1 OVERVIEW OF PROJECT COMPONENTS

This section provides a review of the Project components associated with the Caballero Battery Energy Storage System (BESS) project (DRC2019-00258). Table 1 includes a description of all project components associated with this site that are represented in the Projects' single line diagram and site plan that was submitted as part of the Project application package. It should be noted that the Project is in its early concept stage, so the system design has not yet been finalized. As such, these Project components will be updated by Origis in the case of any material changes.

Table 1 – Key Project Components

Project Component	Description/ Definition
Project Substation	A substation supports the interface between the BESS site and the electrical grid and can step up or down the voltage to connect to the grid as appropriate. For this site, it will facilitate the connection to the PG&E Mesa substation. The Project substation serves as the point of interconnection for the BESS. It also houses some monitoring, communication, and controls equipment.
Substation Component: Main Power Transformer	The transformer is a device that will change the voltage of electricity that flows within the BESS facility. This transformer is responsible for stepping up the voltage of electricity between the medium voltage collection system and the high voltage system at the Point of Interconnection (POI).
BESS Cabinet	The BESS cabinet houses batteries as well as other system components such as the battery cabinets, battery management system (BMS), HVAC system, system controller, fire suppression system, and electrical distribution panel. Cabinets are typically made of steel. Such cabinets are considered unoccupied, with access only by approved personnel for maintenance or repair of any of the BESS system components. The BESS cabinet is located outside on its own, not included inside a building room or area. The cabinet will be designed to UL 9540 standards, which is a BESS system where personnel cannot enter the enclosure other than reaching into access components for maintenance purposes.
Lithium-ion (Li-ion) or Other Battery	Although the batteries have not yet been selected for this project, Lithium ion (Li-ion) batteries are the most common batteries by installation, accounting for more than 90% of energy storage installations. Li-ion batteries use the exchange of lithium ions between electrodes to charge and discharge the battery. Li-ion batteries are typically characterized as power devices capable of short durations or stacked to form longer durations of power. This Project would be considered a long duration system. Li-ion energy storage systems are generally appropriate for serving energy applications, moderate power applications, and applications requiring a short response time (i.e. back-up power or supporting a black start). The three most common Li-ion chemistries are Lithium Nickel Cobalt Manganese Oxide (NCM), Lithium Iron Phosphate (LFP), and Lithium Titanate Oxide (LTO). The BESS battery for the project will

Project Component	Description/ Definition
	use LFP batteries. Lithium iron phosphate batteries are less prone to combustion and thermal runaway, making them safer than typical lithium-ion batteries.
Pad Mounted Transformer	These transformers are used to interface the underground medium voltage collection cables at points in which the BESS service drops are connected to step down the primary voltage on the collection system to a lower voltage that is supplied by the BESS inverters.
BESS Inverter (PV Inverter)	This inverter converts the variable direct current (DC) output of the BESS to alternating current (AC).
AUX Transformer	Another type of power transformer that provides power to the auxiliary equipment of the BESS site during its normal operation. Auxiliary equipment includes things like air conditioning units that keep batteries and other equipment cool, power for internal lighting, and other internal equipment needs for the Project to operate safely.
Fire Suppression	The BESS incorporates heat and smoke detection along with fire suppression systems. Optional integrated hot aerosol fire suppression system.
Fire Suppression Tank	The fire water tank provides a source of water that is dedicated to suppress the fire and for use by first responders in case of a fire. The design of the fire suppression system is not yet finalized, but will be designed in accordance with federal, state and local regulations.
Heating, Ventilation, and Air Conditioning (HVAC) Units	The HVAC units will be included with each BESS container. The HVAC system maintains the BESS container internal temperature and interlocked into the internal fire system. During charge and discharge, cell temperature is maintained between 20 degrees Celsius -35 degrees Celsius.

The Caballero BESS Project is expected to have an interconnection capacity of approximately 100 megawatts (MW) AC/400 megawatt hours (MWh), AC consisting of approximately sixty-eight 5.882 MWh BESS containers, thirty-four 2.968 MW inverters, and thirty-four 3.3 MVA pad mounted transformers. The selection of batteries that will be used in the BESS are not yet finalized; as such, the capacity and size of the containers may change, as may the ratings of the conversion equipment (inverters and transformers) and the number of containers, inverters and transformers are an estimate based on the currently available technology. These numbers will most certainly change, but the overall size of the area for the project will remain generally consistent. While it is still undecided which battery technology will be used for this Project, it is anticipated that one of the more common li-ion technologies will be selected. Each BESS container will be fitted with an HVAC unit for temperature control of the container.

One HVAC system per BESS enclosure will adjust the internal temperature of the battery cabinet automatically .

The Project site will include a 230 kilovolt (kV) Project substation and the main power transformer to match the voltage of the PG&E Mesa Substation that the Project will interconnect with. Currently, the main power transformer rating hasn't been selected. There will be an overhead generation tie line (gen-tie line) connecting the Caballero BESS with the PG&E Mesa Substation that will go from the Project substation over the fence into the PG&E substation on the adjacent parcel. The route of the 0.1-mile gen-tie line will connect into the northwest side of the substation and will be routed to avoid existing power lines. The gen-tie line will be built using similar materials as existing power lines on the PG&E Mesa Substation property.

Safety will be incorporated in all stages of BESS design to the highest available international standards. The BESS will include a battery protection circuit to improve safety by making accidents less likely or by minimizing their severity when they do occur; fire protection system suitable for the chemistry of the battery and the type of chemical fire that could result, and water supply; ventilation and temperature control systems; gas detection and smoke detection systems; Emergency Response Procedures; Occupational and Health and Safety (OHS) Plan; and a maintenance plan. A 20 m safety zone will be provided around the perimeter of the BESS facility.

The fire suppression tank for the BESS is expected to be built outside the Project security fencing, and at the entrance of the Project site so that it is easily accessible to first responders. Each BESS container will have a fire suppression system suitable for the battery chemistry. Lastly, the systems will be expected to be compliant to the latest version of the National Electric Code (currently, NEC 2017, NFPA 70), as well as all other federal (NFPA 1, 855, 68 and 69), state, and local codes, including the in-force revision of the California Fire Code.

2 PROJECT OBJECTIVES

The Caballero BESS Project has been sited in a location that benefits the California electrical grid. The PG&E Mesa Substation is critical to PG&E's electrical system for the California Central Coast and in the PG&E Kern Interconnection Area. While the project is physically located in San Luis Obispo County, electrically it is within what is known as the Kern Interconnection Area, which includes a much broader geographical area that includes parts of San Luis Obispo, Santa Barbara, Kern and Kings counties. The Project will support implementation of SB100 and may help defer additional upgrades to the electrical transmission system by allowing energy to be stored during off-peak hours and dispatched during peak demand.

With the Morro Bay Power Plant recently shut down and the Diablo Canyon Nuclear Power Plant scheduled for closure in 2024 and 2025, much of the power supply for San Luis Obispo County and possibly other areas within the Kern Interconnection Area will need to be imported.

The Caballero BESS Project will create more than 100 jobs during construction, many of which can be sourced from San Luis Obispo and adjacent counties. As many of the required construction workers will be sourced locally as possible, based on the qualifications of the task being performed. The Project does not require any full-time employees and will be operated remotely and only require annual maintenance to service the Project.

The Project will generate state and local tax revenue during construction and operations; however, the total tax revenue has not been calculated at this time but will be based on the total Project cost during construction and energy price during operations.

The Project site consists of fallow agricultural land and environmental impacts will be negligible. The Project is well-sited adjacent to the existing substation to further reduce potential impacts. Because the

Project will be adjacent to the PG&E Mesa Substation, the visual characteristics of the area will not substantially change.

3 REVIEW OF FIRE/HAZARD PROTECTION OF PROPERTY

As described above, Safety will be incorporated in all stages of the project BESS design to the highest available international standards. The BESS will include a battery protection circuit to improve safety by making accidents less likely or by minimizing their severity when they do occur; fire protection system suitable for the chemistry of the battery and the type of chemical fire that could result, and water supply; ventilation and temperature control systems; gas detection and smoke detection systems; Emergency Response Procedures; Occupational and Health and Safety (OHS) Plan; and a maintenance plan. A 20 m safety zone will be provided around the perimeter of the BESS facility.

The Project BESS system will meet nationally recognized industry safety standards for lithium-ion battery energy storage systems (BESS).

The standards that the project will be designed to are as follows:

- California Fire Code-2019, 01JUL2021 Supplement: Section 1206
- NFPA 855 (2020): Standard for the Installation of Stationary Energy Storage Systems (with TIA 20-2)
- NFPA 69
- NFPA 70 (2020): National Electric Code
- NFPA 72 (2019): National Fire Alarm and Signaling Code
- UL 9540 (2020): Standard for Safety – Energy Storage Systems and Equipment
- UL 9540A (2019): Standard for Safety – Test Method for Evaluating Thermal Runaway Fire Propagation in Battery Energy Storage Systems

Caballero will prepare an Emergency Response Plan prior to operations. The Emergency Response Plan (ERP) provides general guidance, organizational structure, and specific direction on preparedness, response, and communication disciplines that are to be followed for managing major emergencies that may threaten the health and safety of the Caballero BESS. The ERP ensures that responders are prepared for “unexpected” events to protect operational personnel and the local community. The ERP identifies departments and personnel that are directly responsible and accountable for emergency response and critical support services. It also provides a structure for coordinating and deploying essential resources. All operational personnel share an individual responsibility for preparedness. The ERP will address potential:

- Response to a fire incident – either external to the container or internal, or associated with the project substation.
- What to do after an incident
- General site maintenance to avoid fires and other emergencies
- Spill response procedures and reporting
- Medical emergencies and reporting
- Response to weather events
- General security

Prior to operations, Caballero will meet with the local fire department and education them on the BESS. The fire department will be informed of appropriate fire suppression methods for the energy storage system type as identified by the equipment manufacturer.

3.1 California Fire Code (CFC)-2019, 01JUL2021 Supplement: Section 1206 Compliance

3.1.1 Section 1206.1 Scope

Per Section 1206.1, lithium-ion batteries with an energy capacity greater than 20 kWh must comply with Section 1206. Where the CFC has requirements that need to be met by the project, those requirements will be listed below with an explanation of how the project can meet the requirement.

3.1.2 Section 1206.1.3 Construction Documents

Per Section 1206.1.3.2, details on the fire-resistance rating of the BESS shall be provided. This information will be provided to the County as part of the building permit submittal once project engineering is complete. However, the BESS cabinet is made from steel and is designed as a custom battery enclosure. It is seismically rated for Zone 4/Category D.

Per Section 1206.1.3.5, a description of the energy storage management system (EMS) will also be provided to the County prior to operation which will be documented in a Safety Analysis Report.

Per Section 1206.1.3.7, details on fire suppression, smoke or fire detection, thermal management, ventilation, exhaust and/or deflagration venting systems, will be incorporated into the design.

3.1.3 Section 1206.1.4 Hazard Mitigation Analysis

Per Section 1206.1.4, a failure modes and effects analysis (FMEA) or other approved hazard mitigation analysis may be provided as a basis for increasing the maximum allowable quantity of Lithium-ion batteries above 600 kWh (see Section 1206.5.2). This requirement is typically met by meeting the requirements of UL9540, which the BESS system for the project will have a UL9540 certification.

3.1.4 Section 1206.1.5 Large-scale Fire Test

Per Section 1206.1.5, large-scale fire testing shall be conducted on a representative BESS in accordance with UL 9540A. The BESS cabinet being used for the project has completed UL9540A cell, module, and unit testing. Installation level testing was not required since no fire started or propagated during the unit level testing.

3.1.5 Section 1206.3 Equipment

Per Section 1206.3.1, the BESS shall be UL 9540 certification.

3.1.6 Section 1206.5 Electrochemical Energy Storage System Protection

Per Section 1206.5.1, BESS with large scale fire testing (UL 9540A) can be in groups larger than 50 kWh and have spacing that complies with the UL 9540A testing. The BESS cabinet for the project has UL 9540A testing completed by the OEM and the BESS cabinet design is in accordance with the UL 9540A results.

Per Section 1206.5.4, an approved automatic smoke detection system or radiant energy sensing fire detection system is required to comply with Section 907 and be installed in rooms, indoor areas, and walk-in BESS. This section isn’t relevant to Caballero, since the BESS cabinet is located outdoors. However, the BESS cabinet does have an automatic smoke detection system designed in accordance with NFPA 72 and included in the UL 9540 listing.

Per Section 1206.5.5, rooms and areas within building and walk-in BESS shall be protected by an automatic fire suppression system. The BESS cabinet system is located outdoors. As such, this requirement is not applicable. However, the cabinet does have an installed dry pipe system. Additionally, during the UL 9540A testing, no fire was detected during thermal runaway events.

3.1.7 Section 1206.6 Electrochemical Energy Storage System Technology Specific Protection

Per Section 1206.6.1, exhaust ventilation is not required for lithium-ion battery systems. Per Section 1206.6.2, spill control and neutralization is not required for lithium-ion battery systems like the project.

Per Section 1206.6.3, explosion control is required for lithium-ion battery systems. However, explosion control is required specifically for rooms, areas, or walk-in BESS. The battery system provided within the project BESS is located in a cabinet. As such, this requirement is not applicable. However, explosion control deflagration venting, designed in accordance with either NFPA 68 or 69, is provided within the cabinet.

Per Section 1206.6.5, thermal runaway protection is required. The battery management system, from the battery OEM, is UL 1973 listed and provides this function.

3.2 NFPA 855 Compliance

3.2.1 Section 4.1.4 Hazard Mitigation Analysis

Per Section 4.1.4, a hazard mitigation analysis will be provided to the AHJ for review as part of the construction permit applications or prior to operation. The hazard mitigation analysis typically includes the following:

- Thermal runaway condition in a single module, array or unit
- Failure of an energy storage management system
- Failure of a required ventilation or exhaust system
- Failure of a required smoke detection, fire detection, fire suppression, or gas
- detection system.

3.2.2 Section 4.1.5 Large-Scale Fire Test

It is required per Section 4.1.5.1 that the batteries used in the BESS cabinet undergo UL9540A or equivalent large-scale fire test. The BESS cabinet used for the project will meet these requirements and the results can be provided to the County, as necessary.

3.2.3 Section 4.2.1 Listings

Per Section 4.2.1 the BESS shall be listed in accordance with UL9540. The project's BESS cabinet can be provided with a UL 9540 certification.

3.2.4 Section 4.3.3 Seismic Protection

Per Section 4.3.3 the BESS shall be seismically braced in accordance with local building codes. The project BESS will be seismically qualified by the EOM to Zone 4/Category D.

3.2.5 Section 4.9 Exhaust Ventilation

Per Section 4.9.1, where required by Table 9.2 or elsewhere in the NFPA 855 standard, exhaust ventilation shall be provided for room, enclosures, walk-in units, and cabinets in accordance with Section 4.9.2 or 4.9.3. Exhaust Ventilation is **NOT** required for lithium-ion BESS. No other section in NFPA 855 requires exhaust ventilation for the project.

3.2.6 Section 4.10 Smoke and Fire Detection

Per Section 4.10 all fire areas containing BESS systems located within buildings or structures shall be provided with a smoke detection system in accordance with NFPA 72. The project design does not include locating the BESS system within a building or structure; therefore, Section 4.10 is not applicable. Regardless, the project design will include an installed smoke and heat detection system in accordance with NFPA 72.

3.2.7 Section 4.11 Fire Control and Suppression

Per Section 4.11, where required elsewhere in the NFPA 855 standard, fire control and suppression for rooms or areas within buildings and outdoor walk-in units containing BESS shall be provided in accordance with this section. The project design does not include BESS system located within a room or area within a building and is not classified as an outdoor walk-in unit. Therefore, Section 4.11 is not applicable to the project and fire sprinklers are not required.

3.2.8 Section 4.2 Explosion Control

Per Section 4.12, where required elsewhere in the NFPA 855 standard, explosion prevention or deflagration venting shall be provided in accordance with this section.

The requirement for explosion control may or may not be applicable to the project design, however, the project will be designed to show compliance with either NFPA 68 or 69.

3.2.9 Section 9.3 Thermal Runaway Protection

Per Section 9.3, where required by Table 9.2, a listed device or other approved method shall be provided to preclude, detect, and minimize the impact of thermal runaway. The ESS Cabinet uses a battery system that is fully UL 1973 listed. That listing includes the Battery Management System (BMS) provided by the battery original equipment manufacturer (OEM). The BMS is tested per UL 1973 to preclude, detect, and minimize thermal runaway. The UL 9540 listing for the ESS Cabinet can include this discussion on thermal runaway protection.

3.3 NFPA 70 Compliance

The project will be designed in accordance with NFPA 70. The UL9540 listing, is required to evaluate the design against NFPA 70 and confirm the requirements from NFPA 70 are met. And the project will have a UL9540 certification.

3.4 NFPA 72 Compliance

Per NFPA 855, meeting the requirements of NFPA 72 are not required. However, some California counties require NFPA 72 compliance. The fire alarm system within the project cabinet design, is designed in accordance with NFPA 72. The Fire detection equipment (external fire panels, smoke detectors, gas detectors, etc.) are NFPA 72 compliant and listed for such use.

3.5 UL9540

Per NFPA 855 and other codes and standard, the project cabinet and overall BESS provided to the project site be certified per UL9540.

3.6 Additional Project Design Features

Thermal Management and Controls: As described in Table 1, a thermal management system or HVAC system is expected be utilized, appropriate for local environmental conditions, that maintains the system within the demonstrated (per test data of battery) appropriate ranges of the battery cells. the thermal management system should at least: control temperature at a battery module level, with circulation providing consistent temperature within each container and within the safe operating temperature ranges of the battery; and control humidity within the safe operating ranges of the battery. The controls system is expected to include both the BMS and higher-level controllers including balance of system (BoS) controllers and/or programmable logic controllers (PLCs). The BMS should be capable of balancing the state of charge (SOC) between cells and modules and monitoring current and voltage between cells and modules, shutting the system or sub-components down automatically in the case of abnormal conditions. The controller should be capable of receiving information from the BMS and should be proven to operate the battery for only the applications and conditions the battery is capable of.

Monitoring and Alarms: The system is anticipated to have sensors allowing for the detection at a minimum of temperature, current, and voltage, at least at the battery module level. Also, battery cell monitoring is expected to include voltage and as many temperature measurements as practical in the battery module. In addition, the system should have ambient temperature sensors, as applicable to larger containers, and smoke and thermal detectors for fire detection in compliance with NFPA 72. In all cases, this information will be monitored remotely, 24/7, to ensure values remain within acceptable ranges (Ranges are manufacturer determined. Test data previously noted can confirm that these ranges are appropriate. In the event of abnormal conditions, an alarm will be sent to the monitoring facility, and systems or sub-systems will be automatically shut down. Additionally, system status will be clearly visible on the outside of unit, indicating status via indicator light or screen (e.g., Off, Idle/Standby, Active/on, Faulted).

Siting: The system shall be protected from access by non-approved personnel, with either locked containers or fencing, as approved by local AHJ to ensure access in case of emergency. If multiple containers are used, and each exceeds 250 kWh, containers will be placed at least 3 feet apart from other battery containers, unless testing demonstrates otherwise. If multiple battery cabinets or racks are used within a single container, there are no requirements for internal spacing as long as the battery rack locations allow for acceptable thermal management. Emergency electrical disconnects are expected to be accessible in case of emergency, in compliance with the NEC and ADA and located on the outside of each container. If electrical disconnect is not within sight of the system, a sign should indicate its location.

4 CONSTRUCTION PLAN

This Project will be built as one system with the following tasks being performed in this anticipated order:

- Clearing and Grubbing of the site
- Rough grading the entire site (with focus on development area and retention basin)
- Install site fencing
- Coordinate with PG&E to ensure interconnection facilities are being constructed
- Project substation ground grid, which will be installed as part of the Project fence
- Excavate MV collection trenching
- Install Storm drain culverts
- Trenching to support fire suppression system.
- Install MV collection cables
- Construct equipment pads
- Install equipment
- Install water tank and connect to fire suppression infrastructure
- Construct gen-tie line to interconnect BESS Project substation with the existing PG&E Mesa Substation
- Complete access road class 2 base and driveway improvements
- Conduct final commissioning of all equipment
- Conduct training and coordination with Operations and Maintenance team and local first responders
- Initiate Project Commercial Operations

5 PG&E SUBSTATION INTERCONNECTION DETAILS

The Caballero BESS will interconnect with California's electrical grid at PG&E's 230kV Mesa Substation. The interconnection will be via a 0.1-mile gen-tie line from the Project substation to the PG&E Mesa Substation. PG&E will install and maintain one to two tubular steel poles and two to three spans of line from the substation Dead-End structure up to the Customer provided tubular steel pole, at the PG&E substation property line. PG&E will also install, terminate and test new fiber cables from the Caballero project line to the PG&E control building within the Mesa Substation. PG&E intends to expand the existing breaker and half bay to allow the BESS Project to connect to the Mesa Substation, which will include:

- One 230kV power circuit breaker, SF6 gas type, rated 230kV, 3000 ACC Continuous, 63kAIC, with two or three current transformers (CT's) as required on each bushing
- Two 230kV disconnect switch, manually operated, for breaker disconnect, and mounted on low profile support structure
- One (1) Dead-end/pull off structure
- Ground conductors, ground rods, and associated hardware for a complete grounding system, including ground wells if needed
- Underground conduits, pull boxes, and junction boxes
- Installing three single phase line capacitor coupled voltage transformer for the new Gen-Tie line protection
- Install one line dead-end structure and line disconnect switch.
- Civil foundations and ground connections

Additional work within the PG&E Mesa Substation consists of installing telecommunications, monitoring and metering equipment.

6 OPERATION AND MAINTENANCE DETAILS

The Caballero BESS will be an unmanned facility, meaning that it does not require full-time employees to perform operations and maintenance activities. Instead, routine maintenance will be performed by regional staff typically on an annual basis. Maintenance may include:

- Replacing batteries that are not performing at their peak
- Changing the oil in transformers (either the main transformer in the Project substation or in the smaller transformers adjacent to the inverters)
- Maintenance of all ancillary systems – fire suppression, storm water, access roads, etc.