**Additional notes to be added to the North Kohala Microgrid BESS Project Single Line Diagram**

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| Proposed Project Name: | North Kohala Microgrid BESS |
| Proposed Project Size: | 5 MW, 22 MWh BESS (Minimum) |
| Customer SLD Revision Number and Date: |  |
| HELCO SLD Revision Number and Date: | Revision 0, 09-09-2021 |
| HELCO Substation: | Hawi |
| HELCO 34kV Circuit: | 3300 Line |
| HELCO 34kV Circuit Breaker #: | TBD |

**Transmission Planning Notes**

1. Customer to ensure manual closing of Project breaker XX-1[TBD] shall be allowed for the following conditions under coordination with the Company system operator:
	1. Hot line (company-side) and hot bus (project-side) with supervised synchro-check for self-energization using grid forming capabilities
		1. Voltages equal in magnitude and phase, and phase angle difference less than 20°
	2. Dead-line (company-side) and hot bus (project-side) for black start capabilities
	3. Hot line (company-side) and dead bus (project-side)
2. There shall be no auto-reclosing on Project breaker XX-1[TBD].

**Protection Notes**

1. The 34 kV bus at [Name TBD] shall have dual differential bus protection relays which will trip and block close HELCO breakers 52-1 and 52-2, and Project breaker XX-1 via manual lockout relays.
2. All 34 kV lines at [Name TBD] HELCO side shall have dual redundant, high-speed line protection relays with separate and diverse communication channels. The remote ends at the Maliu Ridge, Halaula, and Hawi substations shall have the same.
3. Breaker failure of HELCO 34 kV breaker 52-1 or 52-2 at [Name TBD] HELCO side shall trip and block close Project breaker XX-1[TBD] via separate dedicated lockout relay.
4. Breaker failure of HELCO 34 kV breaker 52-1 (or 52-2, whichever is connected to HRD and Waimea) at [TBD] HELCO side shall trip and block close the Waimea and HRD breakers via a separate dedicated lockout relay.
5. Breaker failure of Project breaker XX-1[TBD] shall trip developer-owned dedicated lockout relay which will trip dedicated lockout relay in HELCO side. Dedicated lockout relay in HELCO side will trip and block close HELCO 34 kV breakers 52-1 and 52-2.

**Design Notes**

1. All 34 kV CT’s are to be xxxx/5 MRCT’s with relaying accuracy class C400 unless noted otherwise. MRCT’s are to have full distributed windings on all taps and a minimum thermal rating factor of 2.0.
2. HELCO to provide two bi-directional A and B meters that records both import and export power and revenue metering CTs and PTs.
3. The Project will submit design drawings to HELCO for review and comment.
4. The communications for the primary and secondary pilot protection relays and breaker failure communication for the Developer tie line must be on diverse communication routes.
5. For Telecom requirements (such as communications, etc.), refer to the Telecom SLD.
6. For the microgrid control system design and operation philosophy, refer to the Appendix O of the RFP.

**System Operations Notes**

1. Upon simultaneous communication channels failure longer than 6 seconds for the following channels:
	1. (only applicable if HELCO applies Line Diff Protection) Protection Channels X & Y (as applicable) HELCO-owned protection relay to initiate a “loss of protection communication” alarm to HELCO dispatch.
		1. After 30 seconds of simultaneous failure the HELCO-owned relays are to provide signal to Project to initiate Project perform a controlled ramp of the plant output to 0 MW net. At zero (0) MW, Project to trip Project breaker XX-1[TBD]
	2. Telemetry and Control Channels A & B HELCO-owned RTU to initiate a “loss of communication” alarm to HELCO dispatch.
2. The following Developer’s inputs shall be provided and direct hard wired to HELCO’s recorder:
	1. Status of all Developer’s 35kV breaker
	2. Status of all lockouts for Developer’s breaker
	3. 34kV voltage (3-ph) at point of interconnection
	4. 34kV current (3-ph) at point of interconnection
3. HELCO load dispatcher shall be enabled to issue the following to the Facility via SCADA interface:
	1. Active power set point control signal (analog MW); and
	2. Voltage (analog kV) set point control signal.
	3. Frequency Response mode (droop, isochronous, disabled)
	4. Grid Forming Control (enable/disable)
	5. Transition to islanding Mode (enable/ disable)
	6. 34kV Project breaker (trip/close)
4. All control values must be retained in non-volatile memory such that will be restored immediately upon return from Plant Controller restart, power outage, loss of communication, etc.
5. The Project will provide the following signals for telemetering to the HELCO RTU:
	1. 34kV line amps (3 phase), watts, vars, and voltage (3 phase)
	2. Status of the Project breaker XX-1[TBD]]
	3. Status of all lockouts
	4. Active Power Control Interface Status indicating Local vs. HELCO
	5. Latest received active power set point
	6. Automatic Voltage Regulator Status – Normal or Alarm (regulator On or Off)
	7. Grid Forming Status (Enabled/Disabled)
	8. Frequency Response mode (droop, isochronous, disabled)
	9. Latest received voltage setpoint (kV)
	10. Status for each inverter
	11. MW output for each inverter
	12. MW set point for each inverter
	13. BESS State of Charge (%)
	14. Available Maximum Ramp Rate (MW/min)
	15. Power Production of Facility (MW)
	16. Number of Inverters Available
	17. Facility Inverter Availability (%)
	18. Frequency Droop percent and deadband settings (% & Hz)
6. Each of the following initiates a separate alarm to HELCO load dispatcher:
	1. Protection and RTU Loss of Communication