April 8, 2019

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PUBLIC UTILITIES COMMISSION

The Honorable Chair and Members of the
Hawai'i Public Utilities Commission
Kekuanao'a Building, First Floor
465 South King Street
Honolulu, Hawai'i 96813

Subject: Docket No. 2017-0352 – To Institute a Proceeding Relating to a Competitive Bidding Process to Acquire Dispatchable and Renewable Generation
Draft Requests for Proposals – Technical Attachments

Dear Commissioners:

This letter and attached exhibits are being submitted by the Hawaiian Electric Companies[1] as a supplement to their proposed documentation for their Stage 2 competitive bidding process filed with the Commission on April 1, 2019 in response to Order No. 36187 *Providing Guidance in Advance of the Hawaiian Electric Companies' Phase 2 Draft Request for Proposals for Dispatchable and Renewable Generation* issued February 27, 2019 in the subject proceeding ("Order 36187"). The exhibits are the technical attachments for the Draft PV RDG PPA, Draft Wind RDG PPA and Draft ESPPA for the islands of Hawai'i and Maui.

The Companies submitted the Draft PV RDG PPA, Draft Wind RDG PPA, and Draft ESPPA for the island of O'ahu on April 1, 2019. The PPAs and ESPPAs for Hawai'i Electric Light and Maui Electric will be very similar to the Draft RDG PPAs and Draft ESPPA for O'ahu with the exception of technical and performance standards. As noted in our April 1, 2019 filing in this docket, the Companies determined it would be more efficient to file one version of the Draft RDG PPAs and ESPPA, receive comments, revise such drafts and then create versions of agreements for Hawai'i Electric Light and Maui Electric, as opposed to making identical or very similar edits in three different documents at one time. The Companies stated in its April 1, 2019 filing that it would be filing the separate technical attachments for each island on April 8, 2019, however, as the technical attachments are the same for the islands of Maui and Hawai'i, the Companies are filing a common document in the interest of efficiency.

The Companies respectfully submit their draft technical attachments to the Draft PPAs and ESPPAs for Hawai'i Electric Light and Maui Electric, as provided in the following exhibits:

Exhibit 1 – Maui Electric and Hawai'i Electric Light's Attachment B - Facility Owned By Seller;

[1] The "Hawaiian Electric Companies" or "Companies" are Hawaiian Electric Company, Inc., Hawai'i Electric Light Company, Inc. ("Hawai'i Electric Light"), and Maui Electric Company, Limited ("Maui Electric").

Exhibit 2 – Maui Electric and Hawai'i Electric Light's Attachment N – Acceptance Test General Criteria;

Exhibit 3 – Maui Electric and Hawai'i Electric Light's Attachment O – Control Systems Acceptance Test Criteria;

The draft attachments to the proposed model agreements will be made available to the public on Hawaiian Electric's website at www.hawaiianelectric.com/competitivebidding ("RFP Website").

Sincerely,

Kevin M. Katsura
Director
Regulatory Non-Rate Proceedings

Attachments

cc: Division of Consumer Advocacy (with Attachments)

[ATTACHMENT B WILL BE REVISED TO REFLECT THE RESULTS OF IRS]

ATTACHMENT B
FACILITY OWNED BY SELLER

1. The Facility.

(a) Drawings, Diagrams, Lists, Settings and As-Builts.

(i) Single-Line Drawing, Interface Block Diagram, Relay List, Relay Settings and Trip Scheme. A preliminary single-line drawing (including notes), Interface Block Diagram, relay list, relay settings, and trip scheme of the Facility shall, after Seller has obtained prior written consent from Company, be attached to this Agreement on the Execution Date as Attachment E (Single-Line Drawing and Interface Block Diagram) and Attachment F (Relay List and Trip Scheme). A final single-line drawing (including notes), Interface Block Diagram, relay list and trip scheme of the Facility shall, after having obtained prior written consent from Company, be labeled the "Final" Single-Line Drawing, the "Final" Interface Block Diagram and the "Final" Relay List and Trip Scheme and shall supersede Attachment E (Single-Line Drawing and Interface Block Diagram) and Attachment F (Relay List and Trip Scheme) to this Agreement and shall be made a part hereof on the Commercial Operations Date. After the Commercial Operations Date, no changes shall be made to the "Final" Single-Line Drawing, the "Final" Interface Block Diagram and the "Final" Relay List and Trip Scheme without the prior written consent of Seller and Company. The single-line drawing shall expressly identify the Point of Interconnection of Facility to Company System.

(ii) As-Builts. Seller shall provide final as-built drawings of the Seller-Owned Interconnection Facilities within 30 Days of the successful completion of the Acceptance Test.

(iii) Modeling. Seller shall provide the models as set forth in Exhibit B-1.

(iv) No Material Changes. Seller agrees that no material changes or additions to the Facility as reflected in the "Final" Single-Line Drawing (including notes), the "Final" Interface Block Diagram, and the "Final" Relay List and Trip Scheme shall be made without Seller first having obtained prior written consent from Company. The foregoing are subject to changes and additions as part of any Performance Standards Modifications. If Company directs any changes in or additions to the Facility records and operating procedures that are not part of any Performance Standards Modifications, Company shall specify such changes or additions to Seller in writing, and, except in the case of an emergency, Seller shall have the opportunity to review and comment upon any such changes or additions in advance.

(b) Certain Specifications for the Facility.

(i) Seller shall furnish, install, operate and maintain the Facility, including breakers, relays, switches, synchronizing equipment, monitoring equipment and control and protective devices approved by Company as suitable for parallel operation of the Facility with Company System. The Facility shall be accessible at all times to authorized Company personnel.

(ii) The Facility shall include:

[LIST OF THE FACILITY]

Examples may include, but are not limited to:

- **Seller-Owned Interconnection Facilities**
- **Substation**
- **Control and monitoring facilities**
- **Transformers**
- **Generating and/or Battery Energy Storage System ("BESS") equipment (as described in Attachment A)**
- **"Lockable" cabinets or housings suitable for the installation of the Company-Owned Interconnection Facilities located on the Site**

- **Relays and other protective devices**
- **Leased telephone line and/or equipment to facilitate microwave communication**

(iii) The Facility shall comply with the following **[includes excerpts of language that may be requested by Company]:**

A. Seller shall install a ____ kV gang operated, load breaking, lockable disconnect switch and all other items for its switching station (relaying, control power transformers, high voltage circuit breaker). Bus connection shall be made to a manually and automatically (via protective relays) operated high-voltage circuit breaker. The high-voltage circuit breaker shall be fitted with bushing style current transformers for metering and relaying. Downstream of the high-voltage circuit breaker, a structure shall be provided for metering transformers. From the high-voltage circuit breaker, another bus connection shall be made to another pole mounted disconnect switch, with surge protection.

B. Seller shall provide within the Seller-Owned Interconnection Facilities a separate, fenced area with separate access for Company. Seller shall provide all conduits, structures and accessories necessary for Company to install the Revenue Metering Package. Seller shall also provide within such area, space for Company to install its communications, supervisory control and data acquisition ("SCADA") equipment (remote terminal unit or equivalent) and certain relaying if necessary for the interconnection. Seller shall also provide AC and DC source lines as specified by Company. Seller shall provide a telephone line for Company-owned meters. Seller shall work with Company to determine an acceptable location and size of the fenced-in area. Seller shall provide an acceptable demarcation cabinet on its side of the fence where Seller and Company wiring will connect/interface.

C. Seller shall ensure that the Seller-Owned Interconnection Facilities have a lockable cabinet for switching station relaying equipment. Seller shall select and install relaying equipment acceptable to Company. At a minimum, the relaying equipment will provide over and under frequency (81), negative phase sequence (46), under voltage (27), over voltage (59), ground over voltage (59G), over current functions (50/51) and direct transfer trip (if required). The settings shall be consistent with the requirements for over/under frequency and voltage ride-through. Seller shall install protective relays that operate a lockout relay (86), which in turn will trip the main circuit breaker and not allow it to be reclosed without reset.

D. [RESERVED]

E. Seller's equipment also shall provide at a minimum:

(i) Interface with Company's Telemetry and Control, or designated communications and control interface, to provide telemetry of electrical quantities such as total Facility net MW, MVar, power factor, voltages, currents, and other quantities as identified by the Company.

(ii) Interface with Company's Telemetry and Control, or designated communications and control interface, to provide status for circuit breakers, reactive devices, switches, and other equipment as identified by the Company.

(iii) Interface with Company's Telemetry and Control, or designated communications and control interface, to provide control to incrementally raise and lower the voltage target at the point of regulation operating in automatic voltage regulation control.

(iv) Interface with Company's Telemetry and Control, or designated communications and control interface, to provide the active power control requirements of this Agreement. More than one interface may be required if Facility energy components, such as a BESS and variable generation resource are controlled separately by the Company (as in grid-charging BESS.

(v) Interface with Company's Telemetry and Control, or designated communications and control interface, for the Company to specify control system modes of operation and parameters, for remotely configurable parameters and operating states required under this Agreement.

(vi) For Variable Energy Facilities: Interface with Company's Telemetry and Control, or designated communications and control interface, to provide telemetry of equipment availability and meteorological and production data required under Section 8 (Data and Forecasting) of this Attachment B (Facility Owned by Seller) and the Facility's Power Possible.

(vii) Provision for Loss of Telemetry and Control: If Company's Telemetry and Control, or designated communications and control interface, is unavailable, due to loss of communication link, Telemetry and Control failure, or other event resulting in loss of the remote control by Company, provision must be made for Seller to be able to institute via local controls, within 5 minutes (or such other period as Company accepts in writing) of the verbal directive by the Company System Operator, such change in voltage regulation target and real power export or import as directed by the Company System Operator.

F. If Seller adds, deletes and/or changes any of its equipment, or changes its design in a manner that would change the characteristics of the equipment and specifications used in the IRS, Seller shall be required to obtain Company's prior written approval. If an analysis to revise parts of the IRS is required, Seller shall be responsible for the cost of revising those parts of the IRS and modifying and paying for the cost of the modifications to the Facility and/or the Company-Owned Interconnection Facilities based on the revisions to the IRS.

G. Critical Infrastructure Protection.

(i) Documentation. Seller shall submit documentation describing the approach, methodology and design to provide physical and cyber security with its submittal of the design drawings pursuant to Section 1(c) (Design Drawings, Bill of Materials, Relay Settings and Fuse Selection) of Attachment B (Facility Owned by Seller), which shall be at least sixty (60) Days prior to the Acceptance Test.

- The design shall meet industry standards and best practices, as indicated by NERC CIP guidelines and requirements for critical generation facilities. The system shall be designed with the criteria to meet applicable industry standards and guidelines (at the time of this writing, NERC CIP, or any future standard adopted by the industry in its place) compliance requirements and identify areas that are not consistent with NERC CIP guidelines and requirements.

- The cyber-security documentation shall include a block diagram of the control system with all external connections clearly described.

- Seller shall provide such additional information as Company may reasonably request as part of a security posture assessment.

- Company shall be notified in advance when there is any condition that would compromise physical or cyber security, or if any breaches in security, or security incidents are detected.

(ii) Malware. Seller shall (consistent with the following sentence) ensure that no malware or similar items are coded or introduced into any aspect of the Facility, Interconnection Facilities, the Company Systems interfacing with the Facility and Interconnection Facilities, and any of Seller's critical control systems or processes used by Seller to provide energy, including the information, data and other materials delivered by or on behalf of Seller to Company, (collectively, the "Environment"). Seller will continue to review, analyze and implement improvements to and upgrades of its Malware prevention and correction programs and processes that are commercially reasonable and consistent with the then current technology industry's standards and, in any case, not less robust than the programs and processes implemented by Seller with respect to its own information systems. If Malware is found to have been introduced into the Environment, Seller will promptly notify Company and Seller shall take immediate action to eliminate and remediate the effects of the Malware, at Seller's expense. Seller shall not modify or otherwise take corrective action with respect to the Company Systems except at Company's request. Seller will promptly report to Company

the nature and status of all Malware elimination and remediation efforts.

(iii) Security Breach. In the event that Seller discovers or is notified of a breach, potential breach of security, or security incident at Seller's Facility or of Seller's systems, Seller shall immediately (i) notify Company of such potential, suspected or actual security breach, whether or not such breach has compromised any of Company's confidential information; (ii) investigate and promptly remediate the effects of the breach, whether or not the breach was caused by Seller; (iii) cooperate with Company with respect to any such breach or unauthorized access or use; (iv) comply with all applicable privacy and data protection laws governing Company's or any other individual's or entity's data; and (v) to the extent such breach was caused by Seller, provide Company with reasonable assurances satisfactory to Company that such breach, potential breach, or security incident shall not recur. Seller shall provide documentation to Company evidencing the length and impact of the breach. Any remediation of any such breach will be at Seller's sole expense.

(iv) Monitoring and Audit. Seller shall provide information on available audit logs and reports relating to cyber and physical and security. Company may audit Seller's records to ensure Seller's compliance with the terms of this Section 1(b)(iii)(G) (Critical Infrastructure Protection) of this Attachment B (Facility Owned by Seller), provided that Company has provided reasonable notice to Seller and any such records of Seller's will be treated by Company as confidential.

H. Available Power Production

(i) Variable Energy Systems. Seller's available power production considering equipment and resource availability (Power Possible) will be determined at any given time using the best-available data and methods for an accurate representation of the amount of active power at the Point of Interconnection.

(ii) Variable Energy Systems Paired with Storage Operated through a Single Active Power Control Interface. For variable energy systems paired with storage operated through a single active power control interface (i.e., charging indirectly controlled through dispatch), Seller's available power production considering equipment and resource availability and state of charge of the storage (Power Possible) will be determined at any given time using the best-available data and methods for an accurate representation of the amount of active power at the Point of Interconnection. Telemetry will be provided to indicate state of charge, including available estimated duration at the current dispatch given state of charge and forecast production.

(iii) Storage Directly Controlled by the Company. Seller's available power production considering state of charge (Power Possible) will be supplied as an accurate representation of the amount of maximum and minimum (negative) available active power at the Point of Interconnection and the duration available at the current dispatch. If the Facility allows for allocation of capacity to different modes of operation (i.e., reservation of capacity for regulation or contingency response), then the available capacity in each allocated region shall be reported individually and

controlled separately through separately designated dispatch or active power control interface.

I. For variable resources where Power Possible is derived, in part or in whole, from a measured available variable energy source such as solar or wind: To the extent available, the Parties shall use Seller's real time Power Possible communicated to Company through the SCADA System except to the extent that the Potential Energy does not accurately reflect the actual available active power at the Point of Interconnection (plus or minus 0.1 MW). During those periods of time when the SCADA derived Power Possible is unavailable or does not accurately represent the available power production considering equipment and resource availability, the Parties shall use the best available data obtained through commercially reasonable methods to determine the Power Possible. Follow up actions to resolve the discrepancy will be as provided in Section 1(j) (Demonstration of Facility) of this Attachment B (Facility Owned by Seller).

J. Seller shall reserve space within the Site for possible future installation of Company-owned meteorological equipment (such as wind speed, direction and relative humidity monitors, SODAR and irradiance monitors) and AC and DC source lines for such equipment as may be required depending on the Facility resource type and location. In the event Company decides to install such meteorological equipment: (i) Seller shall work with Company to determine an acceptable location for such equipment and any associated wiring, interface or other components; and (ii) Company shall pay for the needed equipment, and installation of such equipment, unless otherwise agreed to by the Parties. Company and Seller shall use commercially reasonable efforts to facilitate installation and minimize interference with the operation of the Facility.

K. The Facility shall, at a minimum, satisfy the wind load and seismic load requirements of the International Building Code and any more stringent requirements imposed under applicable Laws.

(c) Design Drawings, Bill of Material, Relay Settings and Fuse Selection. Seller shall provide to Company for its review the design drawings, Bill of Material, relay settings and fuse selection for the Facility, and Company shall have the right, but not the obligation, to specify the type of electrical equipment, the interconnection wiring, the type of protective relaying equipment, including, but not limited to, the control circuits connected to it and the disconnecting devices, and the settings that affect the reliability and safety of operation of Company's and Seller's interconnected system. Seller shall provide the relay settings, fuse selection, and AC/DC Schematic Trip Scheme (part of design drawings) for the Facility to Company at least sixty (60) Days prior to the Acceptance Test. Company, at its option, may, with reasonable frequency, witness Seller's operation of control, synchronizing, and protection schemes and shall have the right to periodically re-specify the settings. Seller shall utilize relay settings prescribed by Company, which may be changed over time as Company System requirements change.

(d) Disconnect Device. Seller shall provide a manually operated disconnect device which provides a visible break to separate Facility from Company System. Such disconnect device shall be lockable in the OPEN position and be readily accessible to Company personnel at all times.

(e) Other Equipment. Seller shall install, own and maintain the infrastructure associated with the Revenue Metering Package, including but not limited to all enclosures (meter cabinets, meter pedestals, meter sockets, pull boxes, and junction boxes, along with their grounding/bonding connections), CT/PT mounting structures, conduits and ductlines, enclosure support structures, ground buses, pads, test switches, terminal blocks, isolation relays, telephone surge suppressors,

and analog phone lines (one per meter), subject to Company's review and approval.

(f) Maintenance Plan. Seller shall maintain Seller-Owned Interconnection Facilities in accordance with Good Engineering and Operating Practices.

(g) Active Power Control Interface. **[COMPANY TO REVISE THIS SECTION BASED ON SPECIFICS OF THE PROJECT.]**

(i) Seller shall provide and maintain in good working order all equipment, computers and software associated with the control system (the "Active Power Control Interface") necessary to interface the Facility active power controls with the Company System Operations Control Center for real power control of the Facility by the Company System Operator.

The detailed design will be tailored to the specific resource type and configuration to achieve the functional requirements of the Facility.

The Active Power Control Interface will be used to control the net real power export (or import, as applicable) from the Facility for load following, system balancing, energy arbitrage, and/or supplemental frequency control as required under this Attachment B (Facility Owned by Seller).

For variable resources paired with storage: The implementation of the Active Power Control Interface will allow the Company System Operator to control the net real power export (or import, as applicable) from the entire Facility, up to Power Possible, remotely from the Company System Operations Control Center through control signals from the Company System Operations Control Center. The Facility will maintain the power level specified by the Company through the variable resource and BESS available energy, subject to the availability of resource and BESS State of Charge.

For facilities with grid charging storage, the Active Power Control interface may also direct the charging/discharging of energy from the BESS.

The Facility real power output (or import, if storage charging is enabled) will automatically adjust to a change in frequency in accordance with the frequency response requirements provided in this Attachment B (Facility Owned by Seller).

(ii) Company shall review and provide prior written approval of the design for the Active Power Control Interface to ensure compatibility with Company's centralized control systems and use of Facility available energy and storage capabilities. To ensure such continued compatibility, Seller shall not materially change the approved design without Company's prior review and written approval. This will include design description and parameters for the Seller's control system(s), which determine provision of net real power from the variable resource System (i.e., wind or PV) and/or the BESS storage, and charging of the BESS storage, in response to the Active Power Control signal or signals.

(iii) The Active Power Control Interface shall include, but not be limited to, a demarcation cabinet, ancillary equipment and software necessary for Seller to connect to Company's Telemetry and Control, located in Company's portion of the Facility switching station which shall provide the control signals to the Facility and send feedback status to the Company System Operations Control Center. The control type shall be analog output (set point) or raise/lower controls and will be established by the Company prior to final design approval.

(iv) The Active Power Control Interface shall also include provision for feedback points from the Facility indicating active power target in MW for the Active Power Control signal(s). The Facility shall provide the MW target feedback to the Company SCADA system immediately upon receiving the respective control signal from the Company.

(v) Seller shall provide to the telemetry interface analogs for the gross production of the energy resource(s) at the Facility (for example, DC or AC MW production of the Variable Resource

generator(s), depending on design; gross DC MW of the BESS, etc.) Seller shall also provide the total net AC MW production at the Point of Interconnection.

(vi) The Active Power Control Interface shall provide for remote control of the real-power output of the Facility by the Company at all times. If the Active Power Control Interface is unavailable or disabled, the Facility may export electric energy to Company if the Company, in its sole discretion, agrees on an alternate means of dispatch. If Seller fails to provide such remote control capability (whether temporarily or throughout the Term), then, notwithstanding any other provision of this Attachment B (Facility Owned by Seller), Company shall have the right to derate or disconnect the entire Facility during those periods that such control capability is not provided.

(vii) The rate at which the Facility changes net real power in response to the active power control shall not be less than the greater of 2 MW per minute or 10% of the Facility capacity per minute, and shall make available through agreed parameters, such faster ramp as the installed equipment can support. The Facility's Active Power Control Interface will be used by Company to control the rate at which electric energy is changed to achieve the active power limit for load-following and regulation. The Facility will respond to the active power control request immediately with an echo of the set point and measurable change within the 4 second control cycle.

(viii) The Facility shall accept the following controls related to active power and frequency response to or from the Company centralized control system:

A. Power Reference Setpoint from Company (based on the input to the Facility, from the Active Power Control Interface): The Facility output shall match this setting from the Variable Resource and/or BESS so long as it can be supported by the variable resource and/or BESS State of Charge (Power Possible does not change). This net output should be accurate

within +/- 0.1 MW under normal frequency conditions. This setpoint will be modified as appropriate in the controls by the appropriate frequency response as defined in Section 1(g)(xi) (Active Power – Frequency Response (DROOP)) of this Attachment B (Facility Owned by Seller).

B. For variable resources: The Facility shall include Variable Resource Enable/Disable control. When "Disable" is selected, the Facility shall ramp down, shutdown, and leave offline variable resource generators. When "Enable" is selected, the Facility WTGs can start up, ramp up, and remain in normal operations subject to Company active power dispatch.

C. From Company: Frequency Response Mode (DROOP, FFR, isochronous) state (where alternate modes of operation are required).

D. From Seller:

- [For Facilities with a BESS and where required]: Capacity allocation to each mode of operation where ability to allocate capacity to different modes of operation is required (e.g., to allocate a portion of capacity to fast frequency response).

- Power Possible (Available maximum capacity): See above, instantaneous limit for available energy, represents max level the Facility can produce under present resource, BESS State of Charge (if applicable) and equipment conditions. This is used as upper limit for Company Dispatch.

- Minimum Sustained Limit: Minimum output level the Facility can be reduced to continuously without delay (ecomn). For projects with BESS: If BESS charging from the grid is permitted, and charging capacity is available, this may be a negative value.

- Minimum Transient Limit (for frequency response, regulation) (lfcmn). For projects with BESS: If BESS charging from the grid is permitted, and charging capacity is available, this may be a negative value.

- Maximum Dispatchable Ramp Rate: Controlled ramp rate available for controlled changes in output.

- For projects with a BESS, Seller shall also provide the following:

  - BESS potential (BESS State of Charge and projected number of hours at present dispatch, minimum dispatch, and maximum dispatch).

  - Frequency Response Mode (DROOP, FFR, isochronous) state (where alternate modes of operation are required).

  - Capacity allocation to each mode of operation (to allow FFR and Droop allocation).

(ix) Seller shall not override Company's active power controls without first obtaining specific approval to do so from the Company System Operator unless there is a system emergency. Disabling of the remote Active Power Control shall initiate telemetry notification to the Company.

(x) The requirements of the Active Power Control Interface may be modified as mutually agreed upon in writing by the Parties.

Active Power Communications between Company and Seller

Company will receive and send AGC Set-Point and related data through the communications interface in accordance with Company standards. The data points covered under this Agreement, as described below, may overlap with data requirements described elsewhere.

AGC Data Points to be sent from Seller to Company via SCADA

The following data points will be transmitted via SCADA from Seller to Company and represent Facility level data **[Note: May be modified based on resource type and Facility requirements]:**

Description	Units
AGC Set-Point (echo)	MW
Power demand	MW
Actual power	MW
Power Possible	MW
Actual reactive power	Mvars
Average Voltage	Kv
Variable Generation potential	MW
[Wind only] Number of turbines online and running	Integer
BESS State of Charge	Pct
[PV only] Inverters online	Integer
Facility duration at current output	HRS
AGC Status	Remote/Local
[For facilities with alternate modes of frequency response] Indication of Frequency Response Mode	Integer FFR, Droop, ISOCH

Response times and limitations of Facility in regards to Active Power Control

The following protocols outline the expectations for responding to the AGC Set-Point.

Frequency of Changes. Company may send a new AGC Set-Point to the Facility at up to the AGC control cycle (present 4 seconds).

Range of AGC Set-Point. The range of set point values can be between 0% and 100% of Power Possible.

Backup Communications

In the event of an AGC failure, Company and Seller shall communicate via telephone, or other method mutually agreeable between the Parties, in order to correct the failure

(xi) Active Power - Frequency Response (DROOP).

The Facility shall provide a primary frequency response with a frequency droop characteristic reacting to system frequency at the Point of Interconnection in both the overfrequency and underfrequency directions except as limited by the minimum and maximum available capacity and energy potential at the time of the event including BESS state of charge. This response must be timely and sustained rather than injected for a short period and then withdrawn. For over-frequency events, response may include absorption through charging (as applicable under the terms of this Agreement). Seller shall provide minimum operational limits for each online resource and the Facility for primary frequency response.

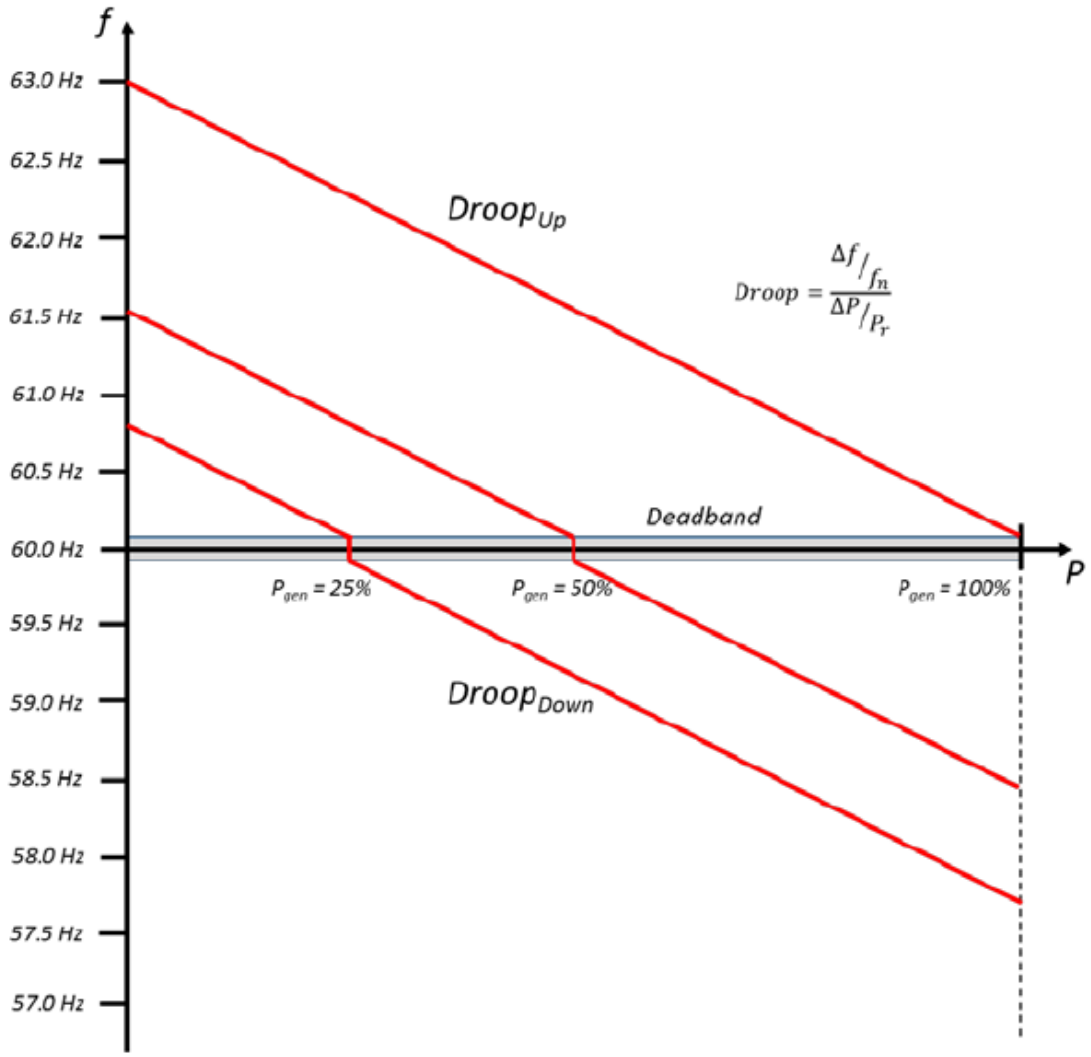
Frequency will be calculated over a period of time (e.g., three to six cycles, or other period as specified by Company), and filtered to take control action on the fundamental frequency component of the calculated signal. Calculated frequency may not be susceptible to spikes caused by phase jumps on the Company system.

The active power-frequency control system, and overall response of the inverter-based resource (plant), must meet the following performance aspects (see figure below):

The active power-frequency control system shall have an adjustable proportional droop characteristic with a default value of [4%] percent. The droop setting shall permit a setting from 0.1% to 10%. This setting shall be changed upon Company's written request as necessary for grid droop response coordination. The droop setting shall be tunable and may be specified during commissioning. The droop shall be a permanent value based on Pmax (maximum nominal active power output of the plant) and Pmin (typically 0 for an inverter based resource). This keeps the proportional droop constant across the full range of operation. The curve for an inverter-based BESS may include the negative active power quadrant of this curve. The droop response must include the capability to respond in both the upward (underfrequency) and downward (overfrequency) directions. Frequency droop will be based on the difference between maximum nameplate active power output (Pmax) and zero output (Pmin) such that the [4%] percent droop line is always constant for a resource.

Seller shall make commercially reasonable efforts to provide frequency response without a deadband, but in any case, not to exceed +/- 0.0166 Hz. If the active power-frequency control system has a deadband, it shall be a nonstep deadband that is adjustable between 0 Hz and the full frequency range of the droop characteristic with a default value not to exceed ± 0.036 Hz. (Nonstep deadband is where the change in active power output starts from zero deviation on either side of the deadband.) (Frequency deadband is the range of frequencies in which the unit does not change active power output.)

Inverter-based resources may consider a small hysteresis characteristic where linear droop meets any deadband to reduce dithering of inverter output when operating near the edges of the deadband. The hysteresis range may not exceed ± 0.005 Hz on either side of the deadband. If measurement resolution is not sufficient to measure this frequency, hysteresis may not be used.



Active Power - Frequency Control Characteristic

Nominal System Frequency is 60.00 Hz.

The closed-loop dynamic response of the active power-frequency control system of the overall inverter-based resources, as measured at the POI must have the capability to meet or exceed the performance specified in below. Seller shall ensure that the models and parameters for the resources and control equipment are consistent with those provided during the IRS process and that any updates have been provided to the Company reflecting currently implemented settings and configuration.

(xii) Dynamic Active Power-Frequency Performance.

For a step change in frequency at the point of measure of the inverter-based resource **[NOTE - MAY BE ADJUSTED AS THE RESULT OF IRS]:**

Reaction time: The time between a step change in frequency and the time when the resource active power output begins responding to the change shall be less than 500 Ms, or as otherwise specified by Company. [1]

Rise time: The time when the resource has reached 90% of the new steady-state (target) active power output shall be less than 4 seconds, or as otherwise specified by Company.[2]

Settling Time: Time in which the resource has entered into, and remains within, the settling band of the new steady-state active power (target) output shall be less than 10 seconds, or as otherwise specified by Company.

Overshoot: Percentage of the rated active power output that the resource can exceed while reaching the settling band shall be less than 5% or as otherwise specified by Company.[3]

Settling Band: Percentage of rated active power output that the resource should settle to within the settling time shall be less than 2.5%.

When operating in parallel with the Company System, the Facility shall operate with its primary frequency response control in automatic operation and in accordance with Company directions. Notification of changes in the status of the frequency response controls and, where applicable, mode of operation must be provided to the Company System Operator immediately through SCADA telemetry indication.

[1] Time between step change in frequency and the time to 10 percent of new steady-state value can be used as a proxy for determining this time.
[2] Percentage based on final (expected) settling value.
[3] Percentage based on final (expected) settling value.

The Facility frequency response control shall adjust, without intentional delay and without regard to the ramp rate limits in Section 3(c) (Ramp Rates) of this Attachment B (Facility Owned by Seller), the Facility's net real power export based on frequency deadband and frequency droop settings specified by the Company.

The Facility frequency response control shall increase the net real power export above the Power Reference Setpoint set under Section 1(g)(viii) of this Attachment B (Facility Owned by Seller) or further decrease the net real power export from the Power Reference Limit in its operations in accordance with the frequency response settings.

The Facility frequency response control shall be in continuous operation directed otherwise by the Company.

(xiii) **[FOR FACILITIES WITH STORAGE].** Alternate Active Power/ Frequency Response Modes. The Facility will provide the capability to supply isochronous or fast frequency response modes of operation, in addition to normal droop, which can be set remotely or locally. The control design shall allow for a bumpless transfer between modes of operation.

A. Fast Frequency Response: The Facility frequency response may be configured to allow for a mode of operation to provide fast frequency response, as an alternative setting to the normal steady-state Frequency Response. When in this mode of operation, the frequency droop characteristic will be configured to charge or discharge with a different set of parameters to allow for a faster and larger proportional charge and discharge in response to frequency changes outside of the configurable deadband.

B. Isochronous / Black Start: The Facility will be capable of operating in a zero droop (isochronous) mode of operation. When in this mode of operation, the frequency droop characteristic will be configured as needed to keep system frequency at a target. In a black

start configuration, the target shall be 60 Hz. If isochronous is specified while in operation, the target shall be initialized to the grid frequency and the target increased or decreased from the Company System through the control interface.

(h) Control System Acceptance Test Procedures.

(i) Conditions Precedent. The following conditions precedent must be satisfied prior to conducting the Control System Acceptance Test:

- Successful Completion of the Acceptance Test.
- Facility has been successfully energized.
- All of the Facility's generators (as applicable) have been fully commissioned.
- The control system computer has been programmed for normal operations.
- All equipment that is relied upon for normal operations (including ancillary devices such as capacitors/inductors, energy storage device, statcom, etc.) shall have been commissioned and be operating within normal parameters.

(ii) Facility Energy Equipment. In the event that all or any portion of the Facility's energy equipment is not available for the duration of the Control System Acceptance Test, the Control System Acceptance Test will have to be re-run from the beginning unless Seller demonstrates to the satisfaction of the Company that the test results attained are consistent with the results that would have been attained if all of the equipment had been available for the duration of the test.

(iii) Procedures. The Control System Acceptance Test will be conducted on Business Days during normal working hours on a mutually agreed upon schedule. No Control System Acceptance Test will be scheduled during the final 21 Days of a calendar year. No later than thirty (30) Days prior to conducting the

Control System Acceptance Test, Company and Seller shall agree on a written protocol setting out the detailed procedure and criteria for passing the Control System Acceptance Test. Attachment O (Control System Acceptance Test Criteria) provides general criteria to be included in the written protocol for the Control System Acceptance Test. Within fifteen (15) Business Days of completion of the Control System Acceptance Test, Company shall notify Seller in writing whether the Control System Acceptance Test(s) has been passed and, if so, the date upon which such Control System Acceptance Test(s) was passed. If any changes have been made to the technical specifications of the Facility or the design of the Facility in accordance with Section 5(f) of Attachment A (Description of Generation, Conversion and Storage Facility), such changes shall be reflected in an amendment to this Agreement, and the written protocol for the Control Systems Acceptance Test shall be based on the Facility as modified. Such amendment shall be executed prior to conducting the Control System Acceptance Test and Company shall have no obligation for any delay in performing the Control Systems Acceptance Test due to the need to complete and execute such amendment.

(i) Facility Security and Maintenance. Seller is responsible for securing the Facility. Seller shall have personnel available to respond to all calls related to security incidents and shall take commercially reasonable efforts to prevent any security incidents. Seller is also responsible for maintaining the Facility, including vegetation management, to prevent security breaches. Seller shall comply with all commercially reasonable requests of Company to update security and/or maintenance if required to prevent security breaches.

(j) Demonstration of Facility. Company shall have the right at any time, other than during maintenance or other special conditions communicated by Seller, to notify Seller in writing of Seller's failure, as observed by Company and set forth in such written notice, to meet the operational and performance requirements specified in Section 1(b)(iii)(H) (Available Power Production), Section 1(g) (Active Power Control Interface) and Section 3 (Performance Standards) of this Attachment B

(Facility Owned by Seller), and to require documentation or testing to verify compliance with such requirements. Upon receipt of such notice, Seller shall promptly investigate the matter, implement corrective action and provide to Company, within thirty (30) Days of such notice, a written report of both the results of such investigation and the corrective action taken by Seller; provided, that, if thirty (30) Days is not a reasonable time period to investigate the matter, implement corrective action and provide such written report, Seller shall complete the foregoing within such longer commercially reasonable period of time agreed to by the Parties in writing. If the Seller's report does not resolve the issue to Company's reasonable satisfaction, the Parties shall promptly commission a study to be performed by one of the engineering firms then included on the OEPR Consultants List to evaluate the cause of the non-compliance and to make recommendations to remedy such non-compliance. Seller shall pay for the cost of the study. The study shall be completed within ninety (90) Days, unless the selected consultant determines such study cannot reasonably be completed within ninety (90) Days, in which case, such longer period of time as the selected consultant determines is necessary to complete such study shall apply. The consultant shall send the study to Company and Seller. Seller (and/or its Third-Party consultants and contractors), at Seller's expense, shall take such action as the study shall recommend with the objective of resolving the non-compliance. Such recommendations shall be implemented by Seller to Company's reasonable satisfaction no later than forty-five (45) Days from the Day the completed study is issued by the consultant, unless such recommendations cannot reasonably be implemented within forty-five (45) Days, in which case, Seller shall implement such recommendations within such longer commercially reasonable period of time agreed to by the Parties in writing. Failure to implement such recommendations within this period shall constitute a material breach of this Agreement.

2. Operating Procedures. **[NOTE: NUMERICAL SPECIFICATIONS IN THIS SECTION 2 MAY VARY DEPENDING ON THE SPECIFIC PROJECT AND THE RESULTS OF THE PROJECT-SPECIFIC INTERCONNECTION REQUIREMENT STUDY.]**

(a) Reviews of the Facility. Company may require periodic reviews of the Facility, maintenance records, available operating procedures and policies, and relay settings, and Seller shall implement changes Company deems necessary for parallel operation or to protect the Company System from damages resulting from the parallel operation of the Facility with the Company System.

(b) Separation. Seller must separate from Company System whenever requested to do so by the Company System Operator pursuant to Article 8 (Company Dispatch) and Article 9 (Personnel and System Safety) of the Agreement.

(c) Seller Logs. Logs shall be kept by Seller for information on unit availability including reasons for planned and forced outages, circuit breaker trip operations, relay operations, including target initiation, and other unusual events. Company shall have the right to review these logs, especially in analyzing system disturbances. Seller shall maintain such records for a period of not less than six (6) years.

(d) Reclosing and Return to Service. Under no circumstances shall Seller, when separated from the Company System for any reason, including tripping during disturbances or due to equipment failure, reclose into the Company System without first obtaining specific approval to do so from the Company System Operator. Ramp rates during return to service shall conform to verbal instructions from the System Operator or Active Power control from Company. Following "system black" conditions, the Facility shall not attempt to automatically reconnect to the grid (unless directed by the Company System Operator) so as to not interfere with blackstart procedures.

(e) Reserved.

(f) Reserved.

(g) Critical Infrastructure Protection. Seller shall comply with the critical infrastructure protection requirements set forth in Section 1(b)(iii)(G) of this Attachment B (Facility Owned by Seller).

(h) Allowed Operations. Facility shall be allowed to export energy to the Company System only when the [_____] circuit is in normal operating configuration served by breaker [_____] at [____] Substation. **[TO BE DETERMINED BY COMPANY BASED ON THE RESULTS AND REQUIREMENTS OF THE IRS]**

3. Performance Standards.

(a) Reactive Power Control. Seller shall control its reactive power by automatic voltage regulation control. Seller shall automatically regulate voltage at a point, the point of regulation, between the Seller's generator terminal and the Point of Interconnection to be specified by Company, to within 0.5% of a voltage or power factor specified by the Company System Operator to the extent allowed by the Facility reactive power capabilities as defined in Section 3(b) (Reactive Power Characteristics) of this Attachment B (Facility Owned by Seller).

(b) Reactive Power Characteristics. **[THESE REQUIREMENTS MAY BE CHANGED BY COMPANY UPON COMPLETION OF THE IRS.**]

(i) The Facility must deliver power up to the Allowed Capacity (MW) at a power factor between 95% lagging and 95% leading to the Company System as illustrated in the **[generator capability]** curve(s) attached to this Agreement as Exhibit B-2, which represents the Facility Composite (Generator and Energy Storage Capability Curve(s)). Facilities with a BESS with grid charging can operate with negative active power. These facilities shall provide automatic voltage control within their reactive capability while acting as a load (charging, negative active power generation). The automatic voltage control aspects of a BESS shall be seamless across the transition from acting as a generating resource to acting as a load. The Facility must be capable of automatically adjusting reactive control to maintain the bus voltage at the Point of Interconnection to meet the scheduled voltage set point target specified by the Company System Operator and be capable of supplying reactive power at the leading/lagging 0.95 power factor at all active power outputs down to zero active

power. The voltage target will be specified remotely by the Company System Operator through the SCADA/EMS. The Facility's voltage set point target must reflect the Company voltage set point target controlled from the SCADA/EMS, without delay. The Facility should not normally operate on a fixed var or fixed power factor unless agreed by Company. The voltage setpoint target and present Facility minimum and maximum reactive power limits based on the Facility Composite capability curve shall be provided to the Company EMS through Company's Telemetry and Control.

(ii) The Facility shall contain equipment able to continuously and actively control the output of reactive power under automatic voltage regulation control reacting to system voltage changes. The response requirements are differentiated for large and small signal disturbance performance characteristics. Small signal disturbances are those that reflect normal variations under non-disturbance conditions, the continuous operation range for voltage ride through: 0.80 pu ≤ V ≤ 1.00 pu at the point of interconnection. Large disturbance is where the voltage at the point of interconnection falls outside the continuous operating range.

(iii) For small signal disturbances, reaction time between the step change in voltage and the reactive power change shall be less than 500 msec (no intentional time delay). The automatic voltage regulation response speed at the point of regulation shall be such that at least 90% of the initial voltage correction needed to reach the voltage control target will be achieved within 1 second following a step change. The percentage of rated reactive power output that the resource can exceed while reaching the settling band shall be less than five percent (5%).

(iv) Large disturbances: Large disturbances are characterized by voltage falling outside of the continuous operating range. The Facility shall adhere to the following characteristics for large disturbances:

The response of each generating resource over its full operating range and for all expected grid conditions should be stable. The dynamic performance of each resource should be tuned to provide this stable response. Company will work with Seller to ensure during the interconnection process that each resource supports Company System reliability and provides a stable transient response to grid events. **[Note - The performance specifications described here may need to be modified based on studies performed for specific interconnections to provide a stable response.]**

Inverter-based resources shall operate in closed loop automatic voltage control at all times to support voltage regulation and voltage stability. Either the individual inverters or the plant-level closed loop automatic voltage controller must operate with a relatively fast response characteristic to mitigate steady-state voltage issues from causing dynamic voltage collapse. The plant-level controller may send voltage or reactive power set point changes to the individual inverters relatively fast, or the inverters will respond locally (depending on control architecture).

For a large disturbance step in voltage, measured at the inverter terminals, where voltage falls outside the continuous operating range, the positive sequence component of the inverter reactive current response must meet the performance specifications set forth below. These parameters may be adjusted following additional study and/or operational testing and performance.

Reaction time: Time between the step change in voltage and when the resource reactive power output begins responding to the change. The reaction time shall be less than 16 msec.

Rise time: Time between a step change in control signal input and when the reactive power output changes by 90 percent of its final value. The rise time shall be less than 100 msec.

Overshoot: Percentage of rated reactive current output that the resource can exceed when reaching the settling band. Overshoot will be determined following the IRS such that any overshoot in reactive power response does not cause Company System voltages to exceed acceptable voltage limits. The magnitude of the dynamic response may be requested to be reduced based on stability studies or actual operational data review.

(v) If the Facility does not operate in accordance with Section 3(b) of this Attachment B (Facility Owned by Seller), Company may disconnect all or a part of Facility from Company System until Seller corrects its operation (such as by installing supplemental reactive power equipment or additional controls modifications, at Seller's expense).

(c) Ramp Rates.

Seller shall ensure that the ramp rate of the Facility is less 2 MW a minute for all conditions other than those under control of the Company System Operator and/or those due to desired frequency response, including start up, depletion of storage charge and resource, locally controlled startup and shut down.

(d) Ride-Through.

Ride-Through requires that the resource continues to inject current within the "No Trip" zone of the voltage and frequency ride-through regions. Unless approved during the Interconnection Requirements Study analysis, resources should not use "momentary cessation" within the ride-through regions.

(e) Undervoltage Ride-Through.

The Facility, as a whole, will meet the following undervoltage ride-through requirements during low voltage affecting one or more of the three voltage phases ("V" is the voltage of any three voltage phases at the Point of Interconnection). For alarm conditions the Facility shall not disconnect from the Company System unless the Facility's equipment is at risk of damage. This is necessary in order to coordinate with

the existing Company System. **[THESE VALUES MAY BE CHANGED BY COMPANY UPON COMPLETION OF THE IRS. WITHOUT LIMITATION, FOR A DISTRIBUTION-CONNECTED FACILITY, UPON COMPLETION OF THE IRS THE COMPANY MAY SPECIFY REQUIREMENTS FOR A MANDATORY DISCONNECTION FROM THE COMPANY SYSTEM.]:**

0.80 pu ≤ V ≤ 1.00 pu	The Facility remains connected to the Company System and in continuous operation.
0.00 pu ≤ V < 0.80 pu	The Facility remains connected to the Company System and in continuous operation for a minimum of 600 milliseconds per event (while "V" remains in this range). The Facility may initiate an alarm if "V" remains in this range for more than 600 milliseconds; the duration of the event is measured from the point at which the voltage drops below 0.80 pu and ends when the voltage is at or above 0.80 pu. The 600 milliseconds represents a delayed clearing time of 30 cycles plus breaker opening time.

Protective Undervoltage Relaying (27) shall be set to alarm only to meet the above ride-through requirements, and shall not initiate a disconnect from the Company System unless Seller reasonably determines based upon Good Engineering and Operating Practices that the Facility's equipment is at risk of damage. This is necessary in order to coordinate with the existing Company System.

Seller shall have sufficient capacity to fulfill the above mentioned requirements to ride-through subsequent events 300 cycles or more apart, between which the voltage at the POI recovers above 0.80 pu. **[THE ACTUAL RIDE-THROUGH TIMES WILL BE DETERMINED BY COMPANY IN CONNECTION WITH THE IRS]**

(f) Over Voltage Ride-Through.

The overvoltage protection equipment at the Facility shall be set so that the Facility will meet the following overvoltage ride-through requirements during high voltage affecting one or more of the three voltage phases (as described below) ("V" is the voltage of any of the three voltage phases at the Point of Interconnection). For alarm conditions the Facility should not disconnect from the Company System unless the Facility's equipment is at risk of damage. This is necessary in order to coordinate with the existing Company System. **[THESE VALUES MAY BE CHANGED BY THE COMPANY UPON COMPLETION OF THE IRS. WITHOUT LIMITATION, FOR A DISTRIBUTION-CONNECTED FACILITY, UPON COMPLETION OF THE IRS THE COMPANY MAY SPECIFY REQUIREMENTS FOR A MANDATORY DISCONNECTION FROM THE COMPANY SYSTEM AT V > 1.2 pu. RIDE-THROUGH REQUIREMENTS FOR OTHER SYSTEMS WILL BE DETERMINED IN THE IRS.]:**

1.00 pu < V ≤ 1.10 pu	The Facility remains connected to the Company System.
1.10 pu < V ≤ 1.15 pu	The Facility remains connected to the Company System and in continuous operation no less than 30 seconds; the duration of the event is measured from the point at which the voltage increases at or above 1.1 pu and ends when voltage is at or below 1.1 pu.
V > 1.15 pu	The Facility remains connected to the Company System and in continuous operation for as long as possible as allowed by the equipment operational limitations.

Protective Overvoltage Relaying (59) shall be set to alarm only to meet the above ride-through requirements, and shall not initiate a disconnect from the Company System unless Seller reasonably determines based upon Good Engineering and Operating Practices that the Facility's equipment is at risk of damage. This is

necessary in order to coordinate with the existing Company System.

(g) Transient Stability Ride-Through.

The Facility shall be designed such that the transient stability of Company System is maintained for normally cleared and secondarily cleared faults. The Facility will be required to remain connected through anticipated rates of change of frequency **[TO BE PROVIDED UPON COMPLETION OF IRS].**

(h) [RESERVED]

(i) Underfrequency ride-through.

The Facility shall meet the following underfrequency ride-through requirements during an underfrequency disturbance, and export of power shall continue with output adjusted as appropriate for Facility droop response specified in Section 1(g)(xi) (Active Power – Frequency Response (DROOP)) of this Attachment B (Facility Owned by Seller) ("f" is the Company System frequency at the Point of Interconnection):

57.0 Hz ≤ f ≤ 60.0 Hz	The Facility remains connected to the Company System and in continuous operation.
56.0 Hz ≤ f < 57.0 Hz	The Facility remains connected to the Company System and in continuous operation for at least six (6) seconds per event. The duration of the event is from the point at which the frequency is below 57 Hz and ends when the frequency is at or above 57 Hz. The Facility may initiate an alarm if frequency remains in this range for more than six (6) seconds.
f < 56.0 Hz	The Facility remains connected to the Company System and in continuous operation for the

	duration allowed by the equipment operational limitations. The Facility may initiate an alarm immediately.

Protective Underfrequency Relaying (81U) shall be set to alarm only to meet the above ride-through requirements, and shall not initiate a disconnect from the Company System unless Seller reasonably determines based upon Good Engineering and Operating Practices that the Facility's equipment is at risk of damage. This is necessary in order to coordinate with the existing Company System.

Any tripping on calculated frequency should be based on accurately calculated and filtered frequency measurement over a time frame of minimum six cycles, or other period as specified by the Company, and should not use an instantaneously calculated value.

(j) Overfrequency ride-through.

The Facility will behave as specified below for overfrequency conditions, and export of power shall continue with output adjusted as appropriate for Facility droop response specified in Section 1(g)(xi) (Active Power – Frequency Response (DROOP)) ("f" is the Company System frequency at the Point of Interconnection):

60.0 Hz < f ≤ 61.5 Hz	The Facility remains connected to the Company System and in continuous operation.
61.5 Hz < f ≤ 63.0 Hz	The Facility remains connected to the Company System for at least ten (10) seconds. After ten seconds the Facility may initiate an alarm and the Facility remains connected and producing power for the duration allowed by the equipment operational limitations. The duration of condition is from the point at which the frequency is above

	61.5 Hz and ends when the frequency is at or below 63.0 Hz.
f > 63.0 Hz	The Facility remains connected to the Company System for the duration allowed by the equipment operational limitations. The Facility may initiate an alarm immediately.

Protective Overfrequency Relaying (81O) shall be set to alarm only to meet the above ride-through requirements, and shall not initiate a disconnect from the Company System unless Seller reasonably determines based upon Good Engineering and Operating Practices that the Facility's equipment is at risk of damage. This is necessary in order to coordinate with the existing Company System.

Any tripping on calculated frequency should be based on accurately calculated and filtered frequency measurement over a time frame of minimum six cycles, or other period as specified by the Company, and should not use an instantaneously calculated value.

(k) Successive Faults.

If the resource necessitates tripping to protect from the cumulative effects of those successive faults, in a period of time to ensure safety and equipment integrity, the constraint and time periods should be provided for inclusion in the interconnection study. For all cases, at a minimum, the ride-through requirements shall be met for two ride-through events within two seconds to allow for the Company's transmission automatic reclosing attempt. **[Note - this requirement may be modified based on the results of the IRS.]**

(l) Rate of Change of Frequency ("ROCOF")

The inverter-based resources in the Facility shall not use rate-of-change-of-frequency protection unless an equipment limitation exists that requires the inverter to trip on high ROCOF. Any ROCOF tripping must be approved by Company.

(m) Phase Angle Shift Ride-Through.

The Facility equipment shall ride through phase angle shift of up to ([ ]) **[Note – requirements will depend on Facility].** Inverter phase lock loop (PLL) loss of synchronism shall not cause the inverter to trip or enter momentary cessation within the voltage and frequency ride-through region. Inverters must be capable of riding through temporary loss of synchronism, and regain synchronism, without causing a trip or momentary cessation of the resource.

(n) DC Protection.

If the Facility requires DC reverse current protection, such protection must be coordinated with the inverter equipment module ratings and set to operate for short circuits on the DC side. DC reverse current protection shall not operate for transient overvoltage or for AC-side faults.

(o) Voltage Flicker.

Any voltage flicker on the Company System caused by the Facility shall not exceed the limits stated in IEEE Standard 1453-2011, or latest version "Recommended Practice – Adoption of IEC 61000-4-15:2010, Electromagnetic compatibility (EMC) – Testing and measurement techniques – Flickermeter – Functional and design specifications".

(p) Harmonics.

Harmonic distortion at the Point of Interconnection caused by the Facility shall not exceed the limits stated in IEEE Standard 519-1992, or latest version "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems". Seller shall be responsible for the installation of any necessary controls or hardware to limit the voltage and current harmonics generated from the Facility to defined levels.

(q) Grid Forming Capabilities.

[NOTE APPLICABILITY BASED ON RESOURCE TYPE AND DESIGN, FOR INVERTER BASED RESOURCES] Grid forming inverter

capability is the capability of an inverter to support System operation under normal and emergency conditions without relying on the characteristics of synchronous machines. This includes operation as a current independent ac voltage source during normal and transient conditions (as long as no limits are reached within the inverter), and the ability to synchronize to other voltage sources or operate autonomously if a grid reference is unavailable.

(r) Black Start Capability.

[NOTE - APPLICABILITY BASED ON RESOURCE TYPE AND DESIGN, FOR INVERTER BASED RESOURCES] [For synchronous machines, require capability to operate in isochronous control and black start.] The BESS storage shall be capable of grid forming inverter capability so it can generate its own AC waveform rather than relying on a grid voltage to synchronize and maintain frequency. Further, inverter-based resources shall ensure they have sufficient energy storage to maintain power injection to the grid during system restoration (i.e., have power available when and if called upon). Inverter based facilities should be capable of support as a black start cranking path to start synchronous generators for restoration.

(s) Provision of Synthetic Inertia. **[TO BE DETERMINED BASED ON IRS.]**

(t) Generator Step-Up Transformer Impedance.

The generator step-up transformer impedance shall be between [ ] percent and [ ] percent, inclusive, on transformer OA rating. [**NOTE: THESE VALUES WILL BE BASED ON THE RESULTS OF THE IRS.]**

(u) Control Systems and Auxiliary Equipment.

The power source for control systems and auxiliary equipment required for normal operation of the Facility shall be designed to be immune from system transients in accordance with the Public Utilities Commission of the State of Hawaii tariff for [Maui Electric Company, Ltd./Hawaii Electric Light Company, Inc.] Rule No. 2, Character of Service (Revised Sheet No. 5, effective Oct. 20, 1991) and Section 3.2(A)(6) (Facility Protection and Control Equipment) to meet

the performance during under/over voltage and under/over frequency conditions pursuant to Section 3(e), Section 3(f), Section 3(i) and Section 3(j) of this Attachment B (Facility Owned by Seller).

4. Maintenance of Seller-Owned Interconnection Facilities.

(a) Seller must address any Disconnection Event (as defined below) according to the requirements of this Section 4 (Maintenance of Seller-Owned Interconnection Facilities) of Attachment B (Facility Owned by Seller). For this purpose, a "Disconnection Event" is the removal of 7.5 MW or more from Company System and/or disconnection of the Facility from the Company's System through the interconnecting breakers that is not the result of Company dispatch, frequency droop response, or isolation of the Facility resulting from designed protection fault clearing.

(b) For every Disconnection Event from the Company System, Seller shall investigate the cause. Within three (3) Business Days, Seller shall provide, in writing to Company, an incident report that summarizes the sequence of events and probable cause.

(c) Within forty-five (45) Days of a Disconnection Event, Seller shall provide, in writing to Company, Seller's findings, data relied upon for such findings, and proposed actions to prevent reoccurrence of a Disconnection Event ("Proposed Actions"). Company may assist Seller in determining the causes of and recommendations to remedy or prevent a Disconnection Event ("Company's Recommendations"). Seller shall implement such Proposed Actions (as modified to incorporate the Company's Recommendations, if any) and Company's Recommendations (if any) in accordance with the time period agreed to by the Parties.

(d) In the event Seller and Company disagree as to (i) whether a Disconnection Event occurred, (ii) the sequence of events and/or probable cause of the Disconnection Event, (iii) whether the Disconnection Event is a disconnection, (iv) the Proposed Actions, (v) Company's Recommendations, and/or (vi) the time period to implement the Proposed Actions and/or Company's Recommendations, then the Parties shall follow

the procedure set forth in Section 5 (Expedited Dispute Resolution) of this Attachment B (Facility Owned by Seller).

(e) Upon the fourth (4th) Disconnection Event (and each subsequent Disconnection Event) within any Contract Year, the Parties shall follow the procedures set forth in Section 4(a) and Section 4(d) of Attachment B (Facility Owned by Seller), to the extent applicable. If after following the procedures set forth in this Section 4 (Maintenance of Seller-Owned Interconnection Facilities) of Attachment B (Facility Owned by Seller), Seller and Company continue to have a disagreement as to (1) the probable cause of the Disconnection Event, (2) the Proposed Actions, (3) the Company's Recommendations, and/or (4) the time period to implement the Proposed Actions and/or the Company's Recommendations, then the Parties shall commission a study to be performed by a qualified independent Third-Party consultant ("Qualified Consultant") chosen from the Qualified Independent Third-Party Consultants List ("Consultants List") attached to the Agreement as Attachment D (Consultants List). Such study shall review the design of, review the operating and maintenance procedures dealing with, recommend modifications to, and determine the type of maintenance that should be performed on Seller-Owned Interconnection Facilities ("Study"). Seller and Company shall each pay for one-half of the total cost of the Study. The Study shall be completed within ninety (90) Days from such fourth Disconnection Event (and each subsequent Disconnection Event) within any Contract Year, unless the Qualified Consultant determines the Study cannot reasonably be completed within ninety (90) Days, in which case, such longer period of time as the Qualified Consultant determines is necessary to complete the Study shall apply. The Qualified Consultant shall send the Study to Company and Seller. Seller (and/or its Third-Party consultants and contractors), at Seller's expense, shall change the design of, change the operating and maintenance procedures dealing with, implement modifications to, and/or perform the maintenance on Seller-Owned Interconnection Facilities recommended by the Study. Such design changes, operating and maintenance procedure changes, modifications, and/or maintenance shall be completed no later than forty-five (45) Days from the Day the

completed Study is issued by the Qualified Consultant, unless such design changes, operating and maintenance procedure changes, modifications, and/or maintenance cannot reasonably be completed within forty-five (45) Days, in which case, Seller shall complete the foregoing within such longer commercially reasonable period of time agreed to by the Parties in writing. In the event the time requirement for the (i) commissioning of the Study, (ii) completion of the Study, or (iii) completion of the design change, operating and maintenance procedure change, modifications, and/or maintenance recommended by the Study is not achieved, Company may limit the total Allowed Capacity to a level that maintains reliable operations in accordance with Good Engineering and Operating Practices for the period that such requirement has not been achieved. Nothing in this provision shall affect Company's right to dispatch the Facility as provided for in this Agreement.

(f) The Consultants List attached hereto as Attachment D (Consultants List) contains the names of engineering firms which both Parties agree are fully qualified to perform the Study. At any time, except when a Study is being conducted, either Party may remove a particular consultant from the Consultants List by giving written notice of such removal to the other Party. However, neither Party may remove a name or names from the Consultants List without approval of the other Party if such removal would leave the list without any names. Intended deletions shall be effective upon receipt of notice by the other Party, provided that such deletions do not leave the Consultants List without any names. Proposed additions to the Consultants List shall automatically become effective thirty (30) Days after notice is received by the other Party unless written objection is made by such other Party within said thirty (30) Day period. By mutual agreement between the Parties, a new name or names may be added to the Consultants List at any time.

5. Expedited Dispute Resolution.

If there is a disagreement between Company and Seller regarding (i) Seller's compliance with the standards set forth in Section 3 (Performance Standards) of this Attachment B (Facility Owned by Seller), and/or (ii) Section 4 (Maintenance of Seller-Owned Interconnection Facilities) of

this Attachment B (Facility Owned by Seller) such as (aa) whether a Disconnection Event occurred, (bb) the sequence of events and/or probable cause of the Disconnection Event, (cc) whether the Disconnection Event is a Disconnection, (dd) the Proposed Actions, (ee) the Company's Recommendations, and (ff) the time period to implement the Proposed Actions and/or the Company's Recommendations, then authorized representatives from Company and Seller, having full authority to settle the disagreement, shall meet in Hawai‘i (or by telephone conference) and attempt in good faith to settle the disagreement. Unless otherwise agreed in writing by the Parties, the Parties shall devote no more than five (5) Business Days to settle the disagreement in good faith. In the event the Parties are unable to settle the disagreement after the expiration of the time period, then either Party may pursue the dispute resolution procedure set forth in Article 28 (Dispute Resolution) of this Agreement.

6. Modeling.

(a) Seller's Obligation to Provide Models. Within 30 Days of Company's written request, but no later than the Commercial Operations Date, Seller shall provide detailed data regarding the design and location of the Facility, in a form reasonably satisfactory to Company, to allow the modeling of the inverters and any other equipment within the Facility identified in the IRS which utilizes Source Code (such as energy storage system, STATCOM or DVAR equipment), including, but not limited to, integrated and validated power flow and transient stability models (such as PSS/E models), a short circuit model (such as an ASPEN model), and an electro-magnetic transient model (such as a PSCAD model) of the inverters and any additional equipment identified in the IRS as set forth above, applied assumptions, and pertinent data sets (each a "Required Model" and collectively, the "Required Models"). Thereafter, during the Term, Seller shall provide working updates of any Required Model within 30 Days of (i) Company's written request, or (ii) Seller obtaining knowledge or notice that any Required Model has been modified, updated or superseded by the Source Code Owner.

(b) Escrow Establishment. If, pursuant to Section 6(a) (Seller's Obligation to Provide Models) of this Attachment B (Facility Owned by Seller), the Required Models are provided to the Company in a form other than Source Code, Seller shall arrange for and ensure that the Source Code for the relevant Required Model is deposited into the Source Code Escrow as

set forth below in Section 6(b)(i) (Source Code Escrow) of this Attachment B (Facility Owned by Seller) no later than the time periods set forth in Section 6(a) (Seller's Obligation to Provide Models) of this Attachment B (Facility Owned by Seller) for delivery of the Required Models. Seller shall be responsible for all costs associated with establishing and maintaining the Source Code Escrow. If, however, Seller is unable to deposit the required Source Code into the Source Code Escrow within the time periods set forth in Section 6(a) (Seller's Obligation to Provide Models), Seller shall, no later than such time periods, instead establish a monetary escrow as set forth below in Section 6(b)(ii) (Monetary Escrow) of this Attachment B (Facility Owned by Seller).

(i) Source Code Escrow.

(A) Establishment of Source Code Escrow. If the Required Models are not provided to the Company in the form of Source Code pursuant to Section 6(a) of this Attachment B (Facility Owned by Seller), Seller shall: (a) arrange for and ensure the deposit of a copy of the current version of the Source Code and relevant documentation for all Required Models with the Source Code Escrow Agent under the terms and conditions of the Source Code Escrow Agreement, and (b) arrange for and ensure the update of the deposited Source Code and relevant documentation for Major Releases and Minor Releases of the Required Models as soon as reasonably possible after they are made generally available.

(B) Release Conditions. Company shall have the right to obtain from the Source Code Escrow Agent one copy of the escrowed Source Code for the Required Models, under the following conditions upon Company's request:

(i) A receiver, trustee, or similar officer is appointed, pursuant to federal, state or applicable foreign law, for the Source Code Owner;

(ii) Any voluntary or involuntary petition or proceeding is instituted, under (x) U.S. bankruptcy laws or (y) any other bankruptcy, insolvency or similar proceeding outside of the United States, by or against the Source Code Owner; or

(iii) Failure of the Source Code Owner to function as a going concern or operate in the ordinary course; or

(iv) Seller and the Source Code Owner fail to provide to Company the Required Models or updated Required Models, or, alternatively, fail to issue a Source Code LC, within the time periods set forth in Section 6(a) (Seller's Obligation to Provide Models) of this Attachment B (Facility Owned by Seller), Company gives written notice of such failure to Seller and the Source Code Owner, and Seller and Source Code Owner fail to remedy such breach within five (5) Days following receipt of such notice.

(C) Remedies. If Company has the right to obtain from the Source Code Escrow Agent one copy of the escrowed Source Code for the Required Models pursuant to Section 6(b)(i)(B) (Release Conditions) of Attachment B (Facility Owned by Seller), and Company finds that Seller failed to arrange for and ensure the update the Source Code Escrow with the modified and/or updated Source Code and relevant documentation for Major Releases and Minor Releases of the Required Models as provided in Section 6(b)(i) (Establishment of Source Code Escrow) of Attachment B (Facility Owned by Seller) or that the Source Code for the Required Models is incomplete or otherwise unusable, Seller shall be liable to Company for liquidated damages in the amount of $500 per Day for each Day Seller fails to provide such Source Code to Company or such update to the Source Code to Company from the date such Major Release or Minor Release was first made available by the Source Code Owner to customers of the Source Code Owner. Failure to provide the updated Source Code of the Required Models within 30 Days' notice from Company of a breach of Section 6(b)(i)(A) (Establishment of Source Code Escrow) of Attachment B (Facility Owned by Seller); provided, that Seller has also failed to provide a satisfactory Source Code LC as set forth in Section 6(b)(ii) (Source Code Security) of this Attachment B (Facility Owned by Seller) shall constitute an Event of Default pursuant to Section 15.2(f) under the Agreement.

(D) Certification. The Source Code Escrow Agent shall release the Source Code of the Required Models to Company upon receipt of a signed statement by a representative of Company that reads substantially as follows:

The undersigned hereby certifies that (i) I am duly authorized to execute this document on behalf of **[select company: Maui Electric Company, Limited ("Maui Electric") / Hawaii Electric Light Company, Inc. ("Hawaii Electric Light")]**, and (ii) **[Maui Electric/Hawaii Electric Light]** is entitled to a copy of the Source Code of the Required Models Pursuant to Section 6(b)(i)(B) (Release Conditions) of Attachment B (Facility Owned by Seller) of the Power Purchase Agreement dated as of _____, between _____, and **[Maui Electric/Hawaii Electric Light]**.

(E) Authorized Use. If Company becomes entitled to a release of the Source Code of the Required Models from escrow, Company may thereafter correct, modify, update and enhance the Required Models for the sole purpose of providing itself the support and maintenance it otherwise would have been entitled to if it had been provided the Required Models by Seller under Section 6(a) (Seller's Obligation to Provide Models) of this Attachment B (Facility Owned By Seller) (the "Source Code Authorized Use").

(F) Confidentiality Obligations. Company shall keep the Source Code of the Required Models confidential pursuant to the confidentiality obligations of the Source Code Escrow Agreement. Company shall restrict access to the Source Code of the Required Models to those employees, independent contractors and consultants of Company who have agreed in writing to be bound by confidentiality and use obligations consistent with those specified in the Escrow Agreement, and who have a need to access the Source Code of the Required Models on behalf of Company to carry out their duties for the Authorized Use. Promptly upon Seller's request, Company shall provide Seller with the names and contact information of all individuals who have accessed the Source Code of the Required Models, and shall take all reasonable actions required to recover any such Source Code in the event of loss or misappropriation, or to otherwise prevent their unauthorized disclosure or use.

(ii) Source Code Security.

(A) Establishment of Source Code Security. If the Required Models and their relevant Source Code are not

provided to the Company in the form of Source Code pursuant to Section 6(a) (Seller's Obligation to Provide Models) of this Attachment B (Facility Owned by Seller) and if the Seller is unable to arrange for and ensure the deposit of the Source Code into the Source Code Escrow established for the benefit of the Company pursuant to Section 6(b)(i) (Source Code Escrow) of this Attachment B (Facility Owned by Seller) then, no later than the time periods set forth in Section 6(a) (Seller's Obligation to Provide Models) of this Attachment B (Facility Owned by Seller) for delivery of the Required Models and Source Code, Seller shall provide an irrevocable standby letter of credit (the "Source Code LC") with no documentation requirement in the amount of Two Hundred Fifty Thousand Dollars ($250,000) per Required Model (and its relevant Source Code) substantially in the form attached to this Agreement as Attachment M (Form of Letter of Credit) from a bank chartered in the United States with a credit rating of "A-" or better from Standard & Poor's or A3 or better from Moody's. Such letter of credit shall be issued for a minimum term of one (1) year. Furthermore, at the end of each year the security shall be renewed for an additional one (1) year term so that at the time of such renewal, the remaining term of any such security shall not be less than one (1) year. The letter of credit shall include a provision for at least thirty (30) Days' advance notice to Company of any expiration or earlier termination of the letter of credit so as to allow Company sufficient time to exercise its rights under said security if Seller fails to extend or replace the security. In all cases, the reasonable costs and expenses of establishing, renewing, substituting, canceling, increasing, reducing, or otherwise administering the letter of credit shall be borne by Seller.

(B) Release Conditions. Company shall have the right to draw on the letter of credit the funds necessary to develop and recreate the Required Model or Required Models upon Company's request if Seller fails to provide the Company the Required Models or updated Required Models within the time periods set forth in Section 6(a) (Seller's Obligation to Provide Models) or Section 6(b)(i)(C) (Remedies) of this Attachment B (Facility Owned by Seller), Company gives written notice of such failure to Seller, and Seller fails to remedy such breach within five (5) Days following receipt of such notice for a breach under Section 6(a) (Seller's Obligation to Provide Models), or within thirty (30) Days

following receipt of such notice for a breach under Section 6(b)(i)(C) (Remedies).

(C) Extend Letter of Credit. If the letter of credit is not renewed or extended no later than thirty (30) Days prior to its expiration or earlier termination, Company shall have the right to draw immediately upon the full amount of the letter of credit and to place the proceeds of such draw (the "Proceeds"), at Seller's cost, in an escrow account in accordance with Section 6(b)(ii)(D) (Proceeds Escrow), until and unless Seller provides a substitute form of letter of credit meeting the requirements of this Section 6(b)(ii) (Source Code Security) of this Attachment B (Facility Owned by Seller).

(D) Proceeds Escrow. If Company draws on the letter of credit pursuant to Section 6(b)(ii)(C) (Extend Letter of Credit) of this Attachment B (Facility Owned by Seller), Company shall, in order to avoid comingling the Proceeds, have the right but not the obligation to place the Proceeds in an escrow account as provided in this Section 6(b)(ii)(D) (Proceeds Escrow) of this Attachment B (Facility Owned by Seller) with a reputable escrow agent acceptable to Company ("Proceeds Escrow Agent") subject to an escrow agreement acceptable to Company ("Proceeds Escrow Agreement"). Without limitation to the generality of the foregoing, a federally-insured bank shall be deemed to be a "reputable escrow agent." Company shall have the right to apply the Proceeds as necessary to recover amounts Company is owed pursuant to this Section 6 (Modeling) of this Attachment B (Facility Owned by Seller). To that end, the Proceeds Escrow Agreement governing such escrow account shall give Company the sole authority to draw from the account. Seller shall not be a party to such Proceeds Escrow Agreement and shall have no rights to the Proceeds. Upon full satisfaction of Seller's obligations under Section 6 (Modeling) of this Attachment B (Facility Owned by Seller), Company shall instruct the Proceeds Escrow Agent to remit to the bank that issued the letter of credit that was the source of the Proceeds the remaining balance (if any) of the Proceeds. If there is more than one escrow account with Proceeds, Company may, in its sole discretion, draw on such accounts in any sequence Company may select. Any failure to draw upon the Proceeds for any damages or other amounts due Company shall not prejudice Company's rights to recover such damages or amounts in any other manner.

(E) Seller's Obligation. If the letter of credit is not sufficient to cover Company's associated consultant fees, costs and expenses to develop and recreate the Required Models, Seller shall pay to Company the difference within ten (10) Days of Company's written notice to Seller.

(F) Model Verification. Seller shall work with the Company to validate the new Required Models developed by or on behalf of Company within sixty (60) Days of receiving such new Required Models. Seller shall also arrange for and ensure that Company may obtain new Required Models directly from the Source Code Owner in the event that Seller ceases to operate as a going concern or is subject to voluntary or involuntary bankruptcy and is unable or unwilling to obtain the new Required Models from the Source Code Owner.

(G) Certification. The terms of the letter of credit shall provide for a release of the funds, or in the event the funds have been placed into a Proceeds Escrow, the Escrow Agent shall release the necessary funds to Company upon receipt of a signed statement by a representative of Company that reads substantially as follows:

> The undersigned hereby certifies that (i) I am duly authorized to execute this document on behalf of **[select company: Maui Electric Company, Limited ("Maui Electric") / Hawaii Electric Light Company, Inc. ("Hawaii Electric Light")]**, and (ii) **[Maui Electric /Hawaii Electric Light]** is entitled to $_____, pursuant to Section 6(b)(ii)(B) (Release Conditions) of Attachment B (Facility Owned by Seller) of the Power Purchase Agreement dated as of _____, between _____, and **[Maui Electric/Hawaii Electric Light]**.

(H) Authorized Use. If Company becomes entitled to a draw of funds from the Source Code Security or a release of funds from the Proceeds Escrow, Company may thereafter use such funds to develop, recreate, correct, modify, update and enhance the Required Models for the sole purpose of providing itself the support and maintenance it otherwise would have been entitled to if it had been provided the Required Models by Seller under Section 6(a) (Seller's Obligation to Provide

Models) of this Attachment B (Facility Owned by Seller) (the "Monetary Authorized Use").

(iii) Supplementary Agreement. The parties stipulate and agree that the escrow provisions in this Section 6(b) (Escrow Establishment) of Attachment B (Facility Owned by Seller), and the Source Code Escrow Agreement and Proceeds Escrow Agreement are "supplementary agreements" as contemplated in Section 365(n)(1)(B) of the Code. In any voluntary or involuntary bankruptcy proceeding involving Seller, failure by Company to assert its rights to "retain its rights" to the intellectual property encompassed by the Source Code or the funds in the Proceeds Escrow, pursuant to Section 365(n)(1)(B) of the Code, under an executory contract rejected in a bankruptcy proceeding, shall not be construed as an election to terminate the contract by Company under Section 365(n)(1)(A) of the Code.

7. Testing Requirements.

(a) Testing Requirements. Once the Control System Acceptance Test has been successfully passed, Seller shall not replace and/or change the configuration of the Facility Control, inverter control settings and/or ancillary device controls, without prior written notice to Company. In the event of any such replacement and/or change, the relevant test(s) of the Control System Acceptance Test shall be redone and must be successfully passed before the replacement or altered equipment is allowed to be placed in normal operations. In the event that Company reasonably determines that such replacement and/or change of controls makes it inadvisable for the Facility to continue in normal operations without a further Control Systems Acceptance Test, the Facility shall be deemed to be in Seller-Attributable Non-Generation status until the new relevant tests of the Control System Acceptance Test have been successfully passed.

(b) Periodic Testing. Seller shall coordinate periodic testing of the Facility with Company to ensure that the Facility is meeting the performance standards specified under this Agreement.

8. Data and Forecasting. Seller shall provide Site, meteorological and production data in accordance with the

terms of Article 6 (Forecasting) of this Agreement and the following requirements:

(i) Physical Site Data: Seller shall provide Company with an accurate description of the physical Site, including but not limited to the following, [as appropriate to Facility resource type(s) and use of storage] which may not be changed during the Term without Company's prior written consent:

A. Location Facility Map showing the layout of the Facility (coverage area or footprint) and the coordinates (latitude and longitude) of generating equipment:

Solar PV: elevation (above ground), orientation angle and direction (north-east-south-west plane) of arrays/concentrators.

Wind Generators: coordinates (latitude and longitude) and height above ground of each wind turbine hub.

B. Location (latitude and longitude) and elevation (above ground) of each MMT / MMS and elevation (above ground) of each field measurement device for, e.g., air density, ambient air pressure and ambient air temperature, located at each MMT or each field measurement device located on such MMS.

C. For solar resource inverters: Inverter type, power rating, array configuration to inverters and DC rating of the Facility at the following standard test conditions: irradiance of 1000 W/m^2, air mass 1.5, and cell temperature 25° C.

D. Solar generation technology employed at the Facility with temperature dependence, mounting and module type.

E. Wind generation technology employed at the Facility with representative power curve(s).

F. BESS technology and related auxiliary equipment, location and type.

(ii) Meteorological and Production Data.

A. Seller shall install and maintain a minimum of two MMS for facilities that have either (i) a DC rating of the Facility of 5 MW or greater or (ii) a coverage area greater than one square kilometer.

B. Placement of each MMS should account for the microclimate of the area and Facility coverage area and shall be oriented with respect to the primary wind direction.

C. Seller shall provide to Company, via SCADA communication and protocol acceptable to Company to support operations and forecasting needs at a continuous scan, all meteorological and production data required under this Agreement updated every 2 seconds.

D. Seller shall arrange for a dedicated 12 kV line to provide separate service from Company, or for such other independent, backup power source as approved by Company in writing, to temporarily store and record the meteorological data from the field measuring devices at the MMSs. Any such backup power source must be capable of providing power for the field measurement devices for a reasonable period of time until primary power is restored. The same backup power source can serve multiple MMSs as needed by the Facility.

(iii) Units and Accuracy:

A. [For PV] The Table below shows minimum required solar irradiance measurements for various types of solar generation technology. **[DRAFTING NOTE: VALUES NEED TO BE INSERTED INTO TABLE.]** This value may not be derived.

Solar Technology	**Direct Normal Irradiance**	**Global Irradiance (GHI)**	**Plane of Array Irradiance (POA)**
Flat Plate (fixed horizontal, fixed angle, tracking, roof		X	X

mounted)			

B. Units and accuracy of measured parameters to be provided to Company in real time shall be as shown in the Table below. These represent the minimum required accuracies.

Table of Units and Accuracy of Meteorological and Production Data (PV)

Parameter	Data Source	Unit	Range	Accuracy
Global Horizontal Irradiance at MMS	Pyranometer or equivalent	W/m^2	0 to 1500 W/m^2	Secondary standard per ISO 9060 or <= 3% from 100 W/m^2 to 1500 W/m^2 if using a PV Reference Cell
Plane of Array Irradiance on same axis as array	Pyranometer or equivalent	W/m^2	0 to 1500 W/m^2	Secondary standard per ISO 9060 or <= 3% from 100 W/m^2 to 1500 W/m^2 if using a PV Reference Cell
Back of Panel temperature at array height	Temperature probe	°C	-20 to +50 °C	+/-1 °C
Power production of Facility	Measured at POI	MW	Up to Capacity	+-0.1 MW
Inverters Available*	Seller's system	digital	Up to the number installed inverters	
	Ratio of inverters online/number of inverters	%	0 to 100%	
Power Possible*	Seller's Model	MW	0 to Allowed Capacity	+/-0.1 MW

Table of Units and Accuracy of Meteorological and Production Data (Wind)

Parameter	Data Source	Unit	Range	Accuracy
Wind speed at MMT (hub height)	Cup or sonic anemometer	Mph	0 to 134 mph	+/-1 mph
Wind direction at MMT (hub height)	Vane, sonic device or equivalent	Degrees (from True North)	360°	+/-5°
Ambient air temperature at MMT (hub height)	Temperature probe	°C	-20 to +50 °C	+/-1 °C
Ambient air pressure at MMT (hub height)	Piezoresistive transducer, barometer or equivalent	Mbar	150 to 1150 mbar	+/-60 mbar (0 to +50°C)
Power production of Facility	Measured at POI	MW		+/- 0.1 mw
Power Possible	Seller's Model	MW	0 to 120% of Allowed Capacity	+/0.1 MW

(iv) Status of Generating Equipment: For each inverter, or wind turbine, Seller shall provide to Company, via SCADA communication and protocol acceptable to Company at a continuous scan updated not less frequently than every 2 seconds, a signal as to whether such inverter is available or unavailable, and on or offline.

(v) Data Collection.

[NOTE COMPANY TO UPDATE REQUIREMENTS; WILL BE SPECIFIC TO FACILITY EQUIPMENT AND RESOURCE TYPE]

A. High Resolution Data: Seller shall install and make available to the Company time stamped and sequential data recordings for all inverter-based resources (and all generating resources) to perform event analysis and verify Facility performance during steady state and transient disturbance

events. This will include a time-synchronized phasor measurement unit at the Facility, and access to multiple sources to provide sufficient clarity as to any abnormal response or behavior within the Facility, including Facility control settings and static values, SCADA data, sequence of events recording (SER) data, dynamic disturbance recorder (DDR) data, and inverter fault codes and inverter-level dynamic recordings.

B. Plant Data: **[Note: specific requirements below are representative and will be tailored to the Facility resource type(s) and geographic arrangement]**

Seller shall install at least three (3) meteorological tower(s), spaced so as to provide the data points set forth below for the entire Facility. At least two months prior to the Commercial Operation Date, Seller shall deliver to Company a report showing (i) manufacturer, model and year of all energy equipment (panels, inverters, energy storage devices, turbine generators), and meteorological instrumentation, and (ii) the latitude and longitude of the center of the energy equipment (i.e., solar panels for every inverter, wind turbines) and every meteorological tower. Beginning upon COD, Seller shall transmit and provide to Company the real-time data set forth below, refreshed as frequently as allowed by the SCADA system, not to exceed sixty (60) second intervals:

- Two (2) data points from each inverter or wind turbine:
  - o Inverter/turbine generation (MW)
  - o Inverter/turbine availability
  - o Inverter/turbine on/offline status
- Two (2) data points from each meteorological tower (solar resources):
  - o Global horizontal solar irradiance (instantaneous solar intensity, full sky)
  - o Plane of array solar irradiance (instantaneous solar intensity at the current angle of the PV array)

- Five data points from each Meteorological Tower (wind resources):
  - o Wind Speed ** (mps)
  - o Wind Direction** (degrees relative to true north)
  - o Temperature (Celsius)
  - o Pressure (mb)
  - o Air Density (kg/m3)

In addition to the other requirements for data collection, if required by Company, a Facility with wind turbines shall install, maintain and operate at least one meteorological tower that is installed at hub height and is placed upstream of the prevailing wind path to provide meteorological data through a means agreed by the Company. The data stream from this meteorological tower to the Company's System must be reliable and include battery back-up at the meteorological tower and a local source of electricity to power the data collection and communication from the Facility to Company during transmission outages.

Seller shall provide a map and key for each inverter or wind turbine sufficient to allow Company to correlate the data received through Company's data historian system to each individual resource.

9. Technology Specific Requirements.

(a) [RESERVED].

(b) [RESERVED].

(c) Inverter Systems.

(i) Direct current generators and non-power (i.e., other than 60 Hertz) alternating current generators can only be installed in parallel with the Company System using a non-islanding synchronous inverter. The design shall comply with the requirements of IEEE Std 1547-2003 (or latest version), except as described in Section 1(g)(xi) (Active Power – Frequency Response (DROOP)) and Section 3

(Performance Standards) of this Attachment B (Facility Owned by Seller).

(ii) Self-commutated inverters of the Company-interactive type shall synchronize to the Company System. Line-commutated, thyristor-based inverters are not recommended and will require additional technical study to determine harmonic and reactive power requirements. All interconnected inverter systems shall comply with the harmonic current limits of IEEE Std 519-1992 (or latest version).

(d) Battery Energy Storage System. The operating parameters of the BESS for facilities with paired storage shall be as follows:

(i) For facilities with variable energy and paired storage: The BESS shall directly charge storage from the variable resource when the Company Active Power Dispatch is for less than the available resource energy.

(ii) **[Note - modify for grid charging BESS]** The BESS shall/shall not be charged from the Company System during the Term. [If grid charging is limited, describe here.]

(iii) The BESS will not be required to discharge more energy than available relative to the available state of charge.

(iv) The BESS shall be designed for an average annual use of [xxxx] cycle(s) per day (a cycle is a discharge equal to the BESS Contract Capacity, and sufficient charging to return the BESS to 100% State of Charge).

10. Operating Committee and Operating Procedures.

Company and Seller shall each appoint one representative and one alternate representative to act as the operating committee in matters relating to the Parties' performance obligations under this Agreement and to develop operating arrangements for the generation, delivery and receipt of renewable energy from the Facility.

The operating committee may develop mutually agreeable written operating procedures consistent with the requirements of this Agreement, to address matters such as day-to-day communications; key personnel; operations-center interface; metering, telemetering, telecommunications, and data acquisition procedures; operations and maintenance scheduling and reporting; reports; operations log; testing procedures; and such other matters as may be mutually agreed upon by the operating committee.

The operating committee shall review the requirements for Active Power Control, the data collection and telemetry, and control system parameters from time to time after the date hereof and may agree on modifications thereto to the extent necessary or convenient for operation of the Facility in accordance with this Agreement.

The operating committee shall have authority to act in all technical and day-to-day operational matters relating to performance of this Agreement and to attempt to resolve potential disputes, provided, however, that except as explicitly provided herein, the operating committee shall have no authority to amend or waive any provision of this Agreement.

EXHIBIT B-1
MODELING REQUIREMENTS

1. Steady State and Dynamic Model Requirements and As-built Data to be provided by Seller. The expected steady state power flow and dynamic models will be provided by the Seller during the interconnection study process. Depending upon Facility design, different representations may be required for steady state and dynamic simulations. Seller will work with Company to derive a complex equivalent model if it is required to meet interconnection study needs. The as-built data and models will be provided by Seller immediately upon commissioning with sufficient information to demonstrate that the as-built parameters match the model. Any changes to plant settings that affect its response and impact to the Company System are required to be studied prior to those changes taking effect. The modeling will include all necessary control settings such that the correct capabilities, flags, and settings can be represented in a base case. Where such parameters are settable according to this Agreement, the initial models will be configured with parameters mutually agreed with Company for the interconnection study analysis. This includes, but is not limited to:

   - Plant Type: A description of the resource type (e.g., storage, solar PV or wind power resource) used as a flag to ensure that the inverter-based resource is accurately represented in the base case, where applicable.

   - Active and Reactive Capability: The overall plant "composite capability curve" shall be provided by Seller for performance purposes. That same curve will be used for accurately modeling the P-Q capability in power flow studies.

   - Plant-Level Voltage Control Settings: Information on the plant voltage control mode to ensure correct voltage control flags and set points are set accordingly in the software tools.

   - The voltage control set point at the POI is provided by the Company. Seller shall provide a description of the coordination of any plant-level shunt compensation (static or dynamic) to ensure it can be accurately represented in the power flow base case.

The models provided by Seller should accurately reflect the contractual requirements established under this Agreement.

2. Positive Sequence Stability Modeling. Seller shall provide a positive sequence stability model representation which provides sufficient detailed modeling for necessary reliability studies, as specified by Company. **[Note – language to be revised based on proposed Facility.]** For example, the following are typical requirements for plants with inverter equipment:

   - Inverter-Level Controller Model: This represents the overall control of the inverter as an energy or generating resource.

   - Electrical Control Model: This represents the detailed electrical controls of the resource, including large disturbance behavior.

   - Plant-Level Controller Model: This represents control of multiple individual inverters and/or generators within the plant

3. Short Circuit Modeling. Seller will provide appropriate and accurate models to Company to support short circuit studies. **[Company to specify requirements based on specific Facility]**

4. Electromagnetic Transient Modeling. Company will require an electromagnetic transient ("EMT") model for the Facility. Seller shall provide Company with an EMT model for the IRS and an updated EMT model after the Facility has been commissioned. These models are in addition to the positive sequence stability models required for interconnection-wide modeling purposes. In addition, Seller shall provide Company with evidence that the expected (and commissioned) EMT model reasonably matches the positive sequence dynamic models provided. This should include a benchmarking report provided by the inverter OEM.

EXHIBIT B-2
GENERATOR AND ENERGY STORAGE CAPABILITY CURVE(S)

ATTACHMENT N
ACCEPTANCE TEST GENERAL CRITERIA

[THIS ATTACHMENT WILL NEED TO BE MODIFIED BASED ON THE RESULTS OF THE IRS]

Upon final completion of Company review of the Facility's drawings, final test criteria and procedures shall be agreed upon by Company and Seller no later than thirty (30) Days prior to conducting the Acceptance Test in accordance with the Agreement. The Acceptance Test shall include, but not be limited to, the following:

1. Interconnection.

   (A) A visual inspection of all Interconnection equipment and verification of as-built drawings.

   (B) Phase rotation testing to verify proper phase connections.

   (C) Based on manufacturer's specification, test the local operation of the Facility's generator breaker(s) and inter-tie breaker(s), and other breaker(s) which connect the Facility equipment to Company System – must open and close locally using the local controls remotely from Company's EMS. Test and ensure that the status shown on the EMS is the same as the actual physical status in the field.

   (D) Relay test engineers to connect equipment and simulate certain inputs to test and ensure that the protection schemes such as any under/over frequency and under/over voltage protection or the Direct Transfer Trip operate as designed. (For example, a fault condition may be simulated to confirm that the breaker opens to sufficiently clear the fault. Additional scenarios may be tested and would be outlined in the final test criteria and procedures.) Seller to also test the synchronizing mechanisms to which the Facility would be synchronizing and closing into the Company System to ensure correct operation. Other relaying also to be tested as specified in the protection review of the IRS and on the single line diagram, Attachment E (Single-

Line Drawing and Interface Block Diagram) for the Facility.

(E) All 69 kV breaker disconnects and other high voltage switches will be inspected to ensure they are properly aligned and operated manually or automatically (if designed).

(F) Step-Up Transformer Enclosure(s) inspections – The Step-Up Transformer Enclosure(s) may be inspected to test and ensure that the equipment that Seller has installed is installed and operating correctly based upon agreed to design. Wiring may be field verified on a sample basis against the wiring diagrams to ensure that the installed equipment is wired properly. The grounding mat at the Step-Up Transformer Enclosure(s) may be tested to make sure there is adequate grounding of equipment.

(G) Communication testing – Communication System testing to occur to ensure correct operation. Detailed scope of testing will be agreed by Company and Seller to reflect installed systems and communication paths that tie the Facility to Company's communications system.

(H) Various contingency scenarios to be tested to ensure adequate operation, including testing contingencies such as loss of communications, and fault simulations to ensure that the Facility's 69 kV breakers, if any, open as they are designed to open. (Back up relay testing)

(I) Metering section inspection; verification of metering PTs, CTs, and cabinet and the installation of the two Company meters.

2. Telephone Communication.

(A) Test to confirm Company has a direct line to the Facility control room at all times and that it is programmed correctly.

(B) Test to confirm that the Facility operators can sufficiently reach Company System Operator.

(C) Verification of dial-up telephone connection for 69 kV metering cabinet.

3. Drawings, Documentation and Equipment Warranties.

The items below are required components of the Acceptance Test and must be satisfied for successful completion of this Test.

(A) Electronic and three (3) hard copies of all Switchyard construction drawings, specifications, calibrations, and settings including as-built drawings.

(B) Equipment operating and maintenance manuals, spare parts lists, commissioning notes, as-built equipment settings, and other information related to the switchyard equipment.

(C) Contractor construction warranties and equipment warranties.

(D) Phase rotation testing to verify proper phase connections.

(E) Switching Station inspections – The Switching Station may be inspected to test and ensure that the equipment that Seller has installed is installed and operating correctly based upon agreed-to design. Wiring may be field verified on a sample basis against the wiring diagrams to ensure that the installed equipment is wired properly. The grounding mat at the Switching Station may be tested to make sure there is adequate grounding of equipment.

(F) If agreed by the Parties in writing, some requirements may be postponed to the Control Systems Acceptance Test.

ATTACHMENT O
CONTROL SYSTEM ACCEPTANCE TEST CRITERIA

[THIS ATTACHMENT WILL NEED TO BE MODIFIED BASED ON THE RESULTS OF THE IRS]

a. The Acceptance Test for the Facility will be conducted, following installation of the Facility. The Acceptance Test procedures will be in accordance with criteria set forth herein. The Acceptance Test shall be performed in accordance with Good Engineering and Operating Practices and demonstrate to Company's satisfaction that the Facility and the interconnection portion of the Facility, including Company-Owned Interconnection Facilities, have met the provisions of Article 8 (Company Dispatch) and Section 3 (Performance Standards) of Attachment B (Facility Owned by Seller).

b. Acceptance Test procedures will be developed by Seller for the Company's review at least sixty (60) Days in advance of performing the tests based on the date provided by Seller.

c. The procedures will include, but not be limited to, demonstration of the functional requirements of the Facility defined in Article 8 (Company Dispatch) and Section 3 (Performance Standards) of Attachment B (Facility Owned by Seller) such as, but not limited to:

   i. Interconnection equipment and communications to support remote monitoring of the Facility and control of Facility breakers

   ii. Droop characteristic and change of frequency control / response modes (if applicable)

   iii. Real power delivery under remote Company Dispatch, Active Power Dispatch. For facilities with directly controlled storage, the storage will be operated to perform at least two full charging/discharging cycles.

   iv. Accurate provision of limits for Minimum and Maximum Dispatch (Power Possible, Minimum load capability)

   v. Ramp rates for controlled actions

   vi. Control of Facility breakers

vii. Voltage regulation

vii. Grid forming and Black start (if applicable)

d. Testing of primary and redundant communications between Company System Operator and Facility Operator

e. The actual dynamic response of the Facility equipment will be confirmed to allow Company transient stability model to reflect the as-left conditions of the unit. During the commissioning the following will be required:

i. A final review by Company engineers of the equipment installed to control the operation and protect the plant will be needed upon installation and prior to the start of commercial operation.

ii. The review will include off-line tuning and testing results of the excitation and governor control and/or control system and the IEEE block diagram utilized for the PSS/E dynamics program.

iii. During the commissioning of the actual Facility, equipment system testing will be conducted to ensure that similar, well damped, expected responses will be produced by the facility. The as-left parameters obtained from real and reactive local response tuning will be determined for use in the Company planning model. The Seller will provide an estimate of the earliest date for the Acceptance Test at least ninety (90) Days before the date.

f. The Acceptance Test procedures for the Facility will be mutually agreed upon between Seller and Company prior to conducting the test.

g. When the Facility is ready for the Acceptance Test, Seller shall notify Company at least seven (7) Days prior to the test and shall coordinate with Company. Seller shall perform and Company shall monitor such test no earlier than seven (7) Days from Company's receipt of such notice.

h. The Control Acceptance Test is to be successfully completed prior to the Commercial Operation Date.

Examples of the type of tests conducted to meet the aforementioned objectives may include, but are not limited to the following:

On-site Tests:

1. SCADA Test to verify the status and analog telemetry, and if the remote controls between the Company's EMS and the Facility are working properly end-to-end.

2. Dispatch Test to verify if the Facility's active power limit controls and the Active Power Control Interface with the Company's EMS are working properly. The Test is generally conducted by setting different active power setpoints and limits and observing the proper dispatch at the appropriate ramp rate limiting of the Facility's real power output.

3. Control Test for Voltage Regulation to verify the Facility can properly perform automatic voltage regulation as defined in this Agreement. Test is generally conducted by making small adjustments of the voltage setpoint and verifying by observation that the Facility regulates the voltage at the point of regulation to the setpoint by delivering/receiving reactive power to/from the Company System to maintain the applicable setpoint according to the reactive power control and the reactive amount requirements of Sections 3(a) (Reactive Power Control) and Section 3(b) (Reactive Power Characteristics) of Attachment B (Facility Owned by Seller) to this Agreement.

4. Frequency Response Test to verify the Facility provides a frequency droop response as defined in this Agreement. Test is generally conducted by making adjustments of the frequency reference setting and verifying by observation that the Facility responds per droop and deadband settings, and appropriately modifies the Company issued Dispatch Setpoint. If different modes of frequency response are provided, each mode is tested (i.e.; isochronous, fast frequency response, active power droop response).

5. Loss-of-Communication Test to verify the Facility will properly shutdown upon the failure of the direct-transfer-trip communication system. Test is generally conducted by simulating a communications failure and observing the proper shutdown of the Facility.

Monitoring Test:

a) The monitoring test requires the Facility to operate as it would in normal operations.

b) To ensure useful and valid test data is collected for variable facilities, the monitoring test shall end when one of the following criteria is met:

   A. For variable energy resources, Facility's gross power production is greater than 85% of its Allowed Capacity, for at least four (4) hours in any continuous 24-hour CSAT period.

   B. For solar facilities, the recorded renewable energy resource at the Facility is above 600 W/m^2 for at least eight (8) hours in any continuous 48-hour CSAT period.

   C. For wind facilities, the recorded wind speed is sufficient for turbines to operate for at least 8 hours in any continuous 48-hour CSAT period.

   D. 14 continuous Days from the start of the CSAT.

c) At the end of the test, an evaluation period is selected based on the criteria that triggered the end of the test.

d) The performance of the Facility during the period of the successfully completed monitoring test is evaluated for, e.g. voltage regulation, frequency response, dispatch control, operating limits and ramp rate performance, to verify the performance meets the requirements of this Agreement according to the criteria set forth in the testing procedures. Certain requirements, such as disturbance ride-through requirements, cannot be adequately tested without actual grid disturbances. These requirements will be confirmed following a grid event based on operational data, which may be after the completion of the Acceptance Test. The Parties understand and agree that a successful completion of the test does not constitute a waiver of any of the performance standards of Seller, all of which are hereby reserved, and shall not alleviate Seller from any of its obligations under the Agreement, in particular, as required in Article 8 (Company Dispatch) and the Performance Standards in Section 3 (Performance Standards) of Attachment B (Facility Owned by Seller).