring shall be terminated at terminal blocks. All I/O modules shall be pre-wired to terminal blocks/termination units (TU), preferably with pre-manufactured cabling designed for the modules. All module points including spares shall be pre-wired to the TU's. Contractor shall verify existing voltage and amperage for all I/O points and ensure they are compatible with the new system. See Appendix A for a detailed I/O count.

3.4. Mitsubishi Heavy Industries- Turbine Control Panel

3.4.1. The MHI Turbine Control & Protection Panel (TCP) consists of the following major components:

3.4.1.1. Woodward 505 Digital Governor.

3.4.1.2. Woodward Electrical to Hydraulic Converter & Amplifier (Not included in upgrade).

3.4.1.3. Woodward ProTech 203 Overspeed Protection System.

3.4.1.4. Bently Nevada 3500, (Option to replace).

3.4.1.5. Turbine Protection Interlock Relay Panel

3.4.1.6. Auxiliary Motor Interlock Relay Panel.

3.4.1.7. Various Relays, Distributors & Isolators.

3.4.2. The MHI TCP is a mixture of devices designed to form all major steam turbine control functions. This is an obsolete design and shall be completely replaced. All components shall be removed from the panel; no unused terminal boards, relays, switches or wiring shall be abandoned in place. The current panel mounted motor control HOA switches shall be retained and intergraded into the new control system. Contractor shall make recommendations for the remaining front panel mounted controls and coordinate with City. All unused panel penetrations shall be covered in a neat manner. The option to replace the panel completely or to use as a remote I/O panel is up to the Contractor. When relays are required for digital outputs, the same relays used throughout the new control system shall be used.

3.4.3. All points wired to the MHI TCP that activate interposing relays and distributors that then send signals to the TCP and DCS shall be removed and go directly to the DCS. The MHI TCP may be used as a marshalling panel or have remote I/O installed. All points shall now be wired directly to the control system.

3.4.4. The DCS is used as an interface and supervisory control, with approximately 75 I/O points going to the MHI TCP and 200 I/O points coming from the MHI TCP. The DCS points that are hard wired commands to the MHI TCP shall be removed, and all wiring removed, or reused. See Appendix A for a detailed I/O count.

3.4.5. The Bently Nevada 3500 is also used to monitor critical steam turbine temperatures and active a turbine trip, then output temperatures to the DCS. All temperature shall come directly into the new control system, the Bently Nevada 3500 will be reconfigured or replaced.

3.4.6. The steam turbine governing valve is controlled by the MHI TCP via the Woodward 505. The electric signal of 20-160 mA from the governor is transmitted to E/H converter in the amplifier (AMP) where the electrical signal is converted into the mechanical signal (i.e. the angular displacement of the E/H converter output lever which is proportional to the electric signal).

3.4.7. As shown in the Steam Turbine Control Block Diagram (Appendix A-2), the DCS has direct control of the HP (HPBV) and LP (LPBV) steam bypass valves and the induction steam control valve (ICV).

3.4.8. The Mitsubishi Electric AVR (Excitation) Cubical consists of redundant MEC-600-CU1 AVR units and various relays, distributors & isolators. This system is to be completely replaced with redundant OCR1100-based control (Emerson Ovation Excitation System) as outlined in Appendix A-8.

4. GENERAL DESCRIPTION OF THE NEW CONTROL SYSTEM

4.1. General

4.1.1. The System shall have direct interface suitable for existing turbine devices and instruments. The new system shall have the modules required for turbine control, including speed measurement and valve interface.

4.1.2. The System shall have a common integrated hardware platform across BOP, HRSG, CTG, and STG controls. With a common engineering tool across BOP, HRSG, CTG, and STG controls.

4.1.3. The System shall be provided with a minimum of 25% usable spare computation capability, memory, logic block capacity, and display block capacity in the most heavily loaded control processor, with point dead bands set to no greater than 0.5% of span.

4.1.3.1. System shall have redundancy at CPU, network, and HMI level.

4.1.3.2. No external devices or signal conditioners are permitted.

4.1.3.3. Sequence of Events (SOE) modules are required for all critical digital IO, at minimum all current DCS SOE points will be configured for high speed sequence of events recording and reporting.

4.1.3.4. Start permissive and trip displays for easy troubleshooting.

4.1.3.5. All Interlocks, Permissive, Runbacks, Holds shall have a detailed graphics display listing the status of each input or condition to the function.

4.1.3.6. All system multi point interlocks and trip functions shall have a detailed status listing, including a First Out for trip functions.

4.1.3.7. Overrides (enable/disable) for interlocks with override status and alarm functions. Critical system protection shall not have overrides. City and Contractor to determine points.

4.1.4. Steam and Gas Turbine Specific Functions

4.1.4.1. Unit operation maintenance summary with equivalent Hours and starts counters calculations.

4.1.4.2. Automatic turbine trip reports. System shall have high speed data recording capable of recording selected critical values, digital and analog, at 10ms (or less) resolution for use in post-disturbance analysis. The automatic trip reports shall go back for at least 1 minute before the event and 1 minute after. The logs shall be automatically archived onto the Historian hard drive.

4.1.4.3. Update time for variable geometry and other critical control loops shall be 10ms or less.

4.1.4.4. Speed detection and over speed trip functions shall be 10ms or less.

4.1.4.5. Over speed test functions from HMI screen.

4.1.4.6. Valve and variable geometry calibration from HMI screen.

4.1.4.7. Manual bias of water injection for improved NOx control.

4.1.4.8. Fully integrated Ovation Excitation Control including all required hardware and software

4.1.5. In addition, controller shall have communications modules for interfacing with industry standard protocols used with devices like protection relays, CEMS, RTUs, Fire & Gas systems, vibration monitor, DCS etc.

4.2. Redundancy and Fault Tolerance

4.2.1. Redundancy shall be provided for, but not limited to, the following.

4.2.1.1. Processors

4.2.1.2. Power supply – Incoming

4.2.1.3. Power supply – System

4.2.1.4. Communications (internal, data highway, HMI communications)

4.2.2. All processing equipment shall be fully redundant (primary and backup). Redundant backup equipment shall be dedicated to the backup of specific equipment on a one-to-one (1+1) basis (active/active resilience level). Floating backup, where one set of equipment can backup two or more pieces of equipment, is not considered reliable and is not permitted.

4.2.3. Upon detection of a fatal failure in the primary equipment, the backup equipment shall assume operation in a bumpless fashion. This condition shall be alarmed. Transfer of control back to the primary equipment will require deliberate manual reset.

4.2.4. For normal operations, the backup equipment shall have parallel access to the system and continuously update while in the backup state. The intent is to maintain the status of the backup equipment current so that transfer of information from the failing primary controller is not required.

4.2.5. The ability shall exist to download to the primary processor to facilitate the testing of new code prior to the backup processor being updated.

4.2.6. When peer-to-peer communication between controllers is employed, there shall be no interruption in communication upon transfer of either the primary processor to its backup, transfer of a backup processor to its primary, or during data highway faults.

4.3. Operator Stations

4.3.1. Total operation and monitoring of the plant shall be through the SCADA/HMI Operator Terminals (OTs). The following functions shall be possible from any OT:

4.3.1.1. Selection of automatic, cascade and manual operation and the adjustment of set points, bias settings, and limits.

4.3.1.2. Motor start/stop and valve open/close control.

4.3.1.3. The ability to enable, disable, and acknowledge alarms.

4.3.1.4. Monitor all analog and discrete points in the system.

4.3.1.5. Access details for every displayed analog and discrete point in the system. Ability to access logic diagrams from point selection.

4.3.1.6. Create trending displays and observe trended information.

4.3.1.7. Calibrate and tune the system from a password protected environment.

4.3.1.8. Operate interactive graphics displays from a password protected environment.

4.3.2. The Control Room shall have a total of sixteen (16) operator display screens. This should be accomplished by four quad screen OT stations. One OT station will have two standard displays (30”) and two large format (55” HDMI Input) displays, all other display screens shall be 30” LCD monitors.

4.3.3. The Auxiliary Power Enclosure (APE) CTG OT local stations. The new system shall incorporate a single desktop dual monitor operator OT station and a single desktop dual monitor EWS station with both CTG 1&2 integrated, instead of the independent TCP panel mounted stations. The TCP panel mounted screens shall be removed and have a blanking plate installed. Alternatively two (2) dual monitor combination OT and EWS stations may be utilized. The remote APE stations shall be locked to view only mode by password protected security by default. See Appendix A-4 for a general OT and EWS layout.

4.4. Engineering Work Stations

4.4.1. There shall be at minimum three (3) dual monitor Engineering Work Stations (EWS), one at each of the following locations.

4.4.1.1. Server Room (new next to Main Control Room).

4.4.1.2. I&C Office.

4.4.1.3. Auxiliary Power Enclosure (as described above).

4.4.2. Each EWS will have the ability to develop, edit and monitor all processors (Logic), processor/interface modules (FDI), and SCADA/HMI stations. The I&C office EWS shall ability to remotely connect to and configure the Domain controllers, Historian and the OPC data servers.

4.5. OPC Servers

There shall be redundant OPC servers for the plant PI system. The OPC servers shall be independent of the SCADA/HMI system. The OPC server shall have separate Ethernet connections for the control system and the plant PI interface.

4.6. Historian

4.6.1. The System shall include redundant historians for gathering, analyzing, and reporting plant information. The historian shall be specifically designed to support plant operations. The historian shall be an integral component of the control system; third party add-on historians or data management systems are not acceptable.

4.6.2. The data historian shall reside on the control system network and provide mass storage into which process values, alarms, sequence-of-events, calculated values, and operator actions shall be archived. The historian shall utilize a dead band compression technique to store information without impacting the fidelity of retrieved data. Trend data will be readily available to plant personnel via defined trend displays, menu driven functions, and ad hoc queries; any point in the system can be trended simply by assigning that point to a new or existing trend display. Personnel shall be able to define and save trends for groups of variables in which they are interested in situations where, for example, there are operational abnormalities meriting investigation.

4.7. Domain Controllers

Domain controllers shall be utilized to facilitate central operator logon credentials. There shall be redundant domain controllers; optionally a system to facilitate central operator logon credentials.

5. EQUIPMENT SPECIFICATIONS

5.1. The OTs shall be completely self-contained and independent. The OTs will utilize PCs, minimum 30" LCD monitors, QWERTY type keyboards and laser mouse pointing devices. A total of five (5) quad monitor OTs will be provided and three (3) dual monitor EWS stations. Four (4) OT stations will be located in the control room and one (1) will be located in the Auxiliary Power Enclosure (APE). The APE OT station will share two (2) monitors with one (1) of the EWS stations.

5.2. Video screen displays, including interactive graphics, shall be fully displayed and operative on the video screen in two seconds or less. All displayed data shall have been actually measured at the input terminations within two seconds or less.

5.3. Any operator-initiated control action, whether requested by the keyboard or mouse shall be executed within one second or less. Confirmation that an operator action has been executed shall be displayed on the video screen within two seconds or less. Execution and confirmation to an operator action shall not be slower due to high system activity, such as an alarm avalanche during a process upset.

5.4. Operator workstations shall be provided with a means of controlling access to the system by means of a password. The functions that are accessible without invoking security shall, in general, include auto/manual selection, set point and bias adjustment (within limits) and control drive positioning.

5.5. The City has standardized on Dell for computers and monitors. The Dell computers specified herein provide minimum system requirements

5.6. Control Room and Auxiliary Power Enclosure Operator Stations

5.6.1. Contractor shall coordinate with the City in the design, procurement and installation of new control stations for the main control room and the addition of a station in the auxiliary power enclosure. The new stations shall incorporate monitor support (2 high), cable management, networking devices and computer placement.

5.6.2. There shall be three (3) distinct sections in the main control room. The new station in the auxiliary power enclosure shall be a combined OT and EWS station.

5.7. Computers, Servers and Monitors

5.7.1. The operator stations and engineering work stations shall be Dell Precision Workstations, with a minimum of 32 GB of RAM, redundant solid state hard drives (minimum 256 GB), Raid 1, two or more NIC's and redundant power supplies. All stations will have Windows 10 or greater operating system and come with Microsoft Office Professional.

5.7.1.1. The four (4) OT's in the Control Room are to be rack mounted Dell Precision Workstations with IP KVM system.

5.7.1.2. The Server Room EWS shall also be a rack mounted Dell Precision Workstation with IP KVM.

5.7.1.3. The Auxiliary Power Enclosure OT and EWS stations shall be tower Dell Optiplex Workstations.

5.7.1.4. The I&C Office EWS station shall be tower Dell Optiplex Workstation.

5.7.2. All server shall be Dell PowerEdge Servers, redundant power supplies, hot pluggable redundant hard drives. Separate hard drives for backups and data storage.

5.7.3. All display screens shall be Dell UltraSharp 30" monitors, with the exception of the two large format (55" HDMI Input) displays.

5.8. IP Based KVM Switching System

All control room OT's and EWS shall utilize IP based KVM system. The KVM system shall use separate redundant networking equipment and switches from the main control system network. The system shall have the capacity to integrate the City's other control system computers and monitors. See Appendix A-4 system diagram. Although the system diagram shows local work stations for the OT's, this is for visualization only.

5.9. Printers

Dedicated printers shall be provided for the following services:

5.9.1. One (1) color laser-jet type, engineering workstation printer capable of printing on 11”x17” paper, to be located near the EWS.

5.9.2. One (1) color laser-jet type, operator terminal printer capable of printing on 8.5”x11” paper, to be located in the Control Room.

5.9.3. All printers shall have Ethernet connectivity built in.

5.9.4. All printers shall be provided with sufficient noise silencing to be compatible with control room operations.

5.10. Network

5.10.1. Contractor shall provide new network switches that are integrated with the overall security program. The control network shall be an isolated network with a DMZ zone for external connections. It is expected that Contractor will provide a comprehensive security system. See System Security section.

5.10.2. All control system network connections between workstations, processors, and I/O modules shall be redundant. Routing for redundant networks will include separate cables and routes (when possible) for redundant pairs.

5.10.3. All network equipment will be located locally to the control system equipment, and internal to the control system cabinets and server room located next to the control room.

5.11. Processors

5.11.1. The process controllers shall be provided with fault tolerant redundancy. The control system processors shall be complete with a redundant data highway communication interface, and mounted in ventilated enclosures.

5.11.2. Processor capability shall be such that operation is not impacted during any condition with loop execution time set to 250ms or less for all loops.

5.12. System Power Supply and Distribution

5.12.1. The power provided for the control system shall be two 120 VAC UPS feeds. All required power supply modules for processor and I/O power shall be furnished with the system. Contractor shall distribute this power, as required, within the cabinets, with appropriate regulation, circuit protection and wiring.

5.12.2. Power supplies shall be provided in 1+1 redundancy configuration. The failure of any supply shall be alarmed. Both of the redundant supplies shall be diode shared, or another suitable redundant method, such that failure of any supply shall not cause a power interruption to any portion of the system. Power supplies shall be capable of being removed and/or replaced on line.

5.12.3. Power supply loading shall be below 75% at time of system shipment (including anticipated spare I/O loading). Loading calculations shall be furnished for review.

5.12.4. Engineering and operator workstations and computer monitors shall be provided with 120 VAC UPS power.

5.12.5. All I/O power shall be monitored and alarmed when failed. The current ABB system has one (1) discrete input dedicated per input module to indicate input power is available. When this input is false, a module power monitor alarm is generated.

5.12.6. Any cabinet containing “processors” or isolated I/O in a separate location shall be provided with a high cabinet temperature alarm. An analog temperature sensor will be used for this purpose. The control system will continually monitor and record this temperature.

6. SYSTEM SECURITY

6.1. The System shall provide enhanced protection for secure, reliable and efficient plant operation without disruption.

6.2. At a minimum, the integrated security suite shall include the components and/or functions detailed below. The security suite must include the appropriate infrastructure hardware and network equipment to host the suite in its own security DMZ while connecting to multiple process networks.

6.2.1. The System shall employ user accounts with password protected access. The System shall have a centralized operator logon credentials and password management.

6.2.2. Antivirus – Centrally monitors and manages antivirus status and activity, delivers validated monthly antivirus signature updates and notifies or reports detected infections by date and antivirus signature version status. Control System OEM validated solutions are preferred and must be approved by City.

6.2.3. Patch Management – Security patch management to facilitate deployment of patches, assess vulnerabilities and streamline documentation. Control system OEM validated solutions are preferred and must be approved by owner.

6.2.4. System Backup and Recovery – Image based backup solution that supports universal restore capability to execute scheduled, event triggered or manual backup schemes. Aids recovery from a disaster. Restore workstations and servers. Control system OEM validated solutions are preferred and must be approved by City.

7. TECHNICAL REQUIREMENTS

7.1. System Configuration

7.1.1. The System shall be configured, calibrated, tuned and modified using workstations with appropriate security to prevent unauthorized changes. It shall not be necessary to use a host computer, or other peripheral device, to configure the System.

7.1.2. The control functions will reside in dedicated redundant microprocessor-based devices that shall be as functionally independent of each other as practical. Peer-to-peer communication via the data highway between all control devices shall be provided.

7.1.3. Functional diagrams shall be per ANSI/ISA-5.1-1984 (R1992), ANSI/ISA-5.2-1976 (R1992), or City approved equal. Contractor shall supply all the system engineering and hardware needed to constitute a fully integrated, complete, and operable startup, shutdown, and on-line control system whether or not specifically detailed.

7.1.4. During transient conditions causing deviations of process variables, the System shall not permit deviations that exceed the specifications set by the manufacturer of the process equipment being controlled. In no event shall the performance of the System become the limiting factor on unit responsiveness. The System shall be capable of producing smooth load changes without overshoot unless these changes are not achievable because of plant equipment limitations.

7.1.5. The System and components shall be designed to react with a predictable and safe response in the event of a voltage dip or spike.

7.1.6. Configuration and interlocks shall be provided to ensure that systems are placed in operation and automatic mode in a safe sequence. Unsafe combinations of automatic and manual modes shall be prohibited.

7.1.7. Wherever control limits, blocks, lock-ups or other overrides are imposed, the affected controllers shall track the occurrence and will discontinue integration (anti-reset windup provided). When the override is removed, the controls shall be balanced to the existing process and shall immediately resume normal control without causing improper movement of the control drive.

7.2. Graphics

7.2.1. Process graphic displays, trend displays, faceplate displays, and permissive displays that show the status of system interlocks shall be included. Faceplates shall also be included as pop-up windows on the process graphic displays. All current process graphics will be reproduced – approximately 110 main graphics screens, not counting alarms summary, face plate, and system status screens.

7.2.1.1. DCS: 68 main display screens

7.2.1.2. GT-1: 18 main display screens

7.2.1.3. GT-2: 18 main display screens

7.2.1.4. New: 7 New screens

7.2.2. The City will provide new startup and overview screen layouts to facilitate the integrated system startup and monitoring. Contractor shall provide suggestions and examples.

7.2.3. In addition to the process graphic displays, it is expected that system status (loop, I/O, processors, power status, etc.), alarm summary, disabled/inhibited alarms, trends, interlock, permissive and general information screens and pop-ups will be developed.

7.2.4. All displays (including loop tuning, trends, and graphics) shall be available at the operator station and engineering work station. All video screens will be capable of displaying color interactive graphics.

7.3. Trending

7.3.1. The operator stations and the engineering workstation shall be capable of displaying trends of any combination of values in the system.

7.3.2. Trending capabilities shall include the following features:

7.3.2.1. The ability to pan and zoom.

7.3.2.2. Both time and variable amplitude grids and a display of the digital value of the trended variables.

7.3.2.3. Current time display in hours, minutes, and seconds to the most recent trend update.

7.3.2.4. Cursor time display in days, hours, minutes, and seconds when displaying historical data during scrolling.

7.3.3. Up to eight (8) trends per page with operator capability to mask or change trend plots to focus on specific trends.

7.4. Alarm Reporting and Logging

7.4.1. Alarms shall be generated in the event of any difficulty (problem) with any part of the control system including, but not limited to, all parts of the data highways, file servers, work stations, processors, power supplies, and input or output cards (even if the system recovered from the difficulty).

7.4.2. Process alarms shall be assignable for every variable in the database. Any one of three levels of alarm severity shall be assignable to every variable, or the alarm can be suppressed. The system shall have filters that can filter alarms by priority or by function group. A suppressed and/or disabled alarm graphics display page and a report function shall incorporated.

7.4.3. Indicated alarms shall have at a minimum three levels of presentation, with Priority 1 being the highest priority and lower priority level increasing in number. All system alarms shall automatically be the lowest priority alarms. Each of the priority alarm levels shall show up as a different color on the LCD display. All alarms shall be reported on the alarm printer.

7.4.4. Three alarm categories shall be available: unacknowledged alarms, alarm history, and alarm list (only those alarms still in alarm).

7.4.5. The displays shall allow a single keystroke for acknowledgment of the most recent alarm and silencing the horn. The alarm summary screen shall allow for page acknowledgement of all active alarms.

7.5. Alarm Generation

7.5.1. High and low process alarms shall be available to be assigned to each analog input and calculated process variable without the need for additional equipment or without affecting system throughput.

7.5.2. Alarm setpoints shall be stated in the engineering units of the process variable to which it is assigned.

7.5.3. An individually set and selected hysteresis dead-band shall be provided for each process alarm. The process variable must return past the alarm setting by the value of the dead-band before the alarm is returned to normal.

7.5.4. The most current alarm shall appear at the top of the alarm display screen. When the alarm screen is activated the actual alarms shall display automatically.

7.6. Logs

The system shall provide status logs, sequence logs, engineering logs, and operations logs. The logs must capture all changes to the system, including development changes.

7.7. Action on Loss of Power

The system design shall recognize that full or partial loss of power can occur. Loss of power, or its restoration, shall not cause spurious motion of any control drive. The system shall allow the user to configure outputs to fail in place, fully open, fully closed, or in some intermediate position.

7.8. System Diagnostics

7.8.1. System diagnostics shall be provided as an integral part of the control system. Automatic recognition and location of instrumentation and control (I&C) faults shall be available at the engineering and operators workstations. Fault alarms shall be for each device fault. The system shall locate and graphically display the fault location down to the I/O point level.

7.8.2. In addition to system fault detection, system hardware components status shall be available to indication performance parameters including cycle times, operating states, space occupied, and buffer memory.

7.9. Data Highway

7.9.1. The data highway will utilize redundant Ethernet networks, via 100 megabit/second (fast) Ethernet, at a minimum, utilizing commercial off the shelf (COTS) component. Each data highway shall be functionally redundant to the extent that any single point of failure shall not cause partial or total control system failure. Redundant cabling shall utilize separate cables, routed in separate conduits (when available).

7.9.2. Highway speed and access time will be such that any operator action will be executed in 1.0 second or less under upset as well as steady state conditions. Contractor shall confirm the guaranteed response time under all operating conditions including an alarm burst of 1000 process variable alarms occurring within 2 seconds.

7.9.3. The failure of any station on the highway to respond shall not inhibit communication between all remaining stations. Back-up controllers, where provided, shall assume all communication functions, including peer-to-peer. This condition shall be alarmed. If data from the failed station is used for control or alarm in another station, appropriate protective action shall be incorporated into the system logic to avoid incorrect control action.

7.9.4. Diagnostics shall continuously monitor the status of the data highway. Failure of the data highway path to communicate with any station on the highway shall be alarmed.

8. INPUT AND OUTPUT MODULES

All currently installed active and spare I/O will be accommodated (see Appendix A-1). Contractor shall provide 5% to 10% installed spare of each unique type of I/O. Spare calculations shall be rounded up to the next highest whole point count. Spare I/O shall be calculated by location (PCU, panel grouping). For example, the current ABB DCS is distributed into 7 PCU's, the spare calculation shall be per PCU per I/O type. Large I/O count locations may be reduced to 5% spare points. While a panel with only one 16-point analog input card shall have 2 spare points, 1.6 points rounded up to 2 points. In some cases, the ability (physical space, system capacity) to add a new I/O card shall be considered satisfactory spare capacity. Each case of less than 10% spare capacity must be identified by the Contractor and approved by the City.

8.1. Analog Inputs

8.1.1. The minimum accuracy of the analog to digital conversion shall be 0.1% of span with a bit resolution of 12 bits plus sign.

8.1.2. Common mode rejection of the analog inputs shall be 90 dB at 60 Hz or greater. Normal mode rejection of the analog inputs shall be 35 dB at 60 Hz or greater.

8.1.3. All inputs shall fully meet the transient surge protection requirements of ANSI/IEEE C37.90, including the requirement that no false or spurious actions will occur.

8.2. Thermocouples

8.2.1. The accuracy of the analog to digital conversion shall be 0.1% of span or better. Analog to digital conversion shall be at least 12 bits plus sign.

8.2.2. Cold junction compensation will be incorporated at the first point of termination, if external terminal blocks are used.

8.2.3. Resistance Temperature Detectors (RTDs)

8.2.4. The accuracy of the analog to digital conversion shall be 0.1% of span or better. Analog to digital conversion shall be at least 12 bits plus sign.

8.3. Discrete Inputs

8.3.1. Discrete inputs shall meet the surge withstand requirements of IEEE-472, including the requirement that no false or spurious action will occur.

8.3.2. In the input cabinets, visual status indication, such as an LED, shall be provided for each discrete input.

8.3.3. Means shall be provided to eliminate the spurious effect of contact bounce. Contractor shall state the means employed to accomplish this while still maintaining a 1-millisecond resolution.

8.4. Discrete Outputs

8.4.1. A visual status indication, such as an LED, shall be provided for each discrete output. All outputs shall be individually fused, or utilize relay contacts with a separate, fused, power supply. The loss of one channel, due to short or ground, will not cause the loss of the entire card or system power supply.

8.4.2. Discrete outputs shall meet the surge requirements of IEEE-472.

8.4.3. Fail-safe features required on discrete outputs include a configurable option to fail open or fail closed on a loss of communication with the control processor. Internal circuit protection for output modules shall be provided such that a fault on one output does not cause other outputs to fail.

8.5. Analog Outputs

All analog outputs shall be short-circuit and open-circuit protected and may be grounded or ungrounded.

9. DOCUMENTATION

Operations, maintenance manuals, engineering drawings, diagrams and configuration data.

9.1. Operations Manual

9.1.1. Contractor shall provide a detailed operation manual or series of manuals by system. Operation manuals shall include the following as a minimum:

9.1.1.1. Startup, shutdown and normal operation steps and sequences.

9.1.1.2. Setpoints, alarms, permissive, interlocks and shutdowns (trips).

9.1.1.3. Control algorithms and sequences.

9.1.2. In general, all control system functions shall be explained. Basic logic diagrams shall be used to explain complex control algorithms. All alarms, permissives, setpoints, conditions and resulting action shall be clearly defined by the use of charts, tables and descriptions.

9.1.3. The operations manual does not need to include basic theory of operations or software general procedures. It is assumed that the operations personnel are qualified in HRSG, BOP, CTG, STG and general plant operations. What is required is a site specific control system description used to operate and trouble shoot plant operations. Control system logic will not substitute for basic logic diagrams. Actual logic includes software functions that are not required to explain operation functionality. There may be two documents produced, i.e. Operations Manual and Control System Specification, as long as all operational sequences, limits, time delays, curves, and alarms, interlocks, permissives conditions and setpoints are detailed.

9.1.4. The Operations Manual and Control System Specification shall be submitted as part of the "System Factory Test and Demonstration" documentation. This will be utilized by the City as part of the factory acceptance testing.

9.2. Electrical System Schematics and Drawings

9.2.1. An electrical system schematic(s) shall be provided to aid in the wiring of the system as well as troubleshooting of the system once installed. Detailed drawings of all internal panel connections shall be provided. Detailed external connection drawings (I/O) with final device connections, tag numbers, descriptions and cable numbers. All panel to panel connections will show detailed terminations shown, i.e., new steam turbine controller connections to the Generator Control & Protection Relay Panel. Final point terminations to other panels shall be identified and have the relevant vendor drawing numbers identified.

9.2.2. Contractor shall provide as an option complete detailed loop drawings showing all intermediate connections, i.e., junction boxes and panels.

9.3. Configuration Data

Configuration (programming) data sheets shall be completely filled and supplied with the hardware when it is shipped. All site specific hardware configurations (i.e. jumpers, dip switches, shunts) shall be included in the documentation. The City understands that these may change slightly during the commissioning of the system and that Contractor will supply updated data sheets after the commissioning.

9.4. Owner Drawings

9.4.1. Contractor shall work with the City to carefully mark up all points where the System interfaces with the City's electrical and hydraulic drawings and show where any changes have been made to the present system.

9.4.2. Contractor shall take existing paper drawings and provide updated CAD drawings based on revisions and information provided by City.

9.5. Installation Manuals

Contractor shall provide three (3) sets of installation and operation manuals. These manuals are to be included with the hardware shipment to the City. These manuals are to be supplied with marked locations where the final drawings are to be inserted after final commissioning. Each manual shall be a hinged, D-Ring type binder with numbered index tabs. Each of these manuals shall include (or include locations as noted above) at least the following data:

9.5.1. An easy to follow contents of enclosures

9.5.2. A material listing of all supplied items with manufacturers part numbers

9.5.3. A system description of operation

9.5.4. Operations and maintenance manuals of all vendors' products used for the project

9.5.5. Mechanical demolition drawings

9.5.6. Mechanical assembly drawings

9.5.7. Electrical system schematic

9.5.8. Control configuration (programming) data

9.6. Network Drawings

9.6.1. Contractor shall provide a control system network drawing that shows all required cables and the appropriate cabinet terminations. Overall system connectivity drawings shall be provided for all ethernet, data highway, remote I/O or any other type of network, showing location to location and detailed point connections.

9.6.2. A combination of drawings and configuration sheets shall be provided including all relevant data, i.e., IP addresses, computer names, switches, security devices, etc.

9.7. Drawing Format

Drawings are to be supplied on paper, electronic printable copies (e.g., PDFs) as well as the native editable format (e.g., AutoCAD native *.dwg file). Acrobat PDF files are not acceptable as an editable format.

10. FURNISHED BY THE CITY

The following will be provided by the City:

10.1. All conduit and wiring between field devices and control panel mounted equipment and control system terminations for the currently installed system.

10.2. Electric power, both line AC and UPS. Input power to the control systems will be 120 VAC UPS.

10.3. Heating and air conditioning of the room housing the control equipment.

10.4. Any additional fiber optic cable runs required for the DCS network or serial link.

11. FURNISHED BY CONTRACTOR

Contractor shall provide the following:

11.1. All control system hardware and software as required to meet this Scope of Services.

11.2. Demolition of existing control cabinet equipment that will no longer be used. Equipment will be stored on site.

11.3. All control system interconnecting cables, pre-assembled or bulk, as well as any required connectors, etc.

11.4. All equipment and tools required for installation and repair.

11.5. Hardware design and configuration.

11.6. Staging, testing, and demonstration of the entire system.

11.7. As-built documentation, including loop drawings (field device to the control system terminal), revised electrical drawings, and control system layout drawings. All drawings to be provided in vector (native file) and raster (PDF, etc.) format.

11.8. The installation, testing, and commissioning of all equipment, including power connections and the termination of field devices.

11.9. Three hard copies and one soft (CD) copy of all documentation and instruction manuals.

11.10. Project management and expediting services required for achieving the requirements of this specification.

11.11. Startup spare parts required to support commissioning.

12. APPLICABLE CODES AND REFERENCES

Pertinent sections of the latest issue of the following codes and standards are provided as references.

12.1. ASME – American Society of Mechanical Engineering

12.2. IEEE – Institute of Electrical and Electronic Engineers

12.3. ISA – Instrumentation, Systems, and Automation (ISA) Standards and Practices

12.4. ANSI/NEMA ICS6 – Enclosures for Industrial Controls and Systems

12.5. ANSI/IEEE C37.90 – Guide for Surge Withstand Capability (SWC) Tests.

12.6. SP51.1 – Instrumentation Terminology

12.7. SP5.1 – Instrumentation Symbols and Identification

12.8. ITS 90 Conversion Tables for Thermocouples.

12.9. NEMA – National Electrical Manufacturers Association

12.10. WECC -- Western Electricity Coordinating Council

12.11. ANSI/ISA18.2-2016, EEMUA 191-3rd edition, and IEC 62682-2014

12.12. NFPA 70 – 2017 National Electric Code

12.13. IEEE PSS2B – Power System Stabilizer Algorithm

12.14. North American Electric Reliability Corporation (NERC) VAR501-WECC-3.1 R3 – Power System Stabilizer

13. ENVIRONMENTAL

The System shall meet the following environmental conditions:

13.1. Ambient temperature: 32°F – 122°F (0°C – 50°C)

13.2. Temperatures greater than 50°C shall require an air conditioning system

13.3. Humidity: 5% to 95%, non-condensing

14. EXECUTION

14.1. Project Management and Engineering

14.1.1. Contractor shall assign a Project Manager (PM) to lead the tasks for the Project. The PM shall be the primary person communicating with the City and keeping City fully apprised on the status and progress of the Project. The PM shall be responsible for project schedule updates, creation and preparation of progress reports, adherence to project scheduling, and general project coordination. The Project Manager shall develop a project implementation plan in coordination with the City. Contractor shall execute the agreed upon implementation plain in accordance with the City's requirements and expectations.

14.1.2. The requirements and expectation shall be reviewed during project kick-off meeting to ensure all parties have a common understanding.

14.1.3. In addition to the designated Project Manager, Contractor shall assign a technical lead and other necessary personnel to support the project.

14.1.4. Contractor shall be responsible for directing the technical implementation of the Project and ensuring consistency and uniformity across the design and implementation phases by following the design agreed upon with the City.

14.2. Schedule

14.2.1. The scheduled outage for installation of DCS Controls at site is November 2, 2019 and finish no later than December 15, 2019 (to be verified at kick-off and again prior to system shipment to site).

14.2.2. The scheduled outage for installation of three Generator Excitation Control Systems is May 3, 2021 and finish no later than May 14, 2021 with testing and acceptance no later than May 21, 2021.

14.2.3. Scheduled dates for kick-off, logic review, software freeze, Factory Acceptance Test (FAT), site mobilization, installation, commissioning, and testing will be finalized with the City, working back from the expected installation dates.

14.3. Commissioning Spares

Contractor shall provide the required spares necessary for commissioning of the System.

14.4. Factory Acceptance Test (FAT) and Demonstration

14.4.1. Contractor shall conduct a complete functional closed loop test of all the inputs, configuration, and control outputs of the automatic control portions of the system.

14.4.2. Inputs that are employed for data acquisition only (and not control) need not be 100% simulated. Contractor shall simulate a sufficient number of these inputs to exercise all of the multiplexing equipment.

14.4.3. The entire system, in its intended configuration, shall be staged at the principal manufacturing facility. All communication links shall be tested during the FAT with the support of the City.

14.4.4. Qualified technicians whose normal job function is to conduct such a test shall conduct the in-house test. Qualified engineer who has primary responsibility for the control system design will personally observe the test. The City's intent is that the test not be conducted in a local sales office or regional service center where sufficient experienced and trained personnel and test equipment would not be expected to be available, on a full-time basis, during the conduction of the test.

14.4.5. The entire control system configuration and all of the system logic shall be exercised and verified.

14.4.6. Contractor shall provide sufficient time, test equipment, and trained personnel for the City to inspect and evaluate the total system. At least ten (10) full days shall be reserved for this demonstration. Contractor shall provide additional time, as required, at no additional cost.

14.4.7. In addition to a functional test, system performance shall be demonstrated. Among the items to be verified with respect to the specification are:

14.4.7.1. Response to a keyboard request.

14.4.7.2. Time to completely display an Engineer configured control display.

14.4.7.3. Action on loss of power and on power-up.

14.4.7.4. Fail over of control equipment.

14.4.7.5. Demonstration of the replacement of redundant equipment on-line.

14.4.7.6. Failure of either, or both, data highway paths.

14.4.7.7. Data highway loading test (see below)

14.4.7.8. Printout of all specified logs.

14.4.8. High Loading Test: Data highway speed and access time shall be demonstrated during extreme loading as in alarm burst of 1000 process variable alarms occurring within 2 seconds while data historian is polling all data at a 1 second archival rate.

14.4.9. At least four (4) weeks prior to the demonstration, Contractor shall submit a written test agenda and advise the City of the schedule.

14.4.10. Contractor shall submit a functional FAT test procedure with loop checking documents capable of witness initials, final signature, and comment section. Contractor shall also submit the Operations Manual and Control System Specification (see Operations Manual in the Documentation section). This will be utilized by the City as part of the factory acceptance test.

14.4.11. The FAT procedure shall include a variance document for changes or corrections.

14.4.12. It is expected that Contractor will make minor adjustments and corrections that may be discovered during the demonstration. However, if serious defects in design and performance are discovered, the demonstration shall be discontinued and the entire test shall be repeated at the Contractor's expense after the necessary corrections are made.

14.4.13. The equipment shall not be shipped until a successful demonstration has been completed.

14.4.14. Within two weeks after shipment of the system, Contractor shall transmit one complete set of prints and one reproducible set of the "as shipped" system, for use during installation and checkout.

14.4.15. Installation and Commissioning

14.4.16. An installation procedure document shall be submitted to the City for review prior to installation. The procedure shall include power isolation and a safe de-energization approach. The procedure shall also include power-up testing when terminations are complete. Procedure documents shall include loop testing forms that include individual loop data, cells for measured values of 0%, 25%, 50%, 75% and 100%, witness initials and final signature and comment section.

14.4.17. All loops will be verified for proper configuration and operation from the field device through the control system. All alarms and switches shall be verified and recorded during loop checks.

14.4.18. All testing documents and procedures shall be submitted for review a minimum of two weeks prior to the commencement of any task. A change procedure shall be provided by the Contractor that documents the process and people capable of changes.

14.4.19. Contractor shall provide a field engineer with the capacity to fully oversee and control the system installation and testing.

14.4.20. Upon completion of the installation and the commissioning of the system, Contractor shall provide revised drawings that incorporate field startup corrections.

14.5. Initial Startup

Contractor shall be responsible for overseeing the initial startup, including providing experienced personnel with the capacity to perform the initial startup while maintaining system process conditions within the OEM specifications. It is expected that out of tolerance conditions that could damage equipment will be prevented. Contractor will be responsible to meet these conditions:

14.5.1. That the initial parameters and tuning values are derived from previous experience with GE LM6000 Gas Turbines, MHI Steam Turbines, dual pressure HRSG's and the remaining BOP equipment.

14.5.2. That all OEM control specifications, sequencing, protection, operational limits and interlocks have been tested and proven during commissioning.

14.5.3. That the operational process limits and time curves for warmup/cooldown requirements are met.

14.5.4. That there is on site support provided for at least five ten-hour days of final tuning and testing after the initial startup.

15. TRAINING

Training shall consist of the following.

15.1. One (1) week of on-site training for up to ten (10) operators.

15.2. Fifteen weeks of training at the factory for up to three (3) individuals to include:

15.3. System configuration and administration.

15.4. Logic programming.

15.5. Graphics building and editing.

15.6. Serial link configuration.

15.7. Security system configuration and updating.

15.8. System backup and recovery.

15.9. Training shall be available for up to 12 months after complete system shipment.

16. FINAL SYSTEM ACCEPTANCE

The Final System Acceptance shall begin upon completion of the commissioning period after all errors have been corrected. The acceptance criteria shall include the following:

16.1. All new equipment has been installed by Contractor and verified by manufacturer's representative.

16.2. All necessary adjustments have been fully implemented.

16.3. The turbine control dynamics have been fully tuned to the turbine and its load.

16.4. All failsafe conditions verified.

16.5. All modes of operation tested, tuned and verified (speed loop, Megawatt loop, etc.).

16.6. All other supplied items are operating correctly.

16.7. Operators have been trained for proper operation.

16.8. Maintenance is fully informed on troubleshooting.

16.9. All documentation has been turned over and accepted by City.

16.10. Resolution of all corrective action items.

17. MAINTENANCE AND SUPPORT

17.1. Warranty

For a period of one year following Final System Acceptance ("Warranty Period"), Contractor shall warrant that the System will perform and operate in accordance with the functional requirements and specifications set forth in this Agreement. All inclusive costs, (parts, labor, repairs, Contractor travel time, Contractor expenses, etc.) covered by the warranty and incurred during the Warranty Period shall be provided without additional cost to the City.

17.2. Maintenance and Support Services After Warranty Period

17.2.1. Contractor shall provide maintenance and support services for a period of no less than five (5) years after Final System Acceptance at City's cost.

17.2.2. Appendix A-7, SureService™ Customer Support Program, describes the various support programs offered by Contractor. Contractor shall provide such support for as long as the City pays the applicable fees.

17.3. Service Availability

17.3.1. Service support network shall be available 24/7 for system support if City purchases the SureService™ support.

17.3.2. Contractor shall provide online access to manuals, technical notes, software updates, and user groups.

17.3.3. Contractor shall provide on-site services within seventy-two (72) hours of initial request for support, if phone support is deemed fruitless.

17.4. Additional Products and Services

Contractor shall provide additional products and services as may be required by the City at the rates set forth in Exhibit B.

18. PRODUCT OBSOLESCENCE

18.1. Contractor must maintain and manage product obsolescence for the System.

18.2. All control systems shall be backward compatible.

APPENDIX A-1

I/O COUNTS

Abbreviation	Description
DCS	Distributed Control System
DMS	DC Motor Starter
EXC	Excitation Cubicle
GBC	Generator Circuit Breaker Cubicle
GCRP	Generator Control & Protection Relay Panel
Local	Local Device
MCC	Motor Control Center
TCP	Turbine Control & Protection Panel
TGB	Turbine Local Gauge Board
AMP	E/H Converter & Amplifier

1. DCS ALL

	Total (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
ABB DCS					
Location: All					
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	35	16	560	400	
mA (4-20)					198
T/C (Type K)					47
T/C (Type E)					128
RTD					27
Analog Input Modules - mA, VDC (14 Point)	26	15	390	257	
Analog Output Modules (14 Point)	13	14	182	95	
Digital Input Modules (14 Point)	67	14	938	665	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	12	14	168	113	
Digital Output Modules (16 Point)	38	16	608	291	
Pulse Input Module (Speed P/U)	2	8	16	3	

2. PCU-1: UNIT #1 HRSG

PCU-1: Unit #1 HRSG (Auxiliary Power Enclosure)	**PCU Total** (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
Cabinets - Processors & Modules	1				
Cabinets - Terminations	3				
Processor's (Redundant Pairs)	2				
Processor's (FDI)	1				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	9	16	144	120	
mA (4-20)					45
T/C (Type K)					20
T/C (Type E)					51
RTD					4
Analog Input Modules - mA, VDC (14 Point)	8	15	120	84	
Analog Output Modules (14 Point)	3	14	42	23	
Digital Input Modules (14 Point)	12	14	168	115	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	1	14	14	5	
Digital Output Modules (16 Point)	8	16	128	40	
Pulse Input Module (Speed P/U)	0	8	0	0	

3. PCU-2: UNIT #2 HRSG

PCU-2: Unit #2 HRSG (Auxiliary Power Enclosure)	**PCU Total** (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
Cabinets - Processors & Modules	1				
Cabinets - Terminations	3				
Processor's (Redundant Pairs)	2				
Processor's (FDI)	1				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	9	16	144	119	
mA (4-20)					44
T/C (Type K)					20
T/C (Type E)					51
RTD					4
Analog Input Modules - mA, VDC (14 Point)	8	15	120	84	
Analog Output Modules (14 Point)	3	14	42	23	
Digital Input Modules (14 Point)	12	14	168	115	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	1	14	14	5	
Digital Output Modules (16 Point)	8	16	128	40	
Pulse Input Module (Speed P/U)	0	8	0	0	

4. PCU-3: BOP

	PCU Total (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
PCU-3: BOP					
Location: Auxiliary Power Enclosure					
Cabinets - Processors & Modules	1				
Cabinets - Terminations	1				
Processor's (Redundant Pairs)	1				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	2	16	32	12	
mA (4-20)					11
T/C (Type K)					0
T/C (Type E)					1
RTD					0
Analog Input Modules - mA, VDC (14 Point)	2	15	30	4	
Analog Output Modules (14 Point)	2	14	28	10	
Digital Input Modules (14 Point)	7	14	98	53	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	1	14	14	3	
Digital Output Modules (16 Point)	3	16	48	13	
Pulse Input Module (Speed P/U)	0	8	0	0	

5. PCU-4: STEAM TURBINE

	PCU Total (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
PCU-4: Steam Turbine					
Location: Electrical Room					
Cabinets - Processors & Modules	1				
Cabinets - Terminations	3				
Processor's (Redundant Pairs)	1				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	6	16	96	71	
mA (4-20)					51
T/C (Type K)					7
T/C (Type E)					0
RTD					13
Analog Input Modules - mA, VDC (14 Point)	1	15	15	9	
Analog Output Modules (14 Point)	1	14	14	4	
Digital Input Modules (14 Point)	11	14	154	121	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	3	14	42	31	
Digital Output Modules (16 Point)	7	16	112	81	
Pulse Input Module (Speed P/U)	1	8	8	1	

6. PCU-5: BOP

	PCU Total (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
PCU-5: BOP					
Location: Electrical Room					
Cabinets - Processors & Modules	1				
Cabinets - Terminations	3				
Processor's (Redundant Pairs)	2				
Processor's (FDI)	2				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	6	16	96	63	
mA (4-20)					33
T/C (Type K)					0
T/C (Type E)					24
RTD					6
Analog Input Modules - mA, VDC (14 Point)	6	15	90	72	
Analog Output Modules (14 Point)	4	14	56	35	
Digital Input Modules (14 Point)	20	14	280	216	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	1	14	14	11	
Digital Output Modules (16 Point)	9	16	144	84	
Pulse Input Module (Speed P/U)	0	8	0	0	

7. PCU-6: GAS COMPRESSOR

	PCU Total (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
PCU-6: Gas Compressor					
Location: Gas Compressor Building					
Cabinets - Processors & Modules	1				
Cabinets - Terminations	1				
Processor's (Redundant Pairs)	1				
Processor's (FDI)	1				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	2	16	32	7	
mA (4-20)					6
T/C (Type K)					0
T/C (Type E)					1
RTD					0
Analog Input Modules - mA, VDC (14 Point)	1	15	15	4	
Analog Output Modules (14 Point)	0	14	0	0	
Digital Input Modules (14 Point)	3	14	42	33	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	1	14	14	14	
Digital Output Modules (16 Point)	3	16	48	33	
Pulse Input Module (Speed P/U)	0	8	0	0	

8. PCU-7: SWITCHYARD

	PCU Total (Modules)	**Capacity (**Module)	**Capacity** (Points)	**Used** (Points)	**AI Type** (Total)
PCU-7: Switchyard					
Location: Duane Substation Switchyard, Relay House					
Cabinets - Processors & Modules	1				
Cabinets - Terminations	1				
Processor's (Redundant Pairs)	1				
Processor's (FDI)	1				
Analog Input Modules - Universal mA, VDC, RTD, T/C (16 Point)	1	16	16	8	
mA (4-20)					8
T/C (Type K)					0
T/C (Type E)					0
RTD					0
Analog Input Modules - mA, VDC (14 Point)	0	15	0	0	
Analog Output Modules (14 Point)	0	14	0	0	
Digital Input Modules (14 Point)	2	14	28	12	
Digital Input Modules High Speed, Time-Synch, SOE (14 Point)	4	14	56	44	
Digital Output Modules (16 Point)	0	16	0	0	
Pulse Input Module (Speed P/U)	1	8	8	2	

9. GE MARK VI (UNIT #1 & 2)

	Modules (Total)	**Module** (Points)	**Points** (Total)	**Points** (Used)	**Points** (Spare)
GE Mark VI (Unit #1)					
Processor: All					
Turbine Control Board	1				
Analog Inputs		4	4	0	4
Trip Output (Relay)		3	3	2	1
Pulse Inputs (Speed P/U)		4	4	4	0
Servo Control Boards (2 Channels per board)	2	2	4	4	0
Driver Outputs (1 dual output per Channel)			8	8	0
Excitation Output (1 per channel)			4	4	0
LVDT Inputs (2 dual input per channel)			16	16	0
Analog Input	4	--	72	34	38
Analog Output	3	--	16	11	5
Thermocouple Inputs	1	--	24	11	13
RTD Input	14	--	68	54	14
Discrete Input	10	--	176	110	66
Discrete Output	1	--	16	2	14
Digital Outputs (Relay)	7	--	116	65	51
GE Mark VI (Unit #2)					
Processor: All					
Turbine Control Board	1				
Analog Inputs		4	4	0	4
Trip Output (Relay)		3	3	2	1
Pulse Inputs (Speed P/U)		4	4	4	0
Servo Control Boards (2 Channels per board)	2	2	4	4	0
Driver Outputs (1 dual output per Channel)			8	8	0
Excitation Output (1 per channel)			4	4	0
LVDT Inputs (2 dual input per channel)			16	16	0
Analog Input	4	--	72	34	38
Analog Output	3	--	16	11	5

Thermocouple Inputs	1	--	24	11	13
RTD Input	14	--	68	54	14
Discrete Input	10	--	176	110	66
Discrete Output	1	--	16	2	14
Digital Outputs (Relay)	7	--	116	65	51

10. GE MARK VI (UNIT #1) - FUEL CONTROL (MARK VI)

	Modules (Total)	**Module** (Points)	**Points** (Total)	**Points** (Used)	**Points** (Spare)
GE Mark VI (Unit #1)					
Processor: Fuel Control (Mark VI)					
Turbine Control Board	1				
Analog Inputs		4	4	0	4
Trip Output (Relay)		3	3	2	1
Pulse Inputs (Speed P/U)		4	4	4	0
Analog Inputs & Outputs	2				
Analog Inputs		20	40	21	19
Analog Outputs		4	8	3	5
Thermocouple Inputs (Type K used)	1	24	24	11	13
RTD Inputs	1	16	16	8	8
Digital Inputs & Relay Outputs	2				
Digital Inputs		48	48 (Note #1)	12	36
Digital Outputs (Relay)		24	36 (Note #2)	19	17
Note #1: No input termination units for second VCRC board.					
Note #2: One of two output termination units for second VCRC board.					
Servo Control Boards (2 Channels per board)	2	2	4	4	0
Driver Outputs (1 dual output per Channel)			8	8	0
Excitation Output (1 per channel)			4	4	0
LVDT Inputs (2 dual input per channel)			16	16	0

11. GE MARK VI (UNIT #1) - SEQUENCER (90-70)

	Modules (Total)	**Module** (Points)	**Points** (Total)	**Points** (Used)	**Points** (Spare)
GE Mark VI (Unit #1)					
Processor: Sequencer (90-70)					
Remote Networks	3				
BIU's Total	6				
BIU's Network #1 (MTTB)	2				
BIU's Network #2 (MGTB)	1				
BIU's Network #3 (TCP)	3				
Modules Network #1 (MTTB)					
Analog Input	1	16	16	6	10
RTD Input	8	4	32	29	3
Discrete Input	3	16	48	28	20
Modules BIU's Network #2 (MGTB)					
RTD Input	4	4	16	15	1
Discrete Input	1	16	16	14	2
Modules BIU's Network #3 (TCP)					
Analog Input	1	16	16	7	9
Analog Output	1	8	8	8	0
RTD Input	1	4	4	2	2
Discrete Input	4	16	64	56	8
Discrete Output	1	16	16	2	14
Digital Outputs (Relay)	5	16	80	46	34

12. GE MARK VI (UNIT #2) - FUEL CONTROL (MARK VI)

	Modules (Total)	**Module** (Points)	**Points** (Total)	**Points** (Used)	**Points** (Spare)
GE Mark VI (Unit #2)					
Processor: Fuel Control (Mark VI)					
Turbine Control Board	1				
Analog Inputs		4	4	0	4
Trip Output (Relay)		3	3	2	1
Pulse Inputs (Speed P/U)		4	4	4	0
Analog Inputs & Outputs	2				
Analog Inputs		20	40	21	19
Analog Outputs		4	8	3	5
Thermocouple Inputs (Type K used)	1	24	24	11	13
RTD Inputs	1	16	16	8	8
Digital Inputs & Relay Outputs	2				
Digital Inputs		48	48 (Note #1)	12	36
Digital Outputs (Relay)		24	36 (Note #2)	19	17
Note #1: No input termination units for second VCRC board.					
Note #2: One of two output termination units for second VCRC board.					
Servo Control Boards (2 Channels per board)	2	2	4	4	0
Driver Outputs (1 dual output per Channel)			8	8	0
Excitation Output (1 per channel)			4	4	0
LVDT Inputs (2 dual input per channel)			16	16	0

13. GE MARK VI (UNIT #2) - SEQUENCER (90-70)

	Modules (Total)	**Module** (Points)	**Points** (Total)	**Points** (Used)	**Points** (Spare)
GE Mark VI (Unit #2)					
Processor: Sequencer (90-70)					
Remote Networks	3				
BIU's Total	6				
BIU's Network #1 (MTTB)	2				
BIU's Network #2 (MGTB)	1				
BIU's Network #3 (TCP)	3				
Modules Network #1 (MTTB)					
Analog Input	1	16	16	6	10
RTD Input	8	4	32	29	3
Discrete Input	3	16	48	28	20
Modules BIU's Network #2 (MGTB)					
RTD Input	4	4	16	15	1
Discrete Input	1	16	16	14	2
Modules BIU's Network #3 (TCP)					
Analog Input	1	16	16	7	9
Analog Output	1	8	8	8	0
RTD Input	1	4	4	2	2
Discrete Input	4	16	64	56	8
Discrete Output	1	16	16	2	14
Digital Outputs (Relay)	5	16	80	46	34

14. MITSUBISHI TURBINE CONTROL PANEL – NON DCS INTERFACE

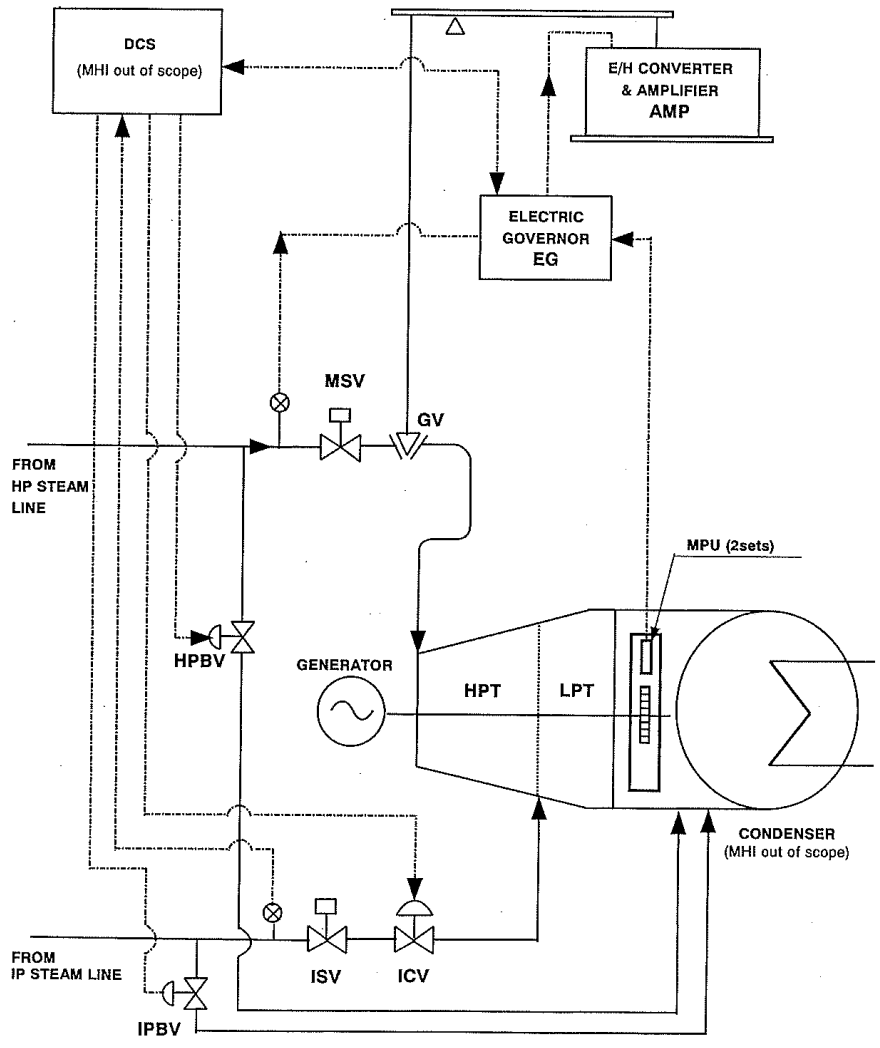
Interface (MHI TCP)	Count	Type	From	To
GBC to GCRP	4	Digital	GBC	GCRP
Local to GCRP	2	Digital	Local	GCRP
GCRP to GBC	10	Digital	GCRP	GBC
Local to TCP	14	Digital	Local	TCP
GCRP to TCP	4	Digital	GCRP	TCP
GBC to TCP	1	Digital	GBC	TCP
Local or TGB to TCP	2	4-20mA	Local	TCP
Local or TGB to TCP	15	RTD	Local	TCP
Local or TGB to TCP	6	Type K	Local	TCP
Local to TCP	13	Vib	Local	TCP
Local to TCP	2	Pulse	Local	TCP
Local to TCP	3	Pulse	Local	TCP
Local to TCP	2	Pulse	Local	TCP
GCRP to TCP	1	4-20mA	GCRP	TCP
Local to TGB	1	Type K	Local	TGB
TCP to GCRP	3	Digital	TCP	GCRP
TCP to Local	11	Digital	TCP	Local
TCP to Local	1		TCP	Local
MCC to TCP	13	Digital	MCC	TCP
TCP to MCC	21	Digital	TCP	MCC
Local to DMS	1	Digital	Local	DMS
TCP to DMS	4	Digital	TCP	DMS
DMS to TCP	1	Digital	DMS	TCP
TCP to AMP	1	20-160mA	TCP	AMP

15. MITSUBISHI TURBINE CONTROL PANEL – DCS INTERFACE

Interface (DCS)	Count	Type	From	To
TCP to DCS	31	Digital	TCP	DCS
TCP to DCS/SOE	30	Digital	TCP	DCS (SOE)
EXC to DCS	19	Digital	EXC	DCS
MCC to DCS	16	Digital	MCC	DCS
GCRP to DCS	13	Digital	GCRP	DCS
Local to DCS	5	Digital	Local	DCS
DMS to DCS	5	Digital	DMS	DCS
GCRP to DCS	4	Digital	GCRP	DCS
TCP to DCS	39	4-20mA	TCP	DCS
Local to DCS	13	RTD	Local	DCS
Local to DCS	9	4-20mA	Local	DCS
Local to DCS	6	Type K	Local	DCS
GCRP to DCS	12	4-20mA	GCRP	DCS
GCRP to DCS	1	Pulse	GCRP	DCS
DCS to TCP	57	Digital	DCS	TCP
DCS to GCRP	15	Digital	DCS	GCRP
DCS to DMS	3	Digital	DCS	DMS
DCS to Local	1	4-20mA	DCS	Local

APPENDIX A-2

STEAM TURBINE CONTROL BLOCK DIAGRAM



SYSTEM BLOCK DIAGRAM

MITSUBISHI HEAVY INDUSTRIES, LTD.

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APPENDIX A-3

TURBINE DATA

1. STEAM TURBINE DATA

Steam Turbine-Generator Unit	
Turbine OEM name:	Mitsubishi Heavy Industries
Turbine Serial Number:	D-934
MHI Work Order Number:	33034/66934
Turbine Rating (kW):	53600
Steam Pressure (psig):	1250
Steam Temperature (°F):	950
Exhaust Pressure (in. of Hg absolute):	4.0
Induction Steam Pressure (psig)	9.5
Rated Speed (rpm):	3600
High-Speed Point (rpm):	3780
Tripping Speed (rpm):	3960

2. GAS TURBINE UNIT #1 DATA

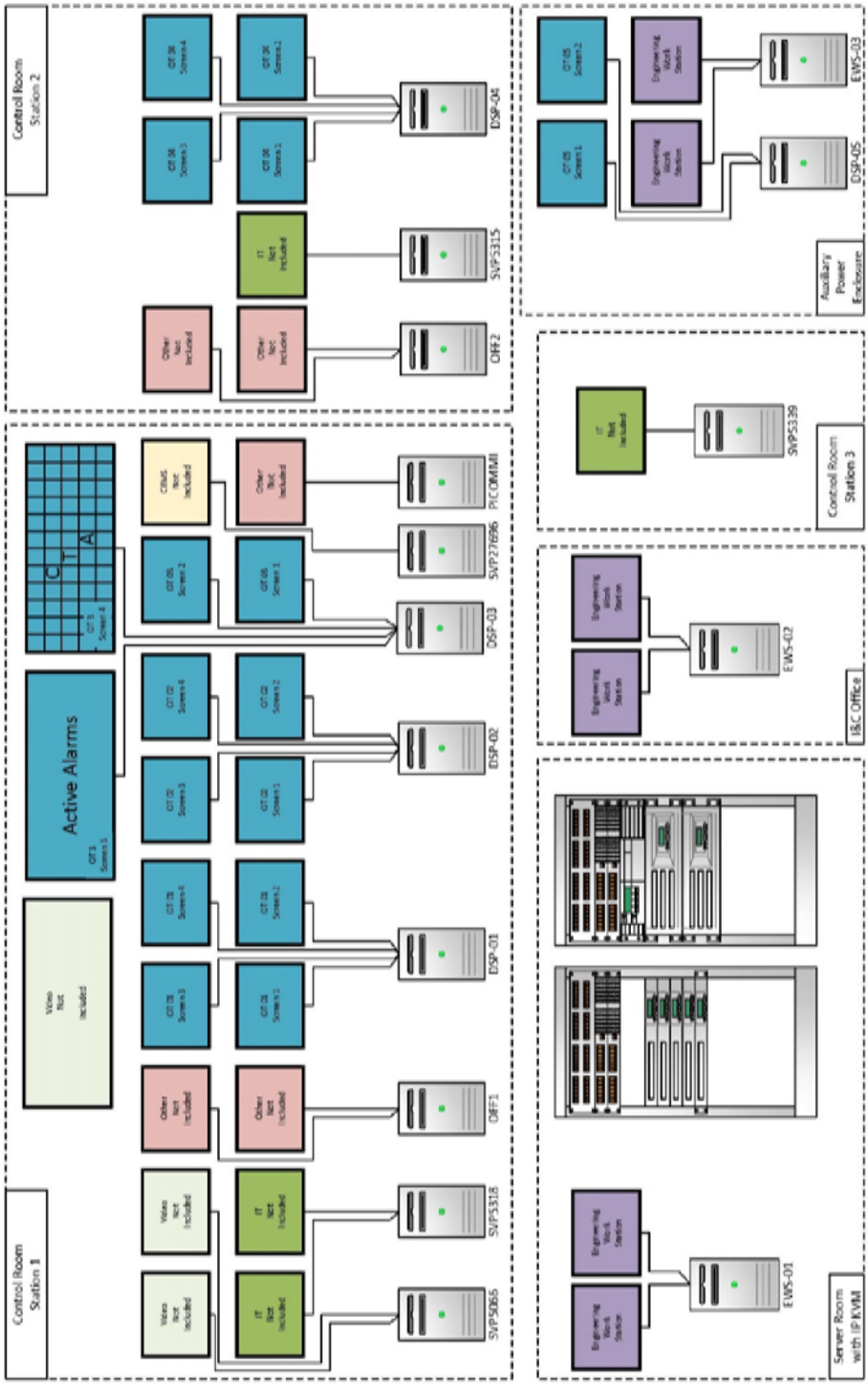
Gas Turbine-Generator Unit #1	
Turbine OEM name:	GE LM6000 PC
Work Order Number:	100039-1
Serial number:	55061
Turbine Number:	191-498
Turbine Rating (kW):	50389
Rated Speed (rpm):	3600
High-Speed Point (rpm): NSD/N25	3780
Tripping Speed (rpm): NSD/N25	4300
Control Software Version:	GE S5
Toolbox Version:	11.02.09C

3. GAS TURBINE UNIT #2 DATA

Gas Turbine-Generator Unit #2	
Turbine OEM name:	GE LM6000 PC
Work Order Number:	100039-1
Serial number:	55371
Turbine Number:	191-502
Turbine Rating (kW):	50389
Rated Speed (rpm):	3600
High-Speed Point (rpm): NSD/N25	3780, 10,700
Tripping Speed (rpm): NSD/N25	4300, 10,800
Control Software Version:	GE S5
Toolbox Version:	11.02.09C

APPENDIX A-4

OT & EWS STATIONS



APPENDIX A-5

PRELIMINARY PROJECT SCHEDULE

The project schedule will proceed in accordance with this Preliminary Project Schedule set forth on the following page, except as may be modified into a Final Project Implementation Schedule that is approved by the City. The Final Project Implementation Schedule, as mutually agreed upon, will become the governing project schedule incorporated into the Agreement.

Task Name	**Start**	**Finish**	**Resource Names**
Submit Hardware / Shop Drawings (ST / GT / BOP)	Mon 7/1/19	Mon 7/1/19	Contractor
Approve Hardware Drawings	Mon 7/1/19	Fri 7/12/19	City
Hardware Release	Fri 7/12/19	Fri 7/12/19	Contractor
Hardware Manufacture Complete	Mon 7/1/19	Thu 9/19/19	Contractor
Design Freeze (BOP)	Mon 8/12/19	Mon 8/12/19	City
Design Freeze (ST & GT)	Mon 9/16/19	Mon 9/16/19	City
Configure Data Links	Mon 7/1/19	Fri 8/23/19	Contractor
Software FAT - Pittsburgh	Mon 9/30/19	Fri 10/4/19	City / Contractor
Software FAT - Integrated - Pittsburgh	Mon 10/7/19	Fri 10/11/19	City / Contractor
Deliver system to site (Software)	Thu 10/31/19	Thu 10/31/19	Contractor
Outage	**Sat 11/2/19**	**Mon 12/16/19**	

APPENDIX A-6

FINAL SYSTEM ACCEPTANCE CERTIFICATE

After the City is satisfied with all test results and resolutions, as specified herein, the City will initiate execution of the Final System Acceptance Certificate.

Customer Name: **City of Santa Clara ("City")**

Project Name: **Distributed Control System Upgrade / Replacement Project**

This Final System Acceptance Certificate memorializes the occurrence of System Acceptance.

Contractor and the City acknowledge that:

1. Contractor has completed all Deliverables promised under this Agreement.

2. The System is accepted, and all punch list items generated during testing have been completed.

3. By acknowledging the Final Acceptance of the System, the City agrees to pay any remaining and approved outstanding invoices to Contractor, including previously withheld retainage.

City of Santa Clara ("City")	**Emerson Process Management Power & Water Solutions, Inc. ("Contractor")**
By:	By:
Name:	Name:
Title:	Title:
Date:	Date:

APPENDIX A-7

SURESERVICE™ CUSTOMER SUPPORT PROGRAMS

Data Sheet

SureService™ Customer Support Programs

Support Modules

- Telephone Support
- Remote System Diagnostics
- Internet Information Access
- Scheduled On-Site Service
- Emergency On-Site Service
- Component Coverage
- Classic System Component Support
- Training Programs
- Software Updates
- Ovation Guardian Support
- Ovation Security Center Support
- Cybersecurity Assessment
- Software Archiving
- Online Tutoring
- Application Enrichment
- Optimization Services
- Simulation Update Services
- Scheduled Alarm Management Services

Introduction

SureService™ customer support programs by Emerson enable utilities to customize the right maintenance package for the unique needs of the power generation and water/wastewater treatment industries.

SureService Support

Emerson is committed to the quality of SureService. Our customer service is designed to enable customers to reach their maintenance objectives. Emerson works with the customers to ensure top-quality support and customer satisfaction. SureService contracts can control and reduce plant maintenance costs by selecting various support applications individually or bundling them together to take advantage of maximum savings into one fixed contract price.

Superior Engineering Support

Emerson's SureService team is comprised of highly qualified engineers and support personnel. They are selected for their impressive experience in field installation, startup, excitation control systems and upgrades of Emerson's process control systems.

Each member of the SureService team follows approved support guidelines including

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EMERSON.

customer consultation to discuss any potential impact of recommended system adjustments before any adjustments are made to the customer's control system.

SureService engineers bring a wealth of industry experience having implemented control systems for a wide range of processes including power generation and water/wastewater operations. Trained in the latest process control technologies, SureService engineers use their knowledge and experience to achieve complete customer satisfaction. By integrating a variety of specialties from multiple areas, Emerson offers a wealth of process control system and excitation control system expertise in:

- Electric utility industry
- Boiler control and tuning
- Gas turbine operation and tuning
- Design, implementation, startup and upgrades of process control systems
- Instrument system design and modification
- System integration and communication interfaces
- Programming in Windows® environments
- Project management, project engineering, integration, implementation, installation and startup of process control systems
- Creation and modification of control strategies, software databases and interface graphics
- Excitation control system testing and calibration

In addition to industry and control system knowledge, many members of the SureService support team have been recognized by customers for their dedication to excellent service.

SureService Telephone Support

Our SureService customer response center stands ready twenty-four hours a day, seven days a week to immediately diagnose and resolve any Ovation™ or excitation control system problems. Armed with powerful troubleshooting skills and a thorough knowledge of control systems, the SureService support team works with the customers to gather relevant information to correctly identify the problem and diagnose the situation.

Our facility in Pittsburgh features fully functional excitation control systems that are used for troubleshooting and determining solutions without interfering with plant operations. After isolating the problem, the SureService team suggests corrective actions and works with the customer to resolve any situation.

Remote System Diagnostics

Remote system diagnostics leverages the remote network connectivity capabilities available with today's technology. Using remote system diagnostic tools, the SureService team can connect directly to a customer's control system. Once connected, the SureService support team can review and remotely troubleshoot the system, performing controller loading and online file and highway error analyses.

The combination of experience, training and background of our operations staff make remote system diagnostics the best assurance

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for identifying and resolving problems quickly. Remote system diagnostics allows the SureService team to solve problems faster and easier than through SureService telephone support alone. If requested by the customer, the SureService support engineer can even perform corrections online.

Moreover, the support engineer may also recommend specific areas where preventative actions or assessments can further improve plant efficiency and processes. In this case, additional SureService support applications may be recommended.

Internet Information Access

Designed specifically for technical plant operations staff, the SureService Ovation Users' web site offers a level of information available only to SureService contract holders. The site provides instant access to software release notes and the latest technical manuals and user documentation. Regular broadcast emails alert subscribers to the availability of new software releases, new or revised documentation, new web site features and more.

The Ovation Users' web site also provides continuous, updated information regarding the status of components returned to us for repair. Online parts ordering and a spare parts price list are available on the site as well. In addition, customers can submit requests for software improvements conveniently and report problems online.

Scheduled On-site Service

Recurring equipment failures, multiple calls to the support center and degrading process efficiency can all signal the need to tune and adjust a system component or perform routine maintenance. By utilizing our control systems and skilled engineers, scheduled on-site visits ensure that critical clean up, backup, testing and calibration of excitation control systems, and maintenance services are performed regularly without diverting manpower from critical tasks.

Scheduled on-site service provides additional staff and support when needed, keeping control systems running at peak performance by scheduling service visits on a regular basis or as-needed. Scheduled on-site service includes simple control system changes, PID and algorithm adjustments, excitation control system testing, calibration, cleanup and inspection services, which can significantly improve plant performance.

Additionally, regular routine system and excitation control system maintenance can decrease parts failures and improve the overall process. Maintenance and preventative activities include (but are not limited to):

- Back up DPU/controller application software to the hard drive and tape.
- Perform Ovation database reconciliation and verification.
- Back up the software server to tape.
- Perform file clean-up on the software server and other workstations.
- Implement minor control and graphics changes at the direction of the customer.
- Excitation control system power supply checks: CPU, firing card supplies, base adjuster, etc.
- Calibration check of PTs, CTs and transducers
- Limiting features check (VHL, MXL and MEL).

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- Protection features check (forcing, VHP, OXP and MEP).
- Ensure all relevant alarms are generated by the regulator.
- Download and analyze alarm history.
- Check configuration files for consistency.

Emergency On-site Service

When telephone support and remote system diagnostics cannot solve or diagnose the problem, immediate on-site assistance may be necessary. In this case, the SureService customer response center dispatches a field service engineer to the plant's site.

The immediate availability of a SureService engineer quickly returns plant operations to normal, reducing or eliminating downtime and unplanned outages to significantly improve plant performance and profitability.

All emergency on-site service subscribers receive priority response, ensuring fast, efficient on-site support. Emerson's team of field service engineers encompasses a wealth of experience and training in every stage of a control system, including field installation, startup and upgrading of complex process control systems.

Trained to assess and evaluate the situation quickly and thoroughly, the field engineer communicates with the SureService team, ensuring access to technical expertise and support resources until the problem has been resolved.

Component Coverage

The SureService team stands ready to eliminate costly interruptions to plant operations by returning failed components to normal. A staff of highly trained technicians and inspectors follow strict methodologies to ensure that critical parts are replaced or repaired quickly, thereby minimizing downtime and maximizing the efficiency of plant operations.

For a single fixed fee, component coverage includes the repair of all Emerson-supplied components that have an assigned Emerson part number during the contract term. When possible, component coverage subscribers don't wait for repair of malfunctioning parts. As soon as Emerson receives a defective part, a replacement part is located within the exchange inventory and shipped.

SureService component coverage subscribers can also arrange for a replacement part to be shipped in advance. All exchange parts are thoroughly tested and include the latest improvements and upgrades. Throughout the process, the SureService team works quickly to ensure minimal disruptions to normal plant operations.

When a part is not available in the exchange inventory, or if a customer requests repair rather than replacement, the component coverage team follows a strict methodology that ensures that the malfunctioning part goes through detailed inspection, repair and testing procedures to return it to proper working order.

Classic System Component Support

Classic system component support extends spare parts, parts exchange and repair service to control systems that have reached a "retired" status. The off-the-shelf technology that makes open control

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systems appealing also makes maintaining a steady level of product support unpredictable. Key spare parts can disappear from the market at any time. With the classic system component support application, Emerson will supply customers with component coverage after the control systems have reached the retired status for as long as the market on the necessary spare parts remains open and repair of those parts is possible.

With classic system component support, customers submit a blanket purchase order as part of their SureService package. The purchase order will include a "not-to-exceed-dollar amount" and will be used on an as-needed basis throughout the contract term for repairs of components that are still available on the market.
Benefits of this service include:

- Extends component coverage to cover retired status
- Provides additional level of confidence in open systems
- Offers an avenue to lengthen the life of the plant's control system
- Provides the opportunity for packaged discounts

Training Programs

Emerson's training programs are designed for the ongoing education and development of the operators, engineers and technicians that support plant operations. When training is built into a SureService contract, plant staff can attend training courses as needed.

Many of our SureService support engineers have training and education backgrounds. This provides them with the ability to communicate clearly and target opportunities for operators to improve their skills to better support the control system and the excitation control system.

Including training programs in a SureService contract encourages plant support staff to develop new skills to communicate with the SureService team during support calls or on-site visits. Whenever possible, the SureService support engineers recommend specific training courses or custom training programs to improve plant operations.

Ovation training programs include:

- Standard course offerings
- On-site and customized training programs
- Training at customer sites
- Custom-developed course content
- On-line instructor-led classes through Emerson's virtual classroom

These comprehensive training programs address the configuration, programming, administration and operation of our product lines under Ovation platforms. Operators, technicians and engineers gain an individual perspective on the understanding and operation of an Ovation system.

Ovation excitation systems training programs are conducted at our training facility in Pittsburgh, Pennsylvania and are targeted for control and electrical engineers, technicians, system engineers and technicians who have the primary responsibility for the excitation controller operation and maintenance.

Software Updates

Emerson's software updates[1] service ensures continual robust functionality of the Ovation control system without significantly changing the software level. In the world of always-evolving technology, software

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updates contain the results of continuing efforts in software improvement.

Customers desire the newest Ovation software updates and third-party patches as they become available; however, complicated installation procedures may cause users to avoid needed updates. Customers may also be concerned about the potential impact of the update on the existing software. Emerson's engineers will ensure that no existing application software is directly or negatively impacted by each update.

Ovation software updates can be obtained from a SureService representative. Validated third-party patches can be downloaded from the SureService section of the Users' Group website. Customers who subscribe to the SureService scheduled on-site service application can also request that one of our experienced field service engineers perform the Ovation software update or install the third-party patches via a scheduled visit. SureService customers will have access to any relevant update documentation for general knowledge and record-keeping purposes.

Ovation and Microsoft security patches are distributed at the end of each month through three unique channels:

- Ovation Users' website
- Box website for Ovation Security Center (OSC), and Power & Water Cybersecurity Suite (PWCS) customers
- CD delivery

Ovation Users' Website

The Ovation Users' website provides a 3-month span of all the security patch downloads that Emerson can legally distribute, such as Microsoft operating system patches. After the 3-month span, all accumulative patches can be requested through SureService software update support via CD delivery.
Links to vendor websites with approved patches that Emerson cannot legally distribute, such as Adobe® Reader and Java™ patches, are also provided on the Ovation Users' site.

OSC and PWCS Box Website

OSC and PWCS customers who have purchased patch management support and are subscribed to the SureService OSC and PWCS support services can download all security patches, including those for Adobe® and Java™ Runtime Environment (JRE) from the Ovation Users' Box website:

- https://ovationusers.account.box.com

OSC and PWCS patch/update files are obtained from Emerson's dedicated Box.com subscription website. The subscription website requires the user to use a unique login assigned in the SureService agreement.

Downloaded security patches are transferred to the patch management application and deployed to all Ovation workstations as scheduled by the OSC or PWCS.

Due to the nature of file sharing employed in this distribution mechanism, it is possible that the Ovation Users' Box websites may be blocked by corporate firewalls. This restriction can be removed by whitelisting these websites in the corporate firewalls to provide authorized personnel access for file retrieval.

CD Delivery

Upon request, CDs containing an accumulation of all security patches can be sent to the customer's site.

Benefits

- Latest available validated patches available for operating systems, Oracle, Adobe Reader, Java and Internet Explorer
- Provides Ovation system software updates
- Avoids potential impacts by the known and corrected system bugs
- Provides immediate access to pertinent update documentation and media information

Software Updates with Antivirus Program

For systems that include Emerson-validated antivirus software for virus protection, anti-spam and content filtering on Windows-based platforms, customers can subscribe to the SureService software updates with antivirus program to receive the latest tested and approved protective software to guard against viruses, cyber-attacks and other unwanted intrusions.

Benefits

- Includes all the features of the SureService software update program
- Receives antivirus signature updates
- Includes antivirus license

Ovation Guardian™ Support

The SureService Ovation Guardian support application displays Ovation system-specific data, as well as technical support information, including the status of the current SureService contract and the state of any technical support calls. Additionally, Guardian collects information related to OEM and commercial off-the-shelf technologies, digital field devices and other Emerson alliance partner products associated with the Ovation system.

The result is a comprehensive collection of system-specific information, accessible from a secure web site connection that will enhance the ability to manage the Ovation distributed control system more effectively and efficiently.

Guardian support users can also download Ovation and Microsoft security patches through the Ovation Users' web site and/or from the OSC, PWCS Box website.

Ovation Security Center Support

The Ovation Security Center (OSC) support application, which is applicable for the OSC 3.0 and forward, is designed to keep the software, contents or license elements promptly updated and the hardware components quickly repaired in case of mechanical failures. In general, the SureService support includes:

- Software updates for maintenance releases and improvements
- Content updates for the vulnerability database, latest security patches and updated security policies or rule settings
- License renewals where applicable
- Hardware repair during the term of a valid SureService contract that includes OSC support

Cybersecurity Assessment

The cybersecurity assessment service can assist in identifying threats and

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vulnerabilities that could impact the reliability and availability of critical control systems, process data and network operations.

The assessment is specifically designed to aid in identifying the current state of the plant's security posture, by providing a better understanding of the strength of defenses against cyber-attacks.

Software Archiving

Software archiving is a remote file storage system that adds an extra edge of protection to plant's operation. With software archiving, Emerson transfers electronically the software and data files to an off-site location to be dated, archived and stored, mitigating unexpected events that can cause financial loss through hardware breakdowns, software crashes and other lost revenues, incurring in high costs.

On a periodic basis, Emerson saves critical software and files running at the plant's workstations and database servers. These include data files such as system databases, control sheets and graphics programs. Other configuration files for routers, switches, historian, log reports, connectivity software or others can be optionally archived when they are manually copied to the proper directory. Software and files saved are transferred via the Internet to the archival system at Emerson's archival center to be dated, archived and stored.

All files remain stored for four periods before being replaced by the newest archival. A period can be defined as weekly, biweekly, monthly or quarterly.

At the end of each cycle, the last archived file will be transferred to an optical media. This optical media will be stored at an off-site for additional protection.

If problems occur, the archived software can be selected to be used for the reload. This software requires minimal re-testing and re-alignment to return the system to normal operations in minimal time, reducing both downtime and engineering time.

Benefits

- Meets NERC CIP-009-1 R4 backup and restore guidelines
- Recovers complete control system application software in a timely manner
- Quickly returns plant to normal operations with the latest saved control parameters
- Minimizes further loss of revenue due to unexpected disaster to the control system

Online Tutoring

Online tutoring provides the next step toward maintaining and increasing the skill level of plant personnel on system operations. By remotely accessing the system and operating environment, an instructor provides instruction for performing programming, diagnostics, maintenance, operations and other functions. The instructor also provides tips and insight to increase operator skill level for better plant control.

As the plant's staff changes with new hires and retired professionals, many new operators must learn system operation through on-the-job training, often not acquiring the full knowledge that operators once carried. Even experienced personnel

might lose certain techniques that are not used frequently.

Application Enrichment

With application enrichment, Emerson's process specialists can remotely modify existing software and implement any changes as necessary to maintain a route for constant system improvements and additions.

Application enrichment allows control technology to effectively adapt to changing requirements. Emerson's engineers provide support with updated knowledge and skills to avoid a complex, re-learning process during implementation of changes necessary to keep the control system running efficiently.

After acceptance, modifications are downloaded and made immediately effective. After the implementation and working together with the customer, the operation of the system is monitored to ensure full software acceptance and compliance. Before the expiration of the current SureService contract, the up-to-date service days will be compared against the contracted days. Any unused days can be converted to other services within the same year.

Benefits

- Uses the most effective resource and avoids the re-learning process
- Expands the application software with operating experiences
- Reflects process changes in software without unnecessary delays
- Explores the system's full capabilities

Optimization Services

SureService support includes an application specific to optimization technology and EDS. As part of this support service, the customer will receive:

- SureService telephone support
- Scheduled on-site service
- Software updates
- Software archival
- Tuning service

Proactive Support

Emerson's highest level of SureService support for optimization assists in maximizing the return on the technology investment. This is accomplished by analyzing the optimization solution through weekly reviews to ensure optimal system operation. A monthly report is generated that details runtime statistics, system availability and affected economic factors.

Optimization Telephone Support

Optimization telephone support, executed through the SureService customer response center, puts Emerson optimization specialists in direct communication with the plant's personnel. The optimization team is ready 24 x 7 to quickly identify and resolve any optimization related issues, as well as provide answers to optimization questions.

Scheduled On-site Service

With scheduled on-site service, optimization engineers travel to the site to evaluate system operation, maintenance services and file and logic backups. Emerson's optimization field engineering team can implement changes or perform accumulated maintenance tasks during

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normal plant operations or planned outages without diverting essential staff manpower from their critical tasks.

Additional services that can be performed during on-site visits include:

- Resolving pre-identified issues
- Backing up software
- Inspecting network communications
- Cleaning-up files
- Implementing minor updates
- Performing other necessary maintenance functions
- Providing recommendations on optimization solutions to accommodate seasonal or operational variation in emission requirements

Software Updates

Following the initial release of a major software level, software updates or "patches" are developed to modify, enhance or fix minor issues associated with the initial release. The software update application downloads the latest updates to the optimization software, ensuring optimum system functionality without significantly changing the operational aspects. As soon as the updates to the customer's software level become available, a remote software upload via virtual private network (VPN) can be requested (this may require the installation of a VPN connection), or the update can be installed during an on-site service visit. Emerson's service team will fully explain the new features and functions contained in the software release, as well as any system configuration changes that may be required with onsite staff.

Software Archiving

Through software archiving, critical software and files are electronically transferred on a periodic basis to the SureService customer support center in Pittsburgh, PA. The software is then dated, archived and securely stored as a secondary mechanism to the local activity. All files remain stored at a dedicated workstation for four weeks and then transferred to storage or optical media. For additional protection, the media can be sent to a secure off-site facility for long-term storage.

Tuning Service

Emerson's service team uses experienced engineering support to adjust optimization solution objectives to accommodate equipment updates, unusual operating modes, seasonal adjustments or operational variation in optimization goals. Emerson engineers can perform these fine-tuning functions during a scheduled on-site service visit or remotely via VPN.

Simulation Update Services

Emerson offers simulation update services as part of the SureService customer support program to help customers' simulation solutions keep pace with control system technology advancements and plant operations. The SureService simulation update service program provides yearly support that starts with a site survey to assess current conditions and then follows with scheduled maintenance aimed at keeping simulator processes operating at peak performance. An investment in the SureService simulation update program will extend the

life of the simulator system, while keeping it aligned with the customer's plant DCS.

Scheduled Alarm Management Services

Scheduled alarm management services provide knowledgeable manpower that assists the plant's workforce in keeping the alarm system and processes operating at optimum levels and thus allowing them to focus on other tasks.

Periodic alarm system assessments may reveal alarm configuration changes that can improve the control system and plant reliability.

Benefits

- Enhances alarm system performance through periodic, scheduled reviews
- Improves operator awareness of priority alarms
- Augments plant staff so they can focus on other responsibilities
- Increases plant efficiency by customizing alarm management tasks to help determine event priorities
- Provides immediate access to alarm management specialists for:
  - Assessing alarm configurations
  - Implementing configuration changes
  - Answering general alarm system questions
  - Providing training to staff

[1] *Ovation software updates for Ovation 3.6 systems and higher include feature pack updates*

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APPENDIX A-8

EXCITATION CONTROL SYSTEM PROPOSAL

APPENDIX A-9

EXCITATION UPGRADE PRELIMINARY SCHEDULE

ID	Task Name	Duration	Work	Start	Finish	Predecessors	Resource Names	Text1
0	**City of Santa Clara_Preliminary Schec**	**186 day**	**0 hrs**	**Fri 10/16/20**	**Thu 7/1/21**			
1	**1 Pre Engineering**	**22 days**	**0 hrs**	**Fri 10/16/20**	**Mon 11/16/20**			
2	1.1 Notice to Proceed	1 day	0 hrs	Fri 10/16/20	Fri 10/16/20			
3	1.2 Receive PO	1 day	0 hrs	Mon 11/16/20	Mon 11/16/20	2		
4	1.3 Internal Kickoff Meeting	1 day	0 hrs	Tue 10/27/20	Tue 10/27/20	2FS+6 days		
5	1.4 Site Kickoff Meeting & Walkdow	3 days	0 hrs	Mon 11/2/20	Wed 11/4/20	4FS+3 days		
6	1.5 Pre Engineering Complete	0 days	0 hrs	Thu 11/5/20	Thu 11/5/20	5FS+1 day		
7	**2 Engineering**	**88 days**	**0 hrs**	**Mon 10/19/20**	**Wed 2/24/21**			
8	2.1 AOS	1 day	0 hrs	Mon 11/2/20	Mon 11/2/20	2FS+2 wks		
9	2.2 Mechanical	3 wks	0 hrs	Mon 11/9/20	Tue 12/1/20	2FS+3 wks		
10	2.3 Mechanical Layout Submittal	1 day	0 hrs	Wed 12/2/20	Wed 12/2/20	9		
11	2.4 Electrical	12 wks	0 hrs	Mon 10/19/20	Fri 1/15/21	2		
12	2.5 Electrical Schematic Submittal	1 day	0 hrs	Mon 1/18/21	Mon 1/18/21	11		
13	2.6 Ovation Design	4 wks	0 hrs	Tue 1/19/21	Mon 2/15/21	12		
14	2.7 Ovation Logic/Graphic Submittal	1 day	0 hrs	Tue 2/16/21	Tue 2/16/21	13		
15	2.8 AEO/BOM Release	1 day	0 hrs	Wed 12/2/20	Wed 12/2/20	9		
16	2.9 Design Review	1 day	0 hrs	Wed 2/24/21	Wed 2/24/21	14FS+1 wk		
17	2.10 Wire List	3 days	0 hrs	Tue 2/2/21	Thu 2/4/21	24SS-2 wks		
18	2.11 Engineering Complete	0 days	0 hrs	Thu 2/4/21	Thu 2/4/21	17		
19	**3 Procurement**	**50 days**	**0 hrs**	**Thu 12/3/20**	**Mon 2/15/21**			
20	3.1 BOM Order	10 wks	0 hrs	Thu 12/3/20	Mon 2/15/21	15		
21	3.2 Procurement Complete	0 days	0 hrs	Mon 2/15/21	Mon 2/15/21	20		
22	**4 Manufacturing**	**31 days**	**0 hrs**	**Tue 2/16/21**	**Tue 3/30/21**			
23	**4.1 GT1**	**15 days**	**0 hrs**	**Tue 2/16/21**	**Mon 3/8/21**			
24	4.1.1 Assembly	2 wks	0 hrs	Tue 2/16/21	Mon 3/1/21	21		
25	4.1.2 Q1	1 wk	0 hrs	Tue 3/2/21	Mon 3/8/21	24		
26	**4.2 GT2**	**15 days**	**0 hrs**	**Tue 3/2/21**	**Mon 3/22/21**			
27	4.2.1 Assembly	2 wks	0 hrs	Tue 3/2/21	Mon 3/15/21	24		
28	4.2.2 Q1	1 wk	0 hrs	Tue 3/16/21	Mon 3/22/21	27		
29	**4.3 ST**	**11 days**	**0 hrs**	**Tue 3/16/21**	**Tue 3/30/21**			
30	4.3.1 Assembly	2 wks	0 hrs	Tue 3/16/21	Mon 3/29/21	27		
31	4.3.2 Q1	1 day	0 hrs	Tue 3/30/21	Tue 3/30/21	30		
32	4.4 Manufacturing Complete	0 days	0 hrs	Tue 3/30/21	Tue 3/30/21	25,28,31		
33	**5 Testing**	**25 days**	**0 hrs**	**Tue 3/9/21**	**Mon 4/12/21**			
34	**5.1 GT1**	**13 days**	**0 hrs**	**Tue 3/9/21**	**Thu 3/25/21**			
35	5.1.1 Ohm Check	2 days	0 hrs	Tue 3/9/21	Wed 3/10/21	25		
36	5.1.2 Setup	2 days	0 hrs	Thu 3/11/21	Fri 3/12/21	35		
37	5.1.3 Engineering Test	7 days	0 hrs	Mon 3/15/21	Tue 3/23/21	36		
38	5.1.4 FAT	2 days	0 hrs	Wed 3/24/21	Thu 3/25/21	37		
39	**5.2 GT2**	**9 days**	**0 hrs**	**Tue 3/23/21**	**Fri 4/2/21**			
40	5.2.1 Ohm Check	2 days	0 hrs	Tue 3/23/21	Wed 3/24/21	28		
41	5.2.2 Setup	2 days	0 hrs	Thu 3/25/21	Fri 3/26/21	40		
42	5.2.3 Engineering Test	5 days	0 hrs	Mon 3/29/21	Fri 4/2/21	41		
43	**5.3 ST**	**9 days**	**0 hrs**	**Wed 3/31/21**	**Mon 4/12/21**			
44	5.3.1 Ohm Check	2 days	0 hrs	Wed 3/31/21	Thu 4/1/21	31		
45	5.3.2 Setup	2 days	0 hrs	Fri 4/2/21	Mon 4/5/21	44		
46	5.3.3 Engineering Test	5 days	0 hrs	Tue 4/6/21	Mon 4/12/21	45		
47	5.4 Project Turnover	0 days	0 hrs	Mon 4/12/21	Mon 4/12/21	38,42,46		
48	5.5 Testing Complete	0 days	0 hrs	Mon 4/12/21	Mon 4/12/21	47		
49	**6 Shipping**	**12 days**	**0 hrs**	**Tue 4/13/21**	**Wed 4/28/21**			
50	6.1 Clean Up, Q3, Prepare to Ship	7 days	0 hrs	Tue 4/13/21	Wed 4/21/21	48		
51	6.2 Ship	0 days	0 hrs	Wed 4/21/21	Wed 4/21/21	50		
52	6.3 On Site	0 days	0 hrs	Wed 4/28/21	Wed 4/28/21	51FS+5 days		
53	6.4 Shipping Complete	0 days	0 hrs	Wed 4/28/21	Wed 4/28/21	52		
54	**7 Post Ship Engineering**	**47 days**	**0 hrs**	**Tue 5/4/21**	**Thu 7/1/21**			
55	7.1 As Built	1 wk	0 hrs	Tue 5/4/21	Sat 5/8/21	53FS+1 wk		
56	7.2 As Commissioned	1 wk	0 hrs	Mon 5/31/21	Fri 6/4/21	74FS+1 wk		
57	7.3 Final Kestrel Report	30 days	0 hrs	Fri 5/21/21	Thu 7/1/21	72		
58	7.4 Post Ship Engineering Complete	0 days	0 hrs	Fri 6/4/21	Fri 6/4/21	56,55		
59	**8 On Site**	**22 days**	**0 hrs**	**Fri 4/30/21**	**Fri 5/21/21**			
60	**8.1 Installation Supervision**	**6 days**	**0 hrs**	**Fri 4/30/21**	**Wed 5/5/21**			
61	8.1.1 Travel	1 day	0 hrs	Fri 4/30/21	Fri 4/30/21	52FS+1 day		
62	8.1.2 GT1	5 days	0 hrs	Sat 5/1/21	Wed 5/5/21	61		
63	8.1.3 GT2	5 days	0 hrs	Sat 5/1/21	Wed 5/5/21	61		
64	8.1.4 ST	5 days	0 hrs	Sat 5/1/21	Wed 5/5/21	61		
65	**8.2 Site Acceptance Testing**	**9 days**	**0 hrs**	**Thu 5/6/21**	**Fri 5/14/21**			
66	8.2.1 GT1	3 days	0 hrs	Thu 5/6/21	Sat 5/8/21	62		
67	8.2.2 GT2	3 days	0 hrs	Sun 5/9/21	Tue 5/11/21	66		
68	8.2.3 ST	3 days	0 hrs	Wed 5/12/21	Fri 5/14/21	67		
69	**8.3 Commissioning**	**7 days**	**0 hrs**	**Sat 5/15/21**	**Fri 5/21/21**			
70	8.3.1 GT1	2 days	0 hrs	Sat 5/15/21	Sun 5/16/21	68		
71	8.3.2 GT2	2 days	0 hrs	Mon 5/17/21	Tue 5/18/21	70		
72	8.3.3 ST	2 days	0 hrs	Wed 5/19/21	Thu 5/20/21	71		
73	8.3.4 Travel	1 day	0 hrs	Fri 5/21/21	Fri 5/21/21	72		
74	8.4 On Site Complete	0 days	0 hrs	Fri 5/21/21	Fri 5/21/21	73		
75	9 Job Complete	0 days	0 hrs	Fri 6/4/21	Fri 6/4/21	58		

EXHIBIT B

COMPENSATION AND PAYMENT SCHEDULE – AMENDED OCTOBER 27, 2020

1. MAXIMUM COMPENSATION

The maximum amount payable for all materials and services provided under this Agreement shall not exceed Three Million Seven Hundred Twenty Five Thousand Dollars ($3,725,000) during the term of the Agreement. Any additional services or materials requested by the City that would exceed the Maximum Compensation will be addressed in an Amendment to the Agreement in advance of initiating work.

Table B-1: Maximum Compensation

Description	**Total**
DCS System Implementation (see Section 2 below)	$2,557,000
Ovation Excitation System	$419,426
Estimated Sales Tax and Shipping Ovation Excitation System	$49,494
Support for five years (see Section 3 below)	$199,080
Contingency	$500,000
Maximum Compensation	**$3,725,000**

2. SYSTEM IMPLEMENTATION

2.1. Firm Fixed Price – Distributed Control System

Contractor shall provide all equipment, materials, and labor to upgrade the Distributed Control System as specified in Exhibit A (including appendices A – 1 through A-7) on a firm fixed cost basis as set forth in Table B-2 below. Any additional products or services will be presented to the City for approval prior to commencement of the work.

Table B-2: Distributed Control System Implementation - Price Breakdown

System Implementation	
Hardware	$682,214
Software Application (including Windows Server 2016, Windows 10, Ovation, and OPH with Crystal Reports for report building)	$476,116
Project Management	$65,000
Installation	$541,365
System Commissioning / Validation / Final System Acceptance	$694,130
Documentation	$3,400
Training (15 weeks factory training; one week on-site)	$32,775
Shipping (FOB Destination)	Included
Expanded Ovation Spare Parts	Included
V-System Server with 1 Virtual Controller (Training System)	Included
Use of LM6000 Simulator (via remote login)	Included
Ovation playback machine	Included
Subtotal	**$2,495,000**
Sales Tax	
Estimated Sales Tax	$62,000
TOTAL SYSTEM IMPLEMENTATION	**$2,557,000**

2.2. Payment Schedule – Distributed Control System

Table B-3: System Implementation Payment Schedule – Distributed Control System

Milestone/Deliverable	**Estimated Completion Date**	**Payment**
Project Management / Kick-off Meeting / Submittal of Hardware Drawings	7/1/19	$748,500
Submittal of Initial Functional Control Drawings	7/29/19	$499,000
Completion of Factory Acceptance Test	10/11/19	$249,500
Completion of System Installation and Commissioning	11/26/19	$499,000
Final System Acceptance*	12/31/19	$499,000
Subtotal		**$2,495,000**
Estimated Sales Tax (to be paid in accordance with applicable milestone for which sales tax is due)		$62,000
TOTAL PAYMENTS		**$2,557,000**

*The signed Final Acceptance Certificate (Appendix A-6) triggers final payment and start of warranty period.

2.2.1. Progress payments shall be made to Contractor by City following acceptance of designated milestones as shown in Table B-3 above.

2.2.2. All payments are based upon City's acceptance of Contractor's performance as evidenced by successful completion of all of the deliverables as set forth for each milestone. City shall have no obligation to pay unless Contractor has successfully completed and City has approved the milestone for which payment is due.

2.2.3. Payment for any part or parts of the System provided hereunder, or inspection or testing thereof by City, shall not constitute acceptance or relieve Contractor of its obligations under this Agreement. City may inspect the components of the System when delivered and reject upon notification to Contractor any and all the System, which does not conform to the specifications or other requirements of this Agreement. Components of the System, which are rejected shall be promptly corrected, repaired, or replaced by Contractor. If City receives components of the System with defects or nonconformities not reasonably apparent on inspection, then City reserves the right to require prompt correction, repair, or replacement by Contractor in accordance with Contractor's warranty obligations.

2.3. Firm Fixed Price – Ovation Excitation System

Contractor shall provide all equipment, materials, and labor to implement the Ovation Excitation System as specified in Appendix A-8 on a firm fixed cost basis as set forth in Table B-4 below. Any additional products or services will be presented to the City for approval prior to commencement of the work.

Table B-4: Excitation System Implementation - Price Breakdown

System Implementation	
Ovation Excitation Control – LM6000 (2 Units) Ovation Excitation Control – Mitsubishi Steam Turbine	$419,426
Subtotal	**$419,426**
Sales Tax	
Estimated Sales Tax and Shipping	$49,494
TOTAL SYSTEM IMPLEMENTATION	**$468,920**

2.4. Payment Schedule – Ovation Excitation System

Table B-5: System Implementation Payment Schedule – Ovation Excitation System

Milestone/Deliverable	Estimated Completion Date	Payment
Project Management / Kick-off Meeting / Submittal of Hardware Drawings	12/2/2020	$125,827
Submittal of Initial Functional Control Drawings	2/16/2021	$83,885
Completion of Factory Acceptance Test	3/25/2021	$38,602
System Installation and Commissioning	5/14/2021	$87,226
Final System Acceptance*	5/21/2021	$83,886
Subtotal		**$419,426**
Estimated Sales Tax (to be paid with System Installation and Commissioning)		$7,850
Estimated Shipping		$7,000
Contingency		$34,644
TOTAL PAYMENTS		**$468,920**

*The signed Final Acceptance Certificate (Appendix A-6) triggers final payment and start of warranty period.

2.4.1. Progress payments shall be made to Contractor by City following acceptance of designated milestones as shown in Table B-5 above.

2.4.2. All payments are based upon City's acceptance of Contractor's performance as evidenced by successful completion of all of the deliverables as set forth for each milestone. City shall have no obligation to pay unless Contractor has successfully completed and City has approved the milestone for which payment is due.

2.4.3. Payment for any part or parts of the System provided hereunder, or inspection or testing thereof by City, shall not constitute acceptance or relieve Contractor of its obligations under this Agreement. City may inspect the components of the System when delivered and reject upon notification to Contractor any and all the System, which does not conform to the specifications or other requirements of this Agreement. Components of the System, which are rejected shall be promptly corrected, repaired, or replaced by Contractor. If City receives components of the System with defects or nonconformities not reasonably apparent on inspection, then City reserves the right to require prompt correction, repair, or replacement by Contractor in accordance with Contractor's warranty obligations.

3. ONGOING SUPPORT AND MAINTENANCE SERVICES

Ongoing support and maintenance services after Final System Acceptance shall be in accordance with the pricing set forth herein.

3.1. SureService™ Customer Support Programs

3.1.1. Contractor provides various support programs as described in Appendix A-7. The City has elected to purchase the service programs listed below. The City reserves the right to delete or add service programs as required to support the System.

3.1.2. Contractor shall invoice the City annually for all applicable support and maintenance costs. In the event of early termination of the Agreement, Contractor shall refund the City on a pro-rated basis any fees paid in advance that have not been expended as of the date of termination.

Table B-6: Selected SureService™ Customer Support Program

Description	Annual Total
Year 1 SureService™ (SureService Telephone Support, Internet Information Access, Remote System Diagnostics, and Software Updates with Antivirus Program)	$9,426
Year 2 SureService™ (SureService Telephone Support, Internet Information Access, Remote System Diagnostics, and Software Updates with Antivirus Program)	$44,232
Year 3 SureService™ (SureService Telephone Support, Internet Information Access, Remote System Diagnostics, and Software Updates with Antivirus Program)	$46,245
Year 4 SureService™ (SureService Telephone Support, Internet Information Access, Remote System Diagnostics, and Software Updates with Antivirus Program)	$48,351
Year 5 SureService™ (SureService Telephone Support, Internet Information Access, Remote System Diagnostics, and Software Updates with Antivirus Program)	$50,835
5-Year Total	**$199,089**
Annual totals are a not-to-exceed amount for each year. As defined in the Agreement, support costs begin one year after system acceptance for each system. Annual support shall be adjusted and billed according to the start date for each system.	

3.2. Additional Services

3.2.1. Unless otherwise included under the SureService™ Customer Support Program for which the City has paid the applicable fees, service rates and spare parts shall be as outlined in Table B-7 below:

Table B-7: Rates

Weekdays First 8 hours that day @ 1,750 per day; Additional hours that day @ $328/hour
Saturdays All hours that day @ $328/hour
Sundays & Holidays All hours that day @ $438/hour
Spare parts - 50% off list price through final system acceptance; 15% off list price thereafter.

3.2.2. All Additional Services shall be authorized in writing in advance of performance of service using the process outlined in this Exhibit B.

4. SYSTEM ENHANCEMENTS AND UPGRADES

4.1. Upon request of the City, Contractor shall provide quotes for services and resources required to implement upgrades, improvements, and enhancements to the System as required by the City.

4.2. Authorization for work:

4.2.1. If remaining contingency funds are available to complete the project quoted, system enhancements may be authorized by written authorization of an Assistant Director of the Electric Utility, Electric Utility Chief Operating Officer, or Chief Electric Utility Officer using the Exhibit F - Sample Work Authorization Form as further defined below:

4.2.1.1. Work Authorizations shall be issued in accordance with the Terms and Conditions of this Agreement. Each Work Order shall describe the services and deliverables (collectively "Work") the Contractor must provide, the time limit within which the Contractor must complete the Work, and the compensation for the Work.

4.2.1.2. Each Work Authorization shall be substantially in the form specified in Exhibit F. Subject to the terms and conditions of this Agreement, Contractor and City will negotiate the specific requirements of each Approved Work Order.

4.2.1.3. Except in the case of emergency, Contractor shall not initiate work and the City will not compensate the Contractor for any Work until the City has executed the Work Authorization for such Work ("Approved Work Authorization").

4.2.1.4. Each Approved Work Authorization incorporates the Terms and Conditions of this Agreement, and becomes a part of this Agreement. An Approved Work Authorization must be consistent with – and cannot alter - the terms and conditions of this Agreement. The terms and conditions of this Agreement control over the terms and conditions contained in an Approved Work Order – even if the Approved Work Order expressly states that it is intended to control. Any conflicting terms and conditions in an Approved Work Order are invalid and unenforceable.

4.2.2. In event of an emergency which shall be defined as a circumstance requiring work by the contractor within 72 hours, work may be initiated in advance of execution of a Work Authorization. In the event of emergency, Contractor shall provide a quote for a Work Authorization within 3 business days of starting work.

4.2.3. If insufficient contingency funds are available to complete all work previously authorized as well as a new enhancement or upgrade, an Amendment to the Agreement shall be executed in advance of starting work.

4.2.3.1. Any additional services or materials requested by the City that would exceed the Maximum Compensation will be addressed in an Amendment to the Agreement in advance of initiating work.

4.2.3.2. No products or services that will commit or authorize funds in excess of the contingency funds outlined in will be provided unless both Parties execute an Amendment to this Agreement.

4.2.4. The City has identified the following system features / enhancements that may be implemented at a later time. Such features / enhancements shall be authorized using the process outlined in this Section 4.

Description	**Unit Price**
Ovation Machinery Health Monitor (OMHM) to replace the Bently Nevada 3500 on the Steam Turbine	$45,782
Workbench with Tie-back Simulation	$185,000
Network Intrusion Detection (NID)	$188,000
Vulnerability Assessment	$39,000

5. INVOICING

5.1. Compensation and payment shall be made to Contractor by City based on Net Thirty (30) days payment terms.

5.2. The City will make payments when due in the form of a check, cashier's check, or wire transfer drawn on a U.S. financial institution.

6. LIQUIDATED DAMAGES

Liquidated damages shall not be applicable to the Ovation Excitation Project portion of this agreement.

EXHIBIT F

SAMPLE WORK AUTHORIZATION FORM

This Work Order is issued by the City of Santa Clara acting by and through its **Electric Utility, Silicon Valley Power** (the "Department") to the contractor listed below. This Work Authorization shall constitute a binding legal contract between the Department and Contractor pursuant to the terms of the Agreement referenced in this Authorization. All services shall be using the terms and rates included in the Agreement. In the event of any inconsistency between this Work Order and the Terms and Conditions of the Agreement, the Terms and Conditions of the Agreement shall govern and control.

PART A: GENERAL INFORMATION

Work Order No.:		☐ Original ☐ First Revised ☐ Second Revised ☐ Other_____
Contract No.		
Contractor Name/Address:		
Agreement Name:		
Expiration Date of Agreement:		
Contractor's Project Manager:	**Name:**	**Email:**
City's Project Manager	**Name:**	**Email:**
Period of Performance for this Work Order:	**Start Date:**	**Expected Completion Date:**
Maximum Work Order Compensation:		
Previously Committed Contingency Funds		
Available Contingency Funds		
Sufficient funds are available in Fund #: (to be completed by City)		

Signatures:

Contractor Name [Print]: Date:

_____ _____

Signature

City's Project Manager [Print]: Date:

_____ _____

Signature

Authorized City Representative Name [Print]*: Date:

_____ _____

Signature

** Authorized City Representatives include Electric Utility Assistant Director, Chief Electric Utility Operating Officer, Chief Electric Utility Officer*

PART B: SERVICES TO BE PERFORMED

1. REVISED WORK ORDER

☐ No

☐ If yes, provide a brief description of the change(s).

2. SCOPE OF WORK TO BE PERFORMED

The Contractor shall perform the service(s) described below in accordance with all of the Terms and Conditions of the Agreement. (Insert a detailed scope of work below or attach as a separate file.)

3. COMPENSATION

a. Basis of Compensation: ☐ Time & Materials ☐ Fixed Fee

b. Reimbursable Expenses:

☐ No expenses are reimbursable.

☐ Expenses are separately reimbursable in the maximum amount of:

_____

c. Payment Schedule:

☐ Monthly ☐ Completion of Deliverable/Milestone ☐ Completion of Work

d. Payment Terms. Provide payment terms below or attach as a separate file.