DRAFT

REQUEST FOR PROPOSALS

FOR

RENEWABLE DISPATCHABLE GENERATION

AND

ENERGY STORAGE

June 27, 2025

Appendix B – Proposer's Response Package / Project Interconnection Data Request

Hawaiian Electric

1.0 GENERAL INSTRUCTIONS TO PROPOSERS

Wood Mackenzie Supply Chain Platform[1] is the Electronic Procurement Platform that the Company has licensed and will utilize for the RFP process. All Proposals and Proposal supporting information must be submitted via the Electronic Procurement Platform, in the manner described in this RFP.

Proposers must adhere to the response structure and file naming conventions identified in this Appendix for the Proposer's response package. Information submitted in the wrong location/section or submitted though communication means not specifically identified by the Company will not be considered by the Company.

Proposers must provide a response for every item. If input/submission items in the RFP are not applicable to a specific Proposer or Proposal variation, Proposers must clearly mark such items as "N/A" (Not Applicable) and provide a brief explanation.

Proposers must clearly identify all confidential information in their Proposals, as described in more detail in RFP Section 3.13 Confidentiality.

All information (including attachments) must be provided in English. All financial information must be provided in U.S. Dollars and using U.S. credit ratings.

It is the Proposer's sole responsibility to notify the Company of any conflicting requirements, ambiguities, omission of information, or the need for clarification prior to submitting a Proposal.

The RFP will be conducted as a "Sealed Bid" event within Sourcing Intelligence, meaning the Company will not be able to see or access any of the Proposer's submitted information until after the event closes.

1.1 ELECTRONIC PROCUREMENT PLATFORM

To access the RFP event, the Proposer must register as a "Supplier"[2] on the Wood Mackenzie Supply Chain Intelligence Platform. One Proposal may be submitted with each Supplier registration. Minor variations, as defined in RFP Section 3.7.2 and 3.7.2.1 may be submitted along with the Proposal under the same registration.

If a Proposer is already registered on the Wood Mackenzie Supply Chain Intelligence Platform, the Proposer may use their current login information to submit their first Proposal. Up to three (3) variations of a Proposal, one of which is the base variation of the Proposal, may be submitted together as a Proposal by following the instructions outlined in this Appendix (see Appendix B Section 3 and 4 below). If the Proposer chooses to submit more than one Proposal, the Proposer must register as a new "Supplier" for each additional Proposal.

Each registration will require a unique username, unique Email address, and unique Company name. Proposers that require multiple registrations to submit multiple Proposals should use the Company name field to represent the Company name and Proposal number (ex: CompanyNameP1). Proposers may use shorthand or clear abbreviations. The unique Email address used to create the Wood Mackenzie Supply Chain account does not necessarily have to match the Email address specified in this Appendix B Section 2.2.1 below. For example, if

[1] Also referred to as PowerAdvocate in prior RFPs, PowerAdvocate became Wood Mackenzie Supply Chain. Any reference to PowerAdvocate in this RFP is referring to the Wood Mackenzie Supply Chain Intelligence Platform.
[2] "Supplier" is a term used by Sourcing Intelligence and refer to the RFP's Proposer.

the Proposer is submitting multiple Proposals, all of the Proposer's Proposals could specify the same primary point of contact Email address if that is what the Proposer requests contact through for all their proposals.

There are no license fees, costs, or usage fees to Proposers for the use of the Electronic Procurement Platform. See Appendix D –for more user information on the Electronic Procurement Platform.

1.2 PROPOSAL SUBMISSION PROCEDURES

An Email notification will be sent to all registered Proposers when the event has been opened to receive Proposals.

After logging onto the Electronic Procurement Platform, the RFP will be visible on the Proposer's dashboard along with several tabs, including the following:

- "**1. Download Documents:**" RFP documents made available for Proposers' use and information will be stored under this tab. Documents can be downloaded and/or printed, as required.
- "**2. Upload Documents:**" Proposal submission documents requested in this Appendix B must be uploaded using this tab.
- Note that "3. Commercial Data:", "4. Technical Data:", and "5. Pricing Data:" tabs are NOT USED for this RFP.

Step-by-step instructions for submitting a complete Proposal are provided below:

1. Proposers must upload their Proposal files, including all required forms and files, to submit a complete Proposal. All files must be uploaded before the respective Proposal Due Date (RFP Section 3.1, Table 2).

2. Submit (upload) files representing your Proposal via the "2. Upload Documents" tab. Generally, one main consolidated PDF file is submitted (referred to as the "Proposal PDF" below), along with supporting files in their native file formats. That Proposal PDF must abide by the format specified in this Appendix B. A Microsoft Word template that outlines the format of this document is available under the "1. Download Documents" tab for the Proposer's use. **Response information must be provided in the order, format, and manner specified in this Appendix B and must clearly identify and reference the Appendix B section number that the information relates to**.
    a. Proposers shall use a filename denoting the following for its Proposal PDF: CompanyName_Proposal#.pdf. (example: AceEnergy_P1.pdf)

3. Supporting Proposal information that cannot be easily consolidated into the Proposal PDF described in Step 2 (such as large-scale drawing files) or files that must remain separate from the Proposal PDF in native file format (such as Appendix B Attachment 1 Proposal Pricing file, all IRS computer model files, Microsoft Excel spreadsheets, Microsoft Word redlined Model IGP Contracts, etc.) shall be **uploaded separately but must be referenced from within the Proposal PDF** (e.g., "See AceEnergyP1V2_2.5_SiteControlMap.kmz"). Such additional files must follow the naming convention below:
    a. File names must include, in order, Company Name, Proposal number (if more than one Proposal being submitted per Proposer), Variation (if any variations are being submitted), Appendix B section number, and a file descriptor, as shown in the example file name below:

AceEnergyP1V2_2.5_SiteControlMap.kmz

Proposers may use abbreviations if they are clear and easy to follow.

b. As specified in the RFP, it is the Proposer's responsibility to ensure the Proposal information is submitted and contained within the defined proposal sections as specified in Appendix B and provided in an organized manner to support the Proposal's evaluation.

c. **All pricing information for a Proposal must only be contained in a separate Proposal Pricing file that is included in the Proposal upload, but separate from the Proposal PDF or other Proposal files.**

4. Upload files using the "**2. Upload Documents**" tab on the Electronic Procurement Platform.
   a. Select "Choose File..." Navigate to and choose the corresponding file from your computer.
   b. For all documents identify the "Document Type" as "Technical Information." (Do not identify any documents as "Commercial and Administrative" or "Pricing.")
   c. "Reference ID" may be left blank.

   There is no limit to the number or size of files that can be uploaded. Multiple files may be grouped into a .zip archive for upload. (Any zipped files must still adhere to the naming directions in #3 above.) When successfully uploaded, documents will appear under the "Bid Submissions" section on the bottom of the tab's page, organized within the "Technical Information" Document Type. Repeat steps a, b, and c, as required for each file upload.

   If a file with the same name is uploaded twice, the Platform will provide notification of the duplication and automatically append a unique numerical extension to the Document Name. To delete a file that has been previously uploaded, click on the "X" button in the "Actions" column. Do not upload any files prior to the issuance of the Final RFP.

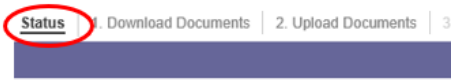
5. The Company will not be responsible for technical problems that interfere with the upload or download of Proposal information. Support is available to answer technical questions about Wood Mackenzie Supply Chain from 8 AM to 8 PM Eastern Time (2 AM to 2 PM Hawai'i Standard Time when daylight savings is in effect) Monday to Friday, except for Holidays posted on the Electronic Procurement Platform's website, both by phone (857-453-5800) and by Email (support@poweradvocate.com).

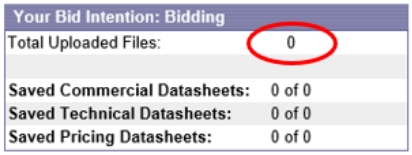
6. Proposers are **strongly encouraged to start uploading early** and avoid waiting until the deadline to upload their Proposals and the required information. Proposers are allowed to add, modify, and/or delete documents that have been previously submitted any time prior to the event close deadline. It is the Proposer's responsibility to ensure a complete Proposal is uploaded into the Electronic Procurement Platform before the Proposal Due Date. At the precise time (typically 2:00pm HST) and date specified for the Proposal Due Date, the Electronic Procurement Platform will automatically close and no files will be accepted by the platform. Proposers are also responsible for following instructions and uploading documents into their appropriate locations in the Electronic Procurement Platform. Documents uploaded in the wrong tab will not be considered by the Company.

7. Any questions or concerns regarding the RFP may be submitted via the RFP Email address provided in RFP Section 1.7. Per RFP Section 1.4.2, the Independent Observer will monitor communication within the bid event. Proposers should always include the Independent Observer when submitting questions to the RFP Email Address.

1.3 PROPOSAL COMPLETION AND CONFIRMATION PROCEDURES

To confirm the submission of all proposal files, in the "Status" tab on the Electronic Procurement Platform, confirm that the "Total Uploaded Files" is the number of expected files to be included in the submission by checking it against your list of submitted files. Example "Status" tab view:





As stated above in Appendix B Section 1.2, nothing should be uploaded to the Commercial, Technical or Pricing Datasheet tabs. Documents uploaded there will not be included in your Proposal submission.

2.0 PROPOSAL SUMMARY TABLE (2.0 BASE VARIATION, 3.0 VARIATION A, 4.0 VARIATION B, AS APPLICABLE)

Summary tables for each Proposal variation. If proposal variations are submitted, summary information for such variations must be identified in similar tables placed in Appendix B Section 3 and Section 4, as applicable.

To be filled out in its entirety by all Proposers:

1	**Proposer Name (Company Name)**	
2	**Parent Company/Owner/Sponsor/Business Affiliation/etc.**	
3	**Project Name**	
4	**Net Nameplate Capacity** (MW) [3]	
4a	**Installed Nameplate Capacity**: the aggregate sum of the net nameplate active power capabilities of all generator and converter equipment (i.e. storage) installed.	
5	**Proposed Facility Location**, Street Address if available, or what City/Area on the island is it near	
6	**TMK(s) of Facility Location** (use 9 digits TMK format)[4]	

[3] A Project's Net Nameplate Capacity is as defined in the applicable IGP Contract.

[4] Island Number (1 digit); Zone Number (1 digit); Section Number (1 digit); Plat Number (3 digits, add leading zeros if less than 3 digits); Parcel Number (3 digits, add leading zeros if less than 3 digits)

7	**Point of Interconnection's Circuit** or **Substation Name**	
7a	**Coordinates for Point(s) of Interconnection** and **Grid Connection Point(s)**, if GCP different from POI (use decimal degrees) [5]	
8	**Proposal Contract Term** (Years)	
9	**Proposal Guaranteed Commercial Operations Date** (MM/DD/YYYY)	
10	**Identify the Project's Generation Technology** (N/A if none) [Firm Projects] **Indicate if Bulk Energy Generating Resource or a Fast Start Generating Resource**	
10a	[PV+BESS, Wind+BESS Projects] **Net Energy Potential (NEP) RFP Projection for the Facility** (MWh) [Firm Projects] **Capacity of the Facility** (MW)	
10b	[Firm Projects] **Renewable Fuel Source for Generation**	
10c	[Firm Projects] **Fossil Fuel Source for Generation**	
11	**Identify the Project's Energy Storage Technology** (N/A if none)	
11a	**Energy Storage Capability for the Facility** (MW and MWh)	
11b	**Is the Project capable of being 100% charged from the grid from the GCOD?** (Yes/No)	
12	**Does the Proposal include any federal tax credits in its pricing?** (Yes/No)	
12a	If the response to #12 is "Yes**," identify each included federal tax credit and assumed value**.	
13	**Does the Project have grid-forming capabilities?** (Yes/No)	
14	**Does the Project have black start capability?** (Yes/No)	
15	**The Proposer hereby certifies that the Project meets all technical and operational requirements identified in the respective IGP Contract (as specified in RFP Section 2.2)?** (Yes/No)	
15a	If the response to #15 is "No", **specify the requirements of the IGP Contract that the Proposal cannot meet and explain in this Appendix B Section 2.10.5 the reasons it cannot.**	
16	**Does the Project have any operational constraints that limit its capabilities?** (Yes/No)	
16a	If the response to #16 is "Yes", **list all operational constraints, and in Appendix B Section 2.2.4 explain and detail every constraints.**	
17	**The Proposer hereby certifies that no single point of failure from the Facility shall result in a decrease of active power measured at the Facility point of interconnection greater than what is specified in RFP Section 2.1.12?** (Yes/No)	
18	**The Proposer hereby certifies that the Proposal (including its pricing elements) is not contingent upon changes to existing County, State or Federal laws or regulations or certain IGP Contract modifications being accepted.** (Yes/No)	

[5] Decimal degrees (YY.YYYYYY, -XXX.XXXXXX) latitude and longitude coordinates of the Point of Interconnection for the project. If there is more than one interconnection point, specify each.

19	**The Proposer hereby certifies under penalties of perjury that this Proposal has been made in good faith and without collusion or fraud with any other person. As used in this certification, the word "person" shall mean any natural person, business partnership, corporation, union, committee, club, or organization, entity, or group of individuals.** (Yes/No)	
20	**The Proposer hereby acknowledges that the Company reserves the right to select more or less than the full amount of generation solicited in this RFP in the event that specific Hawaiian Electric system needs are revised during the course of the RFP process.** (Yes/No)	
21	**Does the Proposer accept the contract terms identified in the applicable Model IGP Contract in its entirety?** (Yes/No)	
21a	If the response to #21 is "No", **specify the name of the Microsoft Word redline file that identifies the proposed modifications to the agreement, provided, however, that such proposed modifications shall be limited to targeted revisions to, and not deletions or waivers of, the agreement's terms, conditions, covenants, requirements or representations.**	
21b	If the response to #21 is "No", confirm that the proposed modifications in the file identified in 21a above are consistent with the information in the Proposal? (Yes/No)	
22	**The Proposer hereby agrees to provide Development Period Security and Operating Period Security as set forth in the applicable model IGP Contract for this Project.** (Yes/No)	
23	**The Proposer hereby certifies that the Proposer, its parent company, or any affiliate of the Proposer: (1) has <u>not</u> defaulted on a current contract with the Company, unless such default was cured by the contracting Proposer, parent company, or affiliate in an expeditious manner to the satisfaction of the Company; (2) has not had a contract terminated by the Company, which was not reinstated or otherwise superseded by a subsequent contract; or (3) has <u>no</u> pending litigation in which the Proposer, parent company, or affiliate has made claims against the Company which is not subject of a settlement agreement that is currently in effect?** (Yes/No)	
23a	If the response to #23 is "No", **specify what part or parts of #23 prevents the Proposer from stating Yes.**	
24	**The Proposer hereby agrees to require all contractors at any tier for a proposed Project, including, but not limited to its engineering, procurement, and construction contractor, enter into a project labor agreement with the Hawaii Building and Construction Trades Council, AFL-CIO and the Hawaii Construction Alliance as required by Section 4.2 of the RFP.** (Yes/No)	
25	**Is the Proposer (or any partner of the Proposer) an Affiliate of the Company?** (Yes/No)	
26	**The Proposer hereby certifies under penalties of perjury that it has not shared this Proposal, or any part thereof, with any other Proposer of a Proposal responsive to this RFP.** (Yes/No)	
27	**Has the Proposer received a PIR for this Project and completed a PIR Meeting for this Project?** (Yes/No) A copy of the report or the PIR Meeting summary is required in this Appendix B Section 2.1.1.	

27a	**Identify the date and time of the PIR Meeting attended by the Proposer.**	
28	**Identify the Proposal Fee submission information** – Date Sent, Delivery Service Used, Tracking Number, U.S.-chartered cashier's check bank name, and check number.	

2.1 REQUIRED FILES ACCOMPANYING PROPOSAL PDF

The following files must accompany each Proposal PDF. All files must be uploaded via the "2. Upload Documents" tab.

2.1.1 These documents can either be merged into the Proposal PDF as part of Section 2.1.1 or they can be submitted as separate files with appropriate pointers to the filenames of the separate files.

- Document signed by an officer or other Proposer representative **authorizing the submission** of the Proposal.
- Fully executed IGP **NDA** (Appendix E to the RFP).
- **Certificate of Vendor Compliance** for the Proposer.
    - In lieu of the Certificate of Vendor Compliance, a **Certificate of Good Standing** for the Proposer and **Federal and State tax clearance certificates** for the Proposer may be provided.
- **Certification of Counsel for Proposer**, if applicable. (See Appendix B Attachment 1.)
- Copy of the **PIR**, or **PIR Meeting written meeting summary** from the Company verifying the project's ability to interconnect at the POI (e.g., capacity available) and/or system upgrades required for the interconnection of the Project.
- [For Hawaiian Electric Proposals Only] **Hawaiian Electric Proposal Team Certification** form**.** See Appendix G Attachment 1.

2.1.2 These documents must be submitted as separate files with appropriate pointers to the filenames of the separate files within each respective Proposal PDF section. These documents which are a necessary part of the Proposal submission must be uploaded along with the Proposal PDF before the Proposal Due Date.

- **Proposal Pricing** file (Appendix B Section 2.2.3 below).
- **All IRS files** specified in Appendix B Section 2.11.1 below.
- Microsoft Word document of **redlines to respective model IGP Contract** (Appendix B Section 2.4.2 below).
- **Community Engagement Plan**, including any community co-creation (See Appendix N).
- **Community Benefits Package** (See Appendix N).
- [For Hawaiian Electric Proposals Only] **Revenue Requirements Worksheets** that support the annual revenue requirements estimates shall be submitted. A starter revenue requirements template file can be requested by the Hawaiian Electric Proposal Team via email to the RFP Email Address once the RFP event opens. The revenue requirements worksheets submitted will be customized by the Hawaiian Electric Proposal Team to reflect the details of the Project's Proposal. All assumptions used will be reflected in an assumptions input tab.
- **Pro Forma Cashflow** for each variation (Appendix B Section 2.3.2.2 below).

2.2 PROPOSAL SUMMARY/CONTACT INFORMATION

2.2.1 Provide a **primary point of contact** for the Proposal being submitted:

- Name
- Title
- Mailing Address

- Phone Number
- Email Address – this will be the official communication address used during the RFP process

2.2.2 **Executive Summary of Proposal.** The executive summary must include an approach and description of the important elements of the Proposal, including variation descriptions if variations to the base variation are being submitted. Refer to RFP Section 3.7.2 and 3.7.2.1 for an explanation of minor variations allowed.

If variations to the base variation are proposed, a **table summarizing the differences between all variations** shall be created and included in this section.

RFP Section 2.2.3 states the Company is not seeking proposals for microgrid. However, if a Project includes microgrid capabilities, as stated in RFP Section 2.2.3 the Proposer shall identify the capabilities and restrictions in this section.

2.2.3 **Pricing information. Proposal pricing information must only be provided in the Proposal Pricing file that is kept as a separate file from the Proposal PDF. (Appendix B Attachment 1)** If variations to the base variation are proposed, each variation's pricing summary must also only be identified in the Proposal Pricing file within the respective worksheet section for the variation as applicable. Proposers must provide pricing information only in the Proposal Pricing file – do not embed pricing information in any other portion of the Proposal. Cost information is allowed in the pro forma cashflow for the Project required with each Proposal. [**For Hawaiian Electric Proposals Only**] Cost information is allowed in the Revenue Requirements Worksheet file that supports the annual revenue requirements estimates.

2.2.4 Provide a **high-level overview of the proposed Facility**, including at a minimum the following information:

- Installed Nameplate Capacity (MW_{AC} and MW_{DC})
- Net Nameplate Capacity of the Facility at the Point(s) of Interconnection (MW_{AC})
- Identified available MW capacity at the Point(s) of interconnection (MW_{AC}).
  - Identify the communication from where the POI has the capacity to interconnect the project (e.g., Company's response to Proposer's inquiry on X date/time).
- Identify all System upgrades the Proposal includes to allow Project to interconnect to System above the identified available MW capacity.
  - Identify the communication from where the System upgrade information was acquired (e.g., Company's response to Proposer's inquiry on X date/time).
- For existing projects, the Proposal must identify and state in this section any changes required to meet the requirements of this RFP and/or applicable IGP Contract.

Projects that include a generation component must specify:

- Technology Type of Generation
- Number of Generators
- Rated Output of each Generator
- Generator Facility Design Characteristics
- Fuel Source for Generation (both Renewable Fuel and Fossil Fuel)

- Provide all applicable operational constraints known such as, but not limited to, those for environmental and/or permit compliance. (e.g. hot/cold start times to full output, start-up fuel requirements, start-up and shut-down sequence, limitation on number of start-ups/shutdowns per day, operational constraints due to noise restrictions, minimum/maximum run hour requirements, minimum up time, minimum down time, etc.)

For RDG Facilities, provide the following items related to the NEP RFP Projection[6]:

- Projected **hourly annual energy potential production profile of the Facility (24 hours x 365 days, 8760 generation profile, POI P50)**
- Preliminary design of the facility
- Typical meteorological year file used to estimate the Renewable Resource Baseline,
- Explanation of the methodology and underlying information used to derive the Project's NEP RFP Projection. Including, but not limited to:
    - Preliminary design of the Facility and the typical meteorological year file used to estimate the Renewable Resource Baseline, as required in the model RDG Contract.
    - Long-term resource data used, gross and net generation (MWh), and assumptions (loss factors, uncertainty values, any grid or project constraints)

Generation projects that include a storage component or stand-alone storage projects must specify:

- Technology Type of Storage (e.g., lithium ion battery)
- Interconnection type (AC or DC)
- BESS Contract Capacity (MW / MWh), as defined in the applicable contract
- Operational Limitations, such as, but not limited to: grid charging limits (with respect to ITC), energy throughput limits (daily, monthly, annually), Stage of Charge ("SOC") restrictions (min/max SOC while at rest (not charging/discharging)), etc. Proposed Operational Limits cannot be in conflict with the energy discharge requirement in the RFP's Section 2.1 Scope of the RFP. If such a conflict is identified, the Proposal may be disqualified.
- Round Trip Efficiency ("RTE"). Specify a single value (percentage) that the Facility is required to maintain throughout the term of the applicable contract. The RTE must consider and reflect:
    - the technical requirements of the Facility (as further set forth in the applicable contract);
    - that the measurement location of charging and discharging energy is at the Point of Interconnection;
    - electrical losses associated with the point of interconnection measurement location;
    - any auxiliary and station loads that need to be served by BESS energy during charge and discharge that may not be done at BESS Contract Capacity or over a fixed duration; and
    - See Attachment W to the applicable RDG PPA or ESPA for details of how the RTE will be operationally validated
- Number of charge/discharge cycles per year the storage component is capable of
- Allowed Losses (kWh/24-hour period)

[6] See RFP Section 2.1.18 and Attachment U to the RDG PPA.

- Describe any augmentation plans for the storage component to maintain the functionality and characteristics of the storage during the term of the applicable contract. Include any expected interval of augmentation (months/years).
- Estimated useful life of the storage component (including augmentation if used) (years)
- For generation coupled with energy storage, described the Allowed Percentage of Storage Component's charging that can come from the System Grid, if any, and any conditions of charging (when, percentage of annual total energy input, etc.)

Firm generation projects that operate on fuel must provide the following information for both its primary biofuel and its alternate fossil fuel:

- Specify if the Proposer agrees to commit to provide the fuel for the entire proposed term of the Firm PPA? (yes/no)
- Provide a guaranteed heat rate curve for the Facility must be provided with your Proposal. The guaranteed heat rate curve must be specified as a three-term second-order polynomial.
- Specify and describe any minimum monthly/quarterly/annual fuel purchases required in your fuel contract, or specify if no minimum fuel purchase is required.
- Specify and describe any minimum loads or minimum up-times that are driven by the technical and operational capabilities of your Facility, or specify if there is no minimum.
- Describe their preliminary plan to ensure an Adequate Fuel Supply required for the operation and maintenance of the facility as described in Attachment Y, Section 14 of the Model Firm PPA.
- For all projects other than biofuel, provide evidence that the fuel will be secured for the duration of the Firm PPA term. For biofuel source Projects, provide evidence of a fuel supply for at least the first 3 years of the Firm PPA term.
- Provide an approximate number of days per year of planned maintenance.
- For Biofuel source Projects, describe:
  - Operational requirements for switching between biofuel and fossil fuel such as:
    - Will all equipment needed to perform a fuel switch be held at the Facility
    - Time to perform a switch, notification period required before a fuel switch, and whether a Facility will be unavailable during the switch
    - Whether operation on fossil fuel will impact financing, land lease agreements, or result in additional permits/permit revisions
  - Operational requirements for operating on a blend of biofuel and fossil fuel, if able, such as:
    - Minimum blend of biofuel that the equipment may run on without modification
    - Time required to adjust blend, notification period required before adjustment of blend, and whether the Facility will be unavailable during the adjustment
    - Whether operation on a fossil fuel blend will impact financing, land lease agreements, or result in additional permits/permit revisions
- For Biofuel source Projects provide a biofuel, fossil fuel, or, if applicable, blend price forecast or formula with your Proposal.

2.3 FINANCIAL BACKGROUND

Provide the following financial information identified below. As specified in the General Instructions in Appendix B Section 1.0 above, all information (including attachments) must be provided in English, be provided in U.S. Dollars and use U. S. credit ratings.

2.3.1 Identification of Equity Participants

2.3.1.1 Who are the **equity participants** in the Project (or the equity partners' other partners)?

2.3.1.2 Provide an **organizational structure** for the Proposer including any general and limited partners and providers of capital that identifies:

- Associated responsibilities from a financial and legal perspective
- Percentage interest of each party

2.3.2 Project Financing

2.3.2.1 **How will the Project be financed** (including construction and term financing)? Address at a minimum:

- The Project's projected financial structure
- Expected source of debt and equity financing

2.3.2.2 [For IPP and Affiliate Proposals] Proposers must identify all **estimated development and capital costs** for the Proposal. Provide a **pro forma cashflow** sheet for each proposal variation (base and optional variations). A separate pro forma cashflow sheet shall be provided for both Investment Grade Pricing and Non-Investment Grade Pricing versions of each variation. Should any conflict arise between the information provided in the Pro Forma Cashflow sheet or the Proposal PDF, the Proposal PDF shall take precedence. The pro forma cashflow should resemble the format provided in Appendix B Attachment 5. A template can be downloaded from the "1. Download Documents" tab in the Electronic Procurement Platform**.** The template is labelled as IGP RFP Appx B - Att 5 Pro Forma. In addition to the pro forma cashflow for each variation, descriptions of the following costs and breakdowns must be provided:

- Equipment
  - Identify the manufacturer and model number for all major equipment
- Construction
  - Identify and breakdown what is included in this category and any assumptions made
- Engineering
- Seller-Owned Interconnection Facilities
  - Identify and breakdown what is included in this category and any assumptions made
- Company-Owned Interconnection Facilities
  - Identify and breakdown what is included in this category and any assumptions made, including:
    - Company costs per Appendix H
    - Proposer's estimated costs for Proposer-Built COIF
  - Provide the cost breakdown and assumptions using the template provided in Appendix H, Attachment 1
- System upgrades necessary to interconnect Project to existing transmission line/substation

        - Identify and breakdown what is included in this category and any assumptions made, including:
            - Proposer's estimated costs for all System upgrades identified in Company's feedback of upgrades required for Project interconnection.
            - Proposer's estimated costs for all System upgrades beyond what was identified in Company's feedback.
        - Provide the cost breakdown and assumptions using the template provided in Appendix H, Attachment 1
    - Land
    - Financing Costs
    - Annual O&M
    - (For Projects that include a storage component) Specify a percentage of the total project cost that is estimated to be attributed to the storage functionality of the Facility. As the storage functionality is treated as a lease, the Company will use the percentage for its preliminary calculation of the lease liability only. This percentage requested for the Company's accounting purposes does not affect nor alter the liquidated damage provisions of the PPA, as those provisions reflect the benefit the Company seeks from the Project's storage functionality.

[For Hawaiian Electric Proposers Only] Proposer must identify all **estimated development and capital costs** for the Proposal. At a minimum, the following costs and breakdowns must be provided:

- Facility (including any generation and storage components)
- Outside Services
- Interconnection
    - Seller-Owned Interconnection Facilities
        - Identify and breakdown what is included in this category and any assumptions made
    - Company-Owned Interconnection Facilities
        - Identify and breakdown what is included in this category and any assumptions made, including:
            - Company costs per Appendix H
            - Proposer's estimated costs for Proposer-Built COIF
        - Provide the cost breakdown and assumptions using the template provided in Appendix H, Attachment 1
- Overhead Costs
- Allowance for Funds Used During Construction
- Annual O&M
- Specify the percentage of the total cost associated with the storage component of the Facility
- (For Projects that include a storage component) Specify a percentage of the total project cost that is estimated to be attributed to the storage functionality of the Facility. As the storage functionality is treated as a lease, the Company will use the percentage for its preliminary calculation of the lease liability only. This percentage requested for the Company's accounting purposes does not affect nor alter the liquidated damage provisions of the PPA, as those provisions reflect the benefit the Company seeks from the Project's storage functionality.

2.3.2.3 Discuss and/or provide **supporting information on any project financing guarantees**.

2.3.2.4 Describe any **written commitments obtained from the equity participants**.

2.3.2.5 Describe any **conditions precedent to project financing**, and the Proposer's plan to address them, other than execution of the IGP Contract or any other applicable project agreements and State of Hawaii Public Utilities Commission approval of the IGP Contract and other agreements.

2.3.2.6 Provide any **additional evidence to demonstrate that the Project is financeable**.

2.3.3 Project Financing Experience of the Proposer

Describe **the project financing experience of the Proposer** in securing financing for projects of a similar size (i.e., no less than two-thirds the size) and technology as the one being proposed including the following information for any referenced projects:

- Project Name
- Project Technology
- Project Size
- Location
- Date of Construction and Permanent Financing
- Commercial Operations Date
- Proposer's Role in Financing of the Project
- Off-taker
- Term of the Interconnection Agreement
- Financing Structure
- Major Pricing Terms
- Name(s) of Finance Team Member(s); Time (i.e., years, months) worked on the project and Role/Responsibilities

2.3.4 Evidence of the Proposer's Financial Strength

2.3.4.1 Provide **copies of the Proposer's audited financial statements** (balance sheet, income statement, and statement of cash flows):

- Legal Entity
  - Three (3) most recent fiscal years
  - Quarterly report for the most recent quarter ended
- Parent Company
  - Three (3) most recent fiscal years
  - Quarterly report for the most recent quarter ended

2.3.4.2 Provide the **current credit ratings** for the Proposer (or Parent Company, if not available for Proposer), affiliates, partners, and credit support provider:

- Standard & Poor's
- Moody's
- Fitch

2.3.4.3 Describe any **current credit issues** regarding the Proposer or affiliate entities raised by rating agencies, banks, or accounting firms.

2.3.4.4 Provide evidence that **credit-worthy entities are interested in financing the Project**, such as, but not limited to:

- Letters of Interest or Intent from banks or investors
- Formal Commitment Letters from financial institutions
- Written commitments from equity participants
- Proof of access to lines of credit
- Bank references or credit ratings

2.3.4.5 Provide any **additional evidence that the Proposer has the financial resources and financial strength** to complete and operate the Project as proposed.

2.3.5 Provide **evidence** that the Proposer can **provide the required securities**

2.3.5.1 Describe the Proposer's **ability (and/or the ability of its credit support provider) and proposed plans to provide the required securities** including:

- Irrevocable standby letter of credit
- Sources of security
- Description of its credit support provider

2.3.6 Disclosure of Litigation and Disputes

Disclose any **litigation, disputes, and the status of any lawsuits or dispute resolution** related to projects owned or managed by the Proposer or any of its affiliates.

2.3.7 State to the best of the Proposer's knowledge: Will the Project result in **consolidation** of the Developer entity's finances onto the Company's financial statements under FASB ASC 810. **Provide supporting information** to allow the Company to verify such conclusion.

2.4 PROPOSED CONTRACT MODIFICATIONS

2.4.1 **State whether the Proposer accepts the contract terms identified in the model IGP Contract** in its entirety or if modifications to the model agreements are proposed. For the RDG PPA, Proposers should additionally review and mark for deletion any technology-specific provisions that are not applicable to the proposed project (e.g., wind provisions, if proposing a PV project). Such information is denoted with brackets within the model contracts.

2.4.2 If Proposers elect to propose modifications to the applicable IGP Contract, **identify the name of the Microsoft Word red-line file** in the proposal submission that offers the proposed modifications to the model language that the Proposer is agreeable to. Proposers electing to propose modifications must **provide a Microsoft Word red-line version of the applicable IGP Contract** identifying specific proposed modifications to the model language that the Proposer is agreeable to and a detailed explanation and supporting rationale for each modification. General comments, drafting notes and footnotes such as "parties to discuss" are unacceptable and will be considered non-responsive.

Proposers that do not upload redlines of the applicable IGP Contract with their Proposal submission will be deemed to have accepted the Model IGP Contract in its entirety. If no modifications are proposed, please state in this section "no modifications to the Model IGP Contract".

As set forth in RFP Section 3.11.5.1, proposed modifications to the IGP Contract will be subject to negotiation between the Company and the Final Award Group and should not be assumed to have been accepted either as a result of being selected to the Final Award Group or based on any previously executed PPA.

2.5 SITE INFORMATION

2.5.1 The Proposal must demonstrate that the Proposer has Site Control for all real property required for the successful implementation of a specific Proposal at a Site not controlled by the Company, including any Interconnection Facilities, with the exception of right-of-way or easements for the interconnection route, for which the Proposer is responsible. In addition to the information required below, Proposals must identify in this section any developmental requirements and restrictions such as zoning of the Site, whether the Site is within a special management area or within conservation district lands, and the status of all required easements. **Proposer must provide documentation set forth in RFP Section 4.3 to prove Site Control.**

2.5.2 Provide a **map of the Project site** that clearly identifies:

- Location of the parcel on which the site is located
- Tax map key number (9-digit format: Island Number (1 digit), Zone Number (1 digit), Section Number (1 digit), Plat Number (3 digits, add leading zeros if less than 3 digits), Parcel Number (3 digits, add leading zeros if less than 3 digits)
- Site boundaries (if the site does not cover the entire parcel)
- Total acreage of the site
- Point(s) of Interconnection
- Grid Connection Point(s)
- Relationship of the site to other local infrastructure
- Existing easements encumbering the parcel on which the site is located

2.5.3 Provide a **site layout plan** which illustrates:

- Proposed location of all equipment
- Proposed location of all facilities on the site, including any proposed line extensions

2.5.4 Describe the **Interconnection route** and include:

- Site sketches of how the facility will be interconnected to the Company's System (above-ground and/or underground).
- Identify the approximate latitude and longitude of the proposed Point of Interconnection, in decimal degrees format, to six (6) decimal places.
- Description of the rationale for the interconnection route.

2.5.5 Identify **any rights-of-way or easements** that are required for access to the site or for interconnection route:

- Describe the status of rights-of-way or easement acquisition.
- Describe the detailed plan for securing the necessary rights-of-way or easement, including the proposed timeline and any evidence of any steps taken to date. Proposers must provide a credible and viable plan for obtaining such rights-of-way or easement(s), including the proposed timeline, the identification of all steps necessary to obtain such right-of-way or easement(s), and evidence of any steps taken to date.

2.5.6 Provide the following information related to **land use and impervious cover**[7] of the proposed Project:

- **Land use map** including current zoning of the proposed Project site and adjacent properties; indicate percentage of the proposed Project site for each zoning type identified.
- **Hawaii Land Study Bureau map** identifying the overall productivity rating class(es) for all lands located within the boundaries of the proposed Project site.
- **Map depicting existing impervious cover** of the proposed Project site; must include the current percentage of impervious cover of the utilized area for the proposed Project.
- **Map depicting final impervious cover** of the proposed Project site; must include the proposed percentage of impervious cover of the utilized area for the proposed Project.
    - In calculations, Proposer must use a consistent area as the base (denominator) between percentages for existing and final impervious cover.
- If the proposed Project is on reclaimed land, such as brownfield,[8] included a **complete description of the reclaimed land and any current land use restrictions**.

2.6 ENVIRONMENTAL COMPLIANCE AND PERMITTING PLAN

Proposals must address each item listed below and provide evidence of analysis of environmental impacts associated with the Project, regulatory requirements, and mitigation efforts. Each proposal must incorporate the list below as an outline, together with complete and thorough responses to each item.

2.6.1 Proposers must identify and disclose all significant permits, approvals, appurtenances, and entitlements (including applicable access, rights of way and/or easements, environmental permits, and other determinations) (collectively, the "permits") required and have a plan and schedule for securing such permits. The Proposer must disclose all identified (a) discretionary permits required, i.e., those requiring public or contested case hearings and/or review and discretionary approval by an appropriate government agency, and (b) ministerial conditions without discretionary approval conditions. In all cases, the Proposer must provide a credible and viable plan to secure all necessary and appropriate permits for the Project. Proposer shall identify the need for such permit, exemption or amendment and provide a list of required prerequisites and/or conditions and a realistic timeline necessary to obtain such permit, exemption or amendment satisfactory for Proposer to meet its designated GCOD. For example, suppose the Project is located within an agricultural

[7] As defined by the EPA (8 Tools of Watershed Protection in Developing Areas | Watershed Academy Web | US EPA), impervious cover is "the sum total of all hard surfaces within a watershed including rooftops, parking lots, streets, sidewalks, driveways, and surfaces that are impermeable to infiltration of rainfall into underlying soils/groundwater." For purposes of evaluation, PV panels shall be considered impervious.

[8] As defined by the EPA (Overview of EPA's Brownfields Program | US EPA), brownfield is "a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant."

district. In that case, the Proposer shall provide evidence of the Proposer's verification with the appropriate government agency that the Project complies with HRS Section 205-2 and Section 205-4.5, relating to solar energy facilities placed on agricultural land, provided, however, that where a special use permit (under Section 205-6), exemption (under Section 205-6), or amendment to land use district boundary lines (under Section 205-4) is required to secure such compliance.

2.6.1.1 Describe your **overall land use and environmental permits and approvals strategy** and approach to obtaining successful, positive results from the agencies and authorities having jurisdiction. Your proposal must include:

- Explanation of the conceptual plans for siting
- Studies/assessments completed and still required
- All permits and approvals for the project site, including those for the interconnection route.
- The Gantt format schedule identifies the sequencing of the permit application, approval activities, and critical path. (schedule must be in MM/DD/YY format.)

2.6.1.2 Discuss the **city zoning, state land use classification, and Federal land use**:

- Identify present and required zoning and the ability to site the proposed Project within those zoning allowances.
- Identify present and required land use classifications and the ability to site the proposed Project within those classifications.
- Provide evidence of proper zoning and land use classifications for selected sites and interconnection routes.
- If changes in the above are required for the proposed Project, provide a plan and timeline to secure the necessary approvals.

2.6.1.3 Identify all required discretionary and non-discretionary **land use, environmental and construction permits, and approvals** as are necessary for the development, financing, construction, and operation of the proposed Project, including but not limited to zoning changes, Environmental Assessments, and/or Environmental Impacts Statements. Provide a **listing of such permits and approvals** indicating:

- Permit Name
- Federal, State, or Local agencies and authorities having jurisdiction over the issuance
- Status of approval and anticipated timeline for seeking and receiving the required permit and/or license
- Explanation of your basis for the assumed timeline, including input from regulators
- Explain any situation where a permit or license for one aspect of the Project may influence the timing or permit of another element (e.g., a case where one permit is contingent upon completion of another permit or license), if applicable.
- Explain your plans to secure all permits and approvals required for the Project.
- Air Permits: Firm projects with combustion sources must address the following items.
    - Identify the type of permit required (Prevention of Significant Deterioration (PSD), Covered Source Permit (CSP), Noncovered Source Permit (NSP))
    - Identify if the Project has an existing air permit or requires a new source permit or a modification to an existing air permit.
    - Identify amounts and types of pollutants and permit thresholds or provide a statement if not applicable to the proposed source.
    - Identify the best available control technology anticipated to be used.

- If responder is bidding using an existing plants, please submit max capacity factor and a permit for allowed capacity factor.

2.6.2 Provide a **preliminary environmental assessment of the site** (including any environmental and/or biological reports and identifying future additional studies needed). The evaluation should include potential short- and long-term **impacts** associated with, or resulting from, the proposed Project – including direct, indirect, and cumulative effects associated with the proposed Project's development, construction, operation, and maintenance in every area identified below. Discuss if alternatives have been or will be considered. Potential impacts should be determined based on each resource area's proposed actions area of potential effect (APE). The assessment shall also include Proposer's short- and long-term plans to mitigate such impacts and if they impact the overall Project timeline, and an explanation of the mitigation strategies for, but not limited to, each of the significant environmental areas as presented below:

- Natural Environment
  - Air quality
    - For all fuels that may be used, discuss estimated emissions and greenhouse gas calculations (including biogenic emissions), their potential impacts, and mitigation related to air quality
    - Include short-term impacts and mitigation measures for the construction phase (dust control, etc.)
  - Natural Resources
    - At a minimum, Proposer will include preliminary information on existing habitat(s), critical habitats, avian protection, wetlands, wildlife refuges, flora and fauna, essential fish habitats, and threatened and/or endangered species.
    - Include existing or planned mitigation and comprehensive surveys/studies.
  - Climate:
    - Discuss any impacts to climate and any potential effects that climate change (sea-level rise etc.) may have on the Project over the course of the Project term.
  - Geology and Soils
    - Describe the applicable proposed sites' topography, soil classification, underlying geology, and volcanic/seismic activity
    - Discuss any impacts and mitigation efforts for soils and topography erosion, changes to impervious cover before and after development, run-off concerns etc.)
    - Discuss any potential effects of volcanic/seismic activity on the Project
    - If applicable, discuss bathymetry and seasonal sea states
- Land Regulation
  - Land Uses, including any land use restrictions and/or pre-existing environmental conditions/contamination
    - At a minimum, Proposer will include information on past use of the property, any previous Phase I and/or Phase II Environmental Site Assessments (ESAs), information on any known releases to the environment and/or contamination, any State of Hawaii Department of Health (DOH) Environmental Hazard Management Plans (EHMPs), or environmental covenants.
    - Discuss any additional planned Phase I and/or Phase II ESAs
  - Flood and tsunami hazards (including the site's flood zone based on the Hawaii Department of Land and Natural Resources flood map)
  - Discuss current uses (i.e., recreational, agricultural, fishing, hunting, boating, gathering, views [parks, scenic overlooks, scenic drives, others], etc.) of the property and any potential impacts and mitigations to those uses
  - Noise
    - Discuss any potential short- and long-term noise impacts on the surrounding community

        - Discuss any mitigation measures for potential noise impacts
- Solid Waste & Utilities
    - Discuss any solid waste streams that will be generated during construction and throughout the life of the Project. Define any disposal plans for such waste streams and discuss potential impacts and mitigations
    - Discuss the impacts on community utilities (water use, sewer, etc.)
- Hazardous Materials and Wastes
    - Discuss any hazardous materials to be utilized or hazardous wastes generated and define disposal plans (if applicable)
- Socioeconomics
    - Describe the socioeconomics of the proposed site location
    - Discuss potential socioeconomic impacts such as food security and mitigations
- Transportation
    - Discuss any potential impacts on transportation infrastructure use and traffic patters (i.e., availability and use of deep draft harbors, airports, airspace, roads, sea space, etc.). Also, discuss potential mitigations.
- Water Resources
    - Discuss any impacts to water quality and demonstrate that the Project complies with the Federal Clean Water Act and any applicable State and County regulations related to water quality.
    - Discuss dewatering Best Management Practices (BMPs), Stormwater Pollution Prevention Plans, and National Pollutant Discharge System (NPDES) (if applicable)
    - Describe the aquifer, water availability, and amounts of water to be used over the stages of the Project with potential impacts and mitigations
- Public Safety Services (Police, Fire, Emergency Medical Services)
    - Describe any potential Project impacts to Public Safety Services
    - Fire mitigation plans (including a description of fire suppression systems), site emergency response plans, security plans, and coordination with local Public Safety Services should be discussed.
- Potential Cumulative and Secondary Impacts

2.6.3 Provide a **decommissioning plan**, including:

- Developing and implementing program for recycling to the fullest extent possible, or otherwise properly disposing of installed infrastructure, if any, and
- Demonstrating how restoration of the Site to its original ecological condition is guaranteed in the event of default by the Proposer in the applicable Site Control documentation.

2.7 CULTURAL RESOURCE IMPACTS

2.7.1 Provide a **proposal to ensure cultural sites are identified and carefully protected** as part of a cultural impact plan as it pertains to the Project Site and interconnection route. This proposal must include at a minimum:

- A high-level plan to complete, within the timeline set forth in RFP Section 4.4.2.1 , a **cultural assessment** that identifies:
    1) valued cultural, historical, or natural resources in the area in question, including the extent to which traditional and customary native Hawaiian rights are exercised in the area;

2) the extent to which those resources – including traditional and customary native Hawaiian rights – will be affected or impaired by the proposed action; and
3) the feasible action, if any, to be taken to reasonably protect any identified cultural, historical, or natural resources in the area in question, and the reasonable protection of traditional and customary native Hawaiian rights in the affected area.

- Proposer's **experience with cultural resource impacts** on past projects
- Consultant's experience with cultural resource impacts on past projects (name, firm, relevant experience, and a signed letter as proof that Proposer has contracted with a Consultant prior to the Proposal Due Date)
- **Status of the cultural impact plan** (including, but not limited to: Cultural Impact Assessment, Cultural Landscape Study, Cultural Resource Management Plan, Ethnographic Survey, Consultation on Section 106 Process, and/or Traditional Cultural Property Studies)

2.7.2 **Archaeological Literature Review** of existing cultural documentation filed with the State Historic Preservation Division and a **Field Inspection Report** which identifies any known archaeological and/or historical sites within the project area. If sites are found, Proposers must provide a plan for mitigation from an archaeologist licensed in the State of Hawaii.

2.8 COMMUNITY ENGAGEMENT

Detailed instructions and requirements related to community outreach and engagement are identified in the RFP's **Appendix N (Community Engagement Requirements)**, including the requirements to submit the Project's **Community Engagement Plan**, any referenced material that is to be considered when evaluating the Community Engagement Plan, and the **Project's Community Benefits Program** with your Proposal submission.

The Proposer's Community Engagement Plan (including any **Community co-creation plan**, if applicable) and Community Benefits Program shall be submitted as standalone documents. As instructed in step 3 of Appendix B Section 1.2 above, pointers to those standalone document files must be specified identifying the file names of those standalone documents.

2.8.1 Identify the Community Engagement Plan filename.

2.8.2 Identify the Community Benefits Program filename.

2.9 OPERATIONS AND MAINTENANCE (O&M)

2.9.1 To demonstrate the long-term operational viability of the proposed Project, describe the **planned operations and maintenance**, including:

- Operations and maintenance funding levels, annually, throughout the term of the contract.
- Description of the operational requirements by frequency (daily, weekly, monthly, yearly, as-necessary, run hour interval) and maintenance requirements by frequency (daily, weekly, monthly, yearly, as-necessary, run hour interval).
- A discussion of the staffing levels proposed for the Project and location of such staff. If such staff is offsite, describe response time and ability to control the Project remotely.

- Technology specific maintenance experience records.
- Identification of any O&M providers.
- The expected role of the Proposer (Owner) or outside contractor.
- Scheduling of major maintenance activity.
- Plan for testing equipment.
- Estimated life of Generation and/or Storage Facilities and associated Interconnection Facilities.
- Safety plan, including historical safety records with environmental history records, violations, and compliance plans.
- Security plan.
- Site maintenance plan.
- Substation equipment maintenance plan.

2.9.2 State whether the Proposer would **consider 24-hour staffing**. Explain how this would be done.

2.9.3 Describe the **Proposer's contingency plan**, including the Proposer's mitigation plans to address failures. Such information should be described in the Proposal to demonstrate the Project's reliability with regard to potential operational issues.

2.9.4 Describe if the Proposer will **coordinate their maintenance schedule** for the Project with the Company's annual planned generation maintenance.

2.9.5 Describe the **status of any O&M agreements or contracts** that the Proposer is required to secure. Include a discussion of the Proposer's plan for securing a long-term O&M contract.

2.9.6 Provide **examples of the Proposer's experience with O&M services** for other similar projects.

2.10 TECHNICAL AND OPERATIONAL REQUIREMENTS

Please also see the Technical and Operational Requirements evaluation criteria (Threshold Requirement in RFP Section 4.3. and Non-Price in RFP Section 4.4.2.1) to better understand the desired contents of the Proposal and how they will be evaluated.

2.10.1 Provide a preliminary **description of the Facility and its design** in accordance with the applicable IGP Contract. Proposals shall provide at a minimum the items listed below:

- Site Plan and General Facility Arrangement Layout
- Details of the major equipment as indicated in Section 5 of Attachment A (Equipment) of the applicable IGP contract. Proposers response should include documentation of the detailed equipment specifications, characteristics, and performance to prove satisfaction of the technical and operational requirements. A completed version of Section 5 (Equipment) Attachment A (Equipment) of the applicable IGP contract is to also be included.
- Drawings, Diagrams, Lists, Settings, and As-Builts
    - Diagrams approved by a Professional Electrical Engineer registered in the State of Hawai‘i, indicated by the presence of the Engineer's Professional seal on all drawings and documents. Including but not limited to:
        - A single-line diagram, relay list, trip scheme and settings of the generating facility, which identifies the Point of Interconnection, demarcation between Seller-Owned and

Company-Owned Interconnection Facilities, circuit breakers, relays, switches, synchronizing equipment, monitoring equipment, and control and protective devices and schemes.

- Overview of the **Facility Control Systems** – descriptions of central control and inverter- or resource-level control; including the philosophy of control.

2.10.2 Provide the **sample rate of critical telemetry** (i.e. local frequency and voltage) used for Plant responses as inputs to the Facility and equipment control systems. Further, provide the expected control cycle time for each Facility Control System.

2.10.3 [**For Facilities that include BESS inverters]** Provide a description of the Facility's **grid-forming mode.**

2.10.4 Provide a description of the Facility's **self-energization and black start capabilities** as further distinguished and described in Section 3 (technical and operational requirements) of Attachment B (Facility owned by Seller) of the applicable IGP contract.

2.10.5 **Capability of meeting Technical and Operational Requirements**. The proposed Facility must meet the performance attributes identified in Attachment B, Section 3 (technical and operational requirements) of the applicable IGP Contract. Proposers **must provide confirmation that the proposed Facility meets the requirements identified in the model IGP Contract** or provide clarification or comments about the Facility's ability to meet the technical and operational requirements. Proposals should include sufficient documentation to support the stated claim that the Facility will be able to meet each technical and operational requirement set forth in Section 3 of Attachment B of the applicable IGP Contract. The Proposal should include information required to make such a determination in an organized manner to ensure this evaluation can be completed within the evaluation review period. For each technical and operational requirement, relevant sections of equipment documentation that indicate the requirement can be met should be extracted into the Proposer's response for each requirement, as well as appropriate reference to the documentation for where the information was extracted from. Examples of documentation to prove certain capabilities include but are not limited to:

- Reactive vs. Active power capability curves
- Absolute equipment limit capability curves or data showing expected performance through the continuous operating and ride-through regions
- Control System design documents
- Active power dispatch constraints (i.e. permit limits and/or equipment limits)

2.10.6 **Coordination of Operations**: Provide a description of the control facilities required to coordinate generator operation with and between the Company's System Operator and the Company's System.

- Include a description of the equipment and technology used to facilitate dispatch to the Company and communicate with the Company.
- Include a description of the control and protection requirements of the generator and the Company's System.

2.10.7 **Active Power Control Interface**: Describe the means of implementing active power control and the Power Possible, including the contribution to the dispatch signal from paired storage, if any. Provide the Proposer's **experience** dealing with active power control, dispatch, frequency response, and ride-through.

2.10.8 **Energy Storage Technology Specific Requirements**: For stand-alone storage projects or generation projects that include a storage component, provide information and documentation to support the ability to meet the requirement in Section 9(d) Battery Energy Storage System of Attachment B, including any additional limitations not already specified.

2.11 IRS SUBMITTAL INFORMATION

2.11.1 Provide the appropriate completed **Project Interconnection Data Request worksheets** for the proposed technology with the Proposal submission. (The worksheets can be found in the Electronic Procurement Platform's "1. Download Documents" tab as IGP RFP Appx B - Att 2a Data Request (PV Gen) 240409.xls, IGP RFP Appx B - Att 2b Data Request (Wind Gen) 240409.xls or IGP RFP Appx B - Att 2c Data Request (Synch Gen) 240409.xls Microsoft Excel files.) Standalone Storage Projects will use the IGP RFP Appx B - Att 2a Data Request (PV Gen) 240409.xls worksheet and omit the PV sections.

2.11.2 Also provide all **project single line diagram(s)** with the Proposal submission**.**

2.11.3 **Models for equipment and controls** (see Appendix B Attachment 4)**, complete documentation and user manuals for all technical models** (for inverters and power plant controller)**, generation unit manufacturer datasheet(s), generation unit reactive power capability curve(s), overlaid generation facility technical model output data for three-phase fault and single-phase fault,** and a **report, with plots, documenting that Proposers have tested their models under all scenarios prescribed** shall be submitted within the timeframes specified in RFP Section 5.1. Proposers may also download the **Hawaiian Electric Generation Facility Technical Model Requirements and Review Process** documentation labelled as IGP RFP Appx B - Att 3 Tech Model Reqmts Review Process.pdf from the "1. Download Documents" tab.

2.11.4 See Appendix B Attachment 4 for a summary of the model requirements and IRS task scope.

2.12 PROVEN TECHNOLOGY

2.12.1 Provide all supporting information for the Company to assess the **commercial and financial maturity of the technology** being proposed. Provide any supporting documentation that shows examples of projects that:

- Use the technology at the scale being proposed
- Have successfully reached commercial operations in commercial applications (for example, by demonstrating evidence of an executed PPA)
- Demonstrate experience in providing active power dispatch

2.13 EXPERIENCE AND QUALIFICATIONS

Proposers, its affiliated companies, partners, and/or contractors and consultants are required to demonstrate project experience and management capability to successfully develop and operate the proposed Project.

2.13.1 Provide a hierarchical **organizational/management chart** for the Project that lists all key personnel and project participants dedicated to the Project and identifies the management structure and responsibilities. In addition to the chart, Proposers must provide biographies/resumes of the key personnel, including position, years of relevant experience and similar project experience. Proposers must provide specifics on each participants' area of expertise in renewable energy projects. Identify architects and engineers or provision to provide same that are licensed to practice in the State of Hawai'i. Proposers must also provide a completed table:

- For each of the project participants (including the Proposer, partners, and proposed contractors), **fill out the table below** and provide statements that list the specific experience of the individual in: financing, designing, constructing, interconnecting, owning, operating, and maintaining renewable energy generating or storage facilities, or other projects of similar size and technology, and
- Provide any evidence that the project participants have worked jointly on other projects.

	EXPERIENCE: In the applicable columns below, include project details (i.e., project name, location, technology, size) and relevant job duties (role/responsibilities) and time (in years/months) spent on the project. List multiple projects if applicable. Do not list projects that did not reach commercial operations.						
Participant Name:	**Financing**	**Designing**	**Constructing**	**Interconnecting**	**Owning**	**Operating**	**Maintaining**
1.							
2.							
3.							
…							

2.13.2 Identify those **members of the team** the Proposer is submitting in the Experience Table above to meet the experience and qualifications requirement, included in the Threshold Requirement. Identify those **members of the team with the experience and qualifications,** including affiliates, and their principal personnel who will be involved in the project. If the Proposer consists of multiple parties, such as joint ventures or partnerships, demonstrate each member(s) firm commitment to provide services to the project (e.g., letter of intent); provide this information for each party, clearly indicating the proposed role of each party, including an ownership chart indicating direct and indirect ownership, and percentage interests in the partnership or joint venture.

2.13.3 Provide a **listing in the table format below, of all renewable energy generation or energy storage projects** the Proposer has successfully developed or that are currently under construction. Describe the Proposer's role and responsibilities associated with these projects (lead developer, owner, investor, etc.). Provide the following information as part of the response:

Project Name	**Location (City, State)**	**Technology (wind, PV, hydro, plus storage, etc.)**	**Size (MW/ MWh)**	**Commercial Operation Date**	**Offtaker (if applicable)**	**Role & Responsibilities**
1.						
2.						

3.						
…						

2.14 PROJECT DEVELOPMENT AND SCHEDULE

2.14.1 Provide a **project schedule in GANTT chart format** with complete **critical path activities** identified for the Proposal from the Notice of Selection of the Proposal through Commercial Operations.

- The **schedule** must include:
  - Interconnection Requirement Study (IRS) assumptions
  - Anticipated contract negotiation period assumptions
  - Regulatory assumptions (including PPA/PUC filings and assumed durations)
  - Anticipated submittal and approval dates for permitting (including but not limited to environmental and archaeological compliance)
  - Siting and land acquisition
  - Cultural Resource implications and mitigation activities
  - Community outreach and engagement activities
  - Energy resource assessment
  - Financing
  - Engineering
  - Procurement (include current lead times for long lead equipment)
  - Facility construction including construction management events
  - Applicable reporting milestone events specified in the Model IGP Contract
  - Testing
  - Interconnection (including engineering, procurement, and construction)
  - Commercial Operations Date (COD)
  - All other important elements outside of the direct construction of the Project
  - For existing projects, any changes required to meet the terms of this RFP and/or applicable IGP Contract
  - Durations should be consistent with appendix H, when applicable
- The project schedule must be created in Microsoft Project and submitted in both a .mpp file format and in .pdf file format.
- For each project element, list the start and end date (must be in MM/DD/YY format), and include predecessors to clearly illustrate schedule dependencies and durations.
- Proposers must also list and describe critical path activities and milestone events, particularly as they relate to the integration and coordination of the project components and the Company's Electric System. Proposers must ensure that the schedule provided in this section is consistent with the milestone events contained in the IGP Contract and/or other agreements.
- Appropriate mitigation or contingency plans should be included with any risk of achieving the proposed COD.

2.14.2 Describe the **construction execution strategy** including:

- Identification of contracting/subcontracting plans
- Modular construction

- Safety plans[9]
- Quality control and assurance plan
- Labor availability
- Likely manufacturing sites and procurement plans
- Similar projects where these construction methods have been used by the Proposer

2.14.3 Provide a description of any **project activities that have been performed to date**.

2.14.4 If applicable, explain any planned actions to reach safe harbor milestones or other schedule-affecting tax credit activities and guaranteed commercial operations, including durations and dependencies which support this achievement.

2.15 CARBON EMISSION QUESTIONNAIRE

2.15.1 Answer the following Carbon Criteria questions. Please provide conservative answers where answers are unknown or uncertain. Guidance for providing conservative answers has been provided for each question. If a Category or Question is not applicable to the Project, please leave blank (e.g., if the Project generation technology does not include solar, leave questions in Category "3e. Procurement – Solar" blank).

Category	**#**	**Question**	***Answer Choices***
1. Siting	1	Please provide the Project's expected developed Site area in units of m^2. *If the answer to this question is unknown or uncertain, please conservatively provide the largest expected developed Site area in units of m^2.*	*Numerical write in*
	2	What is the expected distance from the Project's generation/storage location to the point of interconnection? *If the answer to this question is unknown or if there are multiple possibilities, please conservatively provide the furthest expected distance from the Project's generation/storage location to the point of interconnection*	*Numerical write in*
	3	What fraction of the Project's Site is a "greenfield", e.g., has not been previously developed? *If the answer to this question is unknown or uncertain, please conservatively provide the maximum expected "greenfield" fraction.*	*Numerical write in*
	4	What fraction of the Project's Site requires grading? *If the answer to this question is unknown or uncertain, please conservatively provide the maximum expected fraction.*	*Numerical write in*

[9] A document that describes the various safety procedures and practices that will be implemented on the Project and how applicable safety regulations, standards, and work practices will be enforced on the Project.

	5	What is the expected fraction (in terms of CAPEX) of infrastructure being reused (includes roads, buildings, trenches, pads) for the Project? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
2. Procurement	6	What fraction of concrete, fencing, gravel and other roadway materials used for the Project will be locally sourced on island? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	7	What fraction of roadway materials and gravel used for the Project will be made from recycled materials? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
3a. Procurement – Biofuels ***please answer only if the project includes biofuels-based generation***	8a	Please provide the Project's expected annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Numerical write in*
	9a	What fraction of the biofuel feedstock used for the Project is a waste product or grown specifically for fuel usage? *Please provide the answer as a ratio between "Waste for fuel" vs. "Grow for fuel". If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	10a	Please define the primary and alternative biofuel types for this Project, and provide carbon footprints for major components and feedstock as well as manufacturer-specific supporting documentation such as locations and processing pathways, if available. Please provide the carbon footprint in units of kg CO2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	11a	What fraction of the harvested biofuel feedstock used for the Project will be replaced and regrown within one year of harvesting?	*Numerical write in*

		If the answer to this question is unknown or uncertain, please conservatively provide the minimum fraction.	
	12a	How much hydrogen will be used in the biofuel production process for hydroprocessing (kg hydrogen/kg biofuel produced)? *If the answer to this question is unknown or uncertain, please conservatively provide the maximum expected amount in units of kg hydrogen/kg biofuel produced.*	*Numerical write in*
	13a	What is the expected overall efficiency of the Project (electricity generated by the Project divided by the energy in the biofuels combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency.*	*Numerical write in*
	14a	Please define the fossil fuel type(s) that can be used by this Project to generate electricity. For any fossil fuel type(s) that can be used, please provide carbon footprints and source location information for these fossil fuels, if available. Please provide the carbon footprint in units of kg CO2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	15a	What is the expected overall efficiency of the Project if running fossil fuels (electricity generated by the Project divided by the energy in the fossil combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency*	*Numerical write in*
3b. Procurement – Biomass ***please answer only if the project includes biomass-based generation***	8b	Please provide the Project's expected annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Numerical write in*
	9b	What is the expected overall efficiency of the Project's biomass conversion to electricity (electricity generated by the Project divided by the energy in the biomass combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency.*	*Numerical write in*
	10b	What is the expected biomass combustion efficiency of the biomass used for the Project (actual heat produced by	*Numerical write in*

		combustion divided by the total heat potential of the biomass combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected biomass combustion efficiency.*	
	11b	Please define the primary and alternative biomass types for this Project, and provide carbon footprints for major components and feedstock as well as manufacturer-specific supporting documentation such as locations and processing pathways, if available. Please provide the carbon footprint in units of kg CO_2e/kWh for power generating components, such as a biomass combustor, and in units of kg CO_2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	12b	What fraction of the harvested biomass feedstock used for the Project will be replaced and regrown within one year of harvesting? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum fraction.*	*Numerical write in*
	13b	Please define the fossil fuel type(s) that can be used by this Project to generate electricity. For any fossil fuel type(s) that can be used, please provide carbon footprints and source location information for these fossil fuels, if available. Please provide the carbon footprint in units of kg CO2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	14b	What is the expected overall efficiency of the Project if running fossil fuels (electricity generated by the Project divided by the energy in the fossil combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency*	*Numerical write in*
3c. Procurement – Energy Storage ***please answer only if the project includes energy storage***	8c	Please provide the Project's expected annual energy delivered by the system in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual energy delivery in units of MWh.*	*Numerical write in*

	9c	What is the expected return efficiency of the Project's energy storage system (MWh returned to the grid/MWh stored)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected return efficiency.*	*Numerical write in*
	10c	How many cycles will the batteries used for the Project's energy storage system undergo annually? *If the answer to this question is unknown or uncertain, please conservatively provide the maximum expected number of cycles.*	*Numerical write in*
	11c	Please provide carbon footprints for major components and feedstock as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO2e/kWh for power generating components, such as a battery. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	12c	What is the expected battery lifetime before degradation of the Project's energy storage efficiency below 80%? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected lifetime.*	*Numerical write in*
3d. Procurement – Geothermal ***please answer only if the project includes geothermal generation***	8d	Please provide the Project's expected annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Text write in*
	9d	Will the Project's geothermal process be an enhanced geothermal system (EGS), flash/dry steam, or binary steam power plant? *If the answer to this question is unknown or uncertain, please conservatively answer "Not known at this time".*	*Text write in*
	10d	Will the Project's geothermal process be closed loop? *If the answer to this question is unknown or uncertain, please conservatively answer "No".*	*Yes / No*
	11d	What percentage of mass of fluid will be cascaded compared to total extracted fluid mass? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected percentage.*	*Numerical write in*

	12d	Please provide carbon footprints for major components as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO_2e/kWh for power generating components. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	13d	Will new geothermal wells need to be drilled for the Project? *If the answer to this question is unknown or uncertain, please conservatively answer "Yes".*	*Yes / No*
3e. Procurement – Solar ***please answer only if the project includes solar generation***	8e	Please provide the Project's expected annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Numerical write in*
	9e	What is the expected solar irradiance for the Project (kW/m^2)? *If the answer to this question is unknown or uncertain, please conservatively answer "Not known at this time".*	*Numerical write in*
	10e	Which type of solar panels will be installed for the Project? a. Cadmium Telluride b. Single Crystalline Silicon c. Multi Crystalline Silicon d. Other, if yes, please provide details regarding solar panel technology type. *If the answer to this question is unknown or uncertain, please conservatively answer "Not known at this time".*	*Text write in;* *If "Other", include write-in*
	11e	What is the solar conversion efficiency of the solar panels (solar kW/m^2 / kW/m^2 produced) used for the Project? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum solar conversion efficiency.*	*Numerical write in*
	12e	Please provide carbon footprints for major components as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO_2e/kWh for power generating components, such as solar panels. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
3f. Procurement - Waste-to-Energy	8f	Please provide the Project's expected annual and lifetime production in units of MWh.	*Numerical write in*

please answer only if the project includes waste-to-energy generation		*If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	
	9f	What fraction of the waste feedstock used for the Project will be organic waste (food, waste paper, green/compostable waste, etc.)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	10f	What fraction of the fleet used to transport the waste feedstock to the Facility will consume renewable diesel or be electric? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	11f	If the Waste-to-Energy process used for the Project will emit greenhouse gases, what fraction of the greenhouse gases will be captured? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	12f	What is the expected overall electrical efficiency of the Project (electricity generated by the Project divided by the energy in the waste feedstock combusted? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum overall electrical efficiency expected.*	*Numerical write in*
	13f	Please provide carbon footprints for major components and feedstock as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO2e/kWh for power generating components and in units of kg CO2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	14f	Please define the fossil fuel type(s) that can be used by this Project to generate electricity. For any fossil fuel type(s) that can be used, please provide carbon footprints and source location information for these fossil fuels, if available. Please provide the carbon footprint in units of kg CO2e/MMBtu energy content for feedstock.	*Numerical write in*

		If this information is unavailable, please answer "Not available at this time".	
	15f	What is the expected overall efficiency of the Project if running fossil fuels (electricity generated by the Project divided by the energy in the fossil combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency*	*Numerical write in*
3g. Procurement – Wind ***please answer only if the project includes wind generation***	8g	Please provide the Project's expected annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Numerical write in*
	9g	What fraction of the rotors used for the Project will be made from recycled materials? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	10g	Please provide the average wind speed for the Project location, in units of mph or m/s. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected wind energy availability.*	*Numerical write in*
	11g	Please provide the expected power generation rate (i.e., capacity factor) of the Project. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected power generation ratio.*	*Numerical write in*
	12g	What percentage by weight of the turbine tower will be steel? *If the answer to this question is unknown or uncertain, please conservatively provide the maximum expected percentage.*	*Numerical write in*
	13g	Please provide carbon footprints for major components as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO_2e/kWh for power generating components, such as wind turbines. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*

3h. Procurement – Hydrogen ***please answer only if the project includes hydrogen generation***	8h	Please provide annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Numerical write in*
	9h	What is the expected overall efficiency of the Project (electricity generated by the Project divided by the fuel energy in the H_2 consumed/combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency.*	*Numerical write in*
	10h	Please briefly describe the feedstock of the hydrogen and the hydrogen production process (e.g., natural gas, steam methane reforming, water electrolysis). *If hydrogen is from multiple feedstock sources, please provide a percentage from each feedstock/source.*	*Text write in*
	11h	Please provide the carbon intensity in units of kg CO2e/MMBtu energy content for hydrogen. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	12h	Please specify whether the power generation technology involves combustion (e.g., combined-cycle gas turbine) or not (e.g., fuel cell power generation).	*Text write in*
	13h	Please define the fossil fuel type(s) that can be used by this Project to generate electricity. For any fossil fuel type(s) that can be used, please provide carbon footprints and source location information for these fossil fuels, if available. Please provide the carbon footprint in units of kg CO2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Numerical write in*
	14h	What is the expected overall efficiency of the Project if running fossil fuels (electricity generated by the Project divided by the energy in the fossil combusted)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency*	*Numerical write in*
3i. Procurement – Hydropower	8i	Please provide the Project's expected annual and lifetime production in units of MWh.	*Numerical write in*

please answer only if the project includes hydropower generation		*If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	
	9i	What is the type of hydropower plant of the Project? *Please specify whether the Project is an impoundment, run-of-river, or pumped storage hydropower plant.*	*Text write in*
	10i	Does the Project require construction of a new dam; if so, what is the material of the dam? *Please specify whether the Project would require new construction or significant expansion of a dam or reservoir.*	*Text write in*
	11i	Does the project have other combustion or fugitive GHG emissions (e.g., backup generator during downtime, or fugitive CH4 emissions from the reservoir). *Please briefly describe the type of emission source(s) if answered "Yes".*	*Text write in*
	12i	Please provide carbon footprints for major components as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO_2e/kWh for power generating components, such as the hydropower turbines. *If this information is unavailable, please answer "Not available at this time".*	*Text write in*
3j. Procurement – Other *please answer only if the project is NOT a generation/storage project listed in 3a through 3i*	8j	Please provide the Project's expected annual and lifetime production in units of MWh. *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected annual production capacity in units of MWh.*	*Numerical write in*
	9j	Briefly describe the power generating mechanism. Be sure to include fuel type, key equipment, whether combustion is involved, and other materials that have high emissions or GWP (e.g., HFCs & CFCs). *If this information is unavailable, please answer "Not available at this time".*	*Text write in*
	10j	What are the feedstock and production process of fuel? *If the answer to this question is unknown or uncertain, please conservatively provide all potential feedstock and production process*	*Text write in*

	11j	What is the expected overall efficiency of the Project (electricity generated by the Project divided by the energy input)? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected overall efficiency.*	*Numerical write in*
	12j	Please provide carbon footprints for major components and feedstock as well as manufacturer-specific supporting documentation, if available. Please provide the carbon footprint in units of kg CO_2e/kWh for power generating components, and/or in units of kg CO_2e/MMBtu energy content for feedstock. *If this information is unavailable, please answer "Not available at this time".*	*Text write in*
4. Construction	16	What fraction of the equipment used during the construction phase of the Project will consume renewable fuel? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
	17	Will the Site have an anti-idle policy for the equipment used during the construction phase of the Project? *If the answer to this question is unknown or uncertain, please conservatively answer "No".*	*Yes / No*
	18	How many hours of helicopter use will be required for construction phase of the Project? *If helicopter is not used, please answer "0". If the answer to this question is unknown or uncertain, please conservatively estimate the hours needed.*	*Numerical write in*
	19	What fraction of construction workers traveling to the Site during the construction phase of the Project will be local to the Project Island? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum fraction of construction workers traveling to the Site during the construction phase of the Project may be local to Hawai'i.*	*Numerical write in*
5. Operations & Maintenance	20	What fraction of Project equipment and materials will need to be replaced during the Project's proposed Contract Term (e.g., Project lifetime) as a percentage of capital cost? *If the answer to this question is unknown or uncertain, please conservatively provide the maximum expected fraction of Project equipment and materials may need to be*	*Numerical write in*

		replaced during the Project's proposed Contract Term by using an above-average scenario for number of equipment failures and wear-and-tear on project materials.	
	21	Will any equipment containing high global warming potential gases (such as sulfur hexafluoride (SF_6) or hydrofluorocarbons (HFCs)) be installed or used during operation? If yes, please provide the type of equipment and high global warming potential greenhouse gas and approximate quantity (kg) leaked per year. *If the answer to this question is unknown or uncertain, please conservatively assume "Yes" and provide a maximum expected quantity (kg) leaked per year.*	*Yes / No* *If "Yes", include numerical write in*
	22	What is the on-site electricity demand to maintain normal operation as a percentage of annual electricity production over the Project's proposed Contract Term? *Please provide the response as a percentage of Project's total electricity production. Be sure to include both parasitic electricity demand from on-site generation and from the grid. Provide the response as a percentage of Project's total electricity production.*	*Numerical write in*
	23	What fraction of the equipment used for the Operations & Maintenance of the Project will consume renewable fuel or be electric? *If the answer to this question is unknown or uncertain, please conservatively provide the minimum expected fraction.*	*Numerical write in*
6. General	24	Please provide any additional information that is currently available on the Project's lifecycle greenhouse gas emissions and/or actions, such as carbon capture, utilization and storage (CCUS), that will be taken to reduce the Project's impacts throughout the Project lifecycle (i.e., including raw materials and extraction, transportation, construction, operations & maintenance, and decommissioning & disposal). *Please state if no actions are intended at this time.*	*Text write in*

2.16 PREVIOUS PERFORMANCE

2.16.1 Proposers shall identify all affiliates (as defined in the RFP) which have been a party to a renewable energy contract with the Company within the past five (5) years.

(OPTIONAL) MINOR PROPOSAL VARIATIONS

Proposers submitting minor variations to their base variation (as allowed in RFP Section 3.7.2.1) must provide the **details of each variation in the below section(s)**. In the proposal variation section below, Proposers must (1) provide a completed Proposal Summary Table identical to Appendix B Section 2.0 in any Section 3 and Section 4 (if applicable). The information in these tables must specifically reflect the information for the variation being proposed. Additionally, Proposers must (2) identify all changes to the information provided in response to Appendix B Sections 2.2.4 through 2.14 for the Proposal variation. If differences from any section in Sections 2.2.4 through 2.14 are not identified, the Company will assume that the information contained in the base variation (Sections 2.2.4 through 2.14) also applies to the Proposal variation.

Note: Appendix B Section 2.2.2 above requires the inclusion of a table summarizing the differences among the variations, if variations are proposed.

(AS NECESSARY)

3.1 RESERVED
3.2 VARIATION A SUMMARY
3.3 VARIATION A FINANCIAL BACKGROUND
3.4 VARIATION A PROPOSED CONTRACT MODIFICATIONS
3.5 VARIATION A SITE INFORMATION
3.6 VARIATION A ENVIRONMENTAL COMPLIANCE AND PERMITTING PLAN
3.7 VARIATION A CULTURAL RESOURCE IMPACTS
3.8 VARIATION A COMMUNITY ENGAGEMENT
3.9 VARIATION A O&M
3.10 VARIATION A TECHNICAL AND OPERATIONAL REQUIREMENTS
3.11 VARIATION A IRS SUBMITTAL INFORMATION
3.12 VARIATION A PROVEN TECHNOLOGY
3.13 VARIATION A EXPERIENCE AND QUALIFICATIONS
3.14 VARIATION A PROJECT DEVELOPMENT AND SCHEDULE
3.15 VARIATION A CARBON EMISSION QUESTIONNAIRE

(AS NECESSARY)

4.1 RESERVED
4.2 VARIATION B SUMMARY
4.3 VARIATION B FINANCIAL BACKGROUND
4.4 VARIATION B PROPOSED CONTRACT MODIFICATIONS
4.5 VARIATION B SITE INFORMATION
4.6 VARIATION B ENVIRONMENTAL COMPLIANCE AND PERMITTING PLAN
4.7 VARIATION B CULTURAL RESOURCE IMPACTS

IPP or AFFILIATE PROPOSAL PRICING

ONLY provide Proposal pricing on this separate Appendix B Attachment 1. Do NOT embed proposal pricing anywhere else in your Proposal, including in the cover letter or executive summary.

1	**Proposer Name (Company Name)**	
2	**Parent Company/Owner/Sponsor/Business Affiliation/etc.**	
3	**Project Name**	
4	**Net Nameplate Capacity** (MW) [1]	

SECTION 1.1 (INVESTMENT-GRADE PRICING)

In accordance with Section 3.12.6 of the RFP, the following pricing will apply if either or both of the following circumstances occurs: (a) a successful IPP or Affiliate Proposer selected into the Final Award Group enters into a Step-In Agreement with the State of Hawai‘i or an applicable department thereof when a PPA is executed, or as soon as reasonably possible thereafter, in accordance with the IPP Bill; and/or (b) HEI’s credit rating reaches Investment Grade Status.

[For PV+BESS, Wind, Wind+BESS, and Standalone Storage Projects]

1	**Lump Sum Payment** ($/Year)	

[For Firm Projects only]

1	**Capacity Charge** payment ($/kWAvailable Capacity/Month)	
1a	**Demonstrated Firm Capacity**	
1b	**Available Capacity Factor**	
1c	**Capacity Charge Rate** ($/kW/month)	
1d	**Fixed O&M Component Rate** ($/kW/month)	
2	**Energy Charge**, **if any** ($/kWh, $/service hour, $/start) for Renewable Fuel Sources	
2a	**Fuel Component** ($/kWh)	

[1] A Project’s Net Nameplate Capacity is as defined in the applicable IGP Contract.

2b	**Per kWh Variable Component** ($/kWh)	
2c	**Per Service Hour Variable Component** ($/service hour)	
2d	**Per Start Variable Component** ($/start) [IF APPLICABLE]	
2e	**Fixed Escalation Rate** (%)	
3	**Energy Charge**, **if any** ($/kWh, $/service hour, $/start) for Non-Renewable Fuel Sources	
3a	**Fuel Component** ($/kWh)	
3b	**Per kWh Variable Component** ($/kWh)	
3c	**Per Service Hour Variable Component** ($/service hour)	
3d	**Per Start Variable Component** ($/start) [IF APPLICABLE]	
3e	**Fixed Escalation Rate** (%)	

SECTION 1.2 (NON-INVESTMENT-GRADE PRICING)

In accordance with Section 3.12.6 of the RFP, the following pricing will apply if, by the Construction Financing Closing Milestone: (a) the State elects not to execute a Step-In Agreement with the IPP or Affiliate Proposer, despite the IPP or Affiliate Proposer's good faith and best efforts; and (b) HEI's credit rating does not reach Investment Grade Status. Notwithstanding the foregoing, if such Non-Investment Grade Pricing of an IPP or Affiliate Proposer applies, such Proposer will be required to adjust its Non-Investment Grade Pricing downward to such Proposer's Investment Grade Pricing (established in Section 1.1 (Investment Grade Pricing) above), if, at any time during the term of the IGP Contract, the IPP or Affiliate Proposer executes a Step-In Agreement with the State under the IPP Bill; or (2) HEI's credit rating reaches Investment Grade Status pursuant to the terms of the applicable IGP Contract. For purposes of sub-part (1) above, the affected IPP or Affiliate Proposer may not opt out of the Step-In Agreement in order to maintain its Non-Investment Grade Pricing.

[For PV+BESS, Wind, Wind+BESS, and Standalone Storage Projects]

1	**Lump Sum Payment** ($/Year)	

[For Firm Projects only]

For Firm Projects, with the exception of the Capacity Charge Rate, all components of a Proposer's pricing shall be the same for both Investment Grade Pricing and Non-Investment Grade Pricing.

1	**Capacity Charge** payment ($/kW/Month)	See Section 1.1
1a	**Demonstrated Firm Capacity**	See Section 1.1
1b	**Available Capacity Factor**	See Section 1.1
1c	**Capacity Charge Rate** ($/kW/month)	
1d	**Fixed O&M Component Rate** ($/kW/month)	See Section 1.1
2	**Energy Charge, if any** ($/kWh, $/service hour, $/start) for Renewable Fuel Sources	See Section 1.1
2a	**Fuel Component** ($/kWh)	See Section 1.1
2b	**Per kWh Variable Component** ($/kWh)	See Section 1.1
2c	**Per Service Hour Variable Component** ($/service hour)	See Section 1.1
2d	**Per Start Variable Component** ($/start) [IF APPLICABLE]	See Section 1.1
2e	**Fixed Escalation Rate** (%)	See Section 1.1
3	**Energy Charge**, **if any** ($/kWh, $/service hour, $/start) for Non-Renewable Fuel Sources	See Section 1.1
3a	**Fuel Component** ($/kWh)	See Section 1.1
3b	**Per kWh Variable Component** ($/kWh)	See Section 1.1
3c	**Per Service Hour Variable Component** ($/service hour)	See Section 1.1
3d	**Per Start Variable Component** ($/start) [IF APPLICABLE]	See Section 1.1

HAWAIIAN ELECTRIC PROPOSAL COST INFORMATION

ONLY provide Proposal pricing on this separate Appendix B Attachment 1. Do NOT embed proposal pricing anywhere else in your Proposal, including in the cover letter or executive summary.

1	**Year** (YYYY)	**Project Capital Cost** ($)
2	**Year** (YYYY)	**O&M Cost** ($)
3	**Year** (YYYY)	**Annual Revenue Requirement** ($)

Extend the table for the Project Capital Cost, O&M Cost, and Annual Revenue Requirement for as many years as the Proposal extends.

TARIFF INFORMATION

ONLY provide tariff information on this separate Appendix B Attachment 1. Do NOT embed proposal pricing anywhere else in your Proposal, including in the cover letter or executive summary.

Name of the Equipment or Component	Country of Origin	Assumed Cost ($)	Tariff Rates (%)

Project Interconnection - Data Request

FOR PV and/or BESS GENERATION

PROJECT: _____

DATE: _____

(Nonexclusive Preliminary List)

	Data required at time of Proposal Submittal
	Remaining data required to be provided with model package submittal following selection to Final Award Group

		Response
1)	**Please provide a plan map of the Generation facility. Please indicate the interconnection point to the Hawaiian Electric system. Please also submit a .kmz file**	
2)	**Please provide the following generation and load information for the Renewable Generation facility:**	
	a. Gross and net output of the facility	
	b. Expected KW and KVAR loads including, but not limited to, generators' auxiliary load curve, process load(s) profile(s), etc.	
	c. Expected minimum and maximum MW and MVAR "import from" AND "export to" HECO.	
3)	**Please provide Single-Line Diagram(s), Three-Line Diagram(s), and Protective Relay List & Trip Schedule for the generation and interconnection facilities:**	
	a. Single-line diagrams should be provided for both the generation plant and the interconnection substation.	
	b. The Single-line diagram(s) should include:	
	i. For main and generator step up transformer(s), please show:	
	• Transformer voltage and MVA ratings.	
	• Transformer impedance(s).	
	• Configuration. Note: Main transformer must be solidly grounded wye on the system side and delta on the inverter side.	
	ii. The protective relaying and metering for the generators, transformers, buses, and all other main substation equipment.	
	iii. For the potential transformers, please indicate the type, quantity, ratio, and accuracy rating.	
	iv. For the current transformers, please indicate the type, quantity, ratio, and accuracy rating, and thermal rating factor.	
	v. Auxiliary power devices (e.g. capacitors, reactors, storage systems, etc.) and their rating(s); additional inquiries may be made to obtain technical data for these devices.	
	vi. For the interconnection / tie lines (overhead or underground) and the plant's generation system, please provide the following, as applicable:	
	• Installation details such as cross-section(s), plan and profiles, etc.	
	• Conductor data such as size, insulation, length etc.	
	• Continuous and emergency current ratings.	
	• Voltage rating (nominal and maximum KV).	
	• Short-circuit current capability.	
	• BIL rating.	
	• Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance)	
	• Capacitance or charging current.	
	vii. Include station power for facility and all applicable details.	
	viii. All applicable notes pertaining to the design and operation of the facility.	
	c. The Three-line diagram(s) should include:	
	i. For main and generator step up transformer(s), please show:	
	• Transformer voltage and MVA ratings.	
	• Transformer impedance(s).	
	ii. The protective relaying and metering for the generators, transformers, buses, and all other main substation equipment.	
	iii. For the potential transformers, please indicate the type, quantity, ratio, and accuracy rating.	
	iv. For the current transformers, please indicate the type, quantity, ratio, and accuracy rating, and thermal rating factor.	
	v. Auxiliary power devices (e.g. capacitors, reactors, storage systems, etc.) and their rating(s); additional inquiries may be made to obtain technical data for these devices.	
	vi. For the interconnection / tie lines (overhead or underground) and the plant's generation system, please provide the following, as applicable:	

Project Interconnection - Data Request
FOR PV and/or BESS GENERATION
PROJECT: _____
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(Nonexclusive Preliminary List)

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	Response
• Installation details such as cross-section(s), plan and profiles, etc.	
• Conductor data such as size, insulation, length etc.	
• Continuous and emergency current ratings.	
• Voltage rating (nominal and maximum KV).	
• Short-circuit current capability.	
• BIL rating.	
• Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance)	
• Capacitance or charging current.	
vii. Include station power for facility and all applicable details.	
viii. All applicable notes pertaining to the design and operation of the facility.	
d. The Protective relay list & trip schedule should list the protected equipment; the relay description, type, style number, quantity, ANSI Device No., and range; and the breaker(s)/switching device(s) tripped, for both the generator protection and the interconnection facilities protection.	

4)

For the PV Inverter Based Generating Faciltiy, please provide the following data, as applicable:	
a. Inverter manufacturer, Type, Size, Impedances. Attach copy of inverter data sheet.	
b. Power Factor Range Capability at POI	
c. Inverter Reactive Power Capability Curve	
d. Auxillary loads (P, Q, Power Factor)	
e. Inverter's Internal Isolation Transformer Grounding Method, if used (i.e. effectively grounded, resonant grounded, low inductance grounded, high-resistance grounded, low-resistance grounded, ungrounded). If the transformer is not solidly grounded , provide the impedance value for the grounding neutral and the impedance for the isolation transformer. Note: Transformer must be solidly grounded wye on the system side and delta on the inverter side if there is no main transformer.	
f. Diagram for Inverter's internal isolation transformer	
g. Protection data (voltage ride-through and trip settings, frequency ride-through and trip settings etc.). Include setpoint and clearing time ranges for voltage and frequency settings.	
h. Switching and service restoration practice	
i. Description of harmonic spectrum of inverter injection (order, magnitude)	

5)

For the BESS Inverter Based Generating Faciltiy, please provide the following data (if system is DC coupled, please note DC coupling and reference to 4).	
a. Inverter manufacturer, Type, Size, Impedances. Attach copy of inverter data sheet.	
b. Power Factor Range Capability at POI	
c. Inverter Reactive Power Capability Curve	
d. Auxillary loads (P, Q, Power Factor)	
e. Inverter's Internal Isolation Transformer Grounding Method, if used (i.e. effectively grounded, resonant grounded, low inductance grounded, high-resistance grounded, low-resistance grounded, ungrounded). If the transformer is not solidly grounded , provide the impedance value for the grounding neutral and the impedance for the isolation transformer. Note: Transformer must be solidly grounded wye on the system side and delta on the inverter side if there is no main transformer	
f. Diagram for Inverter's internal isolation transformer	
g. Protection data (voltage ride-through and trip settings, frequency ride-through and trip settings etc.). Include setpoint and clearing time ranges for voltage and frequency settings.	
h. Switching and service restoration practice	
i. Description of harmonic spectrum of inverter injection (order, magnitude)	

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FOR PV and/or BESS GENERATION
PROJECT: _____
DATE: _____
(Nonexclusive Preliminary List)

	Data required at time of Proposal Submittal
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		Response
6)	**Energy Storage System, if applicable**	
	a. Operation characteristics	
	b. Voltage level	
	c. Energy storage system data sheet	
7)	**For the PV plant's collector system, please provide the following, as applicable:**	
	a. Conductor data such as size, insulation, etc.	
	b. Continuous and emergency current ratings.	
	c. Voltage rating (nominal and maximum kV).	
	d. BIL rating.	
	e. Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance).	
	f. Capacitance or charging current.	
	g. Short-circuit current capability.	
8)	**For the BESS plant's collector system, please provide the following, as applicable (if system is DC coupled, please note DC coupling and reference to 7):**	
	a. Conductor data such as size, insulation, etc.	
	b. Continuous and emergency current ratings.	
	c. Voltage rating (nominal and maximum kV).	
	d. BIL rating.	
	e. Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance).	
	f. Capacitance or charging current.	
	g. Short-circuit current capability.	
9)	**For the main transformer and generator step-up transformers, please provide:**	
	a. Transformer voltage and MVA ratings, and available taps. Attach copy of OEM data sheet, or transformer test report (if transfomer test is not available at time of proposal submittal, it shall be provided when available following equipment production)	
	b. Positive, negative, and zero sequence impedance values.	
	c. The tap settings used.	
	d. The LTC Control Scheme.	
10)	**For the circuit breakers and fault-clearing switching devices, including the generator breakers, please provide:**	
	a. The voltage, continuous current and interrupting capability ratings.	
	b. The trip speed (time to open).	

Project Interconnection - Data Request
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		Response
11)	**For the power fuses, please provide:**	
	a. The manufacturer, type, size, and interrupting capability.	
	b. The minimum melt and total clearing curves.	

12)	**For the protective relaying, please provide:**	
	a. Data for the CTs used with the relaying including the manufacturer, type of CT, accuracy class, and thermal rating factor.	
	b. Data for the PTs used with the relaying including the manufacturer, type of PT, voltage ratings, and quantity.	

Project Interconnection - Data Request
FOR WIND and/or BESS GENERATION
PROJECT: _____
DATE: _____
(Nonexclusive Preliminary List)

Data required at time of Proposal Submittal
Remaining data required to be provided with model package submittal following selection to Final Award Group

		Response
1)	**Please provide a plan map of the Generation facility. Please indicate the interconnection point to the HECO system. Please also submit a .kmz file**	
2)	**Please provide the following generation and load information for the NUG facility:**	
	a. Gross and net output of the facility	
	b. Expected KW and KVAR loads including, but not limited to, generators' auxiliary load curve, process load(s) profile(s), etc.	
	c. Expected minimum and maximum MW and MVAR "import from" AND "export to" HECO.	
3)	**Please provide Single-Line Diagram(s), Three-Line Diagram(s), and Protective Relay List & Trip Schedule for the generation and interconnection facilities:**	
	a. Single-line diagrams should be provided for both the generation plant and the interconnection substation.	
	b. The Single-line diagram(s) should include:	
	i. For main and generator step up transformer(s), please show:	
	• Transformer voltage and MVA ratings.	
	• Transformer impedance(s).	
	• Configuration. Note: Main transformer must be solidly grounded wye on the system side and delta on the inverter side.	
	ii. The protective relaying and metering for the generators, transformers, buses, and all other main substation equipment.	
	iii. For the potential transformers, please indicate the type, quantity, ratio, and accuracy rating.	
	iv. For the current transformers, please indicate the type, quantity, ratio, and accuracy rating, and thermal rating factor.	
	v. Auxiliary power devices (e.g. capacitors, reactors, storage systems, etc.) and their rating(s); additional inquiries may be made to obtain technical data for these devices.	
	vi. For the interconnection / tie lines (overhead or underground) and the plant's generation system, please provide the following, as applicable:	
	• Installation details such as cross-section(s), plan and profiles, etc.	
	• Conductor data such as size, insulation, length etc.	
	• Continuous and emergency current ratings.	
	• Voltage rating (nominal and maximum KV).	
	• Short-circuit current capability.	
	• BIL rating.	
	• Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance)	
	• Capacitance or charging current.	
	vii. Include station power for facility and all applicable details.	
	viii. All applicable notes pertaining to the design and operation of the facility.	
	c. The Three-line diagram (s) should include:	
	i. For main and generator step up transformer(s), please show:	
	• Transformer voltage and MVA ratings.	
	• Transformer impedance(s).	
	• Configuration	
	ii. The protective relaying and metering for the generators, transformers, buses, and all other main substation equipment.	
	iii. For the potential transformers, please indicate the type, quantity, ratio, and accuracy rating.	
	iv. For the current transformers, please indicate the type, quantity, ratio, and accuracy rating, and thermal rating factor.	
	v. Auxiliary power devices (e.g. capacitors, reactors, storage systems, etc.) and their rating(s); additional inquiries may be made to obtain technical data for these devices.	

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	Response
vi. For the interconnection / tie lines (overhead or underground) and the plant's generation system, please provide the following, as applicable: • Installation details such as cross-section(s), plan and profiles, etc.	
• Conductor data such as size, insulation, length etc.	
• Continuous and emergency current ratings.	
• Voltage rating (nominal and maximum KV).	
• Short-circuit current capability.	
• BIL rating.	
• Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance)	
• Capacitance or charging current.	
vii. Include station power for facility and all applicable details.	
viii. All applicable notes pertaining to the design and operation of the facility.	
d. The Protective relay list & trip schedule should list the protected equipment; the relay description, type, style number, quantity, ANSI Device No., and range; and the breaker(s)/switching device(s) tripped, for both the generator protection and the interconnection facilities protection.	

4)

For the Wind Generating Faciltiy, please provide the following data:	
a. Turbine manufacturer, Type, Size, Impedances. Attach copy of turbine data sheet.	
b. Power Factor Range Capability	
c. Turbine Reactive Power Capability Curve	
d. Auxillary loads (P, Q, Power Factor)	
e. Grounding Method (i.e. effectively grounded, resonant grounded, low inductance grounded, high-resistance grounded, low-resistance grounded, ungrounded). If the transformer is not solidly grounded or ungrounded, provide the impedance value for the grounding neutral, if applicable. Note: Transformer must be solidly grounded wye on the system side and delta on the inverter side if there is no main transformer	
f. Provide grounding diagram.	
g. Protection data (voltage ride-through and trip settings, frequency ride-through and trip settings etc.). Include setpoint and clearing time ranges for voltage and frequency settings.	
h. Switching and service restoration practice	
i. Description of harmonic spectrum of inverter injection (order, magnitude)	

5)

Energy Storage System, if applicable	
a. Operation characteristics	
b. Voltage level	
e. Energy storage system data sheet	

6)

For the Wind plant's collector system, please provide the following, as applicable:	
a. Conductor data such as size, insulation, etc.	
b. Continuous and emergency current ratings.	
c. Voltage rating (nominal and maximum kV).	
d. BIL rating.	
e. Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance).	
f. Capacitance or charging current.	
g. Short-circuit current capability.	

Project Interconnection - Data Request
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	Response

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FOR WIND and/or BESS GENERATION
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	Data required at time of Proposal Submittal
	Remaining data required to be provided with model package submittal following selection to Final Award Group

		Response
7)	**For the main transformer and generator step-up transformers, please provide:**	
	a. Transformer voltage and MVA ratings, and available taps. Attach copy of OEM data sheet, or transformer test report (if transfomer test is not available at time of proposal submittal, it shall be provided when available following equipment production)	
	b. Positive, negative, and zero sequence impedance values.	
	c. The tap settings used.	
	d. The LTC Control Scheme.	
8)	**For the circuit breakers and fault-clearing switching devices, including the generator breakers, please provide:**	
	a. The voltage, continuous current and interrupting capability ratings.	
	b. The trip speed (time to open).	
9)	**For the power fuses, please provide:**	
	a. The manufacturer, type, size, and interrupting capability.	
	b. The minimum melt and total clearing curves.	
10)	**For the protective relaying, please provide:**	
	a. Data for the CTs used with the relaying including the manufacturer, type of CT, accuracy class, and thermal rating factor.	
	b. Data for the PTs used with the relaying including the manufacturer, type of PT, voltage ratings, and quantity.	

Project Interconnection - Data Request
FOR SYNCHRONOUS GENERATION
PROJECT: _____
DATE: _____
(Nonexclusive Preliminary List)

	Data required at time of Proposal Submittal
	Remaining data required to be provided with model package submittal following selection to Final Award Group

		Response
1)	**Please provide a plan map of the Generation facility. Please indicate the interconnection point to the Hawaiian Electric system. Please also include a .kmz file.**	
2)	**Please provide the following generation and load information for the NUG facility:**	
	a. Gross and net output of the facility	
	b. Expected KW and KVAR loads including, but not limited to, generators' auxiliary load curve, process load(s) profile(s), etc.	
	c. Expected minimum and maximum MW and MVAR "import from" AND "export to" HECO.	
3)	**Please provide Single-Line Diagram(s), Three-Line Diagram(s), and Protective Relay List & Trip Schedule for the generation and interconnection facilities:**	
	a. Single-line diagrams should be provided for both the generation plant and the interconnection substation.	
	b. The Single-line diagram(s) should include:	
	i. For main and generator step up transformer(s), please show:	
	• Transformer voltage and MVA ratings.	
	• Transformer impedance(s).	
	• Configuration Note: Main transformer must be solidly grounded wye on the system side and delta on the inverter side.	
	ii. The protective relaying and metering for the generators, transformers, buses, and all other main substation equipment.	
	iii. For the potential transformers, please indicate the type, quantity, ratio, and accuracy rating.	
	iv. For the current transformers, please indicate the type, quantity, ratio, and accuracy rating, and thermal rating factor.	
	v. Auxiliary power devices (e.g. capacitors, reactors, storage systems, etc.) and their rating(s); additional inquiries may be made to obtain technical data for these devices.	
	vi. For the interconnection / tie lines (overhead or underground) and the plant's generation system, please provide the following, as applicable:	
	• Installation details such as cross-section(s), plan and profiles, etc.	
	• Conductor data such as size, insulation, length etc.	
	• Continuous and emergency current ratings.	
	• Voltage rating (nominal and maximum KV).	
	• Short-circuit current capability.	
	• BIL rating.	
	• Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance)	
	• Capacitance or charging current.	
	vii. Include station power for facility and all applicable details.	
	viii. All applicable notes pertaining to the design and operation of the facility.	
	c. The Three-line diagram (s) should include:	
	i. For main and generator step up transformer(s), please show:	
	• Transformer voltage and MVA ratings.	
	• Transformer impedance(s).	
	• Configuration	
	ii. The protective relaying and metering for the generators, transformers, buses, and all other main substation equipment.	
	iii. For the potential transformers, please indicate the type, quantity, ratio, and accuracy rating.	
	iv. For the current transformers, please indicate the type, quantity, ratio, and accuracy rating, and thermal rating factor.	
	v. Auxiliary power devices (e.g. capacitors, reactors, storage systems, etc.) and their rating(s); additional inquiries may be made to obtain technical data for these devices.	

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	Response
vi. For the interconnection / tie lines (overhead or underground) and the plant's generation system, please provide the following, as applicable: • Installation details such as cross-section(s), plan and profiles, etc.	
• Conductor data such as size, insulation, length etc.	
• Continuous and emergency current ratings.	
• Voltage rating (nominal and maximum KV).	
• Short-circuit current capability.	
• BIL rating.	
• Positive, negative, and zero-sequence impedances (resistance, reactance, and susceptance)	
• Capacitance or charging current.	
vii. Include station power for facility and all applicable details.	
viii. All applicable notes pertaining to the design and operation of the facility.	
d. The Protective relay list & trip schedule should list the protected equipment; the relay description, type, style number, quantity, ANSI Device No., and range; and the breaker(s)/switching device(s) tripped, for both the generator protection and the interconnection facilities protection.	

4)	**For the Synchronous Generating Faciltiy, please provide the following data:**	
	a. Generator manufacturer, Model, Type. Attach copy of genertor data sheet.	
	b. Generator Characteristics (SEE "GENERATOR DATA" TAB)	
	c. Auxillary loads (P, Q, Power Factor)	
	d. Protection data (voltage ride-through and trip settings, frequency ride-through and trip settings etc.). Include setpoint and clearing time ranges for voltage and frequency settings.	
	e. Switching and service restoration practice	
	f. Description of harmonic spectrum of generator injection (order, magnitude)	

5)	**Energy Storage System, if applicable**	
	a. Operation characteristics	
	b. Voltage level	
	c. Energy storage system data sheet	

6)	**For the main transformer and generator step-up transformers, please provide:**	
	a. Transformer voltage and MVA ratings, and available taps. Attach copy of OEM data sheet, or transformer test report (if transfomer test is not available at time of proposal submittal, it shall be provided when available following equipment production)	
	b. Positive, negative, and zero sequence impedance values.	
	c. The tap settings used.	
	d. The LTC Control Scheme.	

7)	**For the circuit breakers and fault-clearing switching devices, including the generator breakers, please provide:**	
	a. The voltage, continuous current and interrupting capability ratings.	
	b. The trip speed (time to open).	

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		Response
8)	**For the power fuses, please provide:**	
	a. The manufacturer, type, size, and interrupting capability.	
	b. The minimum melt and total clearing curves.	

9)	**For the protective relaying, please provide:**	
	a. Data for the CTs used with the relaying including the manufacturer, type of CT, accuracy class, and thermal rating factor.	
	b. Data for the PTs used with the relaying including the manufacturer, type of PT, voltage ratings, and quantity.	

HAWAIIAN ELECTRIC GENERATION FACILITY TECHNICAL MODEL REQUIREMENTS AND REVIEW PROCESS

April 21, 2025

Table of Contents

1 INTRODUCTION

This document summarizes requirements of generation facility technical model submittals and describes the review process for model submittals. The requirements and examples provided are based on Hawaiian Electric's current information as of the date of this document and are subject to change.

2 FACILITY TECHNICAL MODEL REQUIREMENTS

To fully investigate impacts of the proposed utility scale generation facility on Hawaiian Electric's system and correctly identify any mitigation measures, the proposed generation facility technical models, along with related technical documents, will need to be submitted for review prior to System Impact Study (SIS).

2.1 Overview of Submission

For all generation facility types, the technical model submittal shall include the following, unless directed otherwise by Hawaiian Electric:

1. PSCAD facility model and user manual
2. PSS/E power flow facility model
3. Standard Library PSS/E dynamic model
4. User defined PSS/E dynamic model and user manual
5. ASPEN OneLiner model (utilizing the Converter Interfaced Resource (CIR) and Voltage-Controlled Current Source (VCCS) model format) and user manual

For generation facilities categorized as Inverter-Based Resources (IBRs), the respective procurement will dictate whether Grid Following (GFL) and/or Grid Forming (GFM) mode capability will be required from the project. The submitted technical model(s) shall accurately reflect the equipment including the operating mode (GFM or GFL) of the facility resource(s).

It is expected that the supplied technical models represent the entire generation facility. For the requested GFM mode model, the provided facilities models should include all generation resources on-line with any GFM resource operating in GFM mode and if included in the facility design any GFL resource operating in GFL mode. For example, this could be an AC coupled Photovoltaic (PV) Solar and Battery Energy Storage System (BESS) facility.

Along with the technical models, the following documents shall also be submitted for review for all generation facility types:

6. Completed Project Interconnection form
7. User manual for all technical models, including a description of GFM functionality if GFM is used.
    a. This documentation should include specific guidance on which control parameters determine the facilities power – frequency droop, power – frequency deadband, and voltage reactive power droop. Additionally, this documentation should clearly indicate what the technical models are configured to in the submission.
    b. The grid forming control block diagram shall be submitted to Hawaiian Electric for review. This shall include initial settings for tunable controls parameters based on modeling.
8. For Inverter-Based Resources provide attestation from the equipment Original Equipment Manufacturer (OEM) that that the provided PSCAD model conforms with PSCAD Model Requirements document from Electranix Corporation.
9. For all Generation Resources or supporting dynamic devices within the Generation Facility provide a tabular summary of all the protection and tripping mechanisms implemented in inverter and

power plant controller on OEM letterhead. This summary should list all protection/tripping settings, a brief description of the setting, the default value and ranges of allowable settings, and an indication of whether the protection setting is included in the supplied technical models (PSCAD or PSS/E). For synchronous machine-based generation facility, this submittal requirement is not applicable.

10. Generation facility single-line diagram
11. Generation unit manufacturer datasheet(s)
12. Generation unit reactive power capability curve(s)
13. Completed "Technical Model Package Submission Checklist", see Appendix A
14. Completed "Technical Model Review Form", see Appendix B
15. Model Performance Test (MPT) report for submitted Technical Models demonstrating satisfactory performance for the required tests outlined in Appendix C

2.2 Background Functional Description of GFM and GFL

Grid Following and Grid Forming are terms with some ambiguity in current industrial usage. Within the scope of this document, the following definitions are provided as high-level functional descriptions. For more detailed descriptions of what is required for each of these control modes, it is recommended to carefully review descriptions of the functional tests which will be performed.

Grid Following (GFL) Mode:

Grid Following is defined as follows: An inverter-based resource that relies on fast synchronization with the external grid to tightly control the inverter's active and reactive current outputs. If these inverters are unable to remain synchronized effectively during grid events or under challenging network conditions, they will be unable to maintain controlled, stable output. Advanced versions of these devices (Advanced Inverters) can provide grid supporting functions such as: voltage and frequency ride-through, volt-var, frequency-watt, volt-watt, etc. when they are able to remain synchronized.

Grid Forming (GFM) Mode:

Grid Forming is defined as follows: GFM controls set an internal voltage waveform reference such that an inverter with the GFM control shall be able to synchronize with the grid and regulate active and reactive power generation appropriately, regardless of the grid's strength, or operate independently of other generation. An inverter with GFM control shall immediately respond to grid disturbances to support stability of the grid and maintain its own control stability during the system disturbances.

2.3 General requirements for all technical models

All technical models need to represent the whole generation facility, not only a generation unit such as one inverter or as separate files representing pieces of the facility. At minimum, the following equipment shall be included in the single whole generation facility model:

1. Generation unit, such as:
    a) Inverter with DC side model
    b) A rotating machine with explicit representation of excitation system, governor, over excitation limiter, and under excitation limiter

2. Step up transformer, or inverter pad mount transformers, with correct impedances and winding configuration
3. Collection system, aggregated per WECC guidance[1]
4. Main interconnection transformer, or GSU, with its tap changer, if applicable, including correct impedances and winding configuration
5. Grounding transformer if used
6. VAR compensation device, such as cap bank or STATCOM, if applicable
7. Power plant controller (not for ASPEN model)
8. Gen-tie line (as applicable)
9. Battery resources must include the capability to represent the full range of state-of-charge levels.
10. PV and wind resources must have the capability to represent full range of active power availability.
11. All plant level communication delays should be included in the model, including transport delays, measurement delays, delays due to bus (eg. MODBUS) communication, sample and hold logic at the inverter or the PPC, and any other delay that may influence overall plant response in the time-frame of the study.

Equivalent or aggregated representations of the collection system, generator step-up transformers, and inverter systems are acceptable if it can accurately represent the generation facility and its response characteristics.

2.4 Requirements for generation facility PSCAD model

In addition to the general requirements mentioned in Sections 2.1, 2.2, and 2.3, the submitted generation facility PSCAD model should be provided in a standalone package ready for simulation with the facility configured as intended for the SIS. This model should have the same settings as those used in performance of the model performance tests outlined in Section 3; however, it should not include the specific test circuits, or project duplicate. A maximum of two generation facility PSCAD models may be provided as follows (Clearly indicate which model is which in the provided submission package):

1. One model that is intended for the System Impact Study (SIS), if GFM is used for the facility GFM model should be enabled by default and not trigger based on an external event (e.g., breaker status).
2. Optionally, a second model may be provided with different control settings that can be used for Black Start Tests. If this second black start model is provided, please provide a summary document detailing the parameters which are different between them.

The provided PSCAD model(s) shall satisfy the following requirements:

1. Requirements as described in the latest version of the PSCAD Model Requirements document from Electranix Corporation [2] (https://www.electranix.com/the-electranix-library/) and any additional outlined by Hawaiian Electric (including this document).

[1] https://www.wecc.org/Reliability/WECCWindPlantPowerFlowModelingGuide.pdf

[2] https://www.electranix.com/the-electranix-library/)

   a. Additionally, for Inverter-Based Resources an attestation from the equipment Original Equipment Manufacturer (OEM) that that the provided PSCAD model conforms with PSCAD Model Requirements document from Electranix Corporation shall be provided.
2. The generation facility PSCAD model shall be provided for PSCAD versions 4.6.3 and 5.
3. The project shall be modeled at full contract capacity output, with all resources in-service, per the project's Interconnection Request. For example, with an AC coupled solar and storage facility both the aggregate solar and aggregate storage inverters should be in-service in the provided model(s) and able to be dispatched at any desired MW output via explicit means (e.g. constants, PSCAD sliders, etc.). The dispatch commands must be variables, such that they can be adjusted during a simulation (in runtime).

The control implementation (e.g., turbine controls, inverter controls, protection and measurement algorithms, and plant-level controller) in the generation facility PSCAD model shall implement the actual control code from the equipment. The PSCAD model shall provide end-user visible output channels of measured by the Facility and used for Facility's control and protection.

For a generation facility with grid-forming control, a document which describes the general mechanism and implementation of the grid-forming control is required.

2.5 Requirements for generation facility PSS/E power flow model

The generation facility PSS/E power flow model shall be provided for PSS/E versions 33, 34, and 35. Besides the general requirements mentioned above, the following modeling data shall be provided in the model:

1. Conductor
   a. Impedance, both positive sequence and zero sequence
   b. Rating: Rating A – normal rating, and Rating B – emergency rating
2. Transformer
   a. Nominal voltages of windings
   b. Impedance data: specified R and X
   c. Tap ratios
   d. Min and Max tap position limits
   e. Number of tap positions
   f. Regulated bus
   g. Ratings: Rate A – normal rating; Rate B – emergency rating
   h. Winding configuration
3. Reactive power compensation, if applicable
   a. Fixed Shunts: G-Shunt (MW), B-Shunt (MVAr)
   b. Switched Shunts: Voltage limits (Vhi and Vlow), mode of operation (fixed, discrete, continuous), regulated bus, Binit (MVAr), steps and step size (MVAr) and expected control scheme
4. Generation unit
   a. Pmax
   b. Pmin
   c. Qmax (supported by the equipment P-Q capability curves)
   d. Qmin (supported by the equipment P-Q capability curves)

e. Name plate MVA
f. Transformer data: R Tran, X Tran, and Gentap (which should be set to 0,0,1).
g. Voltage control point
h. The project shall be modeled at full contract capacity output, with all resources in-service, per the project's Interconnection Request. For example, with an AC coupled solar and storage facility both the aggregate solar and aggregate storage inverters should be in-service in the provided model and able to be dispatched at any desired output.

5. Station service load
    a. MW
    b. MVar

2.6 Requirements for generation facility user-defined PSS/E dynamic model

The submitted user defined PSS/E dynamic model shall meet the following requirements:

1. The generation facility PSS/E dynamic model shall be provided for PSS/E versions 33, 34 and 35.
2. The project shall be modeled at full contract capacity output, with all resources in-service, per the project's Interconnection Request. For example, with an AC coupled solar and storage facility both the aggregate solar and aggregate storage inverters should be in-service in the provided model and able to be dispatched at any desired output. A maximum of two generation facility PSSE dynamic models may be provided per PSS/E version as follows (Clearly indicate which model is which in the provided submission package):
    a. One model that is intended for the System Impact Study (SIS), if GFM is used for the facility GFM model should be enabled by default and not trigger based on an external event (e.g., breaker status).
    b. Optionally, a second model may be provided with different control settings that can be used for Black Start Tests. If this second black start model is provided, please provide a summary document detailing the parameters which are different between them.
3. User defined dynamic models must accurately model all the relevant control modes and characteristics of the equipment, such as:
    a. All available voltage/reactive power control modes
    b. Frequency/governor response control modes
    c. Voltage and frequency ride-through characteristics
    d. Power plant controller or group supervisory functionality
    e. Appropriate aggregate modeling capability
    f. Charging mode if applicable (e.g., for a battery energy storage device)
4. Dynamic model source code (.flx, .for, .f90, .f, etc.), or dynamic linked library (.dll), and PSS/E dyr file shall be provided.
5. User-defined dynamic model plant-specific settings shall comply with requirements listed in the Power Purchase Agreement (PPA), including ride-through thresholds and other specified control settings if applicable.
6. User-defined dynamic models related to individual units shall be editable in the PSS/E graphic user interface. All model parameters (CONS, ICONS, and VARS) shall be accessible and shall match the description in the model's accompanying documentation.

7. User-defined dynamic models shall have all their data reportable in the "DOCU" listing of dynamics model data, including the range of CONS, ICONS, and VARS numbers. Models that apply to multiple elements (e.g., park controllers) shall also be fully formatted and reportable in DOCU.
8. User-defined dynamic models shall be capable of correctly initializing and run through the simulation throughout the range of expected steady-state starting conditions without additional manual adjustments.
9. Each user-defined dynamic model shall be capable of correctly writing out dyr data/file.
10. User-defined dynamic models shall be capable of allowing all documented (in the model documentation) modes of operation without error.
11. User-defined dynamic model shall be accompanied by the following documentation:
    a. A user's guide for each model
        i. This documentation should clearly state the OEMs allowable and recommended simulation time-steps
    b. Appropriate procedures and considerations for using the model in dynamic simulations
    c. Technical description of characteristics of the model
    d. Block diagram for the model, including overall modular structure and block diagrams of any sub-modules, for various control modes of the model
    e. List of plant-specific settings, which may include:
        i. Ride-through thresholds and parameters
        ii. Plant-level voltage controller settings
        iii. Power ramp rate settings
        iv. ICON flag parameters for specific control modes
        v. Deadbands
        vi. Initial State of Charge (SOC)
    f. Values, names, and detailed explanation for all model parameters
    g. List of all state variables, including expected ranges of values for each variable

2.7 Requirements for generation facility generic PSS/E dynamic model

The submitted generic PSS/E dynamic model should meet the following requirements:

1. All generic PSS/E dynamic models must be standard library models in PSS/E.
2. The generation facility PSS/E dynamic model shall be provided for PSS/E versions 33, 34 and 35.
3. The project shall be modeled at full output, with all resources in-service, per the project's Interconnection Request. For example, with an AC-coupled solar and storage facility both the aggregate solar and aggregate storage inverters should be in-service in the provided model and able to be dispatched at any desired output.
4. Generic dynamic models must accurately model all the relevant control modes and characteristics of the equipment, such as:
    a. All available voltage/reactive power control modes
    b. Frequency/governor response control modes
    c. Voltage and frequency ride-through characteristics
    d. Power plant controller or group supervisory functionality
    e. Appropriate aggregate modeling capability
    f. Charging mode if applicable (e.g., for a battery energy storage device)

5. PSS/E dyr file shall be provided.
6. Generic dynamic models' plant-specific settings should comply with requirements listed in the Power Purchase Agreement (PPA), including ride-through thresholds and other specified control settings if applicable.
7. Generic dynamic models shall be capable of correctly initializing and run through the simulation throughout the range of expected steady state starting conditions without additional manual adjustments.
8. Generic dynamic models shall be accompanied by the following documentation:
    a. A user's guide for each model
    b. Appropriate procedures and considerations for using the model in dynamic simulations
    c. Technical description of characteristics of the model
    d. List of plant-specific settings, which may include:
        i. Ride-through thresholds and parameters
        ii. Plant-level voltage controller settings
        iii. Power ramp rate settings
        iv. ICON flag parameters for specific control modes
        v. Deadbands
        vi. Initial State of Charge (SOC)

2.8 Requirements for generation facility ASPEN model

ASPEN OneLiner models shall be provided in both the Converter Interfaced Resource (CIR) and Voltage-Controlled Current Source (VCCS) model formats. Inverter OEM shall provide an attestation of the short circuit capabilities of its equipment. If the inverter OEM believes the CIR model format does not accurately represent their equipment, a request can be made to submit the ASPEN model in only Voltage-Controlled Current Source (VCCS) model format.

The provided ASPEN OneLiner model should represent the entire generation facility operating at maximum output and all electrical equipment. For example, with an AC coupled solar and storage facility both the aggregate solar and aggregate storage inverters should be in-service in the provided model.

Besides the general requirements, validation results of three-phase fault current from the generation unit represented in the generation facility ASPEN OneLiner model shall be provided in OLR format.

3 GENERATION FACILITY TECHNICAL MODEL REVIEW PROCESS

To review the generation facility technical models, the following procedures are performed in the PSCAD, PSS/E, and ASPEN OneLiner software. A review of the results will be documented and provided to the Customer for confirmation of model acceptance or further model updates. See Appendix C for additional clarification of the test cases to perform. The Company may make these example test cases, in PSSE and PSCAD, available to Proposers upon execution of the applicable Non-Disclosure Agreement and Hold Harmless Agreement for the respective procurement.

3.1 Technical Model Data Review

For all submitted technical models a review for data accuracy and consistency will be performed in accordance with the form outlined in Appendix B. This review will evaluate both steady-state and dynamic model data for the submitted technical models. A completed version of the "Technical Model Data Review" form should be submitted as part of the technical model submittal for all generation facility types Note, this list is subject to change and additional information may be requested by Hawaiian Electric as necessary for verification of technical model quality.

3.2 Model Review in PSCAD

In addition to the "Technical Model Data Review" process outlined in Appendix B, the following items will be reviewed for the submitted PSCAD technical model:

1) Review model data against latest version of the PSCAD Model Requirements document from Electranix Corporation (https://www.electranix.com/the-electranix-library/) provided by Hawaiian Electric. In this step, it will be determined whether the model is complete, generation facility settings are according to the Power Purchase Agreement (PPA), and if the model can be compiled and run without any error. Checklists are provided in this document which are useful for both preparing a model submission and for reviewing a model submission.
    a. For Inverter-Based Resources, provide attestation from the equipment Original Equipment Manufacturer (OEM) that that the provided PSCAD model conforms with PSCAD Model Requirements document from Electranix Corporation
2) Perform Model Performance Testing outlined in Appendix C.

3.3 Model Review in PSS/E

In addition to the "Technical Model Data Review" process outlined in Appendix B, the Model Performance Testing outlined in Appendix C will be performed.

3.4 Model review in ASPEN OneLiner

In addition to the "Technical Model Data Review" process outlined in Appendix B, a review of the ASPEN OneLiner generation model(s) will be performed.

The provided ASPEN OneLiner model(s) should represent the entire generation facility operating at maximum output and all electrical equipment. For example, with an AC coupled solar and storage facility both the aggregate solar and aggregate storage inverters should be in-service in the provided model.

The model review will check if the components of a project are modeled properly, such as transformers, equivalent collector system, equivalent generator, etc., and that the model data is consistent to the completed Project Interconnection Form, submitted single-line diagrams, PSS/E technical model data, and PSCAD technical model data.

A fault simulation test will also be performed using the complete Facility Model. The total current at the fault location and contribution from generation unit will be reviewed and documented.

3.5 GFM Model review in PSCAD and PSS/E

For generation facility which have grid-forming control capability (GFM) their GFM models shall be tested according to the tests described in Table 2 of Appendix C.

4 TYPICAL ISSUES IDENTIFIED FROM THE FACILITY MODEL SUBMITTALS DURING THE PAST RFP PROCESS

1. **Missing/Incorrect documentation**
   Only generation technical facility models are submitted, but no model user manual or any other documentation, or documentation that does not match the models used. Without accurate model documentation, it is very difficult to know the correct procedures for using the technical models and identifying issues during the review.

2. **Model incompleteness**
   Often, the model of a single generation unit, such as an inverter, is submitted instead of model of the whole generation facility, which is insufficient. Additionally, for DC-Coupled hybrid generation, the whole generation facility should have explicit representation of all generation sources (e.g. PV and BESS complete with power conversion models for a PV/BESS hybrid plant). The model of the generation facility should include models for all equipment listed in the section of "General requirements for all technical models".

3. **Settings in the model**
   The following are some settings issues that are typically observed:

   - The PSCAD (GFL and/or GFM) and PSS/E model voltage or frequency ride-through settings do not achieve the minimum requirements outlined in the Power Purchase Agreement (PPA).
   - Electrical equipment parameters, transformer winding configurations, or controller settings are not consistent between submitted Technical Models.
   - Generation facility real power cannot achieve contract capacity.
   - Model facility frequency is set for 50 Hz instead of 60 Hz.

4. **Model function issues**
   Some models do not function as expected during different test scenarios. For example:

   - Fault current contribution from the generation facility is higher than what is described in the generation facility datasheet.
   - Generation level is not stable with provided settings during the initialization test.
   - Inadequately damped oscillations observed in the ringdown test.
   - Facility model(s) is unable to achieve Contract Capacity at POI.
   - Ride-through performance does not reach the minimum requirements defined in the Power Purchase Agreement (PPA).
   - Dynamic response is not consistent between models implemented in different software (e.g. PSS/E vs PSCAD).
   - Provided PSS/E models cannot achieve acceptable initial conditions for all desired operating conditions.

5. Power Plant Controller (PPC)

Often, the PPC control had not yet been fully considered when models are submitted, which results in improperly configured PPC controls, or model submissions missing the PPC altogether. The PPC(s) included in the facility model should include coordination functionality between the plant components and should represent the actual planned implementation. All plant level communication delays should be included in the model, including transport delays, measurement delays, delays due to bus (eg. MODBUS) communication, sample and hold logic at the inverter or the PPC, and any other delay that may influence overall plant response in the time-frame of the study.

REFERENCES

[1] WECC Wind Power Plant Power Flow Modeling Guide: https://www.wecc.org/Reliability/WECCWindPlantPowerFlowModelingGuide.pdf
[2] Latest Revision of Electranix PSCAD Requirements: https://www.electranix.com/the-electranix-library/

APPENDIX A: TECHNICAL MODEL PACKAGE SUBMISSION CHECKLIST

For all generation facilities the following "Technical Model Package Submission Checklist" should be completed and provided with the data package. The checklist summarized in Table A-1 outlines the mandatory data items for a compete model package submission. Note, this list is subject to change and additional information may be requested by Hawaiian Electric as necessary for verification of technical model quality.

Table A-1
Technical Model Package Submission Checklist

Ref No.	Item	Reference File(s)	Notes
1	**PSCAD Facility Model (GFL and/or GFM as required)** *For specific guidance refer to Section 2.4.* - *Models should be provided in PSCAD Versions 4.6.3 and 5* - *Please indicate the OEMs allowable and recommended simulation time-steps. This should also be included in any supplied user documentation.*	Please List:	**PSCAD Facility Model Simulation Time-Step** = *Fill in the OEMs allowable and recommended simulation time-steps*
2	**PSS/E Power Flow Facility Model (GFL and/or GFM as required)** *For specific guidance refer to Section 2.5* - *Models should be provided in PSS/E Versions 33, 34, and 35*	Please List	
3	**User Defined PSS/E Dynamic Model (GFL and/or GFM as required)** *For specific guidance refer to Section 2.6* - *For User Defined models please indicate the OEMs allowable and recommended simulation time-steps. This should also be included in any supplied user documentation.*	Please List	**User Defined PSS/E Dynamic Model Simulation Time-Step** = *Fill in the OEMs allowable and recommended simulation time-steps*
4	**Standard Library PSS/E Dynamic Model (If Applicable)** *For specific guidance refer to Section 2.7* - *Models should be provided in PSS/E Versions 33, 34, and 35* *Subject to Hawaiian Electric's approval, if the original equipment manufacturer (OEM) can certify current standard library dynamic models accurately represent their equipment, standard library dynamic models may be provided and used in lieu of user defined dynamic models. As an example, if the generation facility is a traditional synchronous machine, of which the technology is standardized and widely understood across the industry, it can generally be accurately represented with current standard library dynamic models and thus a user defined dynamic model will not be required.*	Please List	
5	**ASPEN OneLiner Facility Models** *For specific guidance refer to Section 2.8*	Please List	

6	**Completed Project Interconnection Form** *The data within this form should be consistent with the data included in the facility single line diagrams as well as within all submitted technical models.*	Please List	
7	**User Manuals for All Submitted Technical Models**	Please List	**PSS/E Facility Inverter Manual**= Please List **PSS/E Facility PPC Manual** = Please List **PSCAD Facility Inverter Manual**= Please List **PSCAD Facility PPC Manual** = Please List **ASPEN OneLiner Inverter Documentation**= Please List
8	**Description of GFM Functionality (If GFM is used)** *This documentation should include specific guidance on which control parameters determine the facilities power – frequency droop, power – frequency deadband, and voltage reactive power droop. Additionally, this documentation should clearly indicate what the technical models are configured to in the submission.* *The grid forming control block diagram shall be submitted to Hawaiian Electric for review. This shall include initial settings for tunable controls parameters based on modeling.*	Please List	
9	**Attestation That PSCAD Facility Model Conforms with Modeling Requirements (Necessary for all Inverter-Based Resources)** *For Inverter-Based Resources provide attestation from the equipment Original Equipment Manufacturer (OEM) that that the provided PSCAD model conforms with latest PSCAD Model Requirements document from Electranix Corporation* (https://www.electranix.com/the-electranix-library/)	Please List	
10	**Generation Resource Protection Summary** *For the individual generation resources (e.g., PV Inverter, BESS Inverter, Turbine Generator) and supporting devices (e.g., STATCOM) within a Generation Facility* provide a tabular summary of all the protection and tripping mechanisms implemented in inverter and power plant controller on OEM letterhead. This summary should list all protection/tripping settings, a brief description of the setting, the default value and ranges of allowable settings, and an indication of if the protection setting is included in the supplied technical models (PSCAD or PSS/E). For synchronous machine-based generation facility, this submittal requirement is not applicable.	Please List	

11	**Generation Facility Single-Line Diagram**	Please List	
12	**Generation Facility Relay Single-Line Diagram** *Diagrams should be provided for the entire facility which indicate the location of measurement devices as well as the location and types of protection devices.*	Please List	
13	**Generation Unit Manufacturer Datasheet(s)**	Please List	
14	**Generation Unit Reactive Power Capability Curve(s)**	Please List	
15	**Completed Technical Model Review Form, See Appendix B**	Please List	
16	**Completed Model Performance Test (MPT) Report, See Appendix C** *This report should demonstrate satisfactory performance for the required tests outlined in Appendix C*	Please List	
17	**Completed Reactive Power Capability Test, See Appendix D** *This report should include a completed Reactive Power Capability Test summary table demonstrating the overall facilities reactive power capability for the operating conditions outlined in Appendix D*	Please List	

APPENDIX B: TECHINCAL MODEL DATA REVIEW

For all submitted technical models a review for data accuracy and consistency will be performed in accordance with Tables B-1 and B-2. A completed version of the "Technical Model Data Review" form should be submitted as part of the technical model submittal for all generation facility types Note, this list is subject to change and additional information may be requested by Hawaiian Electric as necessary for verification of technical model quality.

Figure B-1 provides an example power – frequency droop characteristic which is referenced within Table 2.

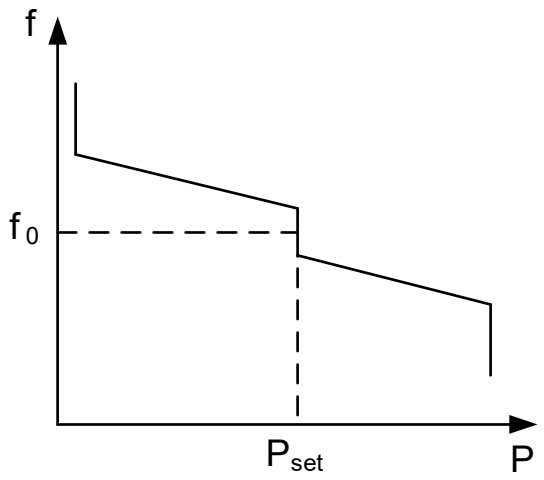


Figure B-1 – Example of Frequency Droop Control Characteristic with Deadband

Table B-1
Steady-State Model Data Review

Ref No.	Equipment	Requirement	Acceptable (Yes/No)	Notes
1	**Generation Unit (s)** *Key Items of consistency include:* - *Unit model* - *Unit MVA rating* - *Number of units* - *Unit terminal voltage* - *Maximum and Minimum Gross Electrical Output (MW)* - *Maximum inductive and capacitive limits at rated and zero real power output (MVAR)* - *Location of voltage control*	Application Data, Single-Line Diagram (SLD), Capability Curve, PSS/E, PSCAD and ASPEN models should match		
2	**Inverter Pad Mount Transformer(s) or Synchronous Generator Step-Up Transformers** *Key Items of consistency include:* - *Unit MVA rating* - *Number of units* - *Winding configuration* - *Winding voltages* - *Tap ratios* - *If applicable, Min and Max tap position limits* - *If applicable, point of voltage regulation* - *Positive and Zero sequence impedance*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		
3	**Collector System Equivalent** *Key Items of consistency include:* - *Rated Voltage* - *Positive and Zero Sequence Impedance*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		
4	**Reactive Power Compensation (If applicable)** *Key Items of consistency include:* - *Location* - *For fixed compensation: number of steps and MVAR for fixed compensation* - *For switched compensation: number of steps, MVAR of each step, voltage control limits, mode of operation, regulated bus*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		

5	**Station Service Load (If applicable)** *Key Items of consistency include:* - *Location* - *Total load amount MW and MVAR*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		
6	**Main Power Transformer(s)** *Key Items of consistency include:* - *Unit MVA ratings* - *Number of units* - *Winding configuration* - *Winding voltages* - *Tap ratios* - *If applicable, Min and Max tap position limits* - *If applicable, point of voltage regulation* - *Positive and Zero sequence impedance*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		
7	**Generator Tie Line(s)** *Key Items of consistency include:* - *Rated Voltage* - *Line Length* - *Positive and Zero Sequence Impedance (R, X, and B on 100 MVA base)* - *Line rating*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		
8	**Plant Power Factor (PF) Capability** *Key Items of consistency include:* - *Facility can meet contract capacity MW requirements while at a minimum supplying 0.95 PF inductive and capacitive at the POI.* - *Note, specific PF requirements to be specified by project PPA.*	Application Data, SLD, PSS/E, PSCAD and ASPEN models should match		
9	**Other Required Items Per PPA**			

Table B-2
Dynamic Model Data Review

Ref No.	Equipment	Requirement	Acceptable (Yes/No)	Notes
1	**Power Plant Controller (PPC)** *Key Items of consistency include:* - *Number of PPCs (Should represent actual setup of plant when in-service).* - *Original Equipment Manufacturer (OEM) supplied model documentation for all software.* - All plant level communication delays should be included in the model, including transport delays, measurement delays, delays due to bus (e.g., MODBUS) communication, sample and hold logic at the inverter or the PPC, and any other delay that may influence overall plant response in the time-frame of the study.	PSS/E and PSCAD models should match		
2	**Control Flags** *Key Items of consistency include:* - *Control modes and settings are consistent between models, such as voltage control mode, frequency response mode, GFL/GFM setting, etc.*	PSS/E and PSCAD models should match		
3	**Voltage Control** *Key Items of consistency include:* - *Point of voltage control* - *Location of voltage measurement and reactive power measurement* - *Voltage - Reactive Power droop is consistent; documentation clearly indicates which variables impact voltage – reactive power droop* - *By default set Voltage – Reactive Power droop in accordance with PPA* ○ ***Droop is calculated as p.u.V/p.u.VAR where the Var base is Facility Contract Capacity*** - ***In the Notes column indicate the default voltage – reactive power droop values in the submitted technical models as well as the PSS/E and PSCAD variables that determine them.***	PSS/E and PSCAD models should match and meet PPA requirements		**PSS/E Voltage – Reactive Power Droop** = Set in accordance with PPA • *Fill in value and variable that determines droop setting* **PSCAD Voltage – Reactive Power Droop** = Set in accordance with PPA • *Fill in value and variable that determines droop setting*

4	**Power and Frequency Control** *Key Items of consistency include:* - *Point of control* - *Location of power and frequency measurements* - *In PSCAD library components are not used for frequency measurement.* - *Power – Frequency droop and deadband are consistent, documentation clearly indicates which variables impact power – frequency droop and deadband.* - *By default set the Power – Frequency droop and deadband in accordance with PPA* ○ *Droop is calculated as the percent change in frequency over 100% real power. Meaning, for a 4% droop a 4% increase in grid frequency, the facility should reduce it's output to 0 MW.* - ***In the Notes column indicate the default droop and deadband values in the submitted technical models as well as the PSS/E and PSCAD variables that determine them.*** - The frequency deadband should be settable in the range from +/- 0.01 Hz to +/- 1.0 Hz and the frequency droop shall be settable in the range of 0.1% to 10% with a typical value of 4%.	PSS/E and PSCAD models should match and meet PPA requirements		**PSS/E Power – Frequency Power Droop** = Set in accordance with PPA • *Fill in value and variable that determines droop setting* **PSCAD Power – Frequency Power Droop** = Set in accordance with PPA • *Fill in value and variable that determines droop setting* **PSS/E Power – Frequency Deadband = Set in accordance with PPA** • *Fill in value and variable that determines droop setting* **PSCAD Power – Frequency Deadband** = Set in accordance with PPA • *Fill in value and variable that determines droop setting*
5	**Initial State of Charge (SOC), if applicable** *Key Items of consistency include:* - *Make sure the initial state of charge is set up correctly to prevent initialization issues.*	Correctly set up in the models		
6	**Energy Availability** - Battery resources must include the capability to represent the full range of state-of-charge levels. - PV and wind resources must have the capability to represent full range of active power availability.	Correctly set up in the models		

7	**Voltage and Frequency Ride Through** *Key Items of consistency include:* - *The voltage and frequency ride through settings should be consistent between submitted Technical Models and should be OEM attested.* - Facility should not have arbitrary trip settings set to exactly the PPA minimum ride through requirements. - ***In the Notes column provide a table which summarizes the Voltage and Frequency ride through settings as well as the PSS/E and PSCAD variables that dictate them.***	PSS/E and PSCAD models should match and meet PPA requirements		
8	**P/Q Priority Data** *Key Items of consistency include:* - *The P/Q priority flags should match in the PSS/E user written, PSS/E generic, and PSCAD models.*	PSS/E and PSCAD models should match and meet PPA requirements		
9	**Synchronous Machine Data, if applicable** *Key Items of consistency include:* - *Generator model data (impedance values, time constants, saturation, inertia)* - *Excitation system model data* - *Governor model data* - *Under excitation limiter* - *Over excitation limiter* - *Power system stabilizer*	PSS/E and PSCAD models should match and meet PPA requirements		
10	**Other Required Items Per PPA**			

APPENDIX C: MODEL PERFORMANCE TEST

To assess the performance of submitted technical models Model Performance Testing (MPT) will be performed in PSS/E and PSCAD. A report summarizing the testing outlined within this Appendix should be included for all generation facilities as part of a complete "Technical Model Package Submission". Independently Hawaiian Electric will perform this analysis for verification of Facility model performance.

The testing shall be performed using the provided standalone complete Facility model package. The MPT analysis outlined within this Appendix should all be performed with the same Facility model without the need to adjust control settings or parameters between tests. The only allowable setting changes between requested tests are adjustments to the facility voltage schedule and generator unit power dispatch.

Control setting changes are only permitted for the Black Start tests (if applicable to the Facility under study). If control setting changes are made for the Black Start test, please clearly indicate which settings were changed.

The following Tables provide a summary of the required simulation events (Cases), required Facility generation dispatch (Mode of Operation), system representation, and acceptance criteria:

- Tables C-1 and C-2 outline the required tests for a given facility.
    - Table C-1 is required for GFL and GFM facilities.
    - Table C-2 is only required for GFM facilities.
        - Applicable for generation facilities which have grid-forming control capability.
        - Assumption is that BESS has available energy and is dispatched suitably for the tests.
        - The project should be configured to be in GFM mode throughout these tests.
- Table C-3 provides an explanation of the various requested Facility "Modes of Operation" i.e., generation dispatch scenarios for a given Facility.
- Tables C-4 and C-5 provide an explanation of the various test systems and test system equivalents.

For each examined case, the following RMS quantity plots should be provided for both PSCAD and PSSE:

- For each aggregate generator
    - V, P, and Q at the generator terminals (RMS Quantities)
    - Relevant protection flags, if available
    - Active Current and Reactive Current
- Grid Frequency for the facility (calculated by PPC, PLL output, or other)
- POI Quantities
    - V, P, and Q (RMS Quantities)

Figures C-3 through C-5 provide example illustrations of overlaid PSCAD and PSS/E plots which should be provided for verification purposes.

Table C-1
Standard Model Testing for GFL and GFM Facilities

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Flat Start Test						
1-1	Facility initializes at ordered set points. Perform test in: PSCAD and PSS/E 20 second simulation for both	GEN output only	Single Machine Infinite Bus (SMIB) @ SCR = 2.5 and X/R = 5	1) Model initializes as quickly as possible (e.g., <1-3 seconds) to user defined conditions. 2) Voltage and power flow matches between PSCAD and PSS/E or differences are reasonable and explained.		
1-2		BESS output only				
1-3		Grid charging BESS				
1-4		GEN charging BESS				
1-5		GEN and BESS at 0 MW				
1-6		GEN at 50%, BESS at 0 MW				
Voltage Ride-Through Test						
2-1	POI Voltage is varied to test the facility's ride-through capabilities and response to POI voltage excursions. Voltage ride-through curve as specified by PPA to be tested Perform test in: PSCAD and PSS/E	GEN at 50%, BESS at 0 MW	Infinite Bus	1) No tripping observed for specified or PPA-required voltage ride-through curve. 2) No momentary cessation of inverter current observed. 3) Reasonable real and reactive power response observed. 4) Facility real power output does not have a sustained output exceeding the Contract Capacity.		

Table C-1 (Continued)
Standard Model Testing for GFL and GFM Facilities

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Frequency Ride-Through Test						
3-1	POI Frequency is varied to test the facility's ride-through capabilities and response to POI voltage excursions. The frequency step should have a 10 Hz/second rate of change (For Synchronous Machines this can be 5 Hz/Second) Frequency ride-through curve as specified by PPA to be tested. Perform test in: PSCAD and PSS/E	GEN at 25%, BESS at 25%	Infinite Bus	1) No tripping observed for PPA required frequency ride-through curve. 2) No momentary cessation of inverter current observed. 3) Reasonable real and reactive power response observed. 4) Facility real power output does not have a sustained output exceeding the Contract Capacity.		
Rate-Of-Change-Of-Frequency (ROCOF) Test						
4-1	Step the grid frequency from 60 Hz to 58 Hz at 5 Hz/sec. Perform test in: PSCAD only	GEN at 50%, BESS at 0 MW	Single Machine Infinite Bus (SMIB) @ SCR = 2.5 and X/R = 5	1) No tripping observed for ROCOF event. 2) No momentary cessation of inverter current observed. 3) Reasonable real and reactive power response observed.		
Voltage Response Step Test						
5-1	A small step (≤5%) is applied in the infinite bus voltage and the reactive power response of the facility is observed. Step size should be sufficiently small such that the facility does not hit a control limit (voltage, reactive power, or current). Perform test in: PSCAD and PSS/E	GEN output only Or BESS output only (for BESS only facilities)	Single Machine Infinite Bus (SMIB) @ SCR = 2.5 and X/R = 5	1) Facility reaches 90% of the final value in MVARs within 1 second, or according to PPA. If response time must be longer because of equipment limitations, provide explanation. 2) Response is well damped or according to PPA. 3) Plant begins to respond between 100 ms and 200 ms following change in system voltage[3] 4) Response consistent with facility voltage – reactive power droop.		
Power-Frequency Response Step Test						
6-1	A 0.5 Hz reduction in system frequency is applied to the system equivalent and the facilities real power response is observed. The frequency step should have a 20 Hz/second rate-of-change. Perform test in: PSCAD and PSS/E	GEN at 50%, BESS at 0 MW	Single Machine Infinite Bus (SMIB) @ SCR = 2.5 and X/R = 5	1) Facility reaches 90% of the final value in MWs within 4 seconds, or according to PPA. If response time must be longer because of equipment limitations, provide explanation. 2) Response is well damped or according to PPA. 3) Response consistent with facility power – frequency droop.		

[3]Response (Reaction) should begin in less than 200 ms unless allowed to be longer by regional standards. Many models have not included delays caused by measurement, communication, data buses, or sample-and-hold, so reaction times less than 100 ms should be confirmed to be accurate

Table C-1 (Continued)
Standard Model Testing for GFL and GFM Facilities

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Fault Simulation Test: Three-Phase Grounded (3LG) Fault at Facility Point of Interconnection (POI)						
7-1	POI 3LG fault (such that three-phase average voltage is ~0%) with 6-cycle clearing Perform test in: PSCAD and PSS/E 30 second simulation in PSS/E and PSCAD	GEN output only	Single Machine Infinite Bus (SMIB) @ SCR = 2.5 and X/R = 5	1) No tripping observed. 2) No momentary cessation observed. 3) Reasonable fault current contribution. 4) If Applicable, Facility measured current at POI meets PPA requirements a. For example, provides current injection in agreement with IEEE Std 2800 clause 7.2.2.3.4		
7-2		BESS output only				
7-3		GEN charging BESS				
Fault Simulation Test: Single-Phase (1LG) Fault at Facility Point of Interconnection (POI)						
8-1	POI 1LG fault with 6-cycle clearing Perform test in: PSCAD Only 30 second simulation in PSCAD	GEN output only	Single Machine Infinite Bus (SMIB) @ SCR = 2.5 and X/R = 5	1) No tripping observed. 2) No momentary cessation observed. 3) Reasonable fault current contribution. 4) If Applicable, Facility measured current at POI meets PPA requirements a. For example, provides current injection in agreement with IEEE Std 2800 clause 7.2.2.3.4		
8-2		BESS output only				
8-3		GEN charging BESS				

Table C-1 (continued)
Additional Model Review for GFL and GFM Facilities in PSCAD and PSS/E

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Weak Grid Operation Test						
9-1	Start with the facility connected to a SMIB test system. Apply a 6-cycle three-phase grounded POI bus fault and change the system strength at the time of fault clearing. The sequence outlined in Figure 1 should be used for this test.	GEN at 50%, BESS at 0 MW	Variable Thevenin equivalent per Figure C-1	1) For information only not a pass/fail	For Information Only	
9-2	Perform test in: PSCAD and PSS/E	BESS output only				
Phase Angle Step Test						
10-1	Using a SMIB source with an externally controllable voltage and phase angle (on the voltage source side of the source impedance) simulate the system phase angle jumps ranging from 20-degree steps to 70-degree steps as shown in Figure C-6. Perform test in: PSCAD only	GEN at 0%, BESS at 0%	Single Machine Infinite Bus (SMIB) @ SCR = 10 and X/R = 5	1) Active power response from grid-forming facilities should temporarily increase to oppose the negative phase angle jump, and remain stable. Voltage should be stable and return to near-nominal shortly after phase angle jump		

Table C-2
Additional Model Review for GFM Facilities in PSCAD and PSS/E

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Black Start Test (If Facility is providing black start capability)						
11-1	Perform the following black start sequence of events (allow system to settle between disturbances): • Energize Facility MPT from generation resource • Connect load (50% of BESS MW at unity PF) at Facility POI • Apply 6-cycle Three-Phase Grounded (3LG) bus fault at POI Allowed to be a separate facility model from the rest of the tests. Perform test in: PSCAD and PSS/E	GEN OFF and BESS (or other black start resource) On-Line output as needed from simulation	None	1) No tripping or undesirable behavior. 2) Voltage and frequency should be stable and settle back to close to their nominal values after the disturbances.		

Table C-2 (continued)
Additional Model Review for GFM Facilities in PSCAD and PSS/E

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Loss of the Last Synchronous Machine						
12-1	With system operating in steady-state condition, trip the last Synchronous Generator. Facilities must automatically ride through grid loss; a trip signal or flag cannot be sent to the Facility or Duplicate Facility. *Note: for Facilities where operating with "GEN Oneline at 0 MW" is not a valid operating conditions this case should be examined with BESS on-line only.* *Additional Guidance in:* *NERC White Paper – Grid Forming Functional Specifications for BPS-Connected Battery Energy Storage Systems, September 2023 [C-1]* Perform test in: PSCAD and PSS/E	**Scenario 1**: Facility: GEN Online at 0 MW, BESS discharging at 20% Duplicate Facility: GEN Online at 0 MW, BESS discharging at 20%	3-Machine Test System: GENROU, SCRX or eq., TGOV1 or eq., P/Q Load, and Facility (with one duplicates) The P/Q Load should be set to 1.5x the Contract Capacity of the facility under study at 0.9 PF inductive (E.g., for a 100 MW facility the load would be 150 MW and 72 Mvar)	1) Immediately following the trip, BESS output should be well controlled. System frequency and voltage should not oscillate excessively or deviate from steady-state levels for any significant amount of time. 2) Voltage and frequency settle to a stable operating point that is expected based on droop and deadband settings. 3) Any oscillation shall be damped and any distortion observed in phase quantities should dissipate over time. 4) **For Scenario 1**: P and Q from each BESS should move immediately to meet the load and voltage regulation requirements. 5) **For Scenario 2**: P and Q from each BESS should move immediately to meet the load and voltage regulation requirements. 6) **For Scenario 3**: P from BESS 1 should move immediately to meet the load requirements. The P from BESS 2 should not exceed its maximum discharge power limit. The Q from each BESS should move immediately to meet the voltage regulation requirements.		
12-2		**Scenario 2**: Facility: GEN Online at 0 MW, BESS charging at 50% Duplicate Facility: GEN Online at 0 MW, BESS charging at 50%				
12-3		**Scenario 3**: Facility: GEN Online at 0 MW, BESS at 0 MW. Duplicate Facility: GEN Online at 0 MW, BESS discharging at maximum.				

[C-1] NERC White Paper – Grid Forming Functional Specifications for BPS-Connected Battery Energy Storage Systems, September 2023
Link: https://www.nerc.com/comm/RSTC_Reliability_Guidelines/White_Paper_GFM_Functional_Specification.pdf

Table C-2 (continued)
Additional Model Review for GFM Facilities in PSCAD and PSS/E

Case No.	Case Description	Mode of Operation (See Table C-3)	System Representation (See Tables C-4 and C-5)	Acceptance Criteria	Acceptable (Yes/No)	Notes
Harmonious Operation Test						
13-1	With the system operating in steady-state conditions with a load at the Facility POI (P = 60% of the Facilities' Contract Capacity at unity PF) perform the following sequence of events (allow system to settle between disturbances): • Increase the load at the Facility POI by 40% of Facilities' contractual capacity at unity PF. Final load size of 100% of the Facilities' contractual capacity at unity PF. • Apply a 6-cycle three-phase grounded POI bus fault. Perform test in: PSCAD and PSS/E	GEN at 60%, BESS at 0 MW Duplicate Facility: GEN at 0 MW, BESS at 0 MWs	3-Machine Test System: GENROU, SCRX or eq., TGOV1 or eq., P/Q Load, and Facility (with one duplicates)	1) After disturbance, voltage and frequency should be stable and settle back to close to nominal, within tolerance of droop and deadband settings. 2) Voltage and frequency settle to a stable operating point that is expected based on droop and deadband settings. 3) Frequency deadband is settable from +/- 0.01 Hz to +/-1.0 Hz.		
GFM Performance Test						
14-1	Using a SMIB source with an externally controllable frequency, voltage and phase angle (on the voltage source side of the source impedance) simulate the fault event outlined in Figure C-2. Perform test in: PSCAD only	GEN at 0%, BESS at 50%	Single Machine Infinite Bus (SMIB) @ SCR = 1.5 and X/R = 5	1) For information only not a pass/fail	For Information Only	
14-2		GEN at 0%, BESS at 100%				

Table C-3

Description of Generation Dispatch by Type of Resource

Ref. No.	Generation Dispatch Description	Equivalent Dispatch for Type of Resource [1,2]				
		PV+BESS	Wind/PV Only	BESS Only	Synchronous Machine + BESS	Synchronous Machine Only
1	GEN output only	PV Max, BESS Online at 0 MW	Generation Max	--	Synch. Machine at Max, BESS Online at 0 MW	Synch. Machine at Max
2	BESS output only	PV Online at 0 MW, BESS Discharging at Maximum	--	Discharging at Maximum	Synch. Machine at Minimum, BESS Discharging at Maximum	--
3	Grid charging BESS	PV Online at 0 MW, BESS Charging at Maximum	--	Charging at Maximum	Synch. Machine at Minimum, BESS Charging at Maximum	--
4	GEN charging BESS	PV Max, BESS Charging at Maximum	--	--	Synch. Machine at Max, BESS Charging at Maximum	--
5	GEN and BESS at 0 MW	PV Online at 0 MW, BESS Online at 0 MW	Generation at 0 MW	BESS at 0 MW	Synch. Machine at Minimum, BESS Online at 0 MW	Synch. Machine at Minimum
6	GEN at 50%, BESS at 0 MW	PV at 50%, BESS at 0 MW	Generation at 50%	BESS Discharging at 50%	Synch. Machine at 50%, BESS at 0 MW	Synch. Machine at 50%
7	GEN at 25%, BESS at 25%	PV at 25%, BESS at 25%	Generation at 50%	BESS Discharging at 50%	Synch. Machine at 25%, BESS at 25%	Synch. Machine at 50%

[1] Note for all dispatches the power flow at the POI should be equal to or less than the Contract Capacity.
[2] If a dispatch doesn't exist for a given resource, indicated by a “--“, then the specific test from Table C-1 or C-2 does not need to be performed.

Table C-4
System Representation Sample Diagrams of Single-Machine Tests for Model Review

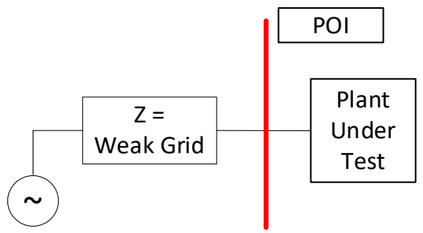
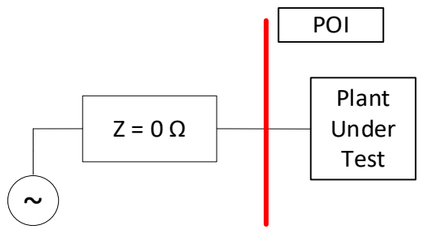
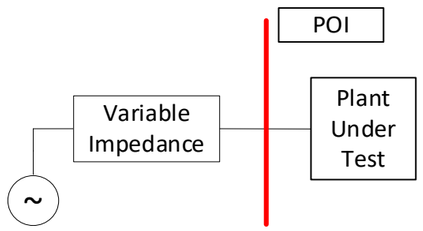
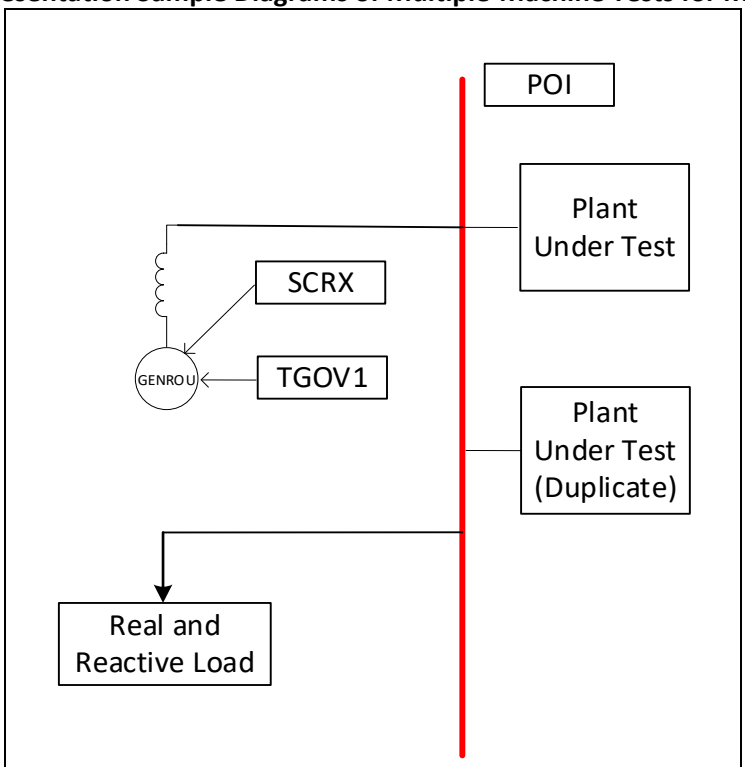
 Single Machine Infinite Bus (SMIB) @ a minimum SCR = 2.5	 Infinite Bus	 Variable Thevenin Equivalent
Minimum Test Strength of SCR = 2.5 Calculated based on Contract Capacity at POI. For example, for a 30 MW facility, the tested short-circuit capacity 75 MVA regardless of plant operating conditions. **PSSE Representation** A GENCLS model must be used for tests in Table 1 and Table 2 that does not require a voltage or frequency signal to be played back. The GENCLS model should be with inertia and damping value of 0. A playback model (e.g. PLBVFU1) must be used for tests that require a voltage and/or frequency signal to be varied. For the playback model, generator should be represented as follows in steady-state Mbase = 100 and Xsource = 0.001	**PSSE Representation** A GENCLS model must be used for tests in Table 1 and Table 2 that does not require a voltage or frequency signal to be played back. The GENCLS model should be with inertia and damping value of 0.	Variable Thevenin Equivalent Ideally, the variable impedance would be represented as a number of parallel impedance branches. **PSSE Representation** A GENCLS model must be used for tests in Table 1 and Table 2 that does not require a voltage or frequency signal to be played back. The GENCLS model should be with inertia and damping value of 0.

Table C-5
System Representation Sample Diagrams of Multiple-Machine Tests for Model Review



3-Machine Test System

In the "3-Machine Test System", the synchronous machine MVA rating is 3 times the Facilities "Contract Capacity" with Xsource = 0.1714 p.u.

3-Machine Test System Equivalent Machine Dynamic Parameters

9700 'TGOV1' '1' 0.05 0.2 1.0 0.0 1.0 0.5 0.0 /
9700 'GENROU' '1' 4.5 0.035 2.5 0.035 4 0.0 1.76 1.76 0.28 0.347 0.1714 0.154 0.09 0.39 /
9700 'SCRX' '1' 0.324 1.082 52.4 0.107 -3.67 3.0 0.0 10.0 /

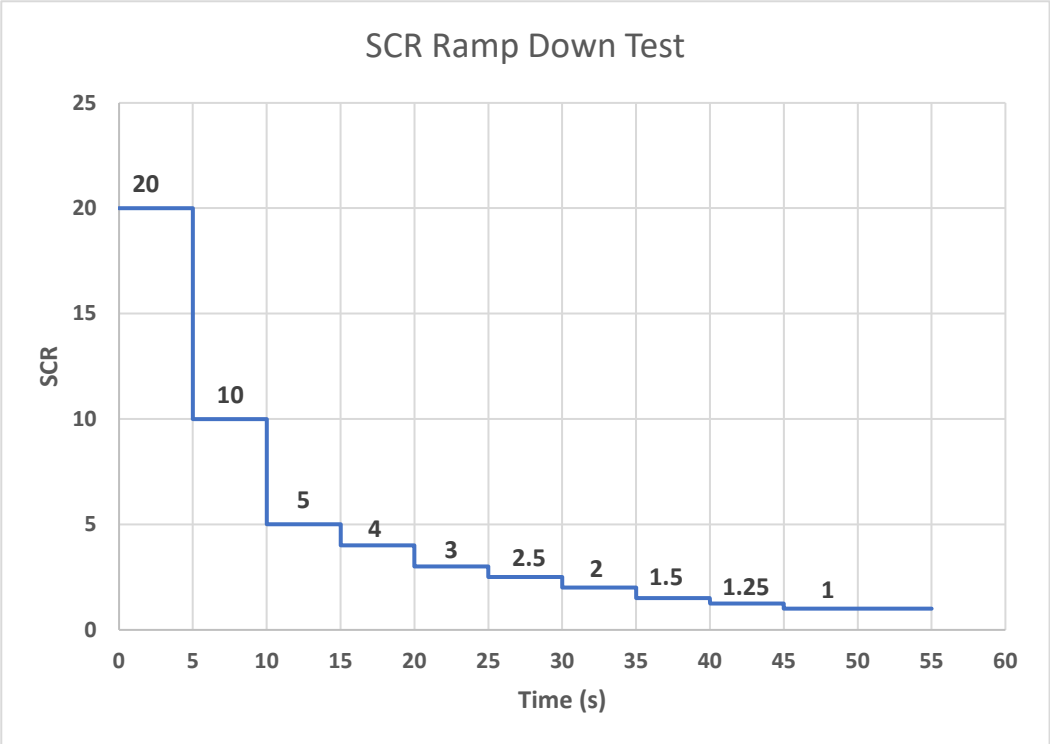


Figure C-1: Variable SCR Value for Weak Grid Operation Test
[Electranix PSCAD Model Requirements Rev. 12]

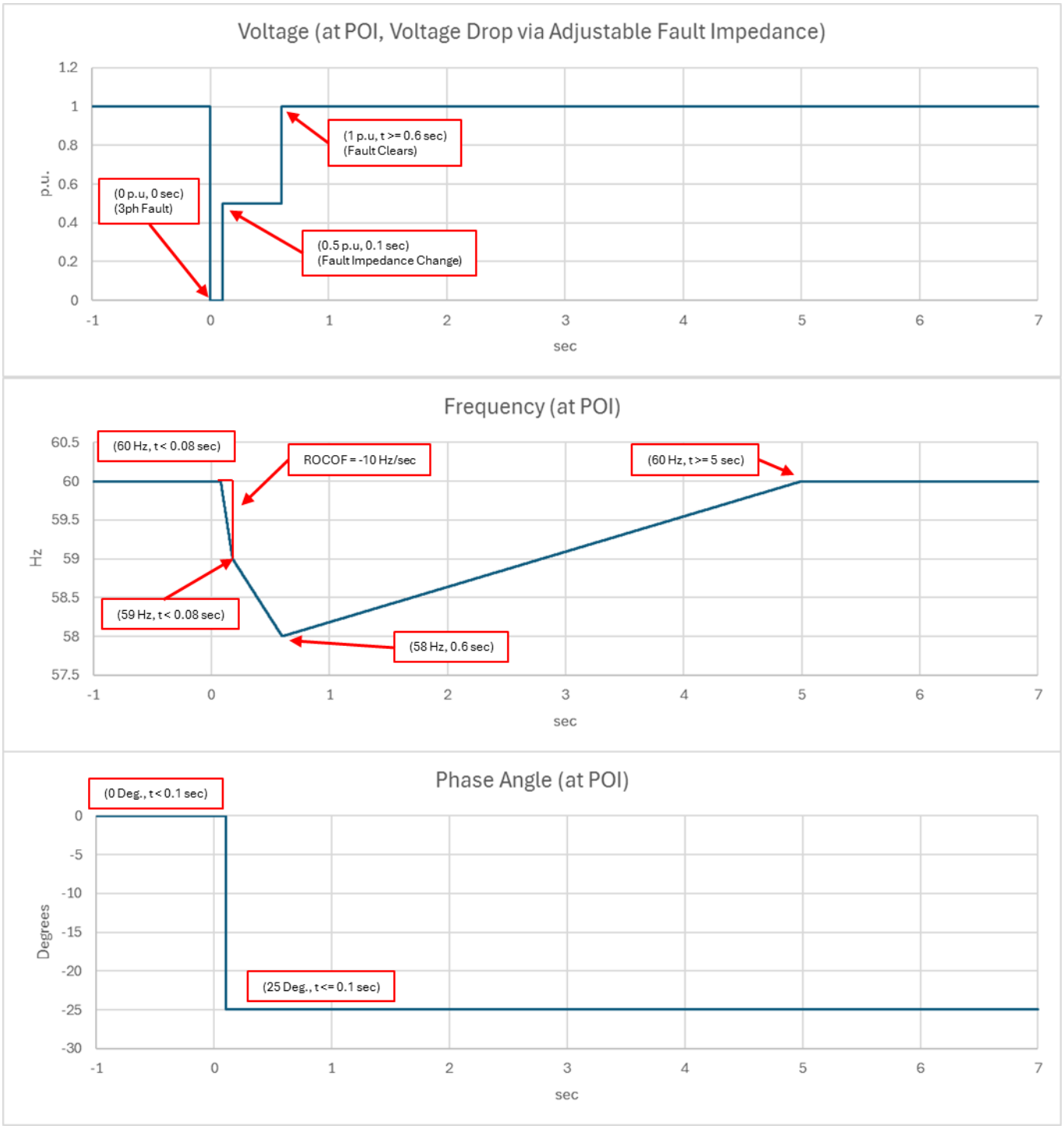


Figure C-2: GFM Performance Test SMIB Source Characteristics

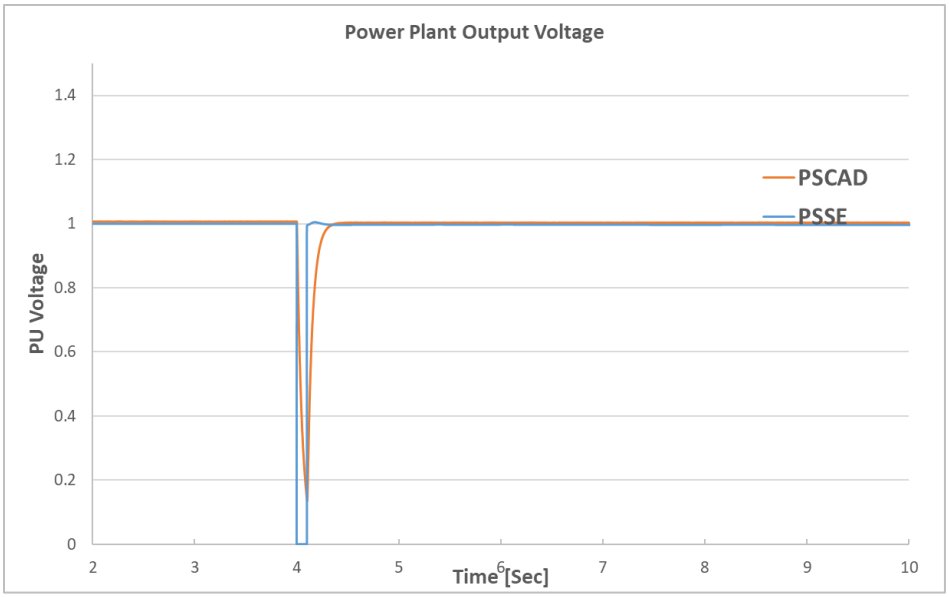


Figure C-3: Overlaid plot for Facility POI Voltage

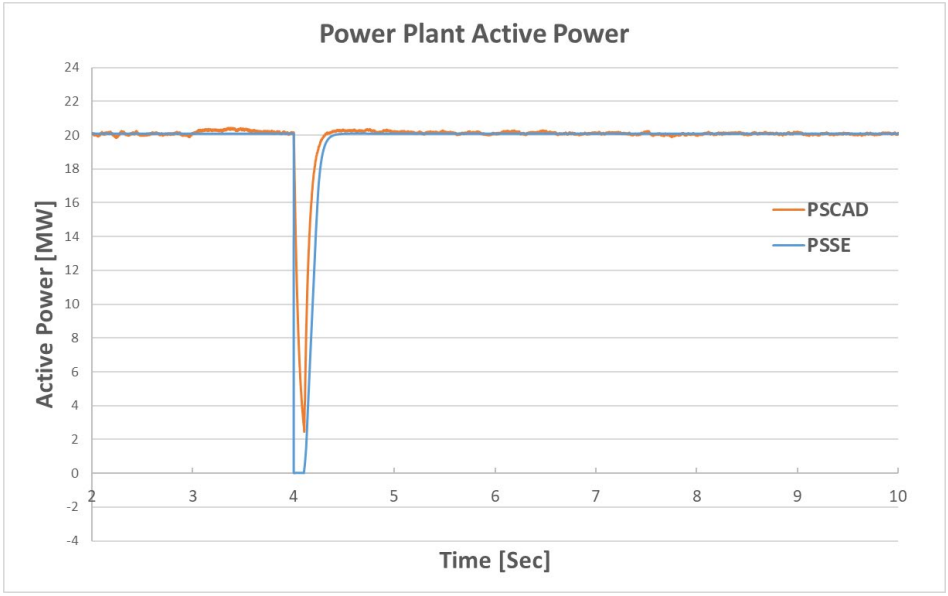


Figure C-4: Overlaid plot for Facility POI Real Power

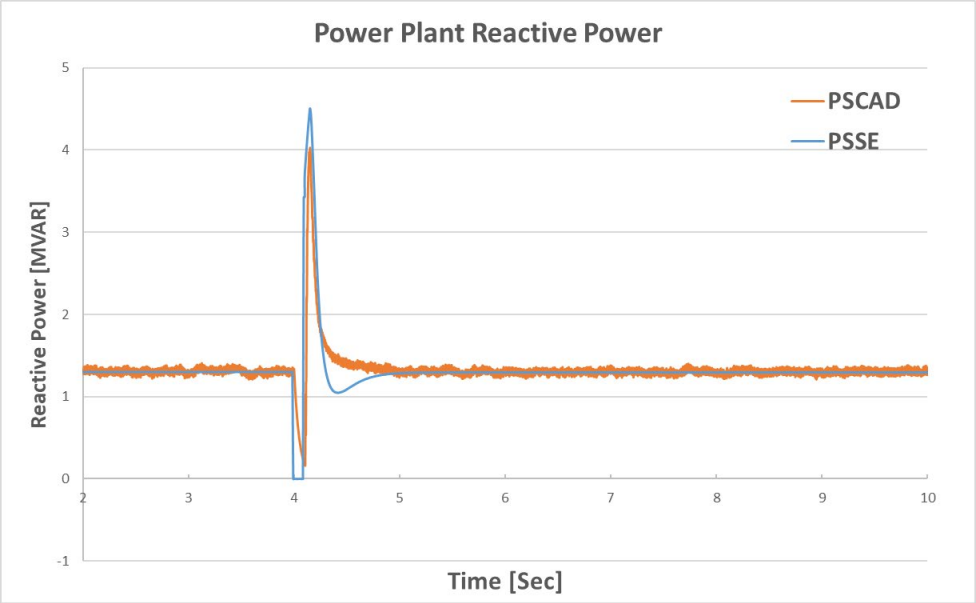


Figure C-5: Overlaid plot for Facility POI Reactive Power

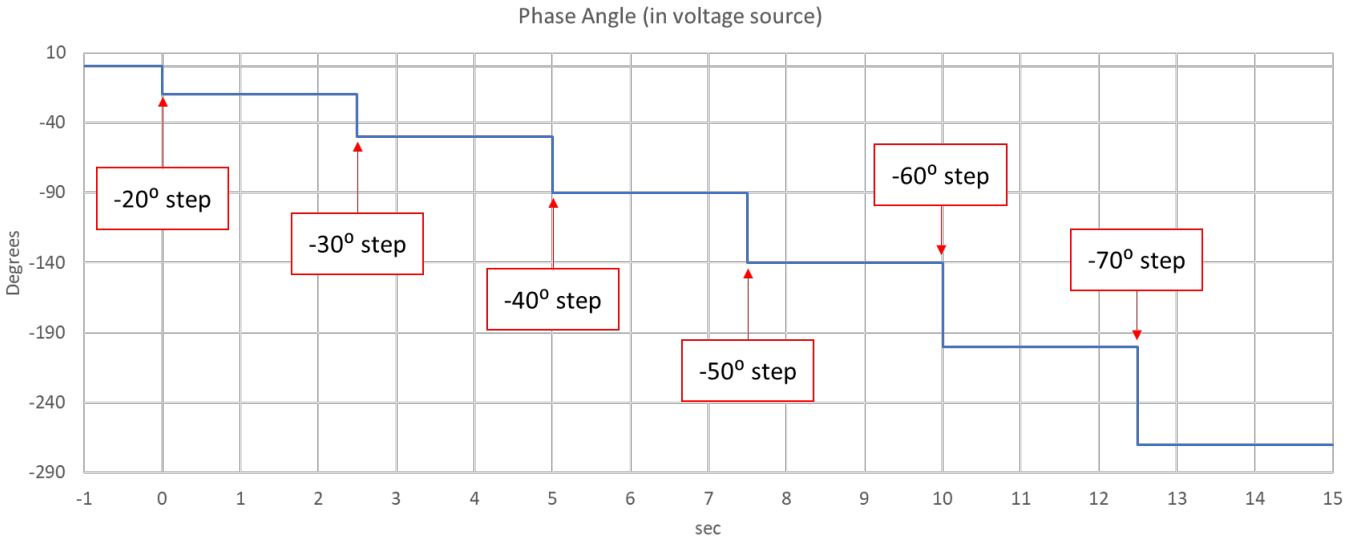


Figure C-6: Phase Angle Jump Test SMIB Angle Change Profile

APPENDIX D: REACTIVE POWER CAPABILITY TESTING

The Generation Facility should demonstrate the reactive power capability of the generating facility on a per POI basis including relevant facility losses considering the requested range of POI voltages and generation dispatches. The reactive power capability testing should demonstrate maximum reactive power injection and absorption at the POI considering, at a minimum, the following operating conditions:

- Facility Dispatches:
  - Facility dispatched at Contract Capacity
  - Facility dispatched at 0 MW, or minimum injecting power if 0 MW is not a valid operating condition
  - If BESS facility with grid charging, at maximum grid charging
- Voltage Range is dependent upon the Project PPA; an example is detailed below
  - Max Injection (Capacitive Operation)
    - Minimum continuous undervoltage ride-through voltage from PPA
    - 0.90 p.u.
    - 0.95 p.u.
    - 1.03 p.u
    - 1.05 p.u.
    - Maximum continuous overvoltage ride-through voltage from PPA
  - Max Absorption (Inductive Operation)
    - Minimum continuous undervoltage ride-through voltage from PPA
    - 0.90 p.u.
    - 0.95 p.u.
    - 0.99 p.u.
    - 1.05 p.u
    - Maximum continuous overvoltage ride-through voltage from PPA

Note, Facilities with multiple POI's or Main Power Transformers (MPTs) will perform the Reactive Power Test for each POI/MPT.

Table D-1 outlines the required reactive power capability tests for a given facility. For multiple aggregate generation feeders, the data columns should be duplicated and numbered such that results can be provided for each aggregate.

Figure D-1 provides an example illustration of a facility, detailing measurement locations for each required data point.

Table D-1
Power Factor Performance Capability Test

Case Conditions				Simulation Results (1)															
P @ POI	V @ POI (p.u.)	Q @ POI (2)	POI P (MW)	POI Q (MVAR)	POI V (p.u.)	Pgen PV-1 (MW)	Qgen PV-1 (MVAR)	Vgen PV-1 (p.u.)	Pgen BESS-1 (MW)	Qgen BESS-1 (MVAR)	Vgen BESS-1 (p.u.)	• • •	Pgen PV-*N* (MW)	Qgen PV-*N* (MVAR)	Vgen PV- *N* (p.u.)	Pgen BESS- *N* (MW)	Qgen BESS- *N* (MVAR)	Vgen BESS- *N* (p.u.)	
Discharging at Contract Capacity	V_{min}	Max Injection																	
	0.90	Max Injection																	
	0.95	Max Injection																	
	1.03	Max Injection																	
	1.05	Max Injection																	
	V_{max}	Max Injection																	
	V_{min}	Max Absorption																	
	0.90	Max Absorption																	
	0.95	Max Absorption																	
	0.99	Max Absorption																	
	1.05	Max Absorption																	
	V_{max}	Max Absorption																	
0 MW Output, or minimum injecting power if 0 MW is not a valid operating condition.	V_{min}	Max Injection																	
	0.90	Max Injection																	
	0.95	Max Injection																	
	1.03	Max Injection																	
	1.05	Max Injection																	
	V_{max}	Max Injection																	
	V_{min}	Max Absorption																	
	0.90	Max Absorption																	
	0.95	Max Absorption																	
	0.99	Max Absorption																	
	1.05	Max Absorption																	
	V_{max}	Max Absorption																	
Maximum Charging (If Grid-Charging BESS)	V_{min}	Max Injection																	
	0.90	Max Injection																	
	0.95	Max Injection																	
	1.03	Max Injection																	
	1.05	Max Injection																	
	V_{max}	Max Injection																	

	V_{min}	Max Absorption																
	0.90	Max Absorption																
	0.95	Max Absorption																
	0.99	Max Absorption																
	1.05	Max Absorption																
	V_{max}	Max Absorption																

Note 1: Results should be provided at the inverter terminal for all aggregate inverters within the Generation Facility.

Note 2: Reactive power injection refers to capacitive operation and absorption refers to inductive operation.

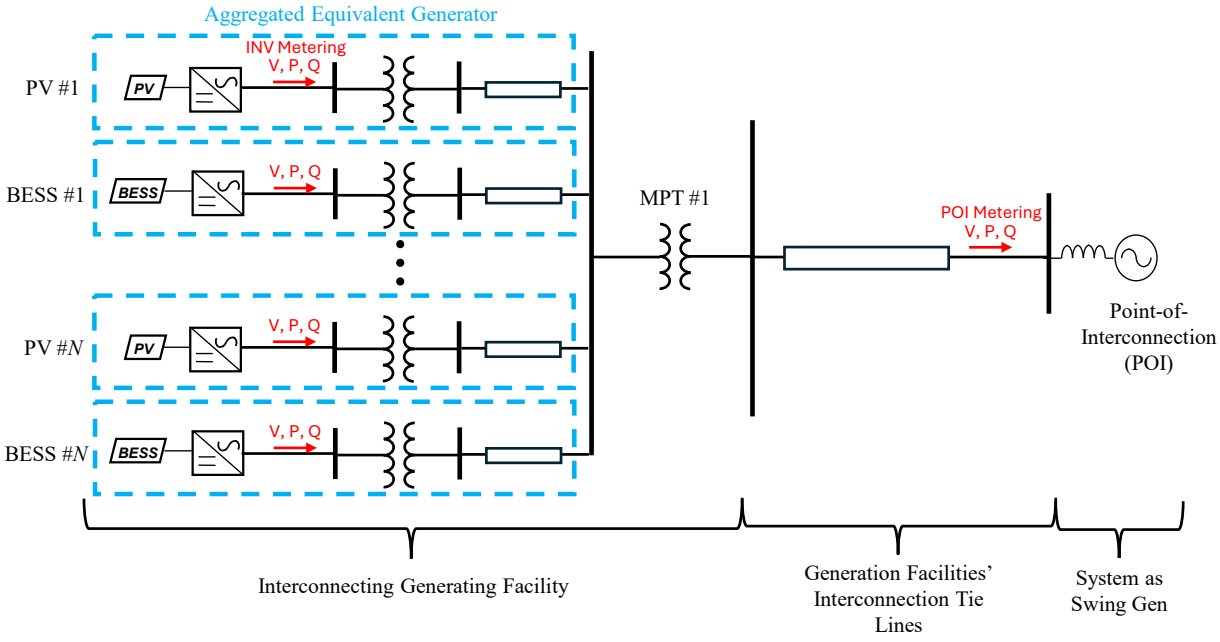


Figure D-1: Example Facility Illustration with Labeled Measurement Locations

Island	Oahu	Oahu	Oahu
Size	Connecting to 138kV Wind	Connecting to 138kV PV+ESS, Wind+ESS, or Standalone ESS	Connecting to 138kV Synchronous Generation
Models[1]	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.	PSS®E Generic, PSCAD, and ASPEN.
System Impact Study Scope	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)
	☒ Interconnection One-Line and Equipment List	☒ Interconnection One-Line and Equipment List	☒ Interconnection One-Line and Equipment List
	☒ Project Data Requirements and Facility Technical Model Review	☒ Project Data Requirements and Facility Technical Model Review	☒ Project Data Requirements and Facility Technical Model Review
	☒ Pre-Project System Performance (Base-Case)	☒ Pre-Project System Performance (Base-Case)	☒ Pre-Project System Performance (Base-Case)
	☒ Post-Project System Performance (IRS Case)	☒ Post-Project System Performance (IRS Case)	☒ Post-Project System Performance (IRS Case)
	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)
	☒ Protection Review	☒ Protection Review	☒ Protection Review
	☐ Voltage Flicker	☐ Voltage Flicker	☐ Voltage Flicker
	☒ Voltage Transients (In-Rush Current)	☒ Voltage Transients (In-Rush Current)	☒ Voltage Transients (In-Rush Current)
	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses (if applicable)	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☐ Grid Forming Analyses
	☒ Ride-Through Requirements	☒ Ride-Through Requirements	☒ Ride-Through Requirements
	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)
	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)
Reference Single Line Diagram	See Appendix H	See Appendix H	See Appendix H

[1] It is expected that the supplied technical models represent the entire generation facility. If providing grid forming (GFM) capability, the provided facilities models should include all generation resources on-line with any GFM resource operating in GFM mode and if included in the facility design any grid following (GFL) resource operating in GFL mode.

Island	Oahu
Size	Connecting to 138kV Synchronous Generation + ESS
Models[1]	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.
System Impact Study Scope	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)
	☒ Interconnection One-Line and Equipment List
	☒ Project Data Requirements and Facility Technical Model Review
	☒ Pre-Project System Performance (Base-Case)
	☒ Post-Project System Performance (IRS Case)
	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)
	☒ Protection Review
	☐ Voltage Flicker
	☒ Voltage Transients (In-Rush Current)
	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses
	☒ Ride-Through Requirements
	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)
	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)
Reference Single Line Diagram	See Appendix H

Island	O`ahu	O`ahu,	O`ahu,
Size	Connecting to 46kV Wind	Connecting to 46kV PV+ESS, Wind+ESS, or Standalone ESS	Connecting to 46kV Synchronous Generation
Models[1]	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.	PSS®E Generic, PSCAD, and ASPEN.
System Impact Study Scope	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)
	☒ Interconnection One-Line and Equipment List	☒ Interconnection One-Line and Equipment List	☒ Interconnection One-Line and Equipment List
	☒ Project Data Requirements and Facility Technical Model Review	☒ Project Data Requirements and Facility Technical Model Review	☒ Project Data Requirements and Facility Technical Model Review
	☒ Pre-Project System Performance (Base-Case)	☒ Pre-Project System Performance (Base-Case)	☒ Pre-Project System Performance (Base-Case)
	☒ Post-Project System Performance (IRS Case)	☒ Post-Project System Performance (IRS Case)	☒ Post-Project System Performance (IRS Case)
	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)
	☒ Protection Review	☒ Protection Review	☒ Protection Review
	☒ Voltage Flicker	☒ Voltage Flicker	☒ Voltage Flicker
	☒ Voltage Transients (In-Rush Current)	☒ Voltage Transients (In-Rush Current)	☒ Voltage Transients (In-Rush Current)
	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses (if applicable)	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☐ Grid Forming Analyses
	☒ Ride-Through Requirements	☒ Ride-Through Requirements	☒ Ride-Through Requirements
	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)
	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)
Reference Single Line Diagram	See Appendix H	See Appendix H	See Appendix H

Island	Oahu
Size	Connecting to 46kV Synchronous Generation + ESS
Models[1]	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.
System Impact Study Scope	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)
	☒ Interconnection One-Line and Equipment List
	☒ Project Data Requirements and Facility Technical Model Review
	☒ Pre-Project System Performance (Base-Case)
	☒ Post-Project System Performance (IRS Case)
	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)
	☒ Protection Review
	☒ Voltage Flicker
	☒ Voltage Transients (In-Rush Current)
	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses
	☒ Ride-Through Requirements
	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)
	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)
Reference Single Line Diagram	See Appendix H

Island	Hawai`i Island	Hawai`i Island	Hawai`i Island
Size	Connecting to 69kV Wind	Connecting to 69kV PV+ESS, Wind+ESS, or Standalone ESS	Connecting to 69kV Synchronous Generation
Models[1]	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.	PSS®E Generic, PSCAD, and ASPEN.
System Impact Study Scope	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)
	☒ Interconnection One-Line and Equipment List	☒ Interconnection One-Line and Equipment List	☒ Interconnection One-Line and Equipment List
	☒ Project Data Requirements and Facility Technical Model Review	☒ Project Data Requirements and Facility Technical Model Review	☒ Project Data Requirements and Facility Technical Model Review
	☒ Pre-Project System Performance (Base-Case)	☒ Pre-Project System Performance (Base-Case)	☒ Pre-Project System Performance (Base-Case)
	☒ Post-Project System Performance (IRS Case)	☒ Post-Project System Performance (IRS Case)	☒ Post-Project System Performance (IRS Case)
	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)
	☒ Protection Review	☒ Protection Review	☒ Protection Review
	☐ Voltage Flicker	☐ Voltage Flicker	☐ Voltage Flicker
	☒ Voltage Transients (In-Rush Current)	☒ Voltage Transients (In-Rush Current)	☒ Voltage Transients (In-Rush Current)
	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses (if applicable)	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☐ Grid Forming Analyses
	☒ Ride-Through Requirements	☒ Ride-Through Requirements	☒ Ride-Through Requirements
	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)
	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)
Reference Single Line Diagram	See Appendix H	See Appendix H	See Appendix H

[1] It is expected that the supplied technical models represent the entire generation facility. If providing grid forming (GFM) capability, the provided facilities models should include all generation resources on-line with any GFM resource operating in GFM mode and if included in the facility design any grid following (GFL) resource operating in GFL mode.

Island	Hawai`i Island
Size	Connecting to 69kV Synchronous Generation+ESS
Models[1]	PSS®E Generic, PSS®E User Defined, PSCAD, and ASPEN.
System Impact Study Scope	**Tasks** (Include selected tasks in the IRS. Exclude tasks that are unselected)
	☒ Interconnection One-Line and Equipment List
	☒ Project Data Requirements and Facility Technical Model Review
	☒ Pre-Project System Performance (Base-Case)
	☒ Post-Project System Performance (IRS Case)
	☒ Steady-State Power Flows ☒ Reverse Power Flow ☒ Reactive Power Requirements (Voltage Regulation)
	☒ Protection Review
	☐ Voltage Flicker
	☒ Voltage Transients (In-Rush Current)
	☒ System Stability ☐ PSSE Analyses ☒ PSCAD Analyses for Weak Grid Conditions ☒ Grid Forming Analyses
	☒ Ride-Through Requirements
	☒ Effective Grounding ☒ Transient Overvoltage (TrOV) ☒ Ground Fault Overvoltage (GFOV)
	☒ Harmonics ☒ Harmonics Monitoring Assessment (pre-project & post-project)
Reference Single Line Diagram	See Appendix H

Hawaiian Electric

2025 Request for Proposal
Cashflow to the Project

Proposal Name:

IRR for PPA Period:
IRR for Project Life:

PPA Type:
PPA Term:

Item	Unit		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
Revenue																		
Net Capacity - Generation	MW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demonstrated Firm Capacity	MW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Available Capacity Factor			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net MW Capacity - Energy Storage	MW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net MWh Capacity - Energy Storage	MWh		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Annual Energy Production - Generation	MWh		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Net Annual Energy Discharge - Energy Storage	MWh		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PPA Revenue																		
Lump Sum Payment	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Energy Charge Payment	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Component (within Energy Charge Payment)	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Capacity Charge Payment	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Post-PPA Revenue assumptions	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Revenue	***$***		***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Operating Expenses																		
Fixed O&M Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Variable O&M Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Fuel Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Initial Overbuild Remainder	MWh		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cumulative Battery Capacity Degradation	MWh		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Battery Capacity Level	MWh		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Battery Augmentation	MWh		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Battery Augmentation	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Property Taxes	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Land Lease	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Insurance	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Community Benefits	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Letter of Credit (as applicable)	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Letter of Credit fees (as applicable)	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Other Operating Expenses	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total Operating Expense	***$***		***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Depreciation and Amortization																		
MACRS Schedule																		
5-year MACRS Depreciation	%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
7-year MACRS Depreciation	%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
10-year MACRS Depreciation	%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
15-year MACRS Depreciation	%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
20-year MACRS Depreciation	%		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Federal																		
Bonus Depreciation			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Adjusted Depreciation Basis for MACRS			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
15-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

Amortization of Out-of-Basis Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Depreciation			***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Hawaii State																		
Depreciation Basis for MACRS			$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
5-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
7-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
10-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
15-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
20-year MACRS Depreciation	$	*0%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Amortization of Out-of-Basis Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Hawaii State Depreciation			***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Net Income																		
EBITDA	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation Expense	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax																		
EBIT	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Taxable Income	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Credit	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Federal Tax Benefit/Liability	***$***	*21%*	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Hawaii State Tax																		
EBIT	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HI Taxable Income	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HI Tax Credit	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HI General Excise Tax Refund	$	*4%*	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
HI Tax Benefit/Liability	***$***	*6.4%*	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Other Incentives	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Income			***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
Project Capital Cost and Benefit																		
Project Capital Costs																		
EPC Costs																		
Generation Facility Major Equipment	$		$0															
Energy Storage Major Equipment	$		$0															
Balance of Systems	$		$0															
Installation Labor/Site Work	$		$0															
Interconnection Costs - Developer Owned	$		$0															
Other EPC Costs	$		$0															
Other Project Costs																		
Interconnection Requirements Study (IRS)	$		$0															
Interconnection Costs - Company Owned, Developer Build	$		$0															
Interconnection Costs - Company Owned, Company Build	$		$0															
Land Acquisition Price	$		$0															
Land Sale Price	$		$0															
Other Owners' Cost	$		$0															
Total Installation Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Depreciation Expense - add back	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plant Removel Cost	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Plant Salvage Value	$		$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Net Project Cash Flow			***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***

APPENDIX B ATTACHMENT 5

Year 16	Year 17	Year 18	Year 19	Year 20	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27	Year 28	Year 29	Year 30
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0

APPENDIX B ATTACHMENT 5

$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***
														$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
$0	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***	***$0***