SCOPE FOR SEC EXPANSION

A. PURPOSE

This document outlines the scope for professional engineering services that will result in a complete and detailed set of engineering documents as described herein including but not limited to all drawings and specifications for procurement and construction of the South Energy Center (SEC) Combined Heat and Power Expansion Project (the Project). The Project will in general install a reciprocating engine-generator, in the range of 4 – 7.5 MW, with accompanying heat recovery steam generator, hot water heat recovery heat exchanger(s), two 2,200 ton electrical centrifugal chillers and supporting cooling towers, and an additional emergency generator to produce thermal energy and electric power at The SEC.

B. EXISTING SEC FACILITIES.

Electric

Two Normal grid 12.47kV feeders, fed from separate substations
Solar Turbines Mercury 50 Gas Turbine (with inlet cooling) ~4.3MW
Cat 3516 Diesel Generator 2.25MW
Cutler Hammer 15kV double ended switchgear - Normal buses 01 & 02; Generation bus 01, and Essential bus 01.
Isolation and plant transformers
Woodward EGCP3 Generator Controls
GE UR Relays in 61850 Fiber based configuration for microgrid
Alpine Power Systems UPS for Switchgear
Eaton Powerware 9335-30 UPS for plant controls
Redundant 12.47kV normal power feeds to Cancer Hospital
Redundant 12.47kV Essential power feeds to Cancer Hospital
The facility currently operates as a complete microgrid with redundant grid feeds and on-site gas turbine capable of supporting the entire hospital and SEC load in island mode. The facility typically operates in grid-connected mode exporting power to the grid, but is capable of entering and returning from Island mode seamlessly. The essential power generator is capable of synchronizing to the grid and using the grid as a load bank for testing purposes. All required 15kV switchgear is installed to support the new equipment required for Phase 2, although additional breakers will be required to complete provision of the existing sections and buckets.

Steam

Cleaver Brooks fire tube boiler – 35,000 #/hr. @ 110 psi saturated.
ERI HRSG with Natcom Duct Burners – 42,000 #/hr. @ 110 psi saturated.
Cleaver Brooks condensate receiver and feedwater system.
RO System with pre-filters and treated water storage – 44 gpm
Nalco Trasar chemical controller
Supply pressure to hospital regulated at SEC to 70 psi.
Single steam and condensate lines to the Cancer Hospital

Chilled Water

York 1,200 ton steam turbine chiller (qty=1)
Trane 1,500 ton electric centrifugal chiller (qty=2)
Evapco 1,500 ton towers (qty=2)

Associated chilled water and condenser water pumps (qty=3/ea)
Grundfos Reclaimed Water Booster Pumps (qty=2) – Cooling tower makeup
Nalco Trasar chemical controller for condensate system
VFDs on CHW and Condenser water pumps, and cooling tower fans
Variable primary chilled water operation.
Single Chilled Water supply and return (42F / 56F) lines to Cancer Hospital

Plant Controls
Allen Bradley Control Logix PLC (Redundant) ControlNet -Balance of Plant
Allen Bradley Compact Logix or Control Logix Ethernet – Skid based systems (multiple)
Rockwell Automation redundant server based Factory Platform -HMI
OSI PI Plant Historian
Allen Bradley 7000 Series adjustable frequency drives Control net (multiple)
Woodward EGCP3 LS & MC Engine Generator Controls
Extensive integration of subsystems via Modbus RTU and Modbus IP
The SEC has a highly integrated control system. Many of the plant systems contain stand-alone PLC based control systems based on either Allen Bradley Control Logix or Compact Logic platforms. Data is brought into a balance of plant control system consisting of redundant Allen Bradley Control Logix PLCs. The plant uses Rockwell Automation Factory suite of products for HMI, and OSI PI as the plant historian. HMI screens have been created for all stand-alone skids (except for the GT) to mimic local panel view displays. Most plant functions are sufficiently automated to permit operation through the HMI's located in the central control room or alternate HMI locations throughout the plant.

Fuel System
Dedicated Natural Gas Gate Station 700# service (Design Capacity >20 MW) with customer owned redundant regulation to 150#.
Diesel Fuel Storage – 2-25,000 gallon diesel underground storage tanks

C. SEC EXPANSION

1. General

GRU has initiated the SEC Combined Heat and Power Expansion Project for the purpose of expanding CHP capability and chilled water capacity at the SEC by adding a reciprocating engine-generator (REG), in the range of 4 – 7.5 MW, for increased electric power production, an accompanying heat recovery steam generator (HRSG) to produce additional thermal energy, and additional chilled water production equipment. The REG and related auxiliaries will be located in a vacant area on the first floor level within SEC. The HRSG will be located on the second floor. The chillers and cooling towers will be located on the third floor and roof respectively. A new emergency generator will be located on the third floor as well.

Other new Project equipment will be located inside of, or within the footprint of the existing SEC building including a new exhaust stacks, chilled water and circulating water pumps, a system to receive, store, process, and deliver urea to the HRSG for emission control, and any new electrical equipment.

When complete, the Project will be operated as an integral part of the existing SEC. It will represent the preferred resource for electric and thermal energy production for the Shands Cancer Hospital so as to maximize the benefit of CHP and will operate in response to campus thermal energy demand.

New equipment installed by the Project will rely on existing infrastructure by developing ties to existing operational plant systems including steam, feed water, condensate, fuel, cooling water, compressed air, and auxiliary power. The SEC represents the only source of thermal energy for the Shands campus and operates throughout the entire year in response to continuous thermal energy demand. As such, specifications and

designs must account for the fact that existing equipment must remain in operation over the entire duration of the Project.

2. Project Systems and Equipment

It is intended that the scope of Project systems and equipment will be all inclusive resulting in a complete and reliable installation that will be fully operational in combination with existing plant systems and equipment. New systems and equipment to be installed by the Project shall include, but are not necessarily limited to:

a) (2) 2,200 ton electric centrifugal chillers, associated cooling towers, and pumps

b) (3) 2,250 ton cooling towers

c) (1) Natural gas powered reciprocating engine and auxiliaries in the range of 4 – 7.5 MW

d) (1) HRSG, SCR and support systems

e) Redundant 15kV normal and essential feeders to the hospital routed partially (outside footprint of SEC) through duct banks designed by the new hospital MEP Engineer.

f) Hot water recovery and generation system and ties for hot water service to new hospital.

g) Additional steam and condensate lines through the SEC to the interface point, and for metering and control within the new hospital basement.

h) Additional diesel generator of size TBD (2.25-4MW)

i) Detailed controls integration with existing SEC plant systems (including point to point diagrams), and with the hospital building management system.

j) Additional 15kV breakers and 480V and 120/240V gear as required to implement the above.

k) The umbilical between the SEC and the new hospital is being designed by the new hospital MEP Engineer firm (Affiliated Engineering) under contract with GRU. The transition point between the work scopes shall be a location along the outside of the building located 6" above grade. It is expected that the two firms will work together to coordinate location and all other coordination details between the hospital and the SEC.

l) Startup and commissioning assistance.

m) As-built drawings and other documentation in AutoCAD and PDF formats.

3. Major Project Interface Points

The Project shall interface with existing systems at the SEC and Hospital Expansion as follows:

a) Steam Produced from HRSG - At an existing capped connection with isolation valve (STM-HV-308) in the steam header adjacent to the existing back-up boiler within the SEC boiler room.

b) Steam for Hot Water Production – Tap off of new line from new HRSG to allow feed from header when engine is down.

c) Hot Water Supply and Return – To a location approximately 6" above grade outside of the NW corner of the SEC. Connection to be coordinated with the new hospital MEP Engineer firm (Affiliated Engineering).

d) Condensate Return – To a location approximately 6" above grade outside of the NW corner of the SEC. Connection to be coordinated with the new hospital MEP Engineer firm (Affiliated Engineering).

e) Steam – To a location approximately 6" above grade outside of the NW corner of the SEC. Connection to be coordinated with the new hospital MEP Engineer firm (Affiliated Engineering).

f) Feed Water -At tie in point TBD in existing boiler feed pump discharge piping header located within the SEC boiler room

g) Natural Gas -At tie in point TBD in the 150psig gas header located within the SEC.

h) Fuel Oil for Emergency Diesel -At tie in point FO-HV-911 in the fuel oil header located within the SEC.

i) Chilled Water (Chillers) – At valves in existing chilled water header (CHW-HV-235 and CHW-HV-236) and extend header to provide connections for new chillers.

j) Chilled Water (Pumps) – At valves in existing chilled water pump header (CHW-HV-210 and CHW-HV-211) and additional point in existing chilled water pump header TBD to extend header to provide connections for second pump.

k) Condenser Water (Chillers) – At valves in existing condenser water header (CW-HV-126 and CW-HV-127) and extend header to provide connections for new chillers.

l) Condenser Water (Pumps) – A tie in point TBD in existing condenser water pump header to provide connections for new pumps.

m) Condenser Water (Cooling Towers) – A tie in point TBD in existing condenser water header to provide connections for new cooling towers.

n) Chilled Water Supply and Return – To a location approximately 6" above grade outside of the NW corner of the SEC. Connection to be coordinated with the new hospital MEP Engineer firm (Affiliated Engineering).

o) Generated Power – Tie to existing available breakers in SW15G01A and SW15G01B

p) Chillers - Tie to existing available breakers in SW15N02A and SW15N02B.

q) Tower Fans and Pumps – New breakers to be installed in existing 480V switchgear MC04N01A and MC04N01B.

r) Engine MCC - New breakers to be installed in spare positions in existing switchgear SW04N01B and SW04E01B.

s) Fire Protection - At locations within the existing SEC fire protection system to be determined during Project design engineering

4. 12.47kV Generator Electrical Connections

The new generation at the GRU SEC will be connected to one of the existing available breakers in SW15G01A or SW15G01B. The setting and configuration of the GE Multilin G30 generator relay will be set to match the generator's requirements for protection and to integrate into the existing relay scheme.

5. Project Functional Requirements

The Project shall be designed to meet the following functional requirements. All requirements shall be met without lifting safeties, without exceeding permitted emission or discharge limits, without causing Project or existing SEC equipment to trip unless intended by design. In addition, all functional requirements shall be met with controls set for normal operation (e.g. -automatic mode with normal set points, all parameters within high and low alarm limits, no forced points, no defeated alarms, and no software or hardware jumpers), and in full compliance with the requirements of all permits, licenses, applicable regulations and approvals.

a) The Project shall be capable of sustained continuous operation at maximum steam and electric power production levels when operated alone or when operated concurrently with any combination of the existing SEC equipment.

b) The Project shall be capable of operating up to maximum steam and electric power production levels adjusted for ambient conditions on a continuous basis (24 hours per day, every day of the week, every week of the year), when operated alone or when operated concurrently with any combination of the existing equipment.

c) The Project shall be capable of operating in cycling mode that will consist of hour to hour cycling throughout its operating range as the SEC responds to continuously changing thermal energy demand.

d) The Project shall be capable of meeting emissions requirements during sustained and cycling operation anywhere within an operating range of no less than 50% of rated electrical production capability and up to full electrical production capability.

e) The Project shall be capable of sustained operation with engine exhaust supply diverted from the HRSG. Maximum levels of bypass shall be determined during project design to maintain steam production and protect the HRSG.

f) The Project shall be designed with PLC control and automation using the same hardware and software platforms that exist at the SEC and such that the Project can be safely and efficiently started, shut down, monitored, and controlled by the PLC. All shall be while attended by the Owners normal operating personnel, without requiring an operator to leave the control room, and without requiring roving operators to take intervening action other than closing startup/shutdown vents and drains. Redundant local controls shall be provided that give operators the option to start up or shut down equipment from locations that are local to the equipment. All local operation shall be fully displayed in the control room.

g) The Project shall be capable of maintaining stable operation during all modes of operation while subjected to gas supply pressure fluctuations of between __ psig and __ psig and at a rate of change not exceed 10 psi per minute.

D. REQUIRED SERVICES

1. General

Engineering and design work product shall be provided that includes but is not necessarily limited to calculations, studies, drawings, plans, specifications, reports, and related consulting and support functions needed for procurement and construction of the Project. The work product shall collectively provide for construction and commissioning of fully integrated and complete operating systems including system functions and overall Project performance as specified herein. Work shall be prepared such that the scope and design is compliant with applicable federal, state, and local code requirements. General scope of services will include the following:

a) Attend bi-weekly design progress meetings via Conference call and/or webex.

b) Prepare four document packages for Owner review:

- Pre-Purchase Specifications – Engineer will develop pre-purchase specification for the Engine, HRSG, and chillers to ensure lead times meet construction schedule and key submittals are received prior to finalizing design.
- Conceptual Design - Engineer will complete a conceptual design of the facility. The design will include key drawings and a narrative design basis to ensure that major scope items are clear, key coordination points identified, and major barriers are discussed. This phase typically represents 30% completion
- Detailed Design - Engineer will complete a detailed design of the facility. The design will include drawings, specifications and an updated narrative design basis. This phase typically represents approximately 60% completion

- Construction Documents - Engineer will complete a detailed design of the facility. The design will include drawings, specifications and an updated narrative design basis. This phase typically represents approximately 100% completion. This phase will not be completed until major equipment submittals have been approved by Engineer and Owner.

c) Engineer will participate in on-site review meetings subsequent to receiving Owner comments at each phase of design.

d) Engineer will prepare and coordinate required documentation for Authorities having Jurisdiction including, but not limited to: City of Gainesville Building Department, State Fire Marshall, Florida Agency for Health Care Administration (AHCA), and the Florida Department of Environmental Protection, and Gainesville Regional Utilities Water and Wastewater Division. Considerable effort is anticipated on the part of the Engineer during the AHCA design and construction review processes.

2. Programming

The Engineer shall provide the programming services to support key scoping decisions. Programming phase is anticipated to last approximately 6-8 weeks.

a) Attend 2-3 day project kick-off charrette.

b) Prepare and distribute indicative pricing packages for the REG. Packages will include outline technical specifications and solicitation letters. Engineer will prepare summary of results.

c) Investigate energy alternatives to optimize thermal cycle and heat recovery.

3. Drawings and Diagrams

Prepare and furnish schematics, physical plans, drawings, and required details needed to present a level of information adequate to procure all required equipment, materials, and other Project components, to solicit and receive bona fide contractor bids for Project construction, and for contractor installation of the Project. Drawings and diagrams shall include but not necessarily be limited to:

a) Site plans that depict existing buildings and equipment at the SEC and show new structures and equipment that will be added by the Project.

b) Site utilization plans showing use of property at the SEC during construction including areas for laydown, temporary equipment if required to support ongoing operation, and field offices

c) General layout drawings including plan and section views that depict equipment locations, \new structures, major piping runs, major electrical conduit runs, and maintenance areas.

d) Demolition plans showing scope and details for removal of structures and equipment as needed to facilitate Project work.

e) Civil and structural drawings, plans, and details Project civil/structural work including site development, site restoration, subsurface conditions, pile plans, foundations, structural steel, bracing, platforms, stairs, ladders, and auxiliary steel.

f) Architectural drawings, plans and details that show temporary and permanent modifications as required for Project work.

g) Mechanical drawings, plans, and details as required for all Project mechanical work including general arrangements, equipment locations, piping and instrumentation diagrams (P&IDs), piping layouts, piping isometrics(high temp), pipe supports, and mechanical installation details.

h) Electrical drawings, plans, and details as required for all Project electrical work including equipment locations, one-line diagrams, protection one line diagrams, three line diagrams, plans and details,

lighting diagrams, electrical panels, major conduit and cable tray routing, and electrical installation details.

i) Instrumentation and control drawings for all Project instruments/controls work including control architecture, point to point wiring diagrams, PLC drawings, instrumentation location plans, instrument schedules, instrument installation details, control room drawings, and panel drawings.

4. Specifications

Prepare and furnish all specifications required for complete Project procurement and construction including but not limited to:

a) Specifications for procurement of engineered equipment including functional and performance requirements. Specifications for the engine, heat recovery steam generator, and chillers will be completed early in the design schedule to ensure final engineering drawings conform to submitted vendor information and drawings received after award.

b) Specifications for all construction and installation as well as design requirements, materials, and standards for all equipment, construction materials and process commodities.

c) Specifications to define the anticipated Sequence of Operations.

5. Calculations, Studies, and Reports

Calculations shall be prepared as required to establish design, capacity, and performance of the overall project, individual systems, equipment, and structures. Calculations shall also provide the basis for specification of suitable materials for required process conditions, structural capability, compliance with applicable codes and standards, and preparation of construction drawings. Calculations shall include but not necessarily be limited to

a) Heat balances

b) Water balances

c) Short Circuit Analysis.

d) Grounding and cathodic protection analysis.

e) Structural Analysis.

f) Pipe Stress Analysis.

g) Pipe Support/Hanger Calculations.

h) Additional Geotechnical Survey and Analyses as required

6. Procurement Support

Services shall be provided to support long lead equipment procurement including the engine generator, heat recovery steam generator, and chillers. Support for solicitation shall include preparing a list of qualified bidders for each item of equipment and commercial and technical bid forms formatted in a way to ensure that all cost, performance, and design information needed to make an objective procurement decision is received from each bidder. The Engineer shall also advise GRU concerning appropriate commercial terms for the bid solicitations. During the proposal period the Engineer shall respond to technical inquiries from prospective bidders and issue addenda as required to maintain equitability of the bid process.

Upon receipt of proposals the Engineer shall conduct a technical assessment of each proposal, evaluate proposed delivery dates in the context of Project schedule, and prepare a total cost of ownership analysis that compares all proposals. Cost of ownership will include proposed purchase price, payment terms, impact on Project constructability if any, Project schedule impact, and life cycle O&M cost. Technical specifications prepared by the Engineer during the Project development phase will be used as the initial technical basis for

procurement.

E. WORK WITHIN OPERATING FACILITIES

The SEC is operated continuously to produce and distribute thermal energy and electric power to the Shands campus. All field work necessary for Project design will occur in and around existing operational energy production and distribution facilities that will remain in operation throughout the entire period of work. Plans for field measurements, inspections, and general reconnaissance shall not prevent or preclude uninhibited operation or access by Owner's operators and contractors.

The Engineer's shall be properly trained on safety precautions associated with working on active energy production and distribution sites and the Engineer shall not grant entry by others except as expressly required to complete work specified herein.

F. SITE CONDITIONS

1. Ambient Conditions

The Project shall be designed to operate continuously over the range of ambient conditions that occur at the SEC. Exact conditions shall be agreed upon by project stakeholders early in the programming phase.

2. Subsurface Conditions

Existing geotechnical data is available for information. It is the Engineer's responsibility to verify existing site conditions and design the Project in accordance with those findings. A new geotechnical survey will be performed by GRU to validate engine subsurface conditions for dynamic foundation design. Burns & McDonnell will prepare required specifications and bore locations.

3. Fuel Properties

Analyses for natural gas and oil fuel received at the SEC will be provided by GRU.

G. PROJECT ENVIRONMENTAL PERFORMANCE

1. General

The Project shall be engineered to meet requirements of all Florida, Federal, and local regulations that are applicable to supply, construction, for operation of the Project. Certification of equipment, and all necessary submittals to allow Owner to obtain permits to operate will be prepared by Owner. Engineer shall provide technical support as it pertains to equipment being specified.

2. Site and Far Field Operational Noise

Noise targets will be established during project programming. Engineer shall provide the design of associated sound mitigating equipment and enclosures.

3. Employee Noise Levels

Careful consideration shall be given to limiting noise exposure to spaces routinely inhabited such as the control room.

H. GENERAL DESIGN REQUIREMENTS

1. Codes, Standards & Regulations

All Project work shall employ United States (U.S.) codes and standards as the basis for design. Project work shall also comply with state, county, and city codes and standards.

2. Language, Weights and Measures
All communications, documents, drawings, plans and other written materials provided by the Engineer shall be formatted in the English language.

3. Component Numbering System
Each component or piece of equipment shall be given a number using existing standards and the number will be shown on all drawings including process flow diagram, P&IDs, one-line diagrams, and physical layouts. Only one number is to be used for each component.

4. Site Surveys, Studies, and Soil Borings
The Engineer shall, as a part of the Project work perform all ground surveys and geotechnical investigations for foundation design and as otherwise required for the design of the project. The resulting geotechnical report shall be submitted to Owner. Project designs shall be in accordance with and appropriate to findings of the geotechnical investigation or suitably detailed follow-on geotechnical studies. The Engineer shall also perform measurements of soil resistivity as necessary to support electrical grounding and cathodic protection design.

5. Design Loads
Design values for wind loads, snow loads, and seismic loads shall, at a minimum, be in accordance with the respective International Building Code and local building code standards. Design floor loadings shall be as follows:

a) Concrete floors for maintenance access-250 psf or greater if required for equipment laydown;

b) All other concrete floors -150 psf;

c) Gratings-150 psf;

d) Stairways -I00 psf.

I. PROJECT LAYOUT

1. General
Project layout shall be based on general arrangement drawings prepared during the CHP study.

2. Reciprocating Engine Area
The REG shall be located within the SEC turbine hall located on the first floor in a way that provides required space for turbine maintenance, generator rotor removal, and simultaneous laydown of removable engine and generator components. Electrical equipment and a local control panel that provides redundancy with operation from the control room shall be located adjacent to the engine.

3. Heat Recovery Steam Generator Area
The heat recovery steam generator shall be located within the SEC Second floor in a way that provides access for operation and maintenance of SCR and CO catalysts, valves, pumps, fans, instrumentation, and electrical equipment. Clearance along the adjacent HRSG aisle way shall be maintained. Heat recovery steam generator electrical equipment and a local control panel that provides redundancy with operation from the control room shall be located adjacent to the heat recovery steam generator.

4. Switchgear
Switchgear shall be arranged in a way that provides required maintenance clearance including clearance to rack out breakers and that provides maintenance and operating clearances required by GRU. Control panels shall be located in a way that will not expose an operator to the front face of rear panel of the switchgear and that generally provides separation between the operator and breaker operation to the maximum possible extent.

5. Cranes and Hoists

Local hoists or rigging frames shall be provided in instances where necessary to move engine, generator, chiller, or other large components to a location where they can be accessed and removed from the SEC. Hoists shall be provided in the heat recovery steam generator area as necessary for removal and handling of SCR and CO catalysts.

6. Stairs and Platforms

A complete system of stairs and platforms shall be provided for Project equipment access and maintenance. All platforms and stairs shall be compliant with OSHA requirements. Ladders shall be used only for access to areas subject to infrequent operation. Platforms and stairs shall be equipped with handrails and kick plates. Grating shall be designed for minimum loading of 150 lb/square foot. All platforms, stairs, handrails, support steel, and pipe racks shall be hot dipped galvanized.

7. Valves and Instruments

Control valve stations and isolation valves will be placed in a way that they are accessible from the floor or platforms. The project layout shall group field mounted instruments and specify placement in areas which are accessible for maintenance, free of vibration, and that do not block walkways or prevent maintenance of other equipment.

J. ARCHITECTURE AND AESTHETICS

All exterior features and modifications at the SEC shall be consistent with the existing infrastructure. Where applicable, modifications shall be consistent with the appearance of existing building features. Exterior equipment shall be architecturally pleasing consistent with an industrial facility, present minimum clutter, conform to local building codes, and be approved by the Owner. In the event that changes are proposed, an updated architect's rendering shall be provided for Owner's review of the aesthetic design. Once accepted, the design shall not deviate materially from the rendering without the approval of Owner.

K. PIPING SYSTEMS

1. Pipe Sizing

Piping will be sized for maximum flow, pressure, and temperature that will occur during full load operation at minimum specified ambient temperature. Pipe sizing will generally be based on allowable pressure drop. In instances where velocity is used as the pipe sizing basis it will be limited to between 5 fps and 10 fps for small water lines, to between 8 fps and 15 fps for large water lines, to no more than 150 fps for saturated steam service, and to no more than 250 fps for superheated steam service.

2. Material and Wall

Piping material and wall thicknesses shall be designed in accordance with the applicable piping code for the maximum anticipated service conditions. Piping systems will generally be all welded, carbon steel. Piping system valves, fittings, and specialties will be specified with materials and ratings that are compatible with the respective pipe rating and material.

3. Vents and Drains

Piping designs will specify a pitch for drainage and stipulate fit out with low point drains and high point vents. Drain and vent valves will be specified for respective high and low points.

Vent and drain valves will be manually operated except for those which are critical for normal startups and shut-downs or for equipment protection.

4. Depiction of Piping

Piping 2-1/2 inches in diameter and larger shall be shown on project piping diagrams and design drawings. Piping 2 inches in diameter and smaller will be field run and field fabricated except for high-temperature/high

pressure piping.

5. Stress Analysis

Piping 2-1/2 inches in diameter and larger that will normally operate above 400° F shall be analyzed for flexibility and piping stresses. Stresses in piping systems shall not exceed the allowable those established by the applicable piping code. Piping systems shall be designed so that forces imposed on equipment do not exceed the forces allowed by the equipment· manufacturers.

6. Other Provisions

Piping for steam service shall be specified with all-welded construction. Where flanges are required for equipment connections they shall be of the raised face type. Specifications and designs shall prohibit threaded joints for steam service.

Valves shall be placed and arranged for convenient operation from an appropriate floor or platform level and shall be specified with extension spindles or gearing as required.

L. MECHANICAL EQUIPMENT AND SYSTEMS

1. Equipment

Equipment types and designs that are specified will insofar as possible be consistent with those having successful industry experience in the type, rating and application required.

Equipment will be sized for maximum conditions that will occur during full load operation at minimum specified ambient temperature. Designs shall account for flow, pressure or temperature variations that may occur during transient or abnormal operating conditions.

Safety margins and derating factors will be applied in sizing equipment to account for wear, fouling, leaking, pressure drop, and etc. Margins on head shall be applied only to the friction portion of the total head. Margins above these conditions will be applied to the fuel gas compressors and closed cooling water pumps as follows. Margins may be adjusted as necessary to obtain economical motor sizes.

2. Isolation Provisions

Redundant equipment shall be configured with appropriate valves and manifolds such that safe isolation for maintenance, repair, and/or replacement can be accomplished without impact on operation of the redundant component. Control valves shall be configured with appropriate valves and manifolds such that safe isolation for maintenance, repair, and/or replacement can be accomplished without interruption or reduction of SEC operation.

M. ELECTRICAL SYSTEMS

1. Switchgear

The existing switchgear SW15G01A has a fully equipped position GA-4 to be used for the 2.25-4MW diesel generator (DG-3) feed in connection. The existing switchgear SW15G01B has a fully equipped position GB-3 to be used for the gas powered reciprocating engine (REG-1) feed in connection. The two positions include the required relaying and engine controls.

The existing switchgear SW15E01A has a fully equipped position EA-3, sans breaker, to be used for the Phase 2 Shands Cancer Hospital Essential loads feeder. The existing switchgear SW15E01B has a fully equipped position EB-3, sans breaker, to be used for the Phase 2 Shands Cancer Hospital Essential loads feeder.

The existing switchgear SW15N01A has a fully equipped position N1A-2, sans breaker, to be used for the Phase 2 Shands Cancer Hospital Normal loads feeder. The existing switchgear SW15N01B has a fully

equipped position N1B-2, sans breaker, to be used for the Phase 2 Shands Cancer Hospital Normal loads feeder.

The existing switchgear SW15N02A has a fully equipped position N2A-3 to be used for a 2,200 ton chiller transformer feeder. The existing switchgear SW15N02B has a fully equipped position N2B-3 to be used for a 2,200 ton chiller transformer feeder.

The existing switchgear SW04N01A has a fully equipped position 102B, sans breaker, to be used for a REG MCC feeder. The existing switchgear SW04N01B has a fully equipped position 106D, sans breaker, to be used for a BOP MCC feeder.

2. Auxiliary Power

The auxiliary power distribution system shall be designed in accordance with applicable ANSI, IEEE, and NEC standards. Protection and isolation of branch circuit and feeders shall be in accordance with the NEC. Individual loads will be configured with a local disconnecting device or a lockable disconnecting means at the power supply/control location as required by the applicable codes and standards.

3. Motor Control

Standard NEMA motor control centers shall be provided for all 230/480 V ac motors, unless normally included as standard supply in a vendor-packaged subsystem.

Control of motors and other loads at centralized motor control centers is preferred to local starters. Phase designations (i.e., front-to-rear, top-to-bottom, and left-to-right) shall be consistent between all new equipment and with the convention used for existing equipment.

Electric motor operators and redundant electric motor driven equipment shall have local hand/off/auto control and DCS lead-lag standby controls such that the standby unit automatically starts up and begins operation when the lead unit trips off line for any reason. In addition, all redundant electric motor driven equipment shall automatically stati up on falling steam outlet header pressure or reduction of flow from feed water pumps. This requirement shall be met without switch-over to the redundant unit tripping any other equipment

Electrical control systems shall be designed to be failsafe and electrical control equipment shall be installed in cabinets and located in ·environmentally controlled indoor locations.

Control panels, equipment enclosures, and other electrical apparatus shall be rated NEMA lA or 12 for environmentally controlled indoor locations and NEMA 3R or 4 for general outdoor locations. For hazardous classified locations, electrical equipment and enclosures shall be of the proper NEMA classification suitable for that hazard.

The controls shall be immune to the electromagnetic noise present in a normal industrial environment with input and output wires run several hundred feet, potentially in a common conduit, before termination. In addition, the controls shall be immune to radiation generated by handheld transceivers and portable power tools (such as electric drills).

4. Wiring and Cable

Power cables shall be specified in accordance with ICEA and NEC standards and sections. In the event of conflict, the most conservative application will be used. All power cables must be jacketed armored or shielded unarmored cable.

Control wiring shall be protected with flame-retardant neoprene jacketing. Wire and cable installation specifications shall stipulate that no splices or taps are to be made between terminal points. Spare low voltage wires shall be included in each multi-conductor cable. Spare terminal block points shall be provided equally to at least 15 percent of the active terminals. No more than two wires shall be connected to each terminal

point.

Redundant electrical circuits, when present, shall be specified in separate raceways and spatially separated. Cables shall be suitable for the raceway in which they are installed and shall be suitable for the environment (i.e., wet, dry, sunlight, etc.).

Junction boxes shall be of galvanized steel and installed at logical interface locations and as otherwise required for proper cable installation! pulling. Junction boxes suitable for use in hazardous areas shall be furnished where explosive concentrations of natural gas could accumulate.

5. Motors

Polyphase motors shall be NEMA design B TEFC unless specifically identified load characteristics require otherwise. All materials shall be corrosion resistant and suitable for the specific motor location. Class F insulation shall be used for all 480 V motors, with Class B temperature rise permitted.

Motor horsepower ratings shall be specified without taking credit for any service factor greater than 1.0. Motors smaller than 1 horsepower shall generally be expected to be rated for 120 V service. Motors rated 3/4 horsepower and above will be rated for 480 V service.

Motors to be installed in hazardous classified areas shall be in accordance with National Electric Code, and approved by Underwriters Laboratories, for installation in corresponding area classification.

DC motors shall be rated for a nominal 125 V system and capable of proper operation from 108 to 140 V.

Motors shall be specified with capable for starting at full voltage. Motors installed in hazardous classified areas shall be suitable for the application.

Motors larger than 20 horsepower shall be provided with space heaters or shall have windings connected to an Allen-Bradley type automatic winding heater device to prevent condensation from forming during nonoperational periods.

6. Lighting and Power Receptacles

Individual lighting fixtures shall be suitable for the environment in which they are located (i.e., indoor, outdoor, and hazardous classified area). Circuits shall be alternated in a given area so that not all lighting is lost in the event of a given circuit trip. Lighting within indoor areas shall be controlled by local switches. Switches in areas that are occupied intermittently shall have automatic on/off feature. Panel boards for multiple lighting circuits shall be at a suitable switching location and readily accessible.

Circuits shall be clearly identified in each panel. A minimum of 15 percent spare breaker and 15 percent extra spaces shall be left in each panel upon completion.

Convenience power receptacles shall be located on in areas where Project facilities and equipment are located that are not already equipped with receptacles. \New receptacles shall be specified with ground fault interrupters and, as a general rule, shall be located within a 50foot cord length of the next adjacent receptacle. Lighting and receptacle source wiring shall be separated from plant power' control' and instrumentation wiring by means of separate raceway systems.

7. Grounding

Plant facilities shall be grounded as required to satisfy applicable code requirements. Grounding shall be accomplished by connecting all electrical equipment, raceways, and systems, as well as plant structural systems, to a buried ground grid of stranded-copper conductors.

An isolated ground system shall be provided for the plant instrument system grounding and shall be connected to the plant grounding grid at a single point only.

N. CONTROLS

1. Function and Design

Principal functional goals of the Project control design are to control all equipment and systems to the parameters selected by the SEC operators and to provide enhanced operating reliability. Control systems must protect Project equipment and assure that the redundancy inherent in system and equipment configurations is maintained. To support this goal, control systems must be more reliable than equipment and systems that are controlled. The following design measures shall be incorporated:

a) Control systems shall be designed so that no single failure of a major control system component will diminish the output of the SEC, nor prevent the control room operator from monitoring and controlling the SEC.

b) Instruments used to activate redundant equipment must be redundant.

c) The control system will process dual redundant inputs using either two out of two, or one out of two interlock circuitry required for protective action, depending on the importance of assuring protection, or avoiding unnecessary activation.

d) Redundant measurements will be compared and any significant deviation will be alarmed.

e) In general the current level of redundancy and resiliency at the SEC will be maintained.

2. Control Loops

Control loops shall be designed to accomplish process control utilizing an operating mode and operator interface which eliminates any necessity for an operator to provide actions or inputs other than the decisions of manual/auto, biasing, set point changes, and similar routine operations. The systems shall not require any operator actions to balance for transfer, or to perform logic tracking, or resetting functions within the systems. The operator interface shall provide convenient operator access to system data and to control functions for each control system. All control loops will be programmed at the Engineer's laboratory. This will include hosting GRU at programming completion to review operational loops and sequences. Engineer will travel to site to integrate new logic and graphics. 6-8 weeks of field service time at the SEC is included to perform integration activities.

3. Information System

The Project information system shall be an on-line real-time data acquisition system consistent and compatible with existing data acquisition and integral to the plant PLC to provide the operator, automatically and on demand, with up-to-date information regarding the status and operating condition of the equipment. PLC alarms shall alert the operator to abnormal plant conditions through monitor alarm displays. Engineer shall recommend points to be added to existing data historian but shall not provide services to upgrade historian database or add acquisition points.

O. CONSTRUCTION ADMINISTRATION

1. General

Engineer shall perform the following during construction to support contractor activities being performed under GRU's supervision and direction:

a) Visit the site during construction for the purpose of confirming that work is proceeding in accordance with drawings and specifications and to report defects and deviations. Site trips shall be limited to a total of 30 two-day trips for one engineer.

b) Review and certify contractor payment applications including confirmation that the amount and quality of work correspond to the payment amount applied for.

c) Review contractor and equipment design submittals.

d) Review contractor change order requests.

e) Prepare as-built drawings based on contractor and GRU red marks.

P. COMISSIONING

1. General

Site commissioning activities will be executed by GRU staff. The primary role of the Engineer in SEC expansion Commissioning activities is to develop the Commissioning plan and when requested observe and document select Cx activities. The Engineer's activities shall include:

a) Develop commissioning specifications for incorporation into construction documents to provide clarity regarding vendor, contractor and GRU staff roles and responsibilities.

b) Develop and issue a comprehensive Commissioning Plan including draft commissioning schedule for incorporation into master project schedule.

c) Review Design Documents.

d) Participate in weekly commissioning review meetings by phone.

e) Witness commissioning activities as requested by GRU. Ten (10), 2 day trips for a single engineer have been included.

f) Plan and conduct commissioning scoping meeting.

g) Review normal Contractor equipment submittals applicable to systems being commissioned for compliance with commissioning needs.

h) Review manufacturers' start-up requirement checklists provided by Contractors or Equipment Representatives.

i) Write and distribute Pre-functional Checklists (PCs).

j) Develop Functional Performance Test (FPT) procedures.

k) Review master log of deficiencies and their resolution.

l) Review final Commissioning Report prepared by GRU.

Q. REFERENCE INFORMATION