**Portland General Electric**
121 SW Salmon Street • Portland, Ore. 97204
PortlandGeneral.com

May 02, 2019

Public Utility Commission of Oregon
Attn: Filing Center
201 High Street, S.E.
P.O. Box 1088
Salem, OR 97308-1088

**RE: UM 1856 PGE's Energy Storage Request for Proposal Draft for a Microgrid Pilot Energy Storage System – Inviting Stakeholder and Commission Review**

Pursuant to Oregon Public Utility Commission (OPUC or Commission) Order Nos. 16-504 and 18-290, enclosed is Portland General Electric Company's (PGE's) request for proposal (RFP) draft for one of the energy storage systems, located in Beaverton as part of the Microgrid pilot. By copy of this to the OPUC Docket No. UM 1856 service list, we invite stakeholders to review and offer comments to the RFP design by May 16, 2019.

History of Energy Storage Docket

The Commission opened Docket No. UM 1751, in September 2015, to implement recently passed legislation, House Bill 2193. House Bill 2193 requires PGE and PacifiCorp to submit proposals by January 1, 2018, for qualifying energy storage systems with capacity to store at least five megawatt hours. In Commission Order 16-504, the Commission adopted guidelines and requirements for energy storage project proposals, in late 2016, and a framework for PAC's and PGE's Energy Storage Potential Evaluations.

PGE filed its Energy Storage Proposal and Final Potential Evaluation on November 1, 2017, which were investigated in UM 1856. Pursuant to Commission Order No. 18-290, filed in UM 1856 on October 25, 2018, PGE filed its plan to advance its energy storage modeling cability. On April 9, 2019, Staff approved this filing via electronic mail, enabling the Microgrid pilot to move forward.

PGE now seeks stakeholder input to the RFP design for an energy storage system used in the Microgrid pilot. The Commission's competitive bidding requirements for House Bill 2193 projects are as follows:

1. An electric company may award a contract for a project without competition if it determines and presents justification that only a single vendor or contractor is capable of meeting the requirements of the project.
2. Where the requirements for sole source procurement are unmet, electric companies must use a competitive process to award contracts.

a. The electric companies will bear the burden of demonstrating that they followed a fair, competitive solicitation process to identify all vendors with the requisite expertise, experience, and capability to install viable projects.
b. *The electric companies must give the Commission and stakeholders the opportunity to review the electric companies' RFP design and offer nonbinding input* (emphasis added).
c. The electric companies must summarize and report to the Commission their solicitation process and scoring approach. The report should be included with the formal project proposal submitted to the Commission, or, if bidding occurs after Commission authorization, at a special public meeting to follow.

Enclosed is the draft RFP for one of the energy storage systems that will be used in the Microgrid pilot.

PGE is seeking stakeholder feedback within the next 30 days. Feedback should be directed to: puc.filingcenter@state.or.us

Should you have any questions or comments regarding this filing, please contact Kalia Savage at (503) 464-7432.

Please direct all formal correspondence and requests to the following email address pge.opuc.filings@pgn.com

Sincerely,

Karla Wenzel
Manager, Pricing and Tariffs

Enclosures

# Draft Request for Proposal for a Microgrid Pilot Energy Storage System (Located in Beaverton)

May 2, 2019

# PORTLAND GENERAL ELECTRIC COMPANY

## Energy Storage System Customer Microgrid Project

*DRAFT Microgrid Energy Storage System Specification*

# Contents

# 1 Scope

Portland General Electric Company (PGE and Owner) plans to procure and install an energy storage system behind a PGE customer's meter (Customer). The Customer is a municipality building, which is a new three-story office building in an urban area. The energy storage system will be owned by PGE although located on the Customer's property and connected to the Customer's 480VAC (nominal) main bus. This energy storage system will provide services to the Area Electric Power System (EPS) while grid connected and will provide reliability and microgrid functions when intentionally islanded. The Energy storage system must be capable of black start to recover the local EPS after an unscheduled intentional islanding event and must be capable of regulating voltage and frequency on the local EPS when intentionally islanded. The energy storage system must also be capable of switching to current regulation mode while islanded. In grid connected mode the energy storage system must be current regulating.

The Customer's microgrid also includes 320 kW of AC coupled photovoltaic (PV) solar and a 1,000kW synchronous diesel generator. All three of these energy resources must operate in either grid-connected mode or islanded mode, individually and in coordination according to site conditions. The PV must operate as part of the microgrid, but it is not a grid-forming resource. Only the energy storage system and the diesel generator can regulate voltage and frequency. The Customer's building load is approximately 200 kW peak.

The scope of supply for Bidders on this Request for Proposals (RFPs) includes:

1. Four-hour modular battery system with Battery Management System (BMS).
2. 250 kW (nominal) Power Conversion System (PCS).
3. Microgrid Energy Management System (MEMS) capable of coordinating the operation of the grid, the energy storage system, the PV and the diesel generator in either grid-tied operation or islanded operation.
4. Fire detection and suppression related to the energy storage system equipment (see Section V. for details).
5. Disconnecting and lock-out means for the energy storage system equipment.
6. Environmental containment in accordance with Environmental Protection Agency (EPA) and Oregon Department of Environmental Quality (ODEQ) requirements.
7. Heating, cooling or other environmental controls required by the energy storage system.
8. All shipping, freight and delivery to Customer's site in Beaverton, Oregon.
9. Installation consultation and supervision as necessary.
10. Bidder will assemble any components on-site that are shipped separately.
11. Installation quality inspection and certification.

12. System commissioning and testing.
13. Demonstration of all functions of the energy storage system and MEMS.
14. Ongoing system maintenance including both preventative corrective maintenances.
15. Ten-year full-coverage warranty of system operation and performance specifications.

# 2 Basic Energy Storage System Electrical Requirements

| **Specification Parameter** | **Definition** | **Units** | **Value** |
|---|---|---|---|
| Rated Continuous Discharge Power | The rate at which the energy storage system can continuously deliver energy for the energy storage component's entire *specified State of Charge (SOC)* range. | kW | 250 |
| Rated Apparent Power | The real or reactive power (leading and lagging) that the energy storage system can provide into the AC grid continuously without exceeding the maximum operating temperature of the energy storage system. | kVA | Bidder shall state the rated kVA that allows for 250kW and 250kVAR |
| Rated Continuous Charge Power | The rate at which the energy storage system can capture energy for the energy storage component's entire SOC range. | kW | 250 |
| Rated Continuous AC Current | The AC current that the energy storage system can provide into the grid continuously and can be charged by the grid continuously without exceeding the maximum operating temperature of the energy storage system. | A | Cannot exceed 320A |
| Output Voltage Operating Range | The range of AC grid voltage under which the energy storage system will operate in accordance with the energy storage system specification. | V | 422V to 528V |
| Enter-Service Voltage | The range of voltage in which the inverter may enter service | V | 422V to 509V (adjustable) |
| Enter-Service Frequency | The range of frequency in which the inverter may enter service | Hz | 59.0 to 61.0Hz (adjustable) |
| Total Response Time | The response time measured in accordance with figure below starting when the signal (command) is received at the energy storage system boundary and continuing until the energy storage system discharge power output (electrical or thermal) reaches 100 ± 2% of its rated power. | seconds | < 1 second |
| System Round Trip Efficiency | Total round trip efficiency from beginning of life to end of life, defined as the ratio of the delivered output | % | No less than 89% |

| Specification Parameter | Definition | Units | Value |
|---|---|---|---|
| | energy of the energy storage system to the absorbed input energy required to restore it to the initial state of charge under specified conditions. | | |
| Ramp Rate | The maximum rate that the energy storage system can change its input and output power. | kW/sec | 100 |
| Enclosure Type | A description of the system enclosure including that supplied with the system, provided as a part of the site installation and/or comprised of building assemblies associated with the installation. Examples include building, containerized–both stationary and transportable. | n/a | All enclosures related to the system shall be outdoor rated (National Electrical Manufacturers Association [NEMA] 3R minimum). This includes the BMS, PCS and MEMS enclosures. |
| Equipment Footprint | Length x Width (LxW) of equipment only (Includes energy storage system and all ancillary units as required) in intended layout. | $Ft.^2$ | Total equipment footprint shall not exceed 300 sq. ft. (10' X 30') |
| Height | Equipment height plus safe clearance distances above the equipment. | Feet | 10 |
| Weight | Weight per individual sub-system (e.g. PCS, energy storage system, accessories), including maximum shipping weight of largest item that will be transported to the project site. | Pounds | 20,000 |
| Grid Communication Protocols/Standards | List of codes/standards with which the energy storage system is compliant. | MEMS must be capable of communicating via Sunspec Modbus to PGE's plant Programmable Logic Controller (PLC). Within the plant, the system may communicate via Modbus protocol. Entire system must be compliant with Underwriters Laboratories (UL) UL1741SA. | |

| **Specification Parameter** | **Definition** | **Units** | **Value** |
|---|---|---|---|
| General Description of Energy Storage | Energy storage technology type (e.g. battery type, flywheel, etc.). | Energy storage shall be via Lithium-ion battery technology (Lithium-Nickel Manganese Cobalt Oxide, LiFePO4 or Nickel-Cobalt-Aluminum) | |
| Rated Discharge Energy | Specify the accessible energy that can be provided by the energy storage system at its AC terminals when discharged at its beginning of life and end of life. | kWh | 1,000 |
| Minimum Charge Time | The minimum amount of time required for the energy storage system to be charged from minimum SOC to its rated maximum SOC. | Hr | 4 |
| Typical Recharge Time | This should include any time for rest a period needed between a full or partial charge or discharge cycle. | Hr | 4 |
| Expected Availability of System | Percentage of time that the system is in full operation performing application specific functions (including standby) considering both planned and unplanned down-time. | Hr/yr (%) | 8670 (99%) of at least partial availability (>50%) |
| Synchronization voltage step change | The allowable amount of step change in voltage during synchronization | V (pu) | 5% |

Energy storage systems shall be Category B.1 as defined by Institute of Electrical and Electronics Engineers (IEEE) 1547-2018.

Energy storage systems shall comply with UL1741SA with the interoperability features of that standard fully enabled.

The energy storage system PCS shall be capable of operation in all four quadrants of the power circle. The PCS shall produce at least 250kVA at any location of the power circle and real power output of 250kW anywhere between +0.9pf and -0.9pf. For all angles θ, where pf = -0.9 to +0.9, S=250kW/0.9=278kVA. For all other angles, 0 to $359^{o}$, P = 250kVA*Cosθ, where P = energy storage system real power output and θ is the phase angle between current and voltage; and Q=250kVA*Sinθ.

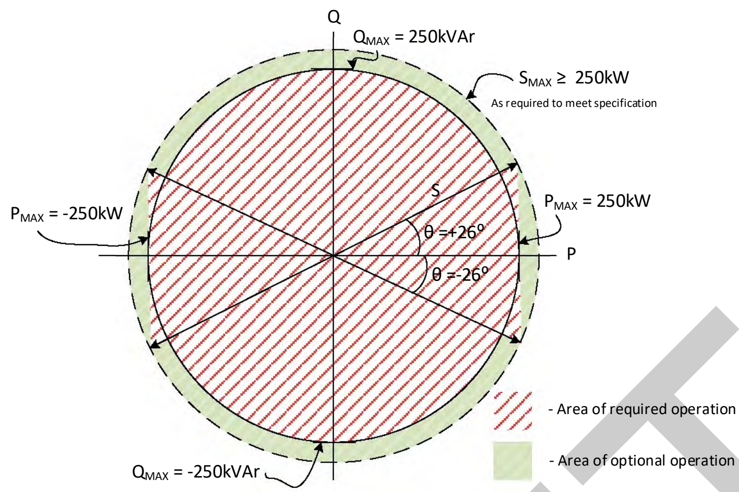



*Illustration of Power Quadrants*

# 3 Microgrid Energy Management System (MEMS) Capability

The MEMS may be a standalone controller or may be integrated into the Bidder's Plant Controller. It must be interoperable with the utility grid, the Customer's PV system, the energy storage system, the diesel generator's control system and the Customer's building energy management system.

The MEMS will optimize the operation of all the energy resources according to dispatch priorities provided by the Owner's plant PLC. The MEMS shall communicate with the Owner's plant PLC via Sunspec Modbus protocol utilizing Category 6 ethernet cable and RJ45 connections. The MEMS will reside on a network with various other components such as the PGE plant PLC, diesel generator controller, various meters such as Ion 8,650 revenue meters, PV inverter, Human Machine Interface (HMI), protective relays and the Customer's building energy management system. Owner will provide a switch for the connection of these devices.

The Bidder shall provide a MEMS containing a full color HMI with minimum dimensions of 16"X16" and a touch screen. The HMI may be built onto the controller enclosure or may be a separate console. The HMI shall display the operating status of all energy resources including on/off status, breaker position, power flow (real and reactive), voltage, current related to all nodes. The HMI shall display basic power quality information about the local area EPS (frequency and voltage).

The HMI shall display in graphical format the historical and real-time values for power flows from the energy resources and status of the grid connection (connected or islanded).

The HMI shall clearly display the optimization program being executed and the service being performed in real time and historical.

The HMI shall have no greater than a one second update time.

The HMI shall provide a login screen according to security level:

1. Viewing – no login required
2. Local Operator – Ability to move between basic states such as entering Storm Avoidance mode or Maximum Energy Reservation, placing the system in standby.
3. Owner operations – All Local Operator functions plus ability to change basic operating constants and parameters
4. Developer – highest level security allowing access to modify all parameters and program functions`

All security levels shall have an inactivity time-out.

In addition to the local HMI, the Customer is providing a large screen high-resolution monitor in a public space. Bidder will provide a connection to this monitor to display live screens illustrating and interpreting the MEMS for laypersons visiting the building. These screens are within the Bidder's scope, and the screens must be reviewed and approved by the Customer and Owner.

MEMS shall employ a watchdog system to the Owner's plant PLC, the diesel generator controller, the energy storage system, the Customer's PV system and the Customer's building energy management system to alarm upon loss of communications.

MEMS must be capable of remote monitoring via a web app. Communication to the web may be wireless or ethernet through the Customer's building network but will not communicate through the plant Modbus network.

The MEMS hardware platform may be either a PLC or an embedded fanless and diskless computer.

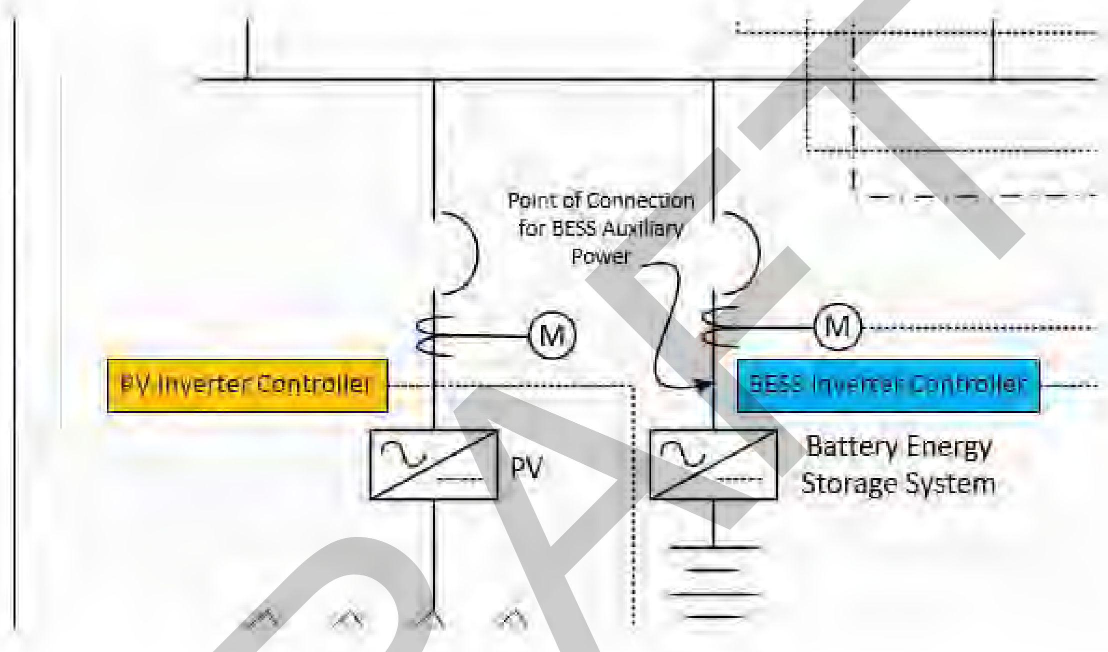
The Owner must be able to communicate directly with a Modbus connection to the MEMS. Access through a web application or API is not sufficient.

# 4 Auxiliary Power

The energy storage system auxiliary power system shall be 120/240Vor 480V. Auxiliary power must be provided within the Bidder's scope of supply. It must include provisions for the black start service which will require Uninterruptable Power Supply (UPS) standby power. Bidder may provide a standalone UPS or utilize energy stored in the energy storage system batteries for this function. Neither the Customer nor the Owner will provide UPS power for black start.

Energy storage systems auxiliary power must consume less than 22,000kWh of energy annually.

Auxiliary power must be connected at a point between the energy storage system equipment and the Ion8650 revenue meter so that auxiliary power is unmetered and remains in the efficiency loss for billing.




*Energy Storage System Aux. Power is Connected Between the Energy Storage System and the Revenue Meter*

# 5 Fire Detection and Suppression

Bidder must provide an integral fire detection and suppression system. The detection must be capable of integration into the Customer's fire alarm panel. The suppression system must be capable of extinguishing the worst-case thermal runaway scenario, containing the fire within the battery enclosure. Fire detection and suppression system must automatically shut down and electrically disconnect the energy storage system from Customer's bus.

The fire detection and suppression system must meet the requirements of UBC and the local Authority Having Jurisdiction (AHJ). It also must meet the minimum best practices for the energy storage industry.

Bidder must provide an off-gas sensing system integrated with the energy storage system plant controller that will detect off-gassing at the individual cell level.

# 6 Warranty and Performance Guarantee

A. Bidder shall provide support to Owner during a twelve (12) month performance verification period, to begin after the energy storage system has been commissioned and has begun commercial operation. This support includes tuning of the optimization algorithms and consulting by phone, e-mail and web meeting regarding operations and maintenance of the energy storage system.
B. The energy storage system shall have an Equipment Warranty for a minimum of (3) years, and a Performance Guarantee for (10) years.
C. The Equipment Warranty shall include periodic evaluation of the energy storage system to identify any premature degradation and/or potential underperformance. Owner will be notified of evaluation results as soon as possible.
D. Bidder shall provide a (10) year minimum Performance Guarantee which will include replacement of battery modules as necessary to maintain guaranteed energy storage capacity and efficiency. At any time during the (10) year term that, as reasonably required to maintain guaranteed capacity or otherwise as defined by the technical specifications, the repair of the energy storage system requires a replacement component, Bidder will bear all the cost of replacement and any related equipment, materials, and/or parts.
E. Energy storage system Bidder shall perform all services in accordance with professional standards and skill, expertise, safety and diligence of professionals regularly involved in the maintenance of energy storage system projects and otherwise in full compliance with all requirements of this Agreement, and all Services shall be warranted against any defect or error whatsoever, including in design and workmanship.

# 7 Seismic Rating

The energy storage system will be installed in an area exposed to seismic hazards potentially exceeding 9.0. The energy storage system is intended for use in a microgrid after such an event. Therefore, the entire system including ancillary components must be designed to survive and function after an event of the following seismic criteria.

| SEISMIC CRITERIA | | |
|---|---|---|
| RISK CATEGORY | IV | |
| SEISMIC DESIGN CATEGORY | D | |
| SITE CLASS | D | |
| IMPORTANCE FACTOR | IE = 1.5 | |
| MCE SPECTRAL ACCELERATION | Ss = 0.98 | S1 = 0.43 |
| SITE COEFFICIENT | Fa = 1.10 | Fv = 1.56 |
| DESIGN SPECTRAL ACCELERATION | SDS = 0.728 | SD1 = 0.45 |
| ANALYSIS PROCEDURE | EQUIVALENT LATERAL FORCE PER ASCE 7-10, SECTION 12.8 | |

# 8 Standards

The energy storage system must be designed, built and installed according to the following standards:

- IEEE 1547-2003
- UL 1741SA with interoperability features unlocked (capable of operation in accordance with California Rule 21)
- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- Institute of Electrical and Electronics Engineers (IEEE)
- Insulated Cable Engineers Association (ICEA)
- National Fire Protection Association (NFPA)
- National Electric Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- Occupational Safety and Health Administration (OSHA)
- Underwriters Laboratories (UL)
- Uniform Building Code (UBC) or International Building Code as required by the local AHJ
- Cells, modules and racks must have undergone testing according to UL9540A and that report must be made available to Owner.

# 9 Sound Level

The maximum sound level of the energy storage system and any associated equipment is 65 dBA measured at 50 feet in any direction generated for the full range of the energy storage system's operation.

# 10 Modes of Operation

The energy storage system and MEMS must provide the following operations:

## 10.1 Grid connected:

### 10.1.1 General

Connecting and Disconnecting – energy storage system must be capable of automatically connecting and disconnecting from the grid based on a remote signal.

Standby – must be capable of remaining synchronized with and electrically connected to the grid neither charging nor discharging capable of responding to a remote command within one second. In standby mode (neither charging nor discharging), the energy storage system, not including auxiliary power, must maintain a power output or input below 5kVA.

Except for reserving 100kWh for customer reliability, the microgrid will give precedence to all utility services over customer services while grid connected. If customer services can be provided without interfering with utility services, then they will be performed as a second priority. Performing utility services shall have no detrimental effects on the Customer's bill beyond what billing would occur if no energy storage system were connected.

### 10.1.2 Customer Services

PV self-generation – energy storage system will maximize the local EPS utilization of Customer's PV generation.

Minimum energy reservation – in grid connected mode, the energy storage system will maintain 100kWh for the Customer in the event of an unscheduled intentional island (utility outage).

### 10.1.3 Utility Services

The energy storage system will provide each of the following utility services: Frequency Regulation, Contingency Reserve, Voltage and Var Support, Demand Response, and Mitigation of Cold Load Pick-up. Detailed descriptions of each utility service are included in Section 11.

# 11 Description of Utility Services

Utility services are only provided when the energy storage system is operating in parallel with the utility. Management of these services and setpoints are provided by Owner's Plant PLC. The Owner's Plant PLC will communicate with the MEMS via Modbus to send setpoints for real power, reactive power, ramp rates and state of charge (SOC). The descriptions of utility services below are intended for use by the bidder to develop performance specifications and warranty provisions.

## 11.1 Frequency Response

For this service, the energy storage system must respond from an idle state to a request for frequency response within two seconds of receiving the command. From that time, the battery output must ramp at a rate of 100kW per second until a full output of 250kW is achieved. 250kW output shall be maintained for three minutes and then the energy storage system output will ramp down at a rate of 25kW per second. When energy storage system output gets to less than or equal to 25kW, the energy storage system will recharge at a rate of 25kW until the SOC setpoint is achieved.

The control for this service will reside in the PGE plant controller. The Bidder's controls must simply respond to a setpoint for kW.

This service shall be provided up to 50 times per year, and sometimes within the same eight-hour period.


*Example of Frequency Response*

## 11.2 Contingency Reserve

For this service, the energy storage system must respond from an idle state to a request for contingency reserve within two seconds of receiving the command. From that time, the battery output must ramp up at a rate of 100kW per second until a full output of 250kW is achieved. 250kW output shall be maintained until a ramp-down and stop command is issued. When ramp-down and stop is received, within two seconds the energy storage system will ramp down at a rate of 25kW per second until the kW output is less than or equal to 25kW.

Once the energy storage system output is less than or equal to 25kW, the energy storage system will be commanded by the PGE plant PLC to recharge at a rate of 25kW until the SOC setpoint is achieved.

The control for this service will reside in the PGE plant controller. The Bidder's controls must simply respond to a setpoint for kW, keep up with the requested ramp and manage SOC.

This service shall be provided up to eight times per year.

## 11.3 Voltage and VAr Support

In this service, the energy storage system will respond to a kVAr setpoint from the PGE plant controller. It may be a steady kVAr request or it may be regulating to maintain a voltage using closed-loop proportion integral (PI) control. Depending on the service(s) being requested at any given time, the energy storage system may be asked to provide voltage or VAr support simultaneous with being in standby for another service such as frequency response or spinning reserve or voltage support may be operated simultaneously with other services providing that the kVA capacity of the system will allow it.

The only limitations on the energy storage system for providing this service must be the kVA rating of the system.

## 11.4 Demand Response

Demand Response (DR) is a service scheduled by the Owner normally a day in advance. DR occurs on days with the highest system load. A demand response event is scheduled for a preset number of hours, typically two. When this schedule is set in PGE's Plant Controller, PGE's Plant Controller will assume that 900kWh of energy will be available for that event. A setpoint of 250kW will be given to the MEMS for the DR service. If for some reason, available energy is less than 900kWh, then a lower kW setpoint will be calculated. For example, if 400kWh are expected to be available and two hours is the scheduled duration of the event, PGE's Plant Controller will calculate a kW setpoint of 400kWh/2h = 200kW and this setpoint will be given to the MEMS as a DR setpoint. If 900kWh of energy are available, but the duration of the event is scheduled to be four hours, then PGE's Plant Controller will calculate the kW setpoint to be 900kWh/4hrs. = 225kW.

This service will be dispatched 20 times per year.

## 11.5 Mitigation of Cold-Load Pick-up

Energy storage system must be able to reduce cold load pick-up after a utility outage. This is accomplished by the MEMS setting the return to grid timer to zero in both the energy storage system PCS and the PV inverter. The energy storage system must adjust to a kW output setpoint delivered by the Owner's plant controller. To mitigate cold load pick-up, the energy storage system will return to grid with no delay once utility power is restored and ramp up to a real power setpoint established by the Owner's plant controller. The MEMS will operate with the Customer's building energy management system to delay starting large loads such as chillers and other Heating, Ventilation, and Air Conditioning (HVAC) equipment until two minutes after the site returns to utility power. Bidder shall assume that the real power setpoint will be the full nameplate rating. This output is maintained for an hour and then the energy storage system will ramp down at a rate of 25kW/second and return to its normal operation.

This service will be dispatched once per year.

# 12 Intentionally Islanded:

### 12.1.1 General

Energy storage system will manage the microgrid for maximum reliability, maximum utilization of renewable energy and minimum operating cost. While intentionally islanded, the energy storage system must regulate voltage within nominal +/- 5% and frequency at 60Hz within +/- 0.2Hz.

### 12.1.2 Customer Services

The MEMS shall cause the diesel generator and/or the energy storage system to serve load as appropriate for optimization of on-site fuel consumption. PV is current regulating only and shall be utilized to the highest possible degree (maximized to serve either load or charge the energy storage system) during an unscheduled intentional island with the goal to minimize energy from the diesel generator.

The MEMS shall utilize the energy storage system to operate the diesel generator in baseload mode at a level recommended by the generator manufacturer to avoid wet-stacking.

During times of ample photonic insolation (meaning the PV and the battery together can serve load without diesel generation), the MEMS shall put the generator in standby mode and utilize only the solar and energy storage system to serve load.

The MEMS will automatically return to grid after an adjustable return-to-grid time. The return-to-grid timer shall be remotely adjustable from 0 to 600 seconds. Return to grid shall be a closed transition.

# 13 Interconnection

The energy storage system shall interconnect to the Customer's 480V main bus via a 400A, 480V 3-phase breaker located in the Customer's switchgear. The lugs on that breaker define the point of connection (POC) for the energy storage system and the reference point of applicability for performance measurements.

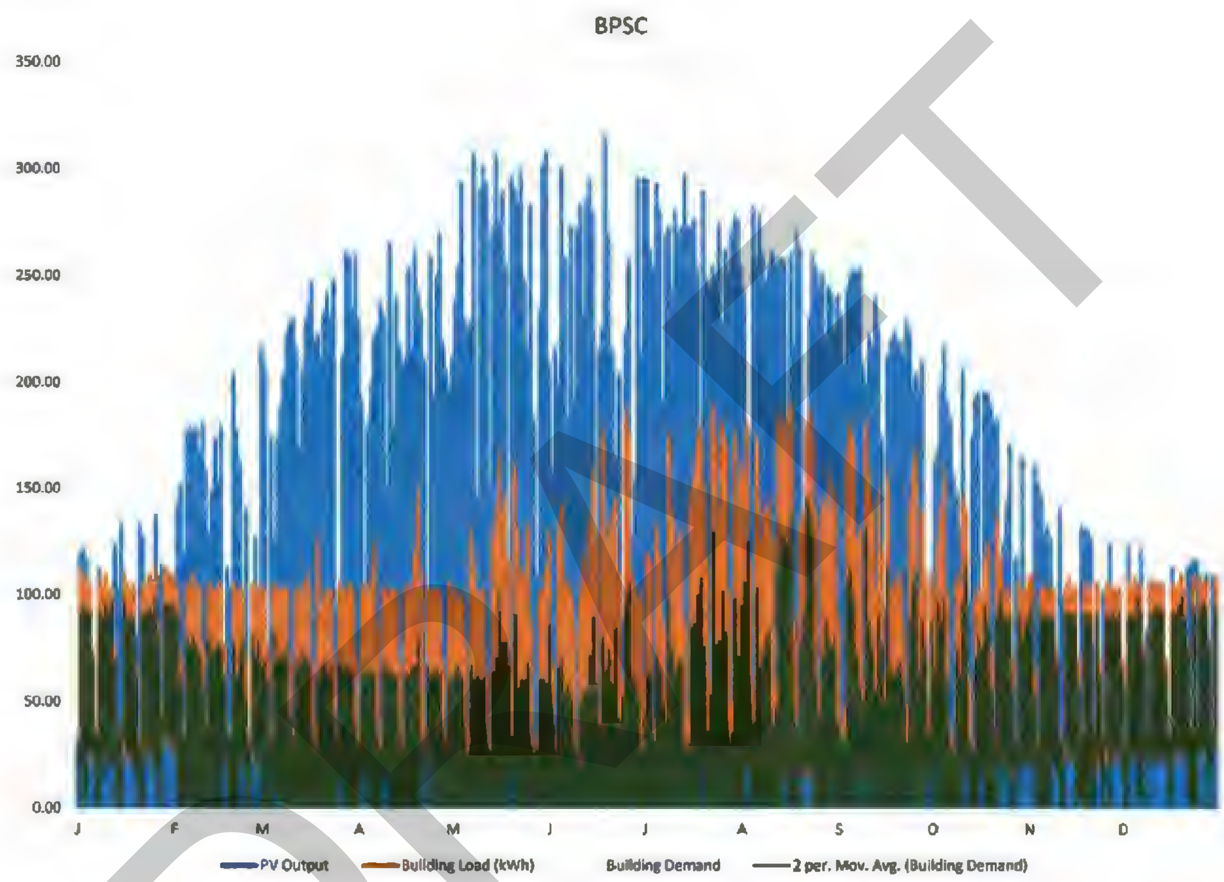
Energy storage system will be connected through a EUSERC rated metering enclosure per PGE service requirements. Metering section to be provided by others.

Bidder shall clearly state all site installation requirements such as pad dimensions and locations of mounting bolts; electrical connection requirements including conductor sizes and lug sizes.

Bidder will provide all electrical specifications of the system including available fault current, voltage ranges of operation and current ratings.

Refer to the drawing E-701, E702 and E-703 for a single-line drawing of the project.

## 14 Projected Building Load And PV Output




## 15 Quality Assurance

The supplier shall use its established Quality Management System (QMS) for the design, production, packaging and shipping of its items and/or services to the PGE. The QMS may be either registered/accredited by an external agency or approved by PGE via an on-site assessment or review of supplier's proposal. Bidder shall state its proposed quality assurance program to the Owner clearly within the proposal. This program shall include procedures for quality assurance of all design, manufacturing and construction activities. As a minimum, it shall address the following:

1. Responsibilities and authorities

2. Document control
3. Design verifications
4. Subcontractor assessment and control
5. Calibration requirements
6. Traceability
7. Non-conformance control
8. Inspection and test plans
9. Internal audits
10. Records

# 16 Commercial

## 16.1 Bidder Information

Provide the following details regarding your company:

- Exact legal name of the firm
- Form of legal entity under which business is conducted
- Mailing address
- Federal Tax Identification Number
- Key contact information - the name, phone number, and email address of the individual who will serve as a primary point of contact with your company for the purposes of this RFP

## 16.2 Schedule

The RFP will be issued on May 16, 2019

Responses to this RFP are required no later than June 7, 2019.

A purchase order shall be issued by July 15, 2019.

The energy storage system with all its components will be delivered to the Customer's site no later than December 20, 2019.

The system will be commissioned (complete) no later than Feb. 28, 2020.

All punch list items will be corrected no later than April 15, 2020.

## 16.3 Transportation

Bidder shall be responsible for all transportation, shipping and loading associated with project to deliver a fully operational energy storage system to Owner's project site including any subsystems or components from sub-suppliers. Scheduling deliveries is the responsibility of the Bidder. Owner will not make special accommodation for storage based upon Bidder's scheduling needs.

All deliveries will be scheduled between 8:00 AM and 5:00 PM on weekdays. Owner (or Owner's representative) shall be given 24-hours' notice in advance of large truck deliveries. If a crane or other special equipment is required for unloading, seven-days' notice must be provided to the Owner.

The Bidder shall prepare materials and equipment for shipment to protect them from damage while in transit.

The delivery shall be coordinated with the PGE Project Manager. Unloading at the site will be by the Owner's contractor.

Construction will be performed by the Owner's electrical contractor according to drawings and installation instructions provided by the bidder. The Bidder will provide construction assistance as necessary for successful installation.

## 16.4 Expansion

Bidders should address in their proposal the capability of expanding the storage components of the system. With maintaining a power rating of 250kW nominal, bidders shall describe what features of the proposal would allow for easy expansion of storage beyond four hours. This should include provisions for electrical connection, controls, cooling systems, safety systems, mechanical connections, etc.

## 16.5 Information to Be Included in Proposal

Bidders must include a description of all components within the offering including:

- Basic system architecture
- Battery cell supplier quantity and chemistry
- PCS supplier and model number
- BMS supplier, basic architecture and control hardware
- DC ground fault protection hardware and design

- System dimensions including all ancillary equipment such as control cabinets and isolation transformer
- Weight of battery module container and mounting requirements
- Description of expansion provisions
- Clear description of major components that are sourced from a third party such as batteries, BMS, PCS, MEMS
- Specification sheets for all major system components
- A list of similarly sized systems operating in a microgrid configuration with a description of services provided (both grid services and customer services)
- One or more reference contacts from previous or current customers
- One or more operational sites where the owner would be agreeable to a site visit by PGE
- Basic pricing for conformance with the RFP
- Separate pricing for performance warranty, ongoing maintenance and shipping
- Pricing for any options that are offered
- Clearly describe any exceptions to the RFP

It is the Owner's preference to purchase a complete energy storage system and MEMS as a package. The Owner will consider proposals structured as a partnership if necessary. Owner will also consider proposals that include only the energy storage system or MEMS, but such a proposal must clearly explain how issues of integration will be dealt with. Owner will not consider purchasing a battery without a PCS.

# 17 Abbreviations

| | |
|---|---|
| AC | Alternating Current |
| AHJ | Authority Having Jurisdiction |
| BMS | Battery Management System |
| DC | Direct Current |
| EPA | Environmental Protection Agency |
| EPS | Electric Power System |
| HMI | Human Machine Interface |
| IEEE | Institute of Electrical and Electronics Engineers |
| kV | Kilovolts |
| kVAr | Kilovar |
| kW | Kilowatt |
| kWh | Kilowatt Hours |
| MEMS | Microgrid Energy Management System |
| ODEQ | Oregon Department of Environmental Quality |
| PCS | Power Conversion System |
| PGE | Portland General Electric Company |
| PLC | Programmable Logic Controller |
| PV | Photovoltaic |
| RFP | Request for Proposal |
| SOC | State of Charge or Energy: Nominal Energy Remaining / Nominal Full Pack Energy Available |
| UL | Underwriters Laboratories |
| UPS | Uninterruptable Power Supply |

# 18 Attachment A - Single-Line Drawings E-701, E-702 And E-703

# 19 Attachment B - A Graphic Depiction of The Microgrid Controls Hierarchy

# 20 Attachment C - Microgrid State Definitions

Attachment A

Single Line Drawings E-701, E-702, and E-703

**Draft Request for Proposal for a Microgrid Pilot Energy Storage System (Located in Beaverton)**

## KEY NOTES:

1. PROVIDE (2) 3" C PROVISION FOR FUTURE DESIGN/BUILD BESS. REFER TO SITE PLAN FOR ADDITIONAL INFORMATION.

2. PROVIDE (2) 4" C FOR MEDIUM VOLTAGE DISTRIBUTION. PGE TO PROVIDE CONDUCTORS. REFER TO SITE PLAN FOR ADDITIONAL INFORMATION.

3. REFER TO GROUNDING SYSTEM DETAIL 2, SHEET E-601 FOR GROUNDING ELECTRODE CONDUCTOR SIZES.

4. GENERATOR REMOTE ANNUNCIATOR PANEL. MOUNT IN LOBBY. SEE FLOOR PLANS FOR LOCATION.

5. CO-LOCATE MICROGRID REMOTE HMI WITH GENERATOR ANNUNCIATION PANEL IN LOBBY. SEE FLOOR PLANS FOR LOCATION.

6. PROVIDE (8) 3" C PROVISION FOR SERVICE LATERAL. PGE TO PROVIDE CONDUCTORS. SEE GROUNDING SYSTEM DETAILS ON SHEET E-601 FOR ADDITIONAL INFORMATION.

7. BREAKERS TAGGED WITH "E" SHALL BE EQUIPPED WITH ELECTRICALLY OPERATED CHARGED SPRING, TRIP AND CLOSE MECHANISMS TO PERMIT CONTROL BY THE MICROGRID SYSTEM CONTROLLER.

8. ALL BREAKERS IN MAIN AND SUB-MAIN DISTRIBUTION BOARDS 4MDP & 4SDP SHALL BE EQUIPPED WITH SOLID STATE TRIP DEVICES WITH INTEGRAL POWER METERING.

54

9. PROVIDE SEL-700G RELAY OR APPROVED ALTERNATIVE. RELAY MUST BE SPECIFIED WITH COMMUNICATIONS OPTIONS TO BE INTEROPERABLE WITH MICROGRID CONTROL SYSTEM.

54

10. PROVIDE (1) 2" C AND PULL STRING BETWEEN PGE REMOTE METER BANK AND PGE SCADA RACK IN THE MAIN ELECTRICAL ROOM. COMMUNICATIONS CABLING TO BE INSTALLED BY PGE.

11. PROVIDE MODIFIED DIFFERENTIAL GROUND FAULT PROTECTION FOR ALL SOURCE INTERCONNECTIONS WITHIN 4MDP.

12. PROVIDE SEL-351S RELAY OR APPROVED ALTERNATE. RELAY MUST BE SPECIFIED WITH COMMUNICATION OPTIONS TO BE INTEROPERABLE WITH MICROGRID CONTROL SYSTEM.

13. FUTURE CONTAINERIZED BESS INCLUDING PSC, ISLOATION TRANSFORMER AND REQUIRED OCPDS TO BE PROVIDED BY PORTLAND GENERAL ELECTRIC.

14. LOCATE EMERGENCY POWER OFF BUTTONS WITHIN MAIN AND EMERGENCY ELECTRICAL ROOMS AND ANY ADDITIONAL LOCATIONS AS REQUIRED BY THE AHJ. EPO BUTTON PRESS SHALL TRIGGER MICROGRID STATE TRANSITION TO "SS6". SEE DETAILS 1 AND 2 ON SHEET E-603 FOR ADDITIONAL INFORMATION.

15. PROVISION TWO SPACES IN 4SDP FOR FUTURE 600A BREAKER FRAMES.

16. PROVISION TWO SPACES IN 4SDP FOR FUTURE 225A BREAKER FRAMES.

57

17. MICRODGRID DESIGN BUILD CONTRACTOR SHALL INCORPORATE UPS AND ANY OTHER ELECTRICAL DISTRIBUTION EQUIPMENT AS NEEDED TO MEET DESIGN/BUILD INTENT. RACK SHALL INCORPORATE 24VDC UPS BACKED POWER SUPPLY OR BATTERY.

54

18. SOURCE BREAKER CONTROL POWER FROM DC STATION BATTERY.

19. PROVIDE FT-1 TEST SWITCHES AS REQUIRED TO SATISFY PORTLAND GENERAL ELECTRIC DSG DESIGN CRITERIA. SEE PGE DSG DESIGN CRITERIA APPENDIX E.

20. SWITCHBOARD MANUFACTURER TO SIZE SURGE PROTECTION DEVICE OVERCURRENT PROTECTION. 57

54

21. PGE SCADA RACK AND EQUIPMENT SHALL BE SPECIFIED, FURNISHED AND INSTALLED BY PORTLAND GENERAL ELECTRIC. SEE SHEET E-501 FOR UPDATED SCADA RACK LOCATION IN THE GENERATOR YARD.

22. PROVIDE (1) 2" C BETWEEN MICROGRID CONTROL RACK AND EACH ELEVATOR CONTROLLER. DAISY-CHAINING CONDUITS IS ACCEPTABLE. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

54

23. PROVIDE (2) 2" C BETWEEN MICROGRID CONTROL RACK AND PGE SCADA RACK. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

24. PROVIDE (2) 2" C BETWEEN MICROGRID CONTROL RACK AND SECTION "RELAY" IN 4MDP. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

54

25. PROVIDE (1) 2" C BETWEEN MICROGRID CONTROL RACK AND EACH ATS IN THE EMERGENCY ELECTRICAL ROOM. DAISY-CHAINING CONDUITS AND CONTROL CABLING IS ACCEPTABLE. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

26. PROVIDE (1) 4CC #14 AWG BETWEEN "ATS-LS" AND THE GENERATOR ENCLOSURE FOR LIFE SAFETY GENERATOR START CONTROL.

27. PROVIDE (1) 4CC #14 AWG (1) 2" C BETWEEN GENERATOR ENCLOSURE AND PORTABLE GEN DOCKING STATION FOR CONTINUATION OF LIFE SAFETY GENERATOR START CONTROL.

28. GENERATOR SHALL BE EQUIPPED WITH EMCP 4.2 CONTROLLER OR APPROVED EQUIVALENT TO FACILITATE SYNCHRONIZATION AND PARALLELING WITH PGE GRID BATTERY ENERGY STORAGE SYSTEM (BESS).

29. PROVIDE (1) 1" C BETWEEN MICROGRID CONTROL RACK AND FOA-101 IN THE BOILER ROOM. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

30. PROVIDE (1) 1" C AND PULL STRING BETWEEN MICROGRID CONTROL RACK AND BMS CONTROLLER ENCLOSURE. MICROGRID DESIGN-BUILD CONTRACTOR TO MAKE DETERMINATION REGARDING OPTION A OR B TO TRIGGER MECHANICAL RESILIENCY OPERATION MODE (MROM). SEE DETAIL 2, SHEET E-703 FOR ADDITIONAL INFO. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

31. PROVIDE (1) 1" C WITH PULL STRING BETWEEN MICROGRID CONTROL RACK AND REMOTE HMI. CONFIRM REMOTE HMI LOCATION WITH ARCHITECT. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

32. MEMS DESIGN-BUILD CONTRACTOR TO PROVIDE RS-485 PLTC CABLE (BELDEN 9841 OR EQUAL) WITHIN MICROGRID CONTROL RACK TO CO-LOCATED PV COMMUNICATIONS GATEWAY.

33. PV SYSTEM COMMERCIAL COMMUNICATIONS GATEWAY (CCG) PROVIDED BY THE PV DESIGN BUILD CONTRACTOR.

34. PROVIDE (1) 1" C AND PULL STRING BETWEEN MICROGRID CONTROL RACK AND PV SYSTEM INVERTER #3 LOCATED IN THE GENERATOR YARD. PV INVERTERS BY PV DESIGN BUILD CONTRACTOR. PV DESIGN BUILD CONTRACTOR TO PROVISION RS-485 PLTC CABLE AND DAISY-CHAIN TERMINATIONS BETWEEN CCG AND ALL PV INVERTERS ON SITE.

57

35. PROVIDE (1) 2" C AND PULL STRING(S) BETWEEN MICROGRID CONTROL RACK AND FUTURE BESS CONTAINER PAD. CONTRACTOR TO LOCATE PULL-BOXES AS NEEDED.

36. PROVIDE (2) 2" C AND PULL STRING(S) BETWEEN MICROGRID CONTROL RACK AND GEN ENCLOSURE. CONTRACTOR TO LOCATE PULL-BOXES AS NEEDED.

37. PARALLELING GENERATOR CONTROLLER TO BE PROVIDED BY MICROGRID DESIGN BUILD CONTRACTOR. GENERATOR CONTROLLER SHALL HAVE PROVISIONS FOR COMMUNICATIONS TO MICROGRID CONTROLLER. BASIS OF DESIGN IS WOODWARD EASYGEN-3200-XT-P1 OR APPROVED ALTERNATE.

38. PROVIDE (1) 3" C (SCHED. 40 PVC) WITH (2) 1" SDR SMOOTH WALL INNER DUCTS WITH PULL TAPE IN EACH. INCLUDE (1) #12 AWG THWN-2 COPPER CONDUCTOR WITH ORANGE INSULATIVE JACKET TO SERVE AS A LOCATE TRACER. ALL 90° BENDS MUST BE 36" SWEEPS. STUB-UP IN ELEC ROOM 131 WITHIN PGE SCADA RACK. 57

39. SEE PANEL 2-S-1A SCHEDULE SHEET E-804 FOR OPTIONAL STANDBY BRANCH CIRCUIT TO PGE SCADA RACK.

40. PROVIDE SHARK REVENUE METER AND CT ENCLOSURE FOR PGE DSG BUILDING LOAD METERING. 54

41. PROVIDE (2) 2" C WITH PULL STRING FROM MICROGRID CONTROL RACK TO 4MDP FOR COMMUNICATIONS. COMMUNICATION/CONTROL CONDUCTORS BY MICROGRID DESIGN-BUILD CONTRACTOR.

54

42. GENSET MANUFACTUER TO PROVIDE 15KVA, 480-208Y/120V STEP DOWN TRANSFORMER AND BRANCH PANEL WITHIN GENSET ENCLOSURE. MINI POWER CENTER OR EQUIVALENT.

43. PROVIDE 480Y/277V, 1600A PORTABLE GENERATOR DOCKING STATION CABINET. TRISTAR OR APPROVED EQUAL.

44. MICROGRID CONTROLLER SHALL BE WIRED TO FUEL OIL HOLDING TANK LOW LEVEL ALARM PANEL (FOA-101) TO RECEIVE FUEL TANK LEVEL AND LEAK STATUS DATA.

45. SEE DETAIL 2, SHEET M-703 FOR ADDITIONAL INFORMATION REGARDING MICROGRID CONTROL OVER MROM. 54

57

46. PROVIDE (1) 1" C MINIMUM FOR 120V, 20A RECEPTACLE BRANCH CIRCUIT POWER FROM THE PGE SCADA RACK UPS TO EACH PGE REMOTE METER . SEE PGE DSG DESIGN CRITERIA APPENDIX B FOR ADDITIONAL INFORMATION.

47. PROVIDE 24VDC STATION BATTERY, RACK (2-TIER, SINGLE ROW) WITH SEISMIC HOLD DOWN RAILS. BASIS OF DESIGN FOR RACK IS ALCAD RSL24N1-2. CONTRACTOR TO CALCULATE BATTERY ENERGY REQUIREMENT IN CONSULTATION WITH PGE. LOCAL 24VDC BEST BATTERY SCHEME IS RECOMMENDED. 57

48. PROVIDE BATTERY CHARGER WITH 120VAC INPUT AND 24VDC OUTPUT. CHARGER SHALL BE EQUIPPED WITH STATUS I/O OR MODBUS COMMUNICATIONS.

49. SWITCHGEAR RELAY SECTION SHALL BE PROVISIONED WITH BACK PANEL TERMINAL BLOCKS FOR PT AND CT SECONDARIES, RELAY CONTROLLED BREAKER TRIP AND CLOSE COILS AND DC POWER. MEMS DESIGN-BUILD CONTRACTOR TO PROVIDE COMPLETE THREE-LINE WIRING AND CONTROL DIAGRAMS FOR APPROVAL.

50. PROVIDE (1) 1"C BETWEEN MICROGRID CONTROL RACK AND STATION BATTERY CHARGER FOR COMMUNICATIONS. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

51. SWITCHBOARD 4MDP SHALL BE SERVICE ENTRANCE RATED WITH CONTINUOUS NEUTRAL, 100% RATED THROUGHOUT. 54

52. PROVIDE (1) 1" C BETWEEN BESS SAFETY SWITCH STRUCTURE AND FUTURE BESS PAD. COORDINATE CONDUIT STUB-UP AT BESS PAD WITH PGE.

53. PROVIDE (1) 2" C BETWEEN THE PGE SCADA RACK AND SECTION "RELAY" IN 4MDP. MEMS DESIGN-BUILD CONTRACTOR TO PULL AND CONNECT (1) MM FIBER OPTIC FOR MIRRORED BIT AND (1) CAT6A FOR ETHERNET. MEMS DESIGN-BUILD CONTRACTOR TO COORDINATE TERMINATIONS WITH PGE.

54. PROVIDE (1) 4CC #14 IN (1) 1" C BETWEEN GEN-DP AND THE MICROGRID CONTROL RACK FOR STATUS OF GENERATOR FEEDER BREAKER POSITION.

55. MEMS DESIGN-BUILD CONTRACTOR TO PROVIDE KEYED SWITCH WITHIN MICROGRID CONTROL RACK. SWITCH ACTIVATION SHALL DISABLE GENERATOR PARALLELING WITH PGE UTILITY GRID.

57

56. PROVIDE (1) 2" C SPARE CONDUITS BETWEEN GEN ENCLOSURE AND BESS PAD. COORDINATE CONDUIT STUB-UP AT BESS PAD WITH PGE.

57. PROVIDE (1) 1-1/4" C AND PULL STRING FOR PT AND CT SECONDARIES. USE ONLY 24" MIN. SWEEPS AT STUB-UPS. COORDINATE LOCATION OF PT/CT CONDUIT STUB-UP WITHIN EUSERC CT SECTIONS WITH PRIMARY FEEDER CONDUIT LOCATIONS. REVIEW ALL STUB-UPS WITHIN EUSERC SECTIONS WITH PGE. 57

54 57

58. PROVIDE (1) 2" CONDUIT AND PULL TAPE BETWEEN PGE SCADA RACK AND THE BESS PAD. COORDINATE CONDUIT STUB-UPS AT SCADA RACK AND BESS PAD WITH PGE. CONDUIT PROVISION FOR COMMUNICATIONS.

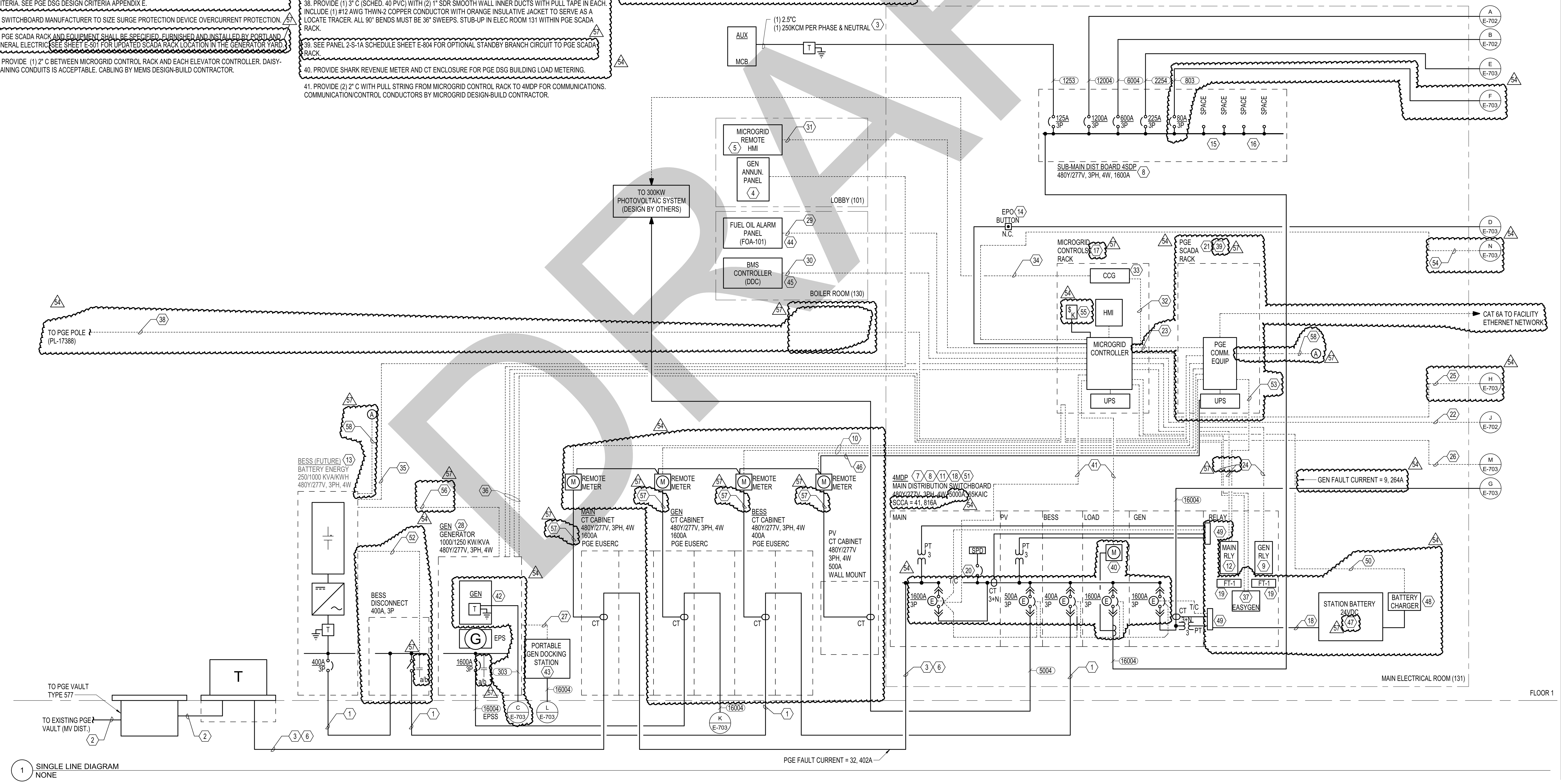
## GENERAL NOTES:

A. PROVIDE POWER AND DATA CONNECTION TO EACH POWER METER EQUIPMENT. VERIFY REQUIREMENTS WITH APPROVED METER MANUFACTURER.

B. SEE PANEL SCHEDULES FOR PANEL BUS BRACING RATINGS.

C. UNLESS OTHERWISE NOTED, PROVIDE 225A FRAME SPACE WHERE "SPACE" IS INDICATED ON DISTRIBUTION BOARDS.

D. SEE SHEET E-702 FOR FEEDER TAG SCHEDULE.




1 SINGLE LINE DIAGRAM
NONE

DRAWINGS TO BE PRINTED IN GRAYSCALE. IF 3 DISTINCT SHADES OF DOTS ARE NOT VISIBLE, INFORMATION MAY BE MISSING.

DRAFT

FFA Architecture + Interiors
FFA Architecture and Interiors, Inc.
520 SW Yamhill Suite 900 Portland OR 97204
Phone: 503.222.1661 Fax: 503.222.1701
www.ffadesign.com

REGISTERED PROFESSIONAL ENGINEER
69195PE
OREGON
JULY 8, 2014
MICHAEL FORREST STREB
4/26/19
EXPIRES 6-30-2020

PAE
pae-engineers.com

| # | DESCRIPTION | DATE |
|---|---|---|
| 15 | ELEC PR1 | 11/6/18 |
| 28 | ASI 006 | 1/14/19 |
| 54 | PR 19 | 04/22/19 |
| 57 | PR 19_R1 | 04/25/19 |

BEAVERTON PUBLIC SAFETY CENTER

CITY OF BEAVERTON POLICE DEPARTMENT

12500 SW Allen Boulevard
Beaverton, OR 97005

| | |
|---|---|
| APPROVED: | KPH |
| DRAWN: | ASH |
| DATE: | 08.31.2018 |
| PROJECT NUMBER: | 240717 |

SINGLE LINE DIAGRAM - POWER SOURCES

# E-701

PERMIT/BID SET

## KEY NOTES:

1. REFER TO GROUNDING SYSTEM DETAIL 2, SHEET E-601 FOR GROUNDING ELECTRODE CONDUCTOR SIZES.

2. VERIFY ELECTRICAL TRIP RATING AND SERVICE SIZE WITH SUBMITTED EQUIPMENT PRIOR TO ELECTRICAL EQUIPMENT PURCHASE.

3. PROVIDE SLIM "I-LINE" STYLE OR EQUIVALENT.

4. VERIFY ELECTRICAL TRIP RATING AND FEEDER SIZE WITH SUBMITTED EQUIPMENT PRIOR TO ELECTRICAL EQUIPMENT PURCHASE. IF FEEDER IS INSTALLED UNDERGROUND, CONDUIT SHALL BE MINIMUM 1".

5. PROVIDED BY ELEVATOR CONTRACTOR.

54

6. PROVIDE (1) 2" C BETWEEN MICROGRID CONTROL RACK AND EACH ELEVATOR CONTROLLER. DAISY-CHAINING CONDUITS AND CONTROL CABLING IS ACCEPTABLE. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

## GENERAL NOTES:

A. PROVIDE POWER AND DATA CONNECTION TO EACH POWER METER EQUIPMENT. VERIFY REQUIREMENTS WITH APPROVED METER MANUFACTURER.

B. SEE PANEL SCHEDULES FOR PANEL BUS BRACING RATINGS.

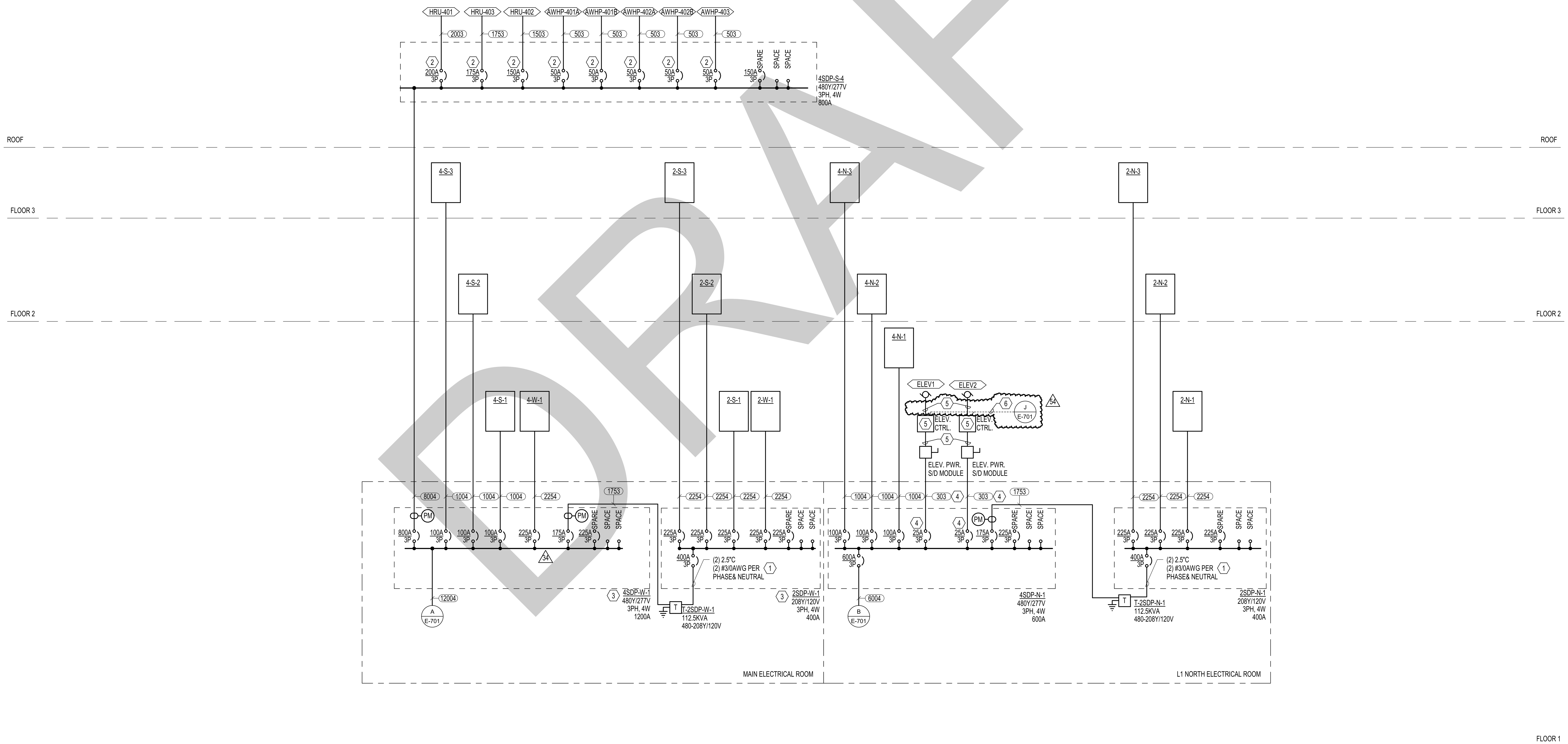
C. UNLESS OTHERWISE NOTED, PROVIDE 225A FRAME SPACE WHERE "SPACE" IS INDICATED ON DISTRIBUTION BOARDS.

**FEEDER SCHEDULE**
**COPPER: 3 PHASE, 3 WIRE + GROUND**

| TAG | NOMINAL AMPACITY | CONDUIT SIZE (MIN) | PHASE CONDUCTORS | GROUND CONDUCTOR |
|---|---|---|---|---|
| 203 | 20 | 1/2" | (3) #12 | #12 |
| 303 | 30 | 1/2" | (3) #10 | #10 |
| 403 | 40 | 3/4" | (3) #8 | #10 |
| 503 | 50 | 3/4" | (3) #6 | #10 |
| 603 | 60 | 3/4" | (3) #6 | #10 |
| 703 | 70 | 1" | (3) #4 | #8 |
| 803 | 80 | 1 1/4" | (3) #3 | #8 |
| 903 | 90 | 1 1/4" | (3) #3 | #8 |
| 1003 | 100 | 1 1/4" | (3) #2 | #8 |
| 1103 | 110 | 1 1/2" | (3) #1 | #6 |
| 1253 | 125 | 1 1/2" | (3) #1 | #6 |
| 1503 | 150 | 1 1/2" | (3) #1/0 | #6 |
| 1753 | 175 | 2" | (3) #2/0 | #6 |
| 2003 | 200 | 2" | (3) #3/0 | #6 |
| 2253 | 225 | 2" | (3) #4/0 | #4 |
| 2503 | 250 | 2" | (3) #4/0 | #4 |
| 3003 | 300 | 2 1/2" | (3) 250KCM | #4 |
| 3503 | 350 | 2 1/2" | (3) 350KCM | #3 |
| 4003 | 400 | (2) 2" | (6) #3/0 | (2) #3 |
| 4503 | 450 | (2) 2" | (6) #4/0 | (2) #2 |
| 5003 | 500 | (2) 2" | (6) #4/0 | (2) #2 |
| 6003 | 600 | (2) 2 1/2" | (6) 250KCM | (2) #1 |
| 8003 | 800 | (2) 3" | (6) 500KCM | (2) #1/0 |
| 10003 | 1000 | (3) 3" | (9) 500KCM | (3) #2/0 |
| 12003 | 1200 | (4) 3" | (12) 350KCM | (4) #3/0 |
| 16003 | 1600 | (4) 4" | (12) 750KCM | (4) #4/0 |

**FEEDER SCHEDULE**
**COPPER: 3 PHASE, 4 WIRE + GROUND**

| TAG | NOMINAL AMPACITY | CONDUIT SIZE (MIN) | PHASE & NEUTRAL CONDUCTORS | GROUND CONDUCTOR |
|---|---|---|---|---|
| 204 | 20 | 1/2" | (4) #12 | #12 |
| 304 | 30 | 3/4" | (4) #10 | #10 |
| 404 | 40 | 3/4" | (4) #8 | #10 |
| 504 | 50 | 1" | (4) #6 | #10 |
| 604 | 60 | 1" | (4) #6 | #10 |
| 704 | 70 | 1 1/4" | (4) #4 | #8 |
| 804 | 80 | 1 1/4" | (4) #3 | #8 |
| 904 | 90 | 1 1/4" | (4) #3 | #8 |
| 1004 | 100 | 1 1/4" | (4) #2 | #8 |
| 1104 | 110 | 1 1/2" | (4) #1 | #6 |
| 1254 | 125 | 1 1/2" | (4) #1 | #6 |
| 1504 | 150 | 2" | (4) #1/0 | #6 |
| 1754 | 175 | 2" | (4) #2/0 | #6 |
| 2004 | 200 | 2" | (4) #3/0 | #6 |
| 2254 | 225 | 2 1/2" | (4) #4/0 | #4 |
| 2504 | 250 | 2 1/2" | (4) 250KCM | #3 |
| 3004 | 300 | 3" | (4) 350KCM | #2 |
| 3504 | 350 | 3 1/2" | (4) 500KCM | #1 |
| 4004 | 400 | (2) 2" | (8) #3/0 | (2) #3 |
| 4504 | 450 | (2) 2 1/2" | (8) #4/0 | (2) #2 |
| 5004 | 500 | (2) 3" | (8) 250KCM | (2) #1 |
| 6004 | 600 | (2) 3" | (8) 350KCM | (2) #2/0 |
| 8004 | 800 | (3) 3" | (12) 350KCM | (3) #2/0 |
| 10004 | 1000 | (3) 4" | (12) 500KCM | (3) #2/0 |
| 12004 | 1200 | (4) 4" | (16) 500KCM | (4) 250KCM |
| 16004 | 1600 | (5) 4" | (20) 500KCM | (5) #4/0 |




DRAWINGS TO BE PRINTED IN GRAYSCALE. IF 3 DISTINCT SHADES OF DOTS ARE NOT VISIBLE, INFORMATION MAY BE MISSING.

1 SINGLE LINE DIAGRAM
NONE

FFA Architecture + Interiors

FFA Architecture and Interiors, Inc.
520 SW Yamhill Suite 900 Portland OR 97204
Phone: 503.222.1661 Fax: 503.222.1701
www.ffadesign.com

REGISTERED PROFESSIONAL ENGINEER 11612
OREGON
July 16, 1982
STEPHEN J. TURINA
04-23-19
EXPIRES 06-30-20

PAE
pae-engineers.com

BEAVERTON POLICE DEPARTMENT
COURAGE COMPASSION INTEGRITY

| # | DESCRIPTION | DATE |
|---|---|---|
| 15 | ELEC PR1 | 11/6/18 |
| 28 | ASI 006 | 1/14/19 |
| 34 | ASI 10 | 2/5/19 |
| 54 | PR 19 | 04/22/19 |

BEAVERTON PUBLIC SAFETY CENTER

CITY OF BEAVERTON
POLICE DEPARTMENT

12500 SW Allen Boulevard
Beaverton, OR 97005

| | |
|---|---|
| APPROVED: | Approver |
| DRAWN: | Author |
| DATE: | 08.31.2018 |
| PROJECT NUMBER: | 240717 |

SINGLE LINE DIAGRAM - NORMAL DISTRIBUTION

E-702
PERMIT/BID SET

## GENERAL NOTES:

A. PROVIDE POWER AND DATA CONNECTION TO EACH POWER METER EQUIPMENT. VERIFY REQUIREMENTS WITH APPROVED METER MANUFACTURER.

B. SEE PANEL SCHEDULES FOR PANEL BUS BRACING RATINGS.

C. UNLESS OTHERWISE NOTED, PROVIDE 225A FRAME SIZE WHERE "SPACE" IS INDICATED ON DISTRIBUTION BOARDS.

D. SEE SHEET E-702 FOR FEEDER TAG SCHEDULE.

## KEY NOTES:

1. REFER TO GROUNDING SYSTEM DETAIL 2, SHEET E-601 FOR GROUNDING ELECTRODE CONDUCTOR SIZES.

2. PROVIDE SLIM "I-LINE" STYLE OR EQUIVALENT.

3. SWITCHBOARD MANUFACTURER TO SIZE SURGE PROTECTION DEVICE OVERCURRENT PROTECTION.

4. ATS EQUIPMENT SHALL BE CLOSE-TRANSITION TYPE AND EQUIPPED WITH RE-TRANSFER DELAY ENABLE FUNCTION AND FULL SUITE OF STATUS CONTACTS.

5. BREAKERS SHALL BE INTERLOCKED VIA KIRK-KEY MECHANISM.

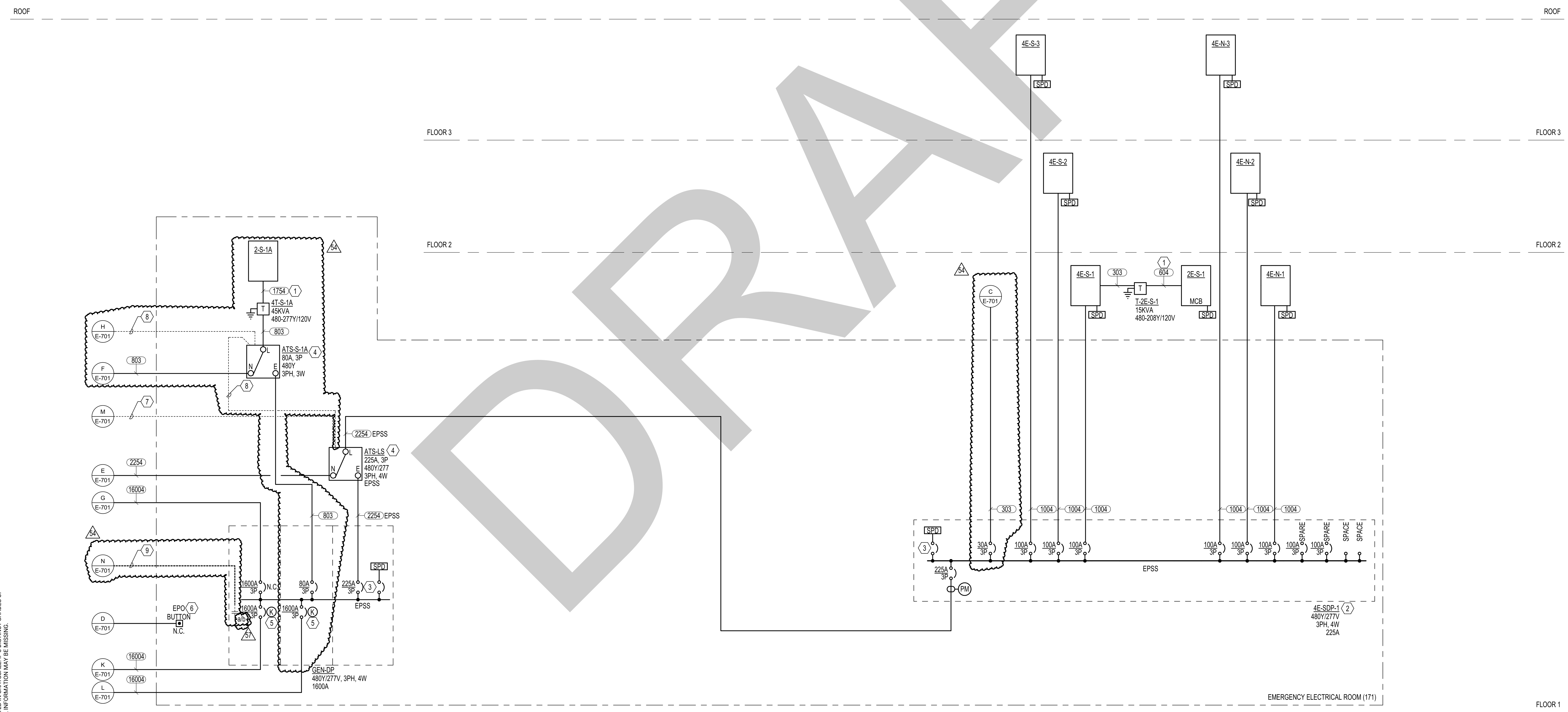
6. LOCATE EMERGENCY POWER OFF BUTTONS WITHIN MAIN AND EMERGENCY ELECTRICAL ROOMS AND ANY ADDITIONAL LOCATIONS AS REQUIRED BY THE AHJ. EPO BUTTON PRESS SHALL TRIGGER MICROGRID STATE TRANSITION TO "SS6". SEE DETAILS 1 AND 2 ON SHEET E-603 FOR ADDITIONAL INFORMATION.

7. PROVIDE (1) 4CC #14 BETWEEN "ATS-LS" AND THE GENERATOR ENCLOSURE FOR LIFE SAFETY GENERATOR START CONTROL.

54

8. PROVIDE (1) 2" C BETWEEN MICROGRID CONTROL RACK AND EACH ATS IN THE EMERGENCY ELECTRICAL ROOM. DAISY-CHAINING CONDUITS AND CONTROL CABLING IS ACCEPTABLE. CABLING BY MEMS DESIGN-BUILD CONTRACTOR.

9. PROVIDE (1) 4CC #14 IN (1) 1" C BETWEEN GEN-DP STRUCTURE 1 AND THE MICROGRID CONTROL RACK FOR STATUS OF GENERATOR FEEDER BREAKER POSITION.




1 SINGLE LINE DIAGRAM
NONE

DRAWINGS TO BE PRINTED IN GRAYSCALE. IF 3 DISTINCT SHADES OF DOTS ARE NOT VISIBLE, INFORMATION MAY BE MISSING.

FFA Architecture + Interiors

FFA Architecture and Interiors, Inc.
520 SW Yamhill Suite 900 Portland OR 97204
Phone: 503.222.1661 Fax: 503.222.1701
www.ffadesign.com

REGISTERED PROFESSIONAL ENGINEER
69195PE
OREGON
JULY 8, 2014
MICHAEL FORREST STREB
4/26/19
EXPIRES 6-30-2020

PAE
pae-engineers.com

BEAVERTON POLICE DEPARTMENT
COURAGE COMPASSION INTEGRITY

| # | DESCRIPTION | DATE |
|---|---|---|
| 15 | ELEC PR1 | 11/6/18 |
| 54 | PR 19 | 04/22/19 |
| 57 | PR 19_R1 | 04/25/19 |

BEAVERTON PUBLIC SAFETY CENTER

CITY OF BEAVERTON POLICE DEPARTMENT

12500 SW Allen Boulevard
Beaverton, OR 97005

| | |
|---|---|
| APPROVED: | KPH |
| DRAWN: | ASH |
| DATE: | 08.31.2018 |
| PROJECT NUMBER: | 240717 |

SINGLE LINE DIAGRAM - LIFE SAFETY DISTRIBUTION

E-703

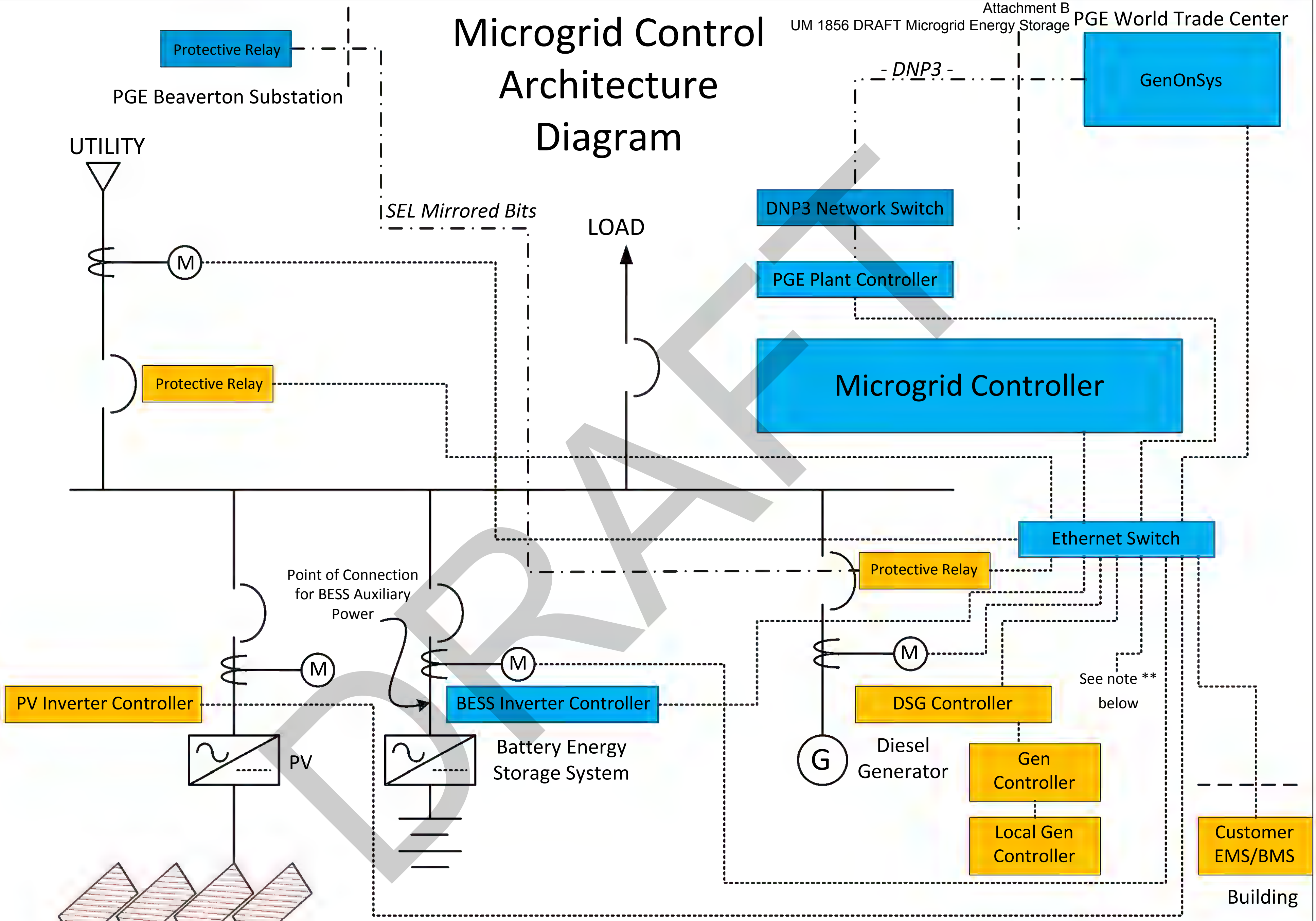
PERMIT/BID SET

Attachment B

A Graphic Depiction of The Microgrid Controls Hierarchy

**Draft Request for Proposal for a Microgrid Pilot Energy Storage System (Located in Beaverton)**

# Microgrid Control Architecture Diagram




** For clarity not all network devices are shown connected to the Ethernet switch. Additional items include:

- Remote HMI
- Fuel Oil Alarm Panel, modbus
- BMS Controller, modbus (likely requires converter to BACNET or modbus card addition at BMS)
- Power circuit breakers for power and status monitoring, modbus

* Assume all comms are Modbus unless noted DNP3 or SEL Mirrored Bits

- PGE
- Customer

# Attachment C

## Microgrid State Definitions

**Draft Request for Proposal for a Microgrid Pilot Energy Storage System (Located in Beaverton)**

# Definition of Microgrid States and Services

## 1 Microgrid States

There are four different states within which the microgrid can operate. These states are:

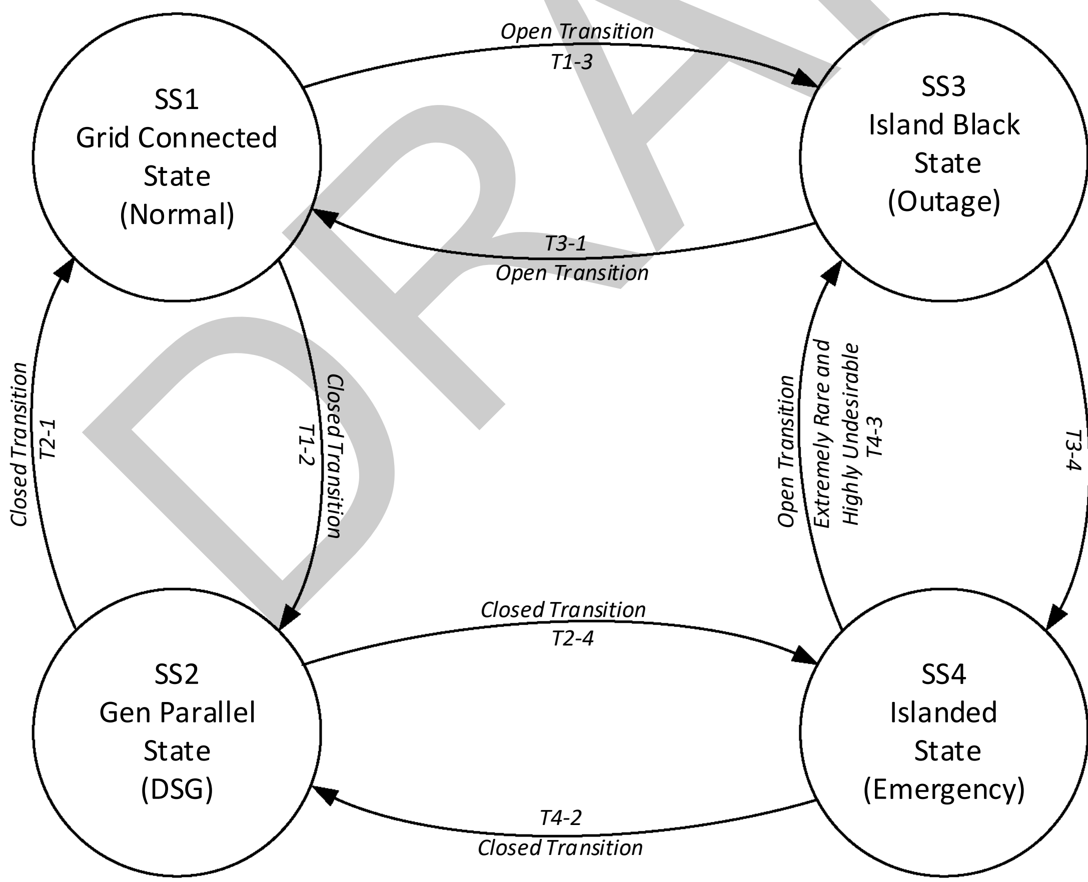
**SS1: Grid Connected State (Normal)**

**SS2: Gen Parallel State (DSG)**

**SS3: Island Black State (Outage)**

**SS4: Islanded State (Emergency)**






*Basic Illustration of Microgrid States and Transitions*

Within these four states, the microgrid can perform various functions or "services" to accomplish operational goals for both the site and for the utility. All the services for the benefit of the utility that the BESS and PV perform are accomplished in either **SS1: Grid Connected State** or **SS2: Gen Parallel State**. Services performed for the benefit of the utility by the diesel generator are performed only in **SS2: Gen Parallel State**.

Most services of the microgrid performed for the Customer's benefit are performed in **SS4: Islanded State.** The exceptions are PV self-generation optimization which is also performed in **SS1: Grid Connected State** and **SS2: Gen Parallel State,** and 100kW energy reservation with is performed in all states except **SS3: Island Black**.

**SS3: Island Black State** is an undesirable mode wherein only battery-backed UPS services are operating. The controls must immediately transition from this state to a state where the Local Area EPS is energized.

**SS1: Grid Connected State**

Grid-Connected State is the normal operating mode. The system should be in this mode more than 99% of the time.

In Grid-Connected State, the utility is serving the customer's load, the PV is generating according to available insolation connected to the Local Electric Power System (EPS), the generator is not connected to the Local EPS. The Battery Energy Storage System (BESS) is connected to the Local EPS and is available to respond to utility commands. The PV is also capable of responding to utility commands according to the interoperability standards associated with UL1741-SA, specifically Ramp Rate, Specified Power Factor, Volt/Var Mode, Frequency Watt and Volt Watt.

- The Utility Main circuit breaker is closed
- The Gen breaker is open
- The utility regulates voltage and frequency
- The microgrid controller will reserve a minimum of 100kW for use in a utility outage
- Both PV and the BESS are operating in current regulation

From this state, the system may transition directly to **SS3: Island Black State** and **SS2: Generator Parallel State**.

**SS2: Generator Parallel State (Local and Remote DSG)**

Functionally, this mode is the same as PGE's Dispatchable Standby Generator (DSG) mode. This mode may be entered by either a local command from the HMI or from a remote command from PGE's downtown command center. PGE will initiate this test remotely once per month for one hour. This mode can also be initiated by PGE without notification due to a utility system emergency (a DSG dispatch). The customer may enter this mode for testing at their choice using the local HMI after notifying PGE. During this mode, the generator starts, synchronizes to the grid and closes the Gen breaker. The generator output then ramps up to the baseload setpoint which can be entered either locally or remotely.

To exit this mode and return to **SS1: Grid Connected**, the stop command is issued either locally or remotely. The generator will follow a prescribed ramp down to a minimum power output, then the Gen breaker will open and the generator will enter cooldown mode for five minutes. After cooldown, the generator will shut down.

In this state, the BESS and PV operate the same as in **SS1: Grid Connected**.

- The Utility Main circuit breaker is closed
- The Gen breaker is closed
- The utility regulates voltage and frequency
- The microgrid controller will reserve a minimum of 100kW for use in a utility outage
- The PV, the BESS and the diesel generator are operating in current regulation

From this state, the system may transition directly to **SS1: Grid Connected State** or **SS2: Islanded State**. The transition to **SS2: Islanded State** occurs when there is a utility outage during **SS2: Generator Parallel State**. The system will perform a closed transition to Islanded mode by opening the Utility Main breaker and allowing the generator to remain connected through the Gen breaker. The generator must then regulate voltage and frequency. Then, the microgrid controller may ramp down the diesel generator and stop it provided the BESS SOC is adequate.

**SS3: Island Black**

This mode is undesirable and should only occur briefly after a utility outage. The Utility Main breaker will open immediately upon sensing a utility outage. Then, the microgrid controller must transition the system quickly from **SS3: Island Black** to **SS4: Islanded,** or if utility power returns prior to this transition occurring, the system should return to **SS1: Grid connected State**. During **SS3: Island Black**, all microgrid functions are suspended.

**SS4: Islanded State**

**SS4: Islanded State** automatically occurs immediately after an unplanned utility outage. When an unplanned utility outage occurs, the system first transitions to **SS3: Island Black** by opening the utility main breaker, and then immediately transitions to **SS4: Islanded**. Most often, when transitioning from **SS3: Island Black State to SS4: Islanded State**, the BESS is employed to energize the Local Area EPS and regulate frequency and voltage, not the diesel generator. Based on system conditions, like a low BESS state of charge (SOC), the diesel generator may be utilized in **SS4: Islanded State** to form the grid (regulate voltage and frequency).

**SS4: Islanded State** can also occur when the Owner elects to enter "Generator Test with Load" mode or "Storm Avoidance" mode. These two functions are the same. They cause **SS4: Islanded State** to operate solely with the diesel generator. To reach this state (from **SS1: Grid Connected State only**), the system transitions to **SS2: Generator Parallel State.** This is achieved by starting the diesel generator, waiting for it to synchronize with the main bus and then closing the Gen breaker. Once the diesel generator is parallel with the grid, its output is ramped up to equal the utility load (facility load minus PV output). The main utility breaker is then opened. The BESS can charge in this mode but not to discharge. Output from the PV is ramped down to near-zero and prevented from further output.

"Generator Test with Load" mode or "Storm Avoidance Mode" can only be selected when the system is in **SS1: Grid Connected State**. To leave this mode of operation, "Return to Grid" must be selected locally". The system will transition to **SS2: Generator Parallel** State by synchronizing across the utility main breaker. Then the generator will follow a prescribed ramp down to a minimum power output. Then the Gen breaker will open and the generator will enter cooldown mode for five minutes. After cooldown, the generator will shut down. The system will then be in **SS1: Grid Connected State.**

Another way that the system can enter **SS4: Islanded State** is by local selection of "Island Microgrid". This can only be selected when the system is in in **SS1: Grid Connected State**. In this mode, the battery is switched from current regulation in **SS1: Grid Connected State** to voltage regulation. The battery output will be ramped up to a level equal to utility load (facility load minus PV). The utility main breaker will then open leaving the system to operate as an islanded microgrid (**SS4: Islanded State**).

When intentionally entering **SS4: Islanded State**, the transition is always closed, meaning the site does not experience an outage.

- The Utility Main circuit breaker is open
- The Gen breaker is open unless the diesel generator is being utilized
- The battery regulates voltage and frequency except in "Generator Test with Load" or "Storm Avoidance" mode
- The microgrid controller will only allow the battery to reach a minimum of 100kW before the diesel generator comes online to supply the Local Area EPS and to recharge the battery in baseload mode
- If the BESS is unavailable, the generator must regulate voltage and frequency

These four states and their transitions are most often controlled by the microgrid controller with the following exceptions:

1. **Transition T1-2** and **Transition T2-1** between **SS1: Grid Connected State** and **SS2: Gen Parallel State** is controlled by the Generator Paralleling Controls.
2. The Customer's site includes two Automatic Transfer Switches (ATS's) for fire and life safety loads. Either of these ATS's may perform a generator start independently of all other controls. The ATS's should be put on a five second delay to give the other controls the opportunity to react prior to the ATS's sending the generator start command. This prevents the ATS's from cycling unnecessarily.
3. If the microgrid controller is entirely out of service, the generator controller (Woodward EasyGen) will create an island and serve the Local Area EPS with the diesel generator. This is considered the last line of defense in the event of an outage. If absolutely every other control system fails to achieve emergency mode with the generator, the EasyGen will accomplish the task.

# 2 Microgrid Services

The various resources and controllers associated with the microgrid are intended to provide beneficial services to both the electric utility and to the site. What service is being provided at any given time depends upon what state the microgrid is operating in at the time and what service is being requested from the hierarchy of microgrid controls.

In general, services for the benefit of the electric utility can only be performed when the microgrid is connected to the utility grid. Services for the benefit of the site are mostly performed when the microgrid is disconnected from the utility grid. Two exceptions to this are:

1. Maximizing PV Self-Generation
2. Minimum Energy Reservation

These two services are performed for the benefit of the site when the microgrid is connected to the utility grid.

The table below describes all the services provided by the microgrid controller and in which state each service shall function.

| Service | State(s) in Which This Service Can Function | For the Benefit of? | Resource(s) Employed | Service Requested From |
|---|---|---|---|---|
| Frequency Response | SS1 and SS2 (Connected) | Utility | BESS | Local Control - PGE Plant PLC |
| Contingency Reserve | SS1 and SS2 (Connected) | Utility | Gen and BESS | Remote Control - PGE Plant PLC |
| Volt/VAr Support | SS1 and SS2 (Connected) | Utility | BESS and PV | Local Control - PGE Plant PLC |
| VAr or pf support | SS1 and SS2 (Connected) | Utility | BESS and PV | Remote Control - PGE Plant PLC |
| Demand Response | SS1 and SS2 (Connected) | Utility | BESS | Remote Control - PGE Plant PLC |
| Mitigation of Cold Load Pick-up | SS1 and SS2 (Connected) | Utility | BESS | Local Control - PGE Plant PLC |
| PV Self-Generation | SS1, SS2 and SS4 (Islanded and Connected) | Site | PV and BESS | Local Control - Microgrid Controller |
| Minimum Energy Reservation | SS1, SS2 and SS4 (Islanded and Connected) | Site | BESS | Local Control - Microgrid Controller |
| Maximum Energy Reservation | SS1 and SS2 (Connected) | Site | BESS | Local Control - Microgrid Controller |
| Maximize Reliability | SS1, SS2, SS3 and SS4 (All Conditions) | Site | BESS and Gen | Local Control - Microgrid Controller and DSG Controller |
| Economic Optimization | SS4 (Islanded) | Site | BESS, PV and Gen | Local Control - Microgrid Controller |
| Test with Load/Storm Avoidance | SS4 (Islanded) | Site | BESS, PV and Gen | Local Control - Microgrid Controller and DSG Controller |
| Test Island | SS4 (Islanded) | Site | BESS, PV and Gen | Local Control - Microgrid Controller and DSG Controller |

*List of Microgrid Services*

# 3 Detailed Description of Services

**Utility Services**

Utility services are only provided when the BESS is operating in parallel with the utility. Management of these services and setpoints are provided by Owner's Plant PLC. The Owner's Plant PLC will communicate with the microgrid controller via Modbus to send setpoints for real power, reactive power, ramp rates and state of charge (SOC). The descriptions of utility services below are intended for use by the bidder to develop performance specifications and warranty provisions.

Whenever the BESS is operating connected to the utility, Utility Services take precedence over any other service. Services for the benefit of the site are always lower priority when the BESS is grid-connected.

The sole exception is the microgrid controller's role to maximize reliability of the site. Under all conditions, site reliability is paramount.

## 3.1 Frequency Response

For this service, the BESS must respond from an idle state to a request for frequency response within 2 seconds of receiving the command. From that time, the battery output must ramp at a rate of 100kW per second until a full output of 250kW is achieved. 250kW output shall be maintained for three minutes and then the BESS output will ramp down at a rate of 25kW per second. When BESS output gets to less than or equal to 25kW, the BESS will recharge at a rate of 25kW until the SOC setpoint is achieved.

The control for this service will reside in the PGE plant controller. The Bidder's controls must simply respond to a setpoint for kW.

This service shall be provided up to 50 times per year, and sometimes within the same 8-hour period.


*Example of Frequency Response*

## 3.2 Contingency Reserve

For this service, the BESS must respond from an idle state to a request for contingency reserve within 2 seconds of receiving the command. From that time, the battery output must ramp up at a rate of 100kW per second until a full output of 250kW is achieved. 250kW output shall be maintained until a ramp-down and stop command is issued. When ramp-down and stop is received, within two seconds the BESS will ramp down at a rate of 25kW per second until the kW output is less than or equal to 25kW.

Once the BESS output is less than or equal to 25kW, the BESS will be commanded by the PGE plant PLC to recharge at a rate of 25kW until the SOC setpoint is achieved.

The control for this service will reside in the PGE plant controller. The Bidder's controls must simply respond to a setpoint for kW, keep up with the requested ramp and manage SOC.

This service shall be provided up to 8 times per year.

## 3.3 Volt/VAr Support

In this service, the BESS will respond to a request for Volt/VAr support. Depending on the service(s) being requested at any given time, the BESS may be asked to provide Volt/VAr support simultaneous with being in standby for another service such as frequency response or spinning reserve or voltage support may be operated simultaneously with other services providing that the kVA capacity of the system will allow it.  When Volt/VAr is requested, the BESS will respond with a pre-established Volt/VAr curve.

The only limitations on the BESS for providing this service must be the kVA rating of the system.

## 3.4 VAr or Power Factor Support

In this service, the BESS will respond to a kVAr setpoint or power factor setpoint from the PGE plant controller. Depending on the service(s) being requested at any given time, the BESS may be asked to provide VAr or power factor support simultaneous with being in standby for another service such as frequency response or spinning reserve or voltage support may be operated simultaneously with other services providing that the kVA capacity of the system will allow it.

The only limitations on the BESS for providing this service must be the kVA rating of the system.

## 3.5 Demand Response

Demand Response (DR) is a service scheduled by the Owner normally a day in advance. DR occurs on days with the highest system load. A demand response event is scheduled for a preset number of hours, typically two. When this schedule is set in PGE's Plant Controller, PGE's Plant Controller will assume that 900kWh of energy will be available for that event. A setpoint of 250kW will be given to the microgrid controller for the DR service. If for some reason, available energy is less than 900kWh, then a lower kW setpoint will be calculated. For example, if 400kWh are expected to be available and two hours is the scheduled duration of the event, PGE's Plant Controller will calculate a kW setpoint of 400kWh/2h = 200kW and this setpoint will be given to the microgrid controller as a DR setpoint. If 900kWh of energy are available, but the duration of the event is scheduled to be 4 hours, then PGE's Plant Controller will calculate the kW setpoint to be 900kWh/4hrs. = 225kW.

This service will be dispatched 20 times per year.

## 3.6 Mitigation of Cold-Load Pick-up

BESS must be able to reduce cold load pick-up after a utility outage. This is accomplished by the microgrid controller setting the return to grid timer to zero in both the BESS PCS and the PV inverter. The BESS must adjust to a kW output setpoint delivered by the Owner's plant controller. To mitigate cold load pick-up, the BESS will return to grid with no delay once utility power is restored and ramp up to a real power setpoint established by the Owner's plant controller. The microgrid controller will operate with the Customer's building energy management system to delay starting large loads such as chillers and other HVAC equipment until two minutes after the site returns to utility power. Bidder shall assume that the real power setpoint will be the full nameplate rating. This output is maintained for 1 hour and then the BESS will ramp down at a rate of 25kW/second and return to its normal operation.

This service will be dispatched once per year.

**Site Services**

Site services are mostly provided when the BESS is operating islanded from the utility. Management of these services and setpoints are provided by microgrid controller.

## 3.7 PV Self-Generation

For the benefit of the site, the microgrid will always be operated in such a way that solar PV self-generation is maximized. The microgrid controller will use current system status as well as historical data to determine the best times to charge the BESS to facilitate this service.

## 3.8 Minimum Energy Reservation

Whether grid-connected or islanded, the microgrid controller will always maintain 100kWh of energy as an emergency reserve for the site.

## 3.9 Maximum Energy Reservation

While grid-connected, the customer may select on the local HMI to reserve 100% SOC for a potential emergency. Under this mode, the microgrid controller will use the utility source to charge the battery to 100% SOC and then hold that in reserve until this mode is de-selected.

## 3.10 Maximize Reliability

Under all conditions, the microgrid controller will maximize the reliability of the site. This means that open transitions will be limited to events of utility power failure. All other transitions shall be closed transitions.

## 3.11 Economic Optimization

When islanded, the system will always utilize solar PV or stored energy from the BESS as a preference over the diesel generation.

## 3.12 Test with Load/Storm Avoidance

The local site operator may choose to manually test the generator at full load. This service will cause the generator to start and synchronize with the grid. The generator breaker will close and the generator will take over all load. BESS power and PV power will be disabled during this service so that the generator power is maximized.

## 3.13 Test Island

The local site operator may select “Island Microgrid”. In this mode, the site will disconnect from the grid and be islanded. The island will be served by the most economically optimized way.