April 8, 2022

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

Dear Commissioners:

Subject: Docket No. 2019-0323
Instituting a Proceeding to Investigate Distributed Energy Resource Policies
Hawaiian Electric Final Revised Rule 14H, Appendix I Tariff Sheets Amending the
IEEE 1547 Harmonization Date

In accordance with Order No. 38294, issued April 1, 2022 in the subject proceeding,
Hawaiian Electric\(^1\) hereby encloses for filing the Company’s Final Revised Rule 14H, Appendix I tariff sheets, filed on March 17, 2022, which have been updated to reflect an April 21, 2022 effective date.\(^2\)


Sincerely,

/s/ Kevin M. Katsura

Kevin M. Katsura
Director, Non-Rate Proceedings

Enclosures

\(^1\) Hawaiian Electric Company, Inc., Hawai‘i Electric Light Company, Inc., and Maui Electric Company, Limited (collectively referred to herein as “Hawaiian Electric” or the “Company”) are each doing business as “Hawaiian Electric” and have jointly registered “Hawaiian Electric” as a trade name with the State of Hawai‘i Department of Commerce and Consumer Affairs, as evidenced by Certificate of Registration No. 4235929, dated December 20, 2019.

\(^2\) Ordering Paragraph of Order No. 38294 states: “The Commission Orders that the Parties’ Proposed Tariffs, filed March 17, 2022, are approved, and shall take effect on April 21, 2022.”
Hawaiian Electric Company, Inc.

Final Revised
Rule No. 14H, Appendix I Tariff Sheets
APPENDIX I
Distributed Generating Facility Interconnection Standards
Technical Requirements

The following interconnection standards are intended to provide general technical guidelines and procedures to facilitate the interconnection and parallel operation of distributed generating facilities with Hawaiian Electric Company, Inc.'s (HECO, Company or utility) electrical distribution system. If there is a conflict between the technical specifications set forth in this Appendix I with any technical specifications set forth elsewhere in HECO's Distributed Generating Facility Interconnection tariff, the specifications of this Appendix I shall prevail. The specific characteristics or needs of each distributed generating facility may reduce or increase its interconnection requirements. The degree of technical review required for a request for interconnection, and the extent to which an Interconnection Requirements Study (IRS) will be needed, will depend on factors such as the size of the generating facility, the type of technology and the point on the utility's system at which the generating facility will be interconnected. (See Interconnection Process Overview, Appendix III.) These technical interconnection requirements have been established to maintain safety, reliability, and power quality standards for all utility customers and personnel under the objectives described below:

Objectives of Good Interconnection Practice

- **Safety** – To protect the safety of utility personnel, utility customers, and the public.
- **Reliability** – To maintain the reliability of the utility system for all utility customers.
- **Power Quality** – To provide for acceptable power quality\(^1\) and voltage regulation on the utility system and for all utility customers.
- **Restoration** – To facilitate restoration of power on the utility system.
- **Protect Utility and Customer Equipment** – To protect utility and customer equipment during steady state and faulted system operating conditions.
- **Protect Generating Facilities** – To protect generating facilities from operation of utility protective and voltage regulation equipment.
- **Utility System Overcurrent Devices** – To maintain proper operation of the utility system's overcurrent protection equipment.
- **Utility System Operating Efficiency** – To ensure operation at appropriate power factors and minimize system losses.

\(^1\)“Acceptable” power quality is power delivered to customers that does not impair operation of the customers' equipment or cause visible light flickering due to voltage fluctuations under normal operating conditions. One element of power quality is voltage flicker, which is a function of the magnitude of voltage fluctuation and the frequency at which the fluctuation occurs.

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Consistency with Codes and Standards

These technical interconnection standards are based on the requirements of IEEE 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces (or latest version, including amendments such as, IEEE 1547a-2020). HECO intends to maintain consistency between its requirements for interconnection of distributed generating facilities and IEEE interconnection standards to the extent feasible, considering the specific design and operating requirements of HECO’s electric power system.

HECO will evaluate all future revisions to IEEE standards directly related to interconnection of distributed generating facilities, if any, and if, as a result of reviewing such revised or new IEEE standards, HECO determines that an update to its Rule 14H is required, HECO shall file a request with the Commission to modify its interconnection tariff. If, as a result of reviewing such revised or new IEEE standards HECO determines that an update to its Rule 14H is not required, HECO will provide a written explanation of its determination in its Rule 14H annual report to the Commission. HECO will also provide a written explanation of its determinations concerning IEEE distributed generation interconnection standards to interested parties upon request, or will make such information available on a publicly accessible website.

Customers are encouraged to review and discuss these technical interconnection standards with the utility before proceeding with their design and procurement of distributed generating facility equipment.

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2 "IEEE" refers to the Institute of Electrical and Electronics Engineers. IEEE standards or products referred to herein are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated. IEEE publications are made available at https://standards.ieee.org/.

3 IEEE 1547-2018 does not address planning, designing, operating, or maintaining the area electric power system (IEEE 1547-2018, Section 1.4).
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1. Definitions

For the purposes of this Rule, the following terms and definitions apply. The IEEE Standards Dictionary Online should be consulted for terms not defined in this Appendix. If there is a conflict between the IEEE Standards Dictionary Online and the definitions provided in this section, the definitions provided in this section shall prevail.

a. Applicable Voltage: Electrical quantities that determine the performance of a Local Electric Power System (EPS) or Distributed Energy Resource (DER) specified with regard to the reference point of applicability, individual phase-to-neutral, phase-to-ground, or phase-to-phase combination and time resolution. Applicable voltages are used as a synonym for applicable frequency, which can be derived from the applicable voltages.

b. Dedicated Transformer: A transformer that provides electrical service to a single customer.

c. Direct Transfer Trip: Automatic remote trip of a generating facility’s circuit breaker or interrupting device by means of a communication channel that is acceptable to the utility.4

d. Facility Equipment List: Identifies equipment, space, and/or data at the Generating Facility location to be provided by the Customer for use in conjunction with the Company’s Interconnection Facilities. The Facility Equipment List will be included in an exhibit to any interconnection agreement entered between the Company and the Customer.

e. Induction Generator: A rotating machine generator that converts mechanical power to electrical power, in which the rotor current creating the magnetic field is supplied by an external AC source, usually the electric utility system.

f. Initial Technical Review: Pursuant to Appendix III, Section 2, the review by the Company following receipt of an Interconnection Application to determine the following: a) if the Generating Facility qualifies for Simplified Interconnection; or b) if the Generating Facility can be made to qualify for interconnection with a Supplemental Review determining additional requirements, if any.

g. Interconnection Application: Completion of one of the two applicable Commission-approved forms in Exhibit A of Appendix II or II-A hereto, or other Company-approved application for interconnection of a Generating Facility governed by Rule 14H submitted to the Company for interconnection of a Generating Facility.

h. Interconnection Facilities: The electrical wires, switches and related equipment that are required in addition to the facilities required to provide electric distribution service to a Customer to allow interconnection. Interconnection Facilities may be located on either side of the Point of Interconnection as

4 Acceptance of the communications channel depends upon the speed of the operation, availability (up time), reliability, security, and type of electrical interface equipment used. The criteria for selecting the type of acceptable communications are the levels of guaranteed priority for restoration response, maintenance, and system upgrades in order to maximize availability, reliability, and security. Other technical communications channel requirements are determined by the manufacturers of the electrical interface equipment used.

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appropriate to their purpose and design. Interconnection Facilities may be integral to a Generating Facility or provided separately.

i. **Interconnection Requirements Study** (or “IRS”): Pursuant to Appendix III, Section 4, a study to establish the requirements for interconnection of a Generating Facility with the Company’s Distribution System.

j. **Inverter System:** A machine, device, or system that changes direct-current power to alternating-current power.

k. **Island:** A condition in which a portion of an Area EPS is energized solely by one or more Local EPS through the associated Point of Common Coupling (“PCC”) while that portion of the Area EPS is electrically separated from the rest of the Area EPS on all phases to which the DER is connected. When an island exists, the DER energizing the island may be said to be “islanding”.

l. **Line Section:** The portion of the Company’s Distribution System connected to a Customer bounded by automatic sectionalizing devices, or the end of a distribution line. Where a radial distribution circuit does not have automatic sectionalizing devices, the whole circuit is considered one line section. A fuse must be manually replaced and is therefore not considered an automatic sectionalizing device.

m. **Maximum Site Load Without Generation:** maximum amount of load at the premises where the Generating Facility is interconnected, irrespective of any offsetting generation.

n. **Minimum Site Load Without Generation:** minimum amount of load at the premises where the Generating Facility is interconnected, irrespective of any offsetting generation.

o. **Network System:** An electrical system in which two or more utility feeder sources are electrically tied together on the primary or secondary voltage level to form one power source for one or more customers. The network system is designed to provide higher reliability for customers connected to it.

p. **Open Loop Response Time:** See, also, Response Time.

q. **Point of Interconnection:** The point at which the utility and the customer interface occurs.
r. **Program System Size:** Program Size as used herein applies to photovoltaic inverter-based generation. Program Size for all other types of Generating Facilities will be handled on a case-by-case basis. A photovoltaic inverter-based Generating Facility’s Program Size is calculated as the sum of all inverter strings. Each inverter string is calculated as the sum of the photovoltaic kWdc capacity per inverter string or the inverter kWac capacity per inverter string, whichever is less. Program Size is used for program administration and to determine insurance requirements.

s. **Response Time (or Open Loop Response Time):** The time duration between a control signal input step change (reference value or system quantity) and the point in time when the output reaches 90% of its final change (before an overshoot). For example, in volt-watt mode, the Response Time is the time from a change in voltage till the corresponding change in Advanced Inverter output power.

t. **Short Circuit Contribution Ratio ("SCCR"):** The SCCR evaluates the short circuit current contribution of the Generating Facility in two ways. First, the SCCR looks at the ratio of the Generating Facility short circuit contribution to the short circuit contribution of the utility system for a three-phase fault at the high voltage side of the customer or utility transformer connecting the generating facility to the utility (aggregate SCCR must be less than or equal to 10%). Second, it compares the Generating Facility short circuit current to the interrupt rating of the customer’s service panel to ensure that the customer’s equipment will not be overloaded.

u. **Simplified Interconnection:** Interconnection conforming to the Initial Technical Review requirements of Appendix III, Sections 2 and 3.

v. **Source Requirements Document ("SRD"):** A document that includes the required parameters for Advanced Inverter testing that differ from IEEE 1547.1 testing parameters.

w. **Supplemental Review:** Pursuant to Appendix III, Section 3, a process wherein the Company further reviews an Interconnection Application that fails one or more of the Initial Technical Review screens. The intent of the Supplemental Review is to provide a slightly more detailed review of only the conditions that cause the Generating Facility generator to fail the Initial Technical Review. The Supplemental Review may result in one of the following: a) approval of Simplified Interconnection; b) approval of interconnection with additional requirements beyond those required for Simplified Interconnection (together with non-binding, good faith estimate of the Company’s portion of the costs for such additional interconnection requirements); or c) a determination that an IRS is required and a good faith estimate and schedule for the same.
x. **Technical System Size**: Technical System Size as used herein applies to photovoltaic inverter-based generation, including those paired with energy storage systems. Technical System Size for all other types of Generating Facilities will be handled on a case-by-case basis. Technical System Size refers to the maximum possible simultaneous generation (including discharge of energy storage systems) of the Generating Facility, and is calculated as the lesser of the sum of all inverter strings of the aggregate system or the maximum amount of export as permitted by the existence of an on-site limiting element that caps the amount of the Generating Facility's export at the PCC. Each inverter string is calculated as the sum of all simultaneous kWdc per inverter string or the inverter kWac per inverter string, whichever is less. Technical System Size is used as part of the technical review process described herein.

y. **Utility-Required Profile ("URP")**: Full set of configuration parameters that establish the behavior of a DER arranged in a single electronic file in a standardized format.

2. **General Interconnection Guidelines**

a. **Compliance with Laws and Codes**: The generating facility, protection, interconnection equipment, design, and design drawings shall meet all applicable national, state, and local laws, including construction and safety codes. The following construction and safety codes shall be followed for the design and construction of all distributed generating facility installations to ensure the safety of the public, customer, and utility personnel. These codes include, but are not limited to, the following:

- National Electric Code (NEC)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA) Building Code
- City & County of Honolulu Building Code
- Uniform Building Code (UBC)
- American Concrete Institute (ACI)
- American Institute of Steel Construction (AISC)
- American Association of State Highways & Transportation Officials (AASHTO)

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b. **Export of Power:** Generating facilities intending to export power to the utility that will cause a reversal of power flow at any voltage regulation device that is not bidirectional may require Supplemental Review or an IRS that will be completed by the Company to evaluate the impacts on equipment ratings and protective relay settings. If an IRS is required, analyses such as a Feeder Load Flow, Dynamic Stability Analysis, Transient Overvoltage, Short Circuit and Relay Coordination may need to be performed in order to evaluate the impacts of the export of power on equipment ratings and protective relay settings. Generating facilities that export power to the utility system may change the direction of power flow on the utility system. The magnitude of the change in power flow will be a function of the aggregate amount of export power on a feeder, the location of the generating facilities exporting power on a feeder, the feeder load, and the location of loads on a feeder. The need for an IRS will depend on these factors.

c. **Utility Feeder Penetration:** As the penetration of generating capacity increases on the utility distribution feeder, there is increased risk of voltage regulation problems, adverse interactions with the utility’s protection system, and unintentional islanding. Therefore, Supplemental Review to examine the risk of voltage regulation problems, protection malfunction from reverse power flow, and unintentional islanding may be required when the aggregate generating capacity per distribution line section exceeds 15% of the annual peak KVA load of the line section. If an IRS is required, analyses such as a Feeder Load Flow, Dynamic Stability Analysis, Transient Overvoltage, Short Circuit and Relay Coordination may need to be performed in order to evaluate the risk of voltage regulation problems, protection malfunction from reverse power flow and unintentional islanding. The need for an IRS will be identified by the Company during Supplemental Review.

To avoid excessive unbalanced loading on the utility distribution feeder, interconnection of 1-phase generating facilities with a capacity greater than 10 kW shall be reviewed by the Company in its Initial Technical Review. Based upon the results of the Initial Technical Review, the Company may determine that Supplemental Review is necessary.

d. **Short Circuit Contribution Ratio ("SCCR"):** A generating facility’s short circuit current contribution to the utility distribution feeder can affect operation of existing utility protective devices. A good indicator of the potential impact of a generating facility’s short circuit contribution is the Short Circuit Contribution Ratio. To ensure the operation of existing utility protective devices is not compromised, Supplemental Review will be required if the sum of the SCCR of all Generating Facilities on the Distribution System circuit exceeds 10% when measured at the primary side of a dedicated distribution transformer, or the short circuit contribution of the proposed generating facility is greater than 2.5% of the interrupting rating of the Customer-Generator's Service Equipment when measured at secondary side of a shared distribution transformer. Analyses such

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as Short Circuit and Relay Coordination may need to be performed. The need for such analysis will be identified by the Company during Supplemental Review.

e. **Network Interconnection:** Connection of generating facilities on utility distribution network systems shall be reviewed by the Company in its Initial Technical Review of the impact of the distributed generating facility on the Company’s system. Based upon the results of the Initial Technical Review, the Company may determine that Supplemental Review of the network interconnection is necessary.

f. **Interconnection of Generating Facility:** Once any generating facility has been interconnected to the Company’s system, the Company reserves the right to require the installation of, or modifications to, equipment determined by the utility to be necessary to facilitate the delivery of reliable electric service to its customers, provided that the costs associated with such post-interconnection installations or modifications shall be paid by the utility or through other mechanisms approved by the Commission.

3. **Design Requirements**

a. **Integration with Utility Grounding and Ground System Protection:** The grounding scheme and the ground fault protection of the generating facility shall be coordinated with the utility system to ensure a ground fault is properly cleared on the utility system. Any ground faults detected by the utility protection scheme (for faults on the utility feeder between the utility substation and the generating facility) must also be detected by the protection scheme of the generating facility. For a single line to ground fault on the connecting utility feeder, the generating facility’s ground fault protection must be sufficient to prevent damage to the utility system and other customer equipment due to overvoltage caused by ferroresonance, displaced neutral, or self-excitation. The generating facility must disconnect before the utility breaker recloses automatically.

b. **Transformer Winding Configuration:** The transformer winding configuration of the customer or utility distribution transformer serving the generating facility shall be reviewed by the Company in its Initial Technical Review to determine the potential impact to the utility system and generating facility, and subsequent interconnection requirements. Refer to typical single-line diagrams in Figures 1-3 in Exhibit A. Based upon the results of the Line Configuration Screen of the Initial Technical Review, the Company may determine that Supplemental Review of the transformer winding configuration is necessary.
c. **Isolation Device:** The customer shall furnish and install a manual isolation device that has a visible break to isolate their generating facility from the utility distribution system. The isolation device shall either be a disconnect switch or a breaker with rack-out capability. The device must be accessible to utility personnel and be capable of being locked by utility personnel in the open position. For generating facilities that do not have a circuit breaker or interrupting device, the isolation device must be capable of interrupting load. An existing service disconnect device may be used if it meets these requirements. Attach a label indicating "Customer Generating Facility" to the generator isolation device.

d. **Interrupting Device:** Applicable circuit breakers or interrupting devices at the generating facility must be capable of interrupting the maximum available fault current at the site, including any contribution from the generating facility. For generating facilities that are greater than 10 kW, the interrupting device must be accessible to utility personnel at all times.

e. **Dedicated Transformer:** The utility may require the generating facility to install a dedicated transformer, where the generating facility is served from the same transformer secondary as another utility customer and if inverter-based technology is used that does not meet IEEE 1547-2018 (or latest versions) specifications. A dedicated transformer or other current-limiting device is needed for any type of generating facility where the increase in available short circuit current could adversely impact other utility customers on the same secondary circuit (i.e., the short circuit contribution of the generating facility must not increase the available short circuit current to other utility customers on the same secondary circuit such that the ratings of their equipment and protective devices are exceeded). Based upon the results of the Initial Technical Review or Supplemental Review, the Company shall determine whether an adverse impact may occur and whether a dedicated transformer is necessary. In accordance with Section 1.c of Appendix III, the Company shall provide the customer with final results of all technical screenings and Supplemental Review in writing upon request, and shall notify the customer of such determination and the reasons for such determination as part of the written results.

f. **SCADA:** For generating facilities with an aggregate capacity greater than 1 MW, computerized SCADA shall be required to ensure the safety of working personnel and prompt response to system abnormalities in case of islanding of the generating facility. SCADA may be required for generating facilities with an aggregate capacity greater than 250 kW and up to 1 MW, but shall not be required for generating facilities with an aggregate capacity of 250 kW or less.

SCADA shall include monitoring of: (a) gross generation by the generating facility; (b) feedback of Watts, Vars, Watt-Hours, current and voltage; (c) Vars furnished by the utility; and (d) status of the interrupting device. In addition, the SCADA will allow the utility to trip the interrupting device during emergency conditions.
conditions. Monitoring will be performed by system dispatchers or operators at the Company’s control center.

g. Surge Capability: The generating facility interconnection equipment and relays shall have the capability to withstand voltage and current surges in accordance with IEEE/ANSI Standard C62.41 or IEEE Standard C37.90.1 as appropriate.

h. Equipment Testing: The generating facility shall provide to the utility the manufacturer’s brochures/instruction manuals and technical specifications of their proposed generating facility equipment, and test reports for evaluation by the utility.

In addition, verification tests of customer-owned equipment shall be performed on-site by the customer to verify protective settings and functionality to ensure that the equipment will not adversely affect the utility distribution system and that it will cease providing power to the system under abnormal conditions. A verification test shall be performed upon initial parallel operation of the generating facility, or whenever interface hardware or software is changed that can affect the protective functions. These tests shall be done by a qualified individual (hired or employed by the customer) in accordance with the manufacturer’s recommended test procedure and in concurrence with the utility. Qualified individuals include professional engineers, factory trained and certified technicians, and licensed electricians with experience in testing protective equipment. To ensure that verification tests of customer-owned equipment are performed correctly, the utility may request to witness the tests and receive written certification of the results from the qualified individual. The customer must inform the Company in writing of proposed changes in the customer’s interconnection hardware or software that are related to the performance, operation, or timing of the protective functions not later than fifteen (15) business days prior to implementation of such changes. Upon receiving notice of such proposed changes from the customer, the Company must notify the customer in writing of any concerns regarding the proposed changes within fifteen (15) business days, in which case the changes shall not be implemented until the customer and Company resolve the concerns to their mutual satisfaction and document the resolution in writing.

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6 Emergency conditions refer to the need for immediate action in response to a situation that has caused injury, loss of life or property damage. Emergency conditions include, but are not limited to:

1. A system emergency or forced outage;
2. A potential hazard to Company personnel or the general public; A hazardous condition relating to the generating facility;
3. The generating facility is interfering with the Company’s equipment or equipment belonging to other customers (including non-utility generating equipment);
4. The generating facility’s protective devices have been tampered with by the customer and/or owner and/or operator of the generating facility; or
5. A need for immediate action in response to a situation that has caused (or has the potential to cause) injury, loss of life or property damage.

6 Also see the Standard Interconnection Agreement, Exhibit B, paragraph 2.a.
All interconnection-related protective functions and transfer trip schemes, if applicable, shall be periodically tested at intervals specified by the manufacturer, or in accordance with industry practice. (When the interval is not specified by the manufacturer or by the Company, protective functions should be tested every four years.) The customer shall submit or make available for inspection by the utility, test reports of such testing. Periodic testing conforming to the utility test intervals for the particular line section can be specified by the utility under special circumstances (e.g., where the generating facility is connected to a utility feeder that has experienced high frequency of outages due to natural or unnatural causes such as in coastal areas where there are high winds). The Company will determine whether special circumstances exist, and must inform the customer in writing of any such determination and the reasons for that determination. A system that depends upon a battery for trip power shall be checked and logged once per month for proper voltage, or monitored continuously.

4. Operating Requirements

This Section 4 (Operating Requirements) shall apply for interconnection of all non-inverter-based Generating Facilities, which, unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, shall be certified to IEEE 1547-2018 requirements beginning October 1, 2022 (“Certification Deadline Date”) using the Company’s equipment certification process described in the Interconnection Guidebook at the time of the Interconnection Application. Non-inverter-based Generating Facilities are required to be certified to the entirety of the IEEE 1547-2018 requirements, except as otherwise provided within this section or as indicated in the Company’s latest Source Requirements Document.

Until July 1, 2021, or other time period ordered by the Hawaii Public Utilities Commission, non-inverter-based Generating Facilities may be formally certified to UL-1741 Supplement SA using the Company’s Source Requirements Document version 1.1 with any modifications to accommodate non-inverter-based generation by mutual consent between the Customer-Generator and the Company.

The non-inverter requirements are intended to be consistent with ANSI/IEEE 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces. In the event of conflict between this Rule and IEEE 1547-2018, this Rule shall take precedence. Refer to the Company’s latest Source Requirements Document for equipment certification for all certification exceptions to IEEE 1547-2018 and to the Company’s latest URP for default settings. The applicable URP will be assigned to the Generating Facility by the Company as the result of the application technical reviews or Interconnection Requirements Study, or other mutually agreed upon method between the parties to the relevant interconnection agreement. The URP is determined from URP’s approved by the Hawaii Public Utilities Commission. Updates to the URP’s will be hosted on the Company’s website and will occur no more frequently than annually. Generating Facility settings different than the URP shall be allowable with mutual agreement.
between the parties to the relevant interconnection agreement.

a. **Disconnection of Generating Facility for Utility Reasons:** Upon providing reasonable notice (generally not to be less than ten (10) business days for scheduled work), the utility may require the generating facility to temporarily disconnect from the utility's system when necessary for the utility to construct, install, maintain, repair, replace, remove, investigate, test, or inspect any of its equipment or other utility customer's equipment, or any part of its system. The generating facility shall not energize a de-energized utility line under any circumstances, but may operate isolated from the utility system with an open tie point in accordance with Section 4.d.

If the utility determines that such disconnection is necessary because of unexpected system emergencies, forced outages, operating conditions on the utility's system, or compliance with good engineering practices as determined by the Company's engineers and/or operations personnel, the Company will immediately attempt to notify, in person, by telephone, by electronic mail, or by facsimile, the customer's designated representatives of the need to disconnect the customer's generating facility. Unless the emergency condition requires immediate disconnection as determined by the utility, the Company shall allow sufficient time for the generating facility operator to manually disconnect the generator (As stated in Section 4.b below, there are circumstances where the utility may disconnect the generating facility without prior notice to the Customer). Following the completion of work and/or rectification of the emergency conditions by the utility, the utility shall reset the Customer's isolation device, if open, as soon as practicable and shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence and nature of the utility's work and/or emergency condition, and the disconnection of the customer's generating facility.

The utility shall take reasonable steps to minimize the number and duration of such disconnections. The utility may disconnect the customer from the utility's system for failure by the customer to disconnect their generating facility under this Section 4.a, until such time that the utility work or emergency condition has been corrected and the normal system condition has been restored.

The generating facility may be disconnected by the utility at the facility location or remotely by SCADA, if available.

b. **Personnel and System Safety:** The utility may disconnect the generating facility from the utility's system, without prior notice to the customer: (a) to eliminate conditions that constitute a potential hazard to the utility's personnel or the
general public; (b) if pre-emergency\(^7\) or emergency conditions\(^5\) exist on the utility system; (c) if a hazardous condition relating to the generating facility is observed by the utility’s inspection; (d) if the generating facility interferes with the utility’s equipment or equipment belonging to other utility customers (including non-utility generating equipment); or (e) if the customer or a party with whom the customer has contracted for ownership and/or operation of the generating facility has tampered with any protective device. The generating facility shall remain disconnected until such time as the utility is satisfied that the endangering condition(s) has been corrected, and the utility shall not be obligated to allow parallel operation of the generating facility during such period. If the utility disconnects the generating facility under this Section 4.b, it shall as soon as practicable notify the customer in person, by telephone, by electronic mail, or by facsimile and provide the reason(s) why the generating facility was disconnected from the Company’s system. Following the rectification of the endangering conditions, the utility shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence and nature of the endangering conditions, and the disconnection of the customer’s generating facility.

The generating facility may be disconnected by the utility at the facility location or remotely by SCADA, if available.

c. **Voltage Disturbances:** Upon mutual agreement between the Customer-Generator and the Company, the Volt-Watt (voltage-active power) function may be activated. The Default Values shall be as specified in the URP.

d. **Inadvertent Energization, Operation During Utility System Outage:** The generating facility shall not energize a de-energized utility circuit for any reason. The generating facility may be operated isolated from the utility system during a utility outage or system emergency only with an open tie breaker or disconnect device which isolates the generating facility from the utility system. This shall generally be done through manual opening and lockout of the Customer’s service breaker or isolation device (required under Section 3.c) by utility personnel prior to starting the generating facility.

Where customers desire the ability to manually or automatically isolate their generating facility from the utility system by themselves, the utility will consider alternative designs proposed by the Customer that will prevent inadvertent energization of a de-energized utility circuit. Such alternative design proposals shall be reviewed and approved in writing by the Company prior to implementation. The utility shall not unreasonably withhold such approval. Upon implementation of an alternative design approved by the Company, the Customer may isolate itself from the utility system during a utility outage and

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\(^7\) Pre-emergency conditions refer to the need for immediate action in response to a situation that has the potential to cause injury, loss of life, or property damage.

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operate its generating facility. Customers' alternative designs may, subject to review and approval by the Company, enable customers to manually or automatically reconnect back to the utility system upon restoration of utility system power, provided that the utility has not locked out the customers' service as described below and subject to the delay requirements specified in the enter service requirements of IEEE 1547-2018.

In certain situations, including any time that utility personnel will be performing work on the distribution system serving the point of interconnection between the utility and Customer, the utility may determine the need to actively verify the open tie point, and to install a Company lock to ensure the safety of utility personnel.

The Customer shall provide access to the isolation device required under Section 3.c for utility personnel to visually confirm the open tie point and install a Company lock if necessary. Following restoration of grid power or rectification of the emergency condition, the utility personnel shall, as soon as practicable, remove the Company lock to allow reconnection of the generating facility with the utility system.

Generators that are not interconnected to the utility's distribution system at any time and which are therefore not covered under an interconnection agreement may be operated by Customer at their discretion.

e. Required Delay on Reconnection: The generating facility shall be equipped with automatic means to prevent reconnection of the generating facility with the utility distribution system until the utility service voltage and frequency are within the utility tariff normal operating ranges and stable for at least 5 minutes, unless earlier directed by the utility

f. Loss of Protection: Failure of the generating facility interconnection protection equipment, including loss of control power, shall result in the automatic disconnection of the generating facility from the utility distribution system until such time that the interconnection protection equipment has been restored. Such failure shall initiate a signal to trip a generating facility circuit breaker or shutdown an inverter. In the case of failure of Company-owned protection equipment, following the rectification of the loss of protection, the utility shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence, and the disconnection of the customer's generating facility.

g. Reclosing Coordination: The generating facility shall be coordinated with the utility system reclosing devices, by disconnecting from the utility distribution system within the first reclose interval and remaining disconnected until the voltage and frequency have stabilized, consistent with the enter service criteria specified in IEEE 1547-2018.

h. Alternative Settings for Microgrids: Electrical islands and microgrids may need different settings from those in the default URP.

i. Overvoltage Test Data: The non-inverter-based system shall meet the limitation of overvoltage contribution requirements of IEEE 1547-2018 Subclause 7.4. Overvoltage test data (IEEE 1547.1-2020 Subclause 5.17) may be requested for evaluation purposes as part of Supplemental Review or IRS.
j. **Disconnection of Customer Generating Facilities:** Except as otherwise provided herein, the disconnection of a customer’s generating facility shall not be subject to standby charges, provided that the disconnection was caused by the utility or by the failure of the utility’s equipment, or the disconnection was requested or required by the utility due to reasons other than problems caused by the customer’s generating facility. The procedure for determining the applicability of standby charges to a disconnection event shall be specified in the Company’s Schedule SS Standby Service tariff.

k. **Limited Export:** The Generating Facility may be designed to minimize the transfer of power to a limited value from the Generating Facility to the utility. The Generating Facility shall not export power across the Point of Interconnection in excess of the limited value, except to provide grid support, including during emergency conditions where DER functions, including functions that result in excess power export, shall be provided pursuant to Section 4. Unless otherwise mutually agreed between the Customer-Generator and the Company, Limited Export Generating Facilities must utilize one or more of the following options:

Option 1 (Directional Power Protection): To ensure power is never exported across the Point of Interconnection beyond the limited value, a reverse power relay may be provided. The default setting for this Directional Power Protection shall be 0.1% (export) of the service transformer’s rating, with a maximum 2.0 second time delay.

Option 2 (Minimum Power Protection): To ensure at least a minimum amount of power is imported across the Point of Interconnection at all times (and, therefore, that power is not exported, other than for the short time periods noted), an under-power protective function may be provided. The default setting for this Minimum Power Protection shall be 5% (import) of the Generating Facility’s total gross rating, with a maximum 2.0 second time delay.

Option 3 (Certified Non-Islanding Protection): To ensure the inadvertent export of power is limited to acceptable levels, this option requires that all of the following conditions be met: a) the total gross capacity of the Generating Facility must be no more than 25% of the nominal ampere rating of the Customer-Generator’s dedicated service equipment; b) the total gross capacity of the Generating Facility must be no more than 50% of the Customer-Generator’s dedicated service transformer capacity rating (this capacity requirement does not apply to Eligible Customer-Generator taking primary service without an intervening transformer); and c) the Generating Facility must be certified as non-islanding.

The ampere rating of the Eligible Customer-Generator’s service equipment to HAWAIIAN ELECTRIC COMPANY, INC.

be used in this evaluation will be that rating for which the Eligible Customer-Generator's utility service was originally sized or for which an upgrade has been approved. It is not the intent of this provision to allow increased export simply by increasing the size of the Eligible Customer-Generator's service panel, without separate approval for the resize.

Option 4 (Relative Generating Facility Rating): This option, when used, requires the net rating of the Generating Facility to be small enough in comparison to its host facility's minimum load such that the use of additional protective functions is not required to ensure that power will not be exported to the Company's Distribution System. This option requires the Generating Facility capacity to be no greater than 50% of the Eligible Customer-Generator's verifiable minimum Host Load over the past 12 months. This option only applies to Eligible Customer-Generators with load profile metering with at least 12 months of historical data.

Option 5 (Certified Power Control Systems): To prevent reverse power flow beyond the limited value from the Customer's Generating Facility across the Point of Interconnection, the use of a certified Power Control System is required. The magnitude of Inadvertent Export shall be less than the Generating Facility's Nameplate Rating and the Open Loop Response Time shall be less than 30 seconds for any single event. There are no limits to the number events.

I. Default Activation States for Functions: Unless otherwise provided by the utility, the default activation status for IEEE 1547-2018 functions shall be given in the URP and shall be consistent with IEEE 1547-2018, except as stated below:

Voltage-active power – Mandatory activation
Voltage-reactive power – Mandatory activation
Soft-Start Ramp Rate – Mandatory activation (randomized delay deactivated)
Constant power factor – Mandatory deactivation

Default activation states may also be modified by mutual agreement between the utility and Customer-Generator.

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HAWAIIAN ELECTRIC COMPANY, INC.
4A. **Inverter-Based Generating Facility Operating Requirements**

This Section 4A (Inverter-Based Generating Facility Operating Requirements) shall apply for interconnection of all inverter-based Generating Facilities, which, unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, shall be certified to IEEE 1547-2018 requirements beginning on the Certification Deadline Date using the Company's equipment certification process described in the Interconnection Guidebook at the time of the Interconnection Application. Inverter-based Generating Facilities are required to be certified to the entirety of the IEEE 1547-2018 requirements, except as otherwise provided within this section or as indicated in the Company's latest Source Requirements Document.

Until July 1, 2021, or other time period ordered by the Hawaii Public Utilities Commission, inverter-based Generating Facilities may be formally certified to UL-1741 Supplement SA using the Company's Source Requirements Document version 1.1.

The inverter requirements are intended to be consistent with ANSI/IEEE 1547-2018 *Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces*. In the event of conflict between this Rule and IEEE 1547-2018, this Rule shall take precedence. Refer to the Company’s latest Source Requirements Document for equipment certification for all certification exceptions to IEEE 1547-2018 and to the Company’s latest URP for default settings. The URP is determined through a collaborative stakeholder process using values from within the URP Ranges of Adjustment approved by the Hawaii Public Utilities Commission. Updates to the URP will be hosted on the Company’s website and will occur no more frequently than annually. Generating Facility settings different than the URP shall be allowable with mutual agreement between the parties to the relevant interconnection agreement.

**Prevention of Interference**

Customer-Generator shall not operate Inverter-based Generating Facilities that superimpose a voltage or current upon the utility’s Distribution System that interferes with utility operations, service to utility Customers, or communication facilities. If such interference occurs, Customer-Generator must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by utility. If Customer-Generator does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, utility may, without liability, disconnect Customer-Generator’s facilities from the utility's Distribution Systems.

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Personnel and System Safety: See Section 4.b.

Voltage Disturbances: See Section 4.c.

Inadvertent Energization, Operation During Utility System Outage: See Section 4.d._

Required Delay on Reconnection: See Section 4.e

Loss of Protection: See over existing provision from Section 4.f.

Reclosing Coordination: See Section 4.g.

Alternative Settings for Microgrids: See Section 4.h.

Overvoltage Test Data: See Section 4.i.

Disconnection of Customer Generating Facilities: See Section 4.j.

Limited Export: See Section 4.k.

Default Activation States for Functions: Unless otherwise provided by the utility, the default activation status for IEEE 1547-2018 functions shall be given in the URP and shall be consistent with IEEE 1547-2018, except as stated below:

Voltage-active power – Mandatory activation
Voltage-reactive power – Mandatory activation
Soft-Start Ramp Rate – Mandatory activation (randomized delay deactivated)
Constant power factor – Mandatory deactivation

Default activation states may also be modified by mutual agreement between the utility and Customer-Generator.

5. Technology Specific Requirements

a. Three-Phase Synchronous Generators: The generating facility circuit breakers shall be 3-phase devices with electronic or electromechanical control. The customer shall be responsible for properly synchronizing its generating facility with the utility distribution system by means of either a manual or automatic synchronizing function. Automatic synchronizing is required for all synchronous generators which have an SCCR greater than 5%. For a generating facility whose SCCR exceeds 5%, the customer shall provide protective equipment suitable for detecting loss of synchronism and automatically disconnecting the

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generating facility from the utility distribution system. Unless otherwise agreed to in writing between the utility and customer, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the utility system.

b. **Induction Generators:** Induction generators may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured at the Point of Interconnection is within the visible flicker limits as defined by IEEE 1453-2015 (or latest version). The same requirements also apply to induction generation connected at or near synchronous speed because a similar voltage dip is present due to an inrush magnetizing current. The customer shall submit number of starts per specific time period and maximum starting kVA draw data for the utility to verify that the voltage dip due to starting is within the visible flicker limits and does not degrade the normal voltage provided by the utility.

Induction generators do not require separate synchronizing equipment. Starting or rapid load fluctuations on induction generators can adversely impact the utility's system voltage. Corrective step-switched capacitors or other techniques may be necessary if the voltage fluctuations measured at the Point of Interconnection are not within the visible flicker limits as defined by IEEE 1453-2015 (or latest version). These measures can, in turn, cause ferroresonance. If these measures (additional capacitors) are installed on the customer’s side of the Point of Interconnection, the utility will review these measures and may require the customer to install additional protective relaying equipment, provided that the utility provides the customer with written notice of the additional equipment required and the reasons for such determination. The Company will determine whether additional equipment is required to protect the Company’s system.

c. **Inverter Systems:** Inverter interfaced distributed generators that are to be installed in parallel with the utility Distribution System must employ a non-islanding synchronous inverter. The inverter design shall comply with the requirements of IEEE Std 1547 and UL 1741 standards (or latest versions) and be certified to have anti-islanding protection such that the synchronous inverter will automatically disconnect upon a utility system interruption.

Self-commutated inverters of the utility-interactive type shall synchronize to the utility. Inverters capable of stand-alone operation shall not attempt to control the voltage while operating in parallel with the utility Distribution System, except through volt-var and volt-watt control as specified above. Line-commutated, thyristor-based inverters are not recommended and will require Supplemental Review or IRS to determine harmonic and reactive power requirements. All interconnected inverter systems shall comply with the harmonic current limits of IEEE Std 519-2014 and/or IEEE Std 1547 (or latest versions).

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6. Protection, Synchronizing, and Control Requirements

a. Protection Requirements: The generating facility shall, at a minimum, provide adequate protective devices which include over/under voltage trip, over/under frequency trip, reverse power relay (for non-export generating facilities), and a means for automatically disconnecting the generating facility from the utility distribution system whenever a protective device initiates a trip. Based upon the results of the Initial Technical Review and/or Supplemental Review by the Company, additional protective devices may be required. Photovoltaic generating systems are to follow the guidelines set by UL 1741 standard (or latest version). Typical equipment and protective device requirements for large synchronous, induction, and inverter generators are illustrated in Figures 1, 2, and 3 respectively in Exhibit A.

b. Suitable Equipment: All protective devices (described in this document) for generating facilities ≥ 30 kW shall be utility-grade except for inverter-based generating facilities which shall comply with UL 1741 standard (or latest version) and IEEE 1547 (or latest version). The generating facility shall be responsible for identifying the specific models of their protective devices. All protective devices shall be used in accordance with their intended application.

c. Review of Design Drawings: The following engineering drawings/documents are required for review and approval by the utility prior to construction of the generating facility interconnection. Prior to being submitted to the utility, all drawings/documents shall be approved by a Professional Electrical Engineer registered in the State of Hawaii for generating facilities ≥ 30 kW. That approval shall be indicated by the presence of the Engineer's Professional seal on all drawings and documents.

- A single-line diagram, relay list, trip scheme and settings of the generating facility, which identifies the Point of Interconnection, circuit breakers, relays, switches, synchronizing equipment, monitoring equipment, and control and protective devices and schemes.

- A three-line diagram which shows the Point of Interconnection, potential transformer (PT) and current transformer (CT) ratios, and details of the generating facility configuration, including relays, meters and test switches (Not required for generating facilities < 30 kW).
EXHIBIT A

Typical Equipment and Protective Device Requirements for Large Synchronous, Induction, and Inverter Generators

HAWAIIAN ELECTRIC COMPANY, INC.

Large Synchronous Generator (Non-export) 

Typical Equipment and Protective Device Requirements 

Figure 1

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Figure 3

Large Static Inverter (Non-export)

Typical Equipment and Protective Device Requirements

Superseding REVISED SHEET NO. 34B-25
Effective February 20, 2018

REVISED SHEET NO. 34B-26
Effective November 16, 2021

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Superseding REVISED SHEET NO. 34B-32
Effective February 20, 2018

REVISED SHEET NO. 34B-33
Effective November 16, 2021

Hawaiian Electric Company, Inc.

HAWAIIAN ELECTRIC COMPANY, INC.

Superseding SHEET NO. 34B-34
Effective February 20, 2018

REVISED SHEET NO. 34B-35
Effective November 16, 2021

[SHEET NOT USED]

HAWAIIAN ELECTRIC COMPANY, INC.

Superseding SHEET NO. 34B-35
Effective February 20, 2018

REVISED SHEET NO. 34B-36
Effective November 16, 2021

[SHEET not used]

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HAWAIIAN ELECTRIC COMPANY, INC.

[Sheet not used]
Hawai‘i Electric Light Company, Inc.

Final Revised
Rule No. 14H, Appendix I Tariff Sheets
APPENDIX I
Distributed Generating Facility Interconnection Standards
Technical Requirements

The following interconnection standards are intended to provide general technical guidelines and procedures to facilitate the interconnection and parallel operation of distributed generating facilities with Hawaii Electric Light Company, Inc.’s (HELCO, Company or utility) electrical distribution system. If there is a conflict between the technical specifications set forth in this Appendix I with any technical specifications set forth elsewhere in HELCO’s Distributed Generating Facility Interconnection tariff, the specifications of this Appendix I shall prevail. The specific characteristics or needs of each distributed generating facility may reduce or increase its interconnection requirements. The degree of technical review required for a request for interconnection, and the extent to which an Interconnection Requirements Study (IRS) will be needed, will depend on factors such as the size of the generating facility, the type of technology and the point on the utility’s system at which the generating facility will be interconnected. (See Interconnection Process Overview, Appendix III.) These technical interconnection requirements have been established to maintain safety, reliability, and power quality standards for all utility customers and personnel under the objectives described below:

Objectives of Good Interconnection Practice

- **Safety** – To protect the safety of utility personnel, utility customers, and the public.
- **Reliability** – To maintain the reliability of the utility system for all utility customers.
- **Power Quality** – To provide for acceptable power quality and voltage regulation on the utility system and for all utility customers.
- **Restoration** – To facilitate restoration of power on the utility system.
- **Protect Utility and Customer Equipment** – To protect utility and customer equipment during steady state and faulted system operating conditions.
- **Protect Generating Facilities** – To protect generating facilities from operation of utility protective and voltage regulation equipment.
- **Utility System Overcurrent Devices** – To maintain proper operation of the utility system’s overcurrent protection equipment.
- **Utility System Operating Efficiency** – To ensure operation at appropriate power factors and minimize system losses.

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1“Acceptable” power quality is power delivered to customers that does not impair operation of the customers' equipment or cause visible light flickering due to voltage fluctuations under normal operating conditions. One element of power quality is voltage flicker, which is a function of the magnitude of voltage fluctuation and the frequency at which the fluctuation occurs.

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Consistency with Codes and Standards

These technical interconnection standards are based on the requirements of IEEE\(^2\) 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces (or latest version, including amendments such as, IEEE 1547a-2020). HELCO intends to maintain consistency between its requirements for interconnection of distributed generating facilities and IEEE interconnection standards to the extent feasible, considering the specific design and operating requirements of HELCO’s electric power system.\(^3\)

HELCO will evaluate all future revisions to IEEE standards directly related to interconnection of distributed generating facilities, if any, and if, as a result of reviewing such revised or new IEEE standards, HELCO determines that an update to its Rule 14H is required, HELCO shall file a request with the Commission to modify its interconnection tariff. If, as a result of reviewing such revised or new IEEE standards HELCO determines that an update to its Rule 14H is not required, HELCO will provide a written explanation of its determination in its Rule 14H annual report to the Commission. HELCO will also provide a written explanation of its determinations concerning IEEE distributed generation interconnection standards to interested parties upon request, or will make such information available on a publicly accessible website.

Customers are encouraged to review and discuss these technical interconnection standards with the utility before proceeding with their design and procurement of distributed generating facility equipment.

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\(^2\) IEEE\(^\text{™}\) refers to the Institute of Electrical and Electronics Engineers. IEEE standards or products referred to herein are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated. IEEE publications are made available at https://standards.ieee.org/.

\(^3\) IEEE 1547-2018 does not address planning, designing, operating, or maintaining the area electric power system (IEEE 1547-2018, Section 1.4).

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Exhibit A – Typical Equipment & Protective Device Requirements for Large Synchronous,
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1. Definitions
For the purposes of this Rule, the following terms and definitions apply. The IEEE Standards Dictionary Online should be consulted for terms not defined in this Appendix. If there is a conflict between the IEEE Standards Dictionary Online and the definitions provided in this section, the definitions provided in this section shall prevail.
   a. Applicable Voltage: Electrical quantities that determine the performance of a Local Electric Power System (EPS) or Distributed Energy Resource (DER) specified with regard to the reference point of applicability, individual phase-to-neutral, phase-to-ground, or phase-to-phase combination and time resolution. Applicable voltages are used as a synonym for applicable frequency, which can be derived from the applicable voltages.
   b. Dedicated Transformer: A transformer that provides electrical service to a single customer.
   c. Direct Transfer Trip: Automatic remote trip of a generating facility's circuit breaker or interrupting device by means of a communication channel that is acceptable to the utility.4
   d. Facility Equipment List: Identifies equipment, space, and/or data at the Generating Facility location to be provided by the Customer for use in conjunction with the Company's Interconnection Facilities. The Facility Equipment List will be included in an exhibit to any interconnection agreement entered between the Company and the Customer.
   e. Induction Generator: A rotating machine generator that converts mechanical power to electrical power, in which the rotor current creating the magnetic field is supplied by an external AC source, usually the electric utility system.
   f. Initial Technical Review: Pursuant to Appendix III, Section 2, the review by the Company following receipt of an Interconnection Application to determine the following: a) if the Generating Facility qualifies for Simplified Interconnection; or b) if the Generating Facility can be made to qualify for interconnection with a Supplemental Review determining additional requirements, if any.
   g. Interconnection Application: Completion of one of the two applicable Commission-approved forms in Exhibit A of Appendix II or II-A hereto, or other Company-approved application for interconnection of a Generating Facility governed by Rule 14H submitted to the Company for interconnection of a Generating Facility.
   h. Interconnection Facilities: The electrical wires, switches and related equipment that are required in addition to the facilities required to provide electric distribution service to a Customer to allow interconnection. Interconnection Facilities may be located on either side of the Point of Interconnection as

4 Acceptance of the communications channel depends upon the speed of the operation, availability (up time), reliability, security, and type of electrical interface equipment used. The criteria for selecting the type of acceptable communications are the levels of guaranteed priority for restoration response, maintenance, and system upgrades in order to maximize availability, reliability, and security. Other technical communications channel requirements are determined by the manufacturers of the electrical interface equipment used.

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appropriate to their purpose and design. Interconnection Facilities may be integral to a Generating Facility or provided separately.

i. **Interconnection Requirements Study (or “IRS”):** Pursuant to Appendix III, Section 4, a study to establish the requirements for interconnection of a Generating Facility with the Company’s Distribution System.

j. **Inverter System:** A machine, device, or system that changes direct-current power to alternating-current power.

k. **Island:** A condition in which a portion of an Area EPS is energized solely by one or more Local EPS through the associated Point of Common Coupling (“PCC”) while that portion of the Area EPS is electrically separated from the rest of the Area EPS on all phases to which the DER is connected. When an island exists, the DER energizing the island may be said to be “islanding”.

l. **Line Section:** The portion of the Company’s Distribution System connected to a Customer bounded by automatic sectionalizing devices, or the end of a distribution line. Where a radial distribution circuit does not have automatic sectionalizing devices, the whole circuit is considered one line section. A fuse must be manually replaced and is therefore not considered an automatic sectionalizing device.

m. **Maximum Site Load Without Generation:** maximum amount of load at the premises where the Generating Facility is interconnected, irrespective of any offsetting generation.

n. **Minimum Site Load Without Generation:** minimum amount of load at the premises where the Generating Facility is interconnected, irrespective of any offsetting generation.

o. **Network System:** An electrical system in which two or more utility feeder sources are electrically tied together on the primary or secondary voltage level to form one power source for one or more customers. The network system is designed to provide higher reliability for customers connected to it.

p. **Open Loop Response Time:** See, also, Response Time.

q. **Point of Interconnection:** The point at which the utility and the customer interface occurs.
r. **Program System Size:** Program Size as used herein applies to photovoltaic inverter-based generation. Program Size for all other types of Generating Facilities will be handled on a case-by-case basis. A photovoltaic inverter-based Generating Facility’s Program Size is calculated as the sum of all inverter strings. Each inverter string is calculated as the sum of the photovoltaic kWdc capacity per inverter string or the inverter kWac capacity per inverter string, whichever is less. Program Size is used for program administration and to determine insurance requirements.

s. **Response Time (or Open Loop Response Time):** The time duration between a control signal input step change (reference value or system quantity) and the point in time when the output reaches 90% of its final change (before an overshoot). For example, in volt-watt mode, the Response Time is the time from a change in voltage till the corresponding change in Advanced Inverter output power.

t. **Short Circuit Contribution Ratio** ("SCCR"): The SCCR evaluates the short circuit current contribution of the Generating Facility in two ways. First, the SCCR looks at the ratio of the Generating Facility short circuit contribution to the short circuit contribution of the utility system for a three-phase fault at the high voltage side of the customer or utility transformer connecting the generating facility to the utility (aggregate SCCR must be less than or equal to 10%). Second, it compares the Generating Facility short circuit current to the interrupt rating of the customer’s service panel to ensure that the customer’s equipment will not be overloaded.

u. **Simplified Interconnection:** Interconnection conforming to the Initial Technical Review requirements of Appendix III, Sections 2 and 3.

v. **Source Requirements Document** ("SRD"): A document that includes the required parameters for Advanced Inverter testing that differ from IEEE 1547.1 testing parameters.

w. **Supplemental Review:** Pursuant to Appendix III, Section 3, a process wherein the Company further reviews an Interconnection Application that fails one or more of the Initial Technical Review screens. The intent of the Supplemental Review is to provide a slightly more detailed review of only the conditions that cause the Generating Facility generator to fail the Initial Technical Review. The Supplemental Review may result in one of the following: a) approval of Simplified Interconnection; b) approval of interconnection with additional requirements beyond those required for Simplified Interconnection (together with non-binding, good faith estimate of the Company’s portion of the costs for such additional interconnection requirements); or c) a determination that an IRS is required and a good faith estimate and schedule for the same.
x. **Technical System Size**: Technical System Size as used herein applies to photovoltaic inverter-based generation, including those paired with energy storage systems. Technical System Size for all other types of Generating Facilities will be handled on a case-by-case basis. Technical System Size refers to the maximum possible simultaneous generation (including discharge of energy storage systems) of the Generating Facility, and is calculated as the lesser of the sum of all inverter strings of the aggregate system or the maximum amount of export as permitted by the existence of an on-site limiting element that caps the amount of the Generating Facility's export at the PCC. Each inverter string is calculated as the sum of all simultaneous kWdc per inverter string or the inverter kWac per inverter string, whichever is less. Technical System Size is used as part of the technical review process described herein.

y. **Utility-Required Profile ("URP")**: Full set of configuration parameters that establish the behavior of a DER arranged in a single electronic file in a standardized format.

2. **General Interconnection Guidelines**

a. **Compliance with Laws and Codes**: The generating facility, protection, interconnection equipment, design, and design drawings shall meet all applicable national, state, and local laws, including construction and safety codes. The following construction and safety codes shall be followed for the design and construction of all distributed generating facility installations to ensure the safety of the public, customer, and utility personnel. These codes include, but are not limited to, the following:
   - National Electric Code (NEC)
   - National Electrical Safety Code (NESC)
   - National Fire Protection Association (NFPA) Building Code
   - Hawaii County Building Code
   - Uniform Building Code (UBC)
   - American Concrete Institute (ACI)
   - American Institute of Steel Construction (AISC)
   - American Association of State Highways & Transportation Officials (AASHTO)
b. Export of Power: Generating facilities intending to export power to the utility that will cause a reversal of power flow at any voltage regulation device that is not bi-directional may require Supplemental Review or an IRS that will be completed by the Company to evaluate the impacts on equipment ratings and protective relay settings. If an IRS is required, analyses such as a Feeder Load Flow, Dynamic Stability Analysis, Transient Overvoltage, Short Circuit and Relay Coordination may need to be performed in order to evaluate the impacts of the export of power on equipment ratings and protective relay settings. Generating facilities that export power to the utility system may change the direction of power flow on the utility system. The magnitude of the change in power flow will be a function of the aggregate amount of export power on a feeder, the location of the generating facilities exporting power on a feeder, the feeder load, and the location of loads on a feeder. The need for an IRS will depend on these factors.

c. Utility Feeder Penetration: As the penetration of generating capacity increases on the utility distribution feeder, there is increased risk of voltage regulation problems, adverse interactions with the utility’s protection system, and unintentional islanding. Therefore, Supplemental Review to examine the risk of voltage regulation problems, protection malfunction from reverse power flow, and unintentional islanding may be required when the aggregate generating capacity per distribution line section exceeds 15% of the annual peak KVA load of the line section. If an IRS is required, analyses such as a Feeder Load Flow, Dynamic Stability Analysis, Transient Overvoltage, Short Circuit and Relay Coordination may need to be performed in order to evaluate the risk of voltage regulation problems, protection malfunction from reverse power flow and unintentional islanding. The need for an IRS will be identified by the Company during Supplemental Review.

To avoid excessive unbalanced loading on the utility distribution feeder, interconnection of 1-phase generating facilities with a capacity greater than 10 kW shall be reviewed by the Company in its Initial Technical Review. Based upon the results of the Initial Technical Review, the Company may determine that Supplemental Review is necessary.

d. Short Circuit Contribution Ratio ("SCCR"): A generating facility’s short circuit current contribution to the utility distribution feeder can affect operation of existing utility protective devices. A good indicator of the potential impact of a generating facility’s short circuit contribution is the Short Circuit Contribution Ratio. To ensure the operation of existing utility protective devices is not compromised, Supplemental Review will be required if the sum of the SCCR of all Generating Facilities on the Distribution System circuit exceeds 10% when measured at the primary side of a dedicated distribution transformer, or the short circuit contribution of the proposed generating facility is greater than 2.5% of the interrupting rating of the Customer-Generator’s Service Equipment when measured at secondary side of a shared distribution transformer. Analyses such
as Short Circuit and Relay Coordination may need to be performed. The need for such analysis will be identified by the Company during Supplemental Review.

e. **Network Interconnection:** Connection of generating facilities on utility distribution network systems shall be reviewed by the Company in its Initial Technical Review of the impact of the distributed generating facility on the Company's system. Based upon the results of the Initial Technical Review, the Company may determine that Supplemental Review of the network interconnection is necessary.

f. **Interconnection of Generating Facility:** Once any generating facility has been interconnected to the Company's system, the Company reserves the right to require the installation of, or modifications to, equipment determined by the utility to be necessary to facilitate the delivery of reliable electric service to its customers, provided that the costs associated with such post-interconnection installations or modifications shall be paid by the utility or through other mechanisms approved by the Commission.

3. **Design Requirements**

a. **Integration with Utility Grounding and Ground System Protection:** The grounding scheme and the ground fault protection of the generating facility shall be coordinated with the utility system to ensure a ground fault is properly cleared on the utility system. Any ground faults detected by the utility protection scheme (for faults on the utility feeder between the utility substation and the generating facility) must also be detected by the protection scheme of the generating facility. For a single line to ground fault on the connecting utility feeder, the generating facility's ground fault protection must be sufficient to prevent damage to the utility system and other customer equipment due to overvoltage caused by ferroresonance, displaced neutral, or self-excitation. The generating facility must disconnect before the utility breaker recloses automatically.

b. **Transformer Winding Configuration:** The transformer winding configuration of the customer or utility distribution transformer serving the generating facility shall be reviewed by the Company in its Initial Technical Review to determine the potential impact to the utility system and generating facility, and subsequent interconnection requirements. Refer to typical single-line diagrams in Figures 1-3 in Exhibit A. Based upon the results of the Line Configuration Screen of the Initial Technical Review, the Company may determine that Supplemental Review of the transformer winding configuration is necessary.

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c. **Isolation Device:** The customer shall furnish and install a manual isolation device that has a visible break to isolate their generating facility from the utility distribution system. The isolation device shall either be a disconnect switch or a breaker with rack-out capability. The device must be accessible to utility personnel and be capable of being locked by utility personnel in the open position. For generating facilities that do not have a circuit breaker or interrupting device, the isolation device must be capable of interrupting load. An existing service disconnect device may be used if it meets these requirements. Attach a label indicating “Customer Generating Facility” to the generator isolation device.

d. **Interrupting Device:** Applicable circuit breakers or interrupting devices at the generating facility must be capable of interrupting the maximum available fault current at the site, including any contribution from the generating facility. For generating facilities that are greater than 10 kW, the interrupting device must be accessible to utility personnel at all times.

e. **Dedicated Transformer:** The utility may require the generating facility to install a dedicated transformer, where the generating facility is served from the same transformer secondary as another utility customer and if inverter-based technology is used that does not meet IEEE 1547-2018 (or latest versions) specifications. A dedicated transformer or other current-limiting device is needed for any type of generating facility where the increase in available short circuit current could adversely impact other utility customers on the same secondary circuit (i.e., the short circuit contribution of the generating facility must not increase the available short circuit current to the other utility customers on the same secondary circuit such that the ratings of their equipment and protective devices are exceeded). Based upon the results of the Initial Technical Review or Supplemental Review, the Company shall determine whether an adverse impact may occur and whether a dedicated transformer is necessary. In accordance with Section 1.c of Appendix III, the Company shall provide the customer with final results of all technical screenings and Supplemental Review in writing upon request, and shall notify the customer of such determination and the reasons for such determination as part of the written results.

f. **SCADA:** For generating facilities with an aggregate capacity greater than 250 kW, computerized SCADA shall be required to ensure the safety of working personnel and prompt response to system abnormalities in case of islanding of the generating facility. SCADA shall not be required for generating facilities with an aggregate capacity of 250 kW or less.

SCADA shall include monitoring of: (a) gross generation by the generating facility; (b) feedback of Watts, Vars, WattHours, current and voltage; (c) Vars furnished by the utility; and (d) status of the interrupting device. In addition, the SCADA will allow the utility to trip the interrupting device during emergency
conditions. Monitoring will be performed by system dispatchers or operators at the Company's control center.

g. Surge Capability: The generating facility interconnection equipment and relays shall have the capability to withstand voltage and current surges in accordance with IEEE/ANSI Standard C62.41 or IEEE Standard C37.90.1 as appropriate.

h. Equipment Testing: The generating facility shall provide to the utility the manufacturer’s brochures/instruction manuals and technical specifications of their proposed generating facility equipment, and test reports for evaluation by the utility.

In addition, verification tests of customer-owned equipment shall be performed on-site by the customer to verify protective settings and functionality to ensure that the equipment will not adversely affect the utility distribution system and that it will cease providing power to the system under abnormal conditions. A verification test shall be performed upon initial parallel operation of the generating facility, or whenever interface hardware or software is changed that can affect the protective functions. These tests shall be done by a qualified individual (hired or employed by the customer) in accordance with the manufacturer’s recommended test procedure and in concurrence with the utility. Qualified individuals include professional engineers, factory trained and certified technicians, and licensed electricians with experience in testing protective equipment. To ensure that verification tests of customer-owned equipment are performed correctly, the utility may request to witness the tests and receive written certification of the results from the qualified individual. The customer must inform the Company in writing of proposed changes in the customer’s interconnection hardware or software that are related to the performance, operation, or timing of the protective functions not later than fifteen (15) business days prior to implementation of such changes. Upon receiving notice of such proposed changes from the customer, the Company must notify the customer in writing of any concerns regarding the proposed changes within fifteen (15) business days, in which case the changes shall not be implemented until the customer and Company resolve the concerns to their mutual satisfaction and document the resolution in writing.

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5 Emergency conditions refer to the need for immediate action in response to a situation that has caused injury, loss of life or property damage. Emergency conditions include, but are not limited to:

1. A system emergency or forced outage;
2. A potential hazard to Company personnel or the general public; A hazardous condition relating to the generating facility;
3. The generating facility is interfering with the Company’s equipment or equipment belonging to other customers (including non-utility generating equipment);
4. The generating facility’s protective devices have been tampered with by the customer and/or owner and/or operator of the generating facility; or
5. A need for immediate action in response to a situation that has caused (or has the potential to cause) injury, loss of life or property damage.

6 Also see the Standard Interconnection Agreement, Exhibit B, paragraph 2.a.
All interconnection-related protective functions and transfer trip schemes, if applicable, shall be periodically tested at intervals specified by the manufacturer, or in accordance with industry practice. (When the interval is not specified by the manufacturer or by the Company, protective functions should be tested every four years.) The customer shall submit or make available for inspection by the utility, test reports of such testing. Periodic testing conforming to the utility test intervals for the particular line section can be specified by the utility under special circumstances (e.g., where the generating facility is connected to a utility feeder that has experienced high frequency of outages due to natural or unnatural causes such as in coastal areas where there are high winds). The Company will determine whether special circumstances exist, and must inform the customer in writing of any such determination and the reasons for that determination. A system that depends upon a battery for trip power shall be checked and logged once per month for proper voltage, or monitored continuously.

4. Operating Requirements

This Section 4 (Operating Requirements) shall apply for interconnection of all non-inverter-based Generating Facilities, which, unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, shall be certified to IEEE 1547-2018 requirements beginning October 1, 2022 (“Certification Deadline Date”) using the Company’s equipment certification process described in the Interconnection Guidebook at the time of the Interconnection Application. Non-inverter-based Generating Facilities are required to be certified to the entirety of the IEEE 1547-2018 requirements, except as otherwise provided within this section or as indicated in the Company’s latest Source Requirements Document.

Until July 1, 2021, or other time period ordered by the Hawaii Public Utilities Commission, non-inverter-based Generating Facilities may be formally certified to UL-1741 Supplement SA using the Company’s Source Requirements Document version 1.1 with any modifications to accommodate non-inverter-based generation by mutual consent between the Customer-Generator and the Company.

The non-inverter requirements are intended to be consistent with ANSI/IEEE 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces. In the event of conflict between this Rule and IEEE 1547-2018, this Rule shall take precedence. Refer to the Company’s latest Source Requirements Document for equipment certification for all certification exceptions to IEEE 1547-2018 and to the Company’s latest URP for default settings. The applicable URP will be assigned to the Generating Facility by the Company as the result of the application technical reviews or Interconnection Requirements Study, or other mutually agreed upon method between the parties to the relevant interconnection agreement. The URP is determined from URP’s approved by the Hawaii Public Utilities Commission. Updates to the URP’s will be hosted on the Company’s website and will occur no more frequently than annually. Generating Facility settings different than the URP shall be allowable with mutual agreement.

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Transmittal Letter Dated April 8, 2022.
between the parties to the relevant interconnection agreement.

a. **Disconnection of Generating Facility for Utility Reasons:** Upon providing reasonable notice (generally not to be less than ten (10) business days for scheduled work), the utility may require the generating facility to temporarily disconnect from the utility's system when necessary for the utility to construct, install, maintain, repair, replace, remove, investigate, test, or inspect any of its equipment or other utility customer's equipment, or any part of its system. The generating facility shall not energize a de-energized utility line under any circumstances, but may operate isolated from the utility system with an open tie point in accordance with Section 4.d.

If the utility determines that such disconnection is necessary because of unexpected system emergencies, forced outages, operating conditions on the utility's system, or compliance with good engineering practices as determined by the Company's engineers and/or operations personnel, the Company will immediately attempt to notify, in person, by telephone, by electronic mail, or by facsimile, the customer's designated representatives of the need to disconnect the customer's generating facility. Unless the emergency condition requires immediate disconnection as determined by the utility, the Company shall allow sufficient time for the generating facility operator to manually disconnect the generator (As stated in Section 4.b below, there are circumstances where the utility may disconnect the generating facility without prior notice to the Customer). Following the completion of work and/or rectification of the emergency conditions by the utility, the utility shall reset the Customer's isolation device, if open, as soon as practicable and shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence and nature of the utility's work and/or emergency condition, and the disconnection of the customer's generating facility.

The utility shall take reasonable steps to minimize the number and duration of such disconnections. The utility may disconnect the customer from the utility's system for failure by the customer to disconnect their generating facility under this Section 4.a, until such time that the utility work or emergency condition has been corrected and the normal system condition has been restored.

The generating facility may be disconnected by the utility at the facility location or remotely by SCADA, if available.

b. **Personnel and System Safety:** The utility may disconnect the generating facility from the utility's system, without prior notice to the customer: (a) to eliminate conditions that constitute a potential hazard to the utility's personnel or the

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general public; (b) if pre-emergency\textsuperscript{7} or emergency conditions\textsuperscript{5} exist on the utility system; (c) if a hazardous condition relating to the generating facility is observed by the utility's inspection; (d) if the generating facility interferes with the utility's equipment or equipment belonging to other utility customers (including non-utility generating equipment); or (e) if the customer or a party with whom the customer has contracted for ownership and/or operation of the generating facility has tampered with any protective device. The generating facility shall remain disconnected until such time as the utility is satisfied that the endangering condition(s) has been corrected, and the utility shall not be obligated to allow parallel operation of the generating facility during such period. If the utility disconnects the generating facility under this Section 4.b, it shall as soon as practicable notify the customer in person, by telephone, by electronic mail, or by facsimile and provide the reason(s) why the generating facility was disconnected from the Company's system. Following the rectification of the endangering conditions, the utility shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence and nature of the endangering conditions, and the disconnection of the customer's generating facility.

The generating facility may be disconnected by the utility at the facility location or remotely by SCADA, if available.

c. Voltage Disturbances: Upon mutual agreement between the Customer-Generator and the Company, the Volt-Watt (voltage-active power) function may be activated. The Default Values shall be as specified in the URP.

d. Inadvertent Energization, Operation During Utility System Outage: The generating facility shall not energize a de-energized utility circuit for any reason. The generating facility may be operated isolated from the utility system during a utility outage or system emergency only with an open tie breaker or disconnect device which isolates the generating facility from the utility system. This shall generally be done through manual opening and lockout of the Customer's service breaker or isolation device (required under Section 3.c) by utility personnel prior to starting the generating facility.

Where customers desire the ability to manually or automatically isolate their generating facility from the utility system by themselves, the utility will consider alternative designs proposed by the Customer that will prevent inadvertent energization of a de-energized utility circuit. Such alternative design proposals shall be reviewed and approved in writing by the Company prior to implementation. The utility shall not unreasonably withhold such approval. Upon implementation of an alternative design approved by the Company, the Customer may isolate itself from the utility system during a utility outage and

\textsuperscript{7} Pre-emergency conditions refer to the need for immediate action in response to a situation that has the potential to cause injury, loss of life, or property damage.

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operate its generating facility. Customers' alternative designs may, subject to review and approval by the Company, enable customers to manually or automatically reconnect back to the utility system upon restoration of utility system power, provided that the utility has not locked out the customers' service as described below and subject to the delay requirements specified in the enter service requirements of IEEE 1547-2018.

In certain situations, including any time that utility personnel will be performing work on the distribution system serving the point of interconnection between the utility and Customer, the utility may determine the need to actively verify the open tie point, and to install a Company lock to ensure the safety of utility personnel.

The Customer shall provide access to the isolation device required under Section 3.6 for utility personnel to visually confirm the open tie point and install a Company lock if necessary. Following restoration of grid power or rectification of the emergency condition, the utility personnel shall, as soon as practicable, remove the Company lock to allow reconnection of the generating facility with the utility system.

Generators that are not interconnected to the utility's distribution system at any time and which are therefore not covered under an interconnection agreement may be operated by Customer at their discretion.

e. Required Delay on Reconnection: The generating facility shall be equipped with automatic means to prevent reconnection of the generating facility with the utility distribution system until the utility service voltage and frequency are within the utility tariff normal operating ranges and stable for at least 5 minutes, unless earlier directed by the utility.

f. Loss of Protection: Failure of the generating facility interconnection protection equipment, including loss of control power, shall result in the automatic disconnection of the generating facility from the utility distribution system until such time that the interconnection protection equipment has been restored. Such failure shall initiate a signal to trip a generating facility circuit breaker or shutdown an inverter. In the case of failure of Company-owned protection equipment, following the rectification of the loss of protection, the utility shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence, and the disconnection of the customer's generating facility.

g. Reclosing Coordination: The generating facility shall be coordinated with the utility system reclosing devices, by disconnecting from the utility distribution system within the first reclose interval and remaining disconnected until the voltage and frequency have stabilized, consistent with the enter service criteria specified in IEEE 1547-2018.

h. Alternative Settings for Microgrids: Electrical islands and microgrids may need different settings from those in the default URP.

i. Overvoltage Test Data: The non-inverter-based system shall meet the limitation of overvoltage contribution requirements of IEEE 1547-2018 Subclause 7.4. Overvoltage test data (IEEE 1547.1-2020 Subclause 5.17) may be requested for evaluation purposes as part of Supplemental Review or IRS.

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j. **Disconnection of Customer Generating Facilities**: Except as otherwise provided herein, the disconnection of a customer’s generating facility shall not be subject to standby charges, provided that the disconnection was caused by the utility or by the failure of the utility’s equipment, or the disconnection was requested or required by the utility due to reasons other than problems caused by the customer’s generating facility. The procedure for determining the applicability of standby charges to a disconnection event shall be specified in the Company’s Schedule SS Standby Service tariff.

k. **Limited Export**: The Generating Facility may be designed to minimize the transfer of power to a limited value from the Generating Facility to the utility. The Generating Facility shall not export power across the Point of Interconnection in excess of the limited value, except to provide grid support, including during emergency conditions where DER functions, including functions that result in excess power export, shall be provided pursuant to Section 4. Unless otherwise mutually agreed between the Customer-Generator and the Company, Limited Export Generating Facilities must utilize one or more of the following options:

Option 1 (Directional Power Protection): To ensure power is never exported across the Point of Interconnection beyond the limited value, a reverse power relay may be provided. The default setting for this Directional Power Protection shall be 0.1% (export) of the service transformer’s rating, with a maximum 2.0 second time delay.

Option 2 (Minimum Power Protection): To ensure at least a minimum amount of power is imported across the Point of Interconnection at all times (and, therefore, that power is not exported, other than for the short time periods noted), an under-power protective function may be provided. The default setting for this Minimum Power Protection shall be 5% (import) of the Generating Facility’s total gross rating, with a maximum 2.0 second time delay.

Option 3 (Certified Non-Islanding Protection): To ensure the inadvertent export of power is limited to acceptable levels, this option requires that all of the following conditions be met: a) the total gross capacity of the Generating Facility must be no more than 25% of the nominal ampere rating of the Customer-Generator’s dedicated service equipment; b) the total gross capacity of the Generating Facility must be no more than 50% of the Customer-Generator’s dedicated service transformer capacity rating (this capacity requirement does not apply to Eligible Customer-Generator taking primary service without an intervening transformer); and c) the Generating Facility must be certified as non-islanding.

The ampere rating of the Eligible Customer-Generator’s service equipment to

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be used in this evaluation will be that rating for which the Eligible Customer-Generator’s utility service was originally sized or for which an upgrade has been approved. It is not the intent of this provision to allow increased export simply by increasing the size of the Eligible Customer-Generator’s service panel, without separate approval for the resize.

Option 4 (Relative Generating Facility Rating): This option, when used, requires the net rating of the Generating Facility to be small enough in comparison to its host facility’s minimum load such that the use of additional protective functions is not required to ensure that power will not be exported to the Company’s Distribution System. This option requires the Generating Facility capacity to be no greater than 50% of the Eligible Customer-Generator’s verifiable minimum Host Load over the past 12 months. This option only applies to Eligible Customer-Generators with load profile metering with at least 12 months of historical data.

Option 5 (Certified Power Control Systems): To prevent reverse power flow beyond the limited value from the Customer’s Generating Facility across the Point of Interconnection, the use of a certified Power Control System\(^8\) is required. The magnitude of Inadvertent Export shall be less than the Generating Facility’s Nameplate Rating and the Open Loop Response Time shall be less than 30 seconds for any single event. There are no limits to the number events.

I. **Default Activation States for Functions:** Unless otherwise provided by the utility, the default activation status for IEEE 1547-2018 functions shall be given in the URP and shall be consistent with IEEE 1547-2018, except as stated below:

- Voltage-active power – Mandatory activation
- Voltage-reactive power – Mandatory activation
- Soft-Start Ramp Rate – Mandatory activation (randomized delay deactivated)
- Constant power factor – Mandatory deactivation

Default activation states may also be modified by mutual agreement between the utility and Customer-Generator.

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\(^8\) Certification shall be to UL 1741 Certification Requirement Decision (CRD) for Power Control Systems (PCS), issued March 8, 2019 (or latest version).

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4A. **Inverter-Based Generating Facility Operating Requirements**

This Section 4A (Inverter-Based Generating Facility Operating Requirements) shall apply for interconnection of all inverter-based Generating Facilities, which, unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, shall be certified to IEEE 1547-2018 requirements beginning on the Certification Deadline Date using the Company’s equipment certification process described in the Interconnection Guidebook at the time of the Interconnection Application. Inverter-based Generating Facilities are required to be certified to the entirety of the IEEE 1547-2018 requirements, except as otherwise provided within this section or as indicated in the Company’s latest Source Requirements Document.

Until July 1, 2021, or other time period ordered by the Hawaii Public Utilities Commission, inverter-based Generating Facilities may be formally certified to UL-1741 Supplement SA using the Company’s Source Requirements Document version 1.1.

The inverter requirements are intended to be consistent with ANSI/IEEE 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces. In the event of conflict between this Rule and IEEE 1547-2018, this Rule shall take precedence. Refer to the Company’s latest Source Requirements Document for equipment certification for all certification exceptions to IEEE 1547-2018 and to the Company’s latest URP for default settings. The URP is determined through a collaborative stakeholder process using values from within the URP Ranges of Adjustment approved by the Hawaii Public Utilities Commission. Updates to the URP will be hosted on the Company’s website and will occur no more frequently than annually. Generating Facility settings different than the URP shall be allowable with mutual agreement between the parties to the relevant interconnection agreement.

**Prevention of Interference**

Customer-Generator shall not operate Inverter-based Generating Facilities that superimpose a voltage or current upon the utility’s Distribution System that interferes with utility operations, service to utility Customers, or communication facilities. If such interference occurs, Customer-Generator must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by utility. If Customer-Generator does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, utility may, without liability, disconnect Customer-Generator’s facilities from the utility’s Distribution System.

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System, in accordance with Section 4.b. of this Rule. To eliminate undesirable interference caused by its operation, each Advanced Inverter shall meet the following criteria:

a. **Disconnection of Generating Facility for Utility Reasons:** See Section 4.a.

b. **Personnel and System Safety:** See Section 4.b.

c. **Voltage Disturbances:** See Section 4.c.

d. **Inadvertent Energization, Operation During Utility System Outage:** See Section 4.d.

e. **Required Delay on Reconnection:** See Section 4.e

f. **Loss of Protection:** See over existing provision from Section 4.f.

g. **Reclosing Coordination:** See Section 4.g.

h. **Alternative Settings for Microgrids:** See Section 4.h.

i. **Overvoltage Test Data:** See Section 4.i.

j. **Disconnection of Customer Generating Facilities:** See Section 4.j.

k. **Limited Export:** See Section 4.k.

l. **Default Activation States for Functions:** Unless otherwise provided by the utility, the default activation status for IEEE 1547-2018 functions shall be given in the URP and shall be consistent with IEEE 1547-2018, except as stated below:

- Voltage-active power – Mandatory activation
- Voltage-reactive power – Mandatory activation
- Soft-Start Ramp Rate – Mandatory activation (randomized delay deactivated)
- Constant power factor – Mandatory deactivation

Default activation states may also be modified by mutual agreement between the utility and Customer-Generator.

5. **Technology Specific Requirements**

a. **Three-Phase Synchronous Generators**: The generating facility circuit breakers shall be 3-phase devices with electronic or electromechanical control. The customer shall be responsible for properly synchronizing its generating facility with the utility distribution system by means of either a manual or automatic synchronizing function. Automatic synchronizing is required for all synchronous generators which have an SCCR greater than 5%. For a generating facility whose SCCR exceeds 5%, the customer shall provide protective equipment suitable for detecting loss of synchronism and automatically disconnecting the

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generating facility from the utility distribution system. Unless otherwise agreed to in writing between the utility and customer, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the utility system.

b. Induction Generators: Induction generators may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured at the Point of Interconnection is within the visible flicker limits as defined by IEEE 1453-2015 (or latest version). The same requirements also apply to induction generation connected at or near synchronous speed because a similar voltage dip is present due to an inrush magnetizing current. The customer shall submit number of starts per specific time period and maximum starting kVA draw data for the utility to verify that the voltage dip due to starting is within the visible flicker limits and does not degrade the normal voltage provided by the utility.

Induction generators do not require separate synchronizing equipment. Starting or rapid load fluctuations on induction generators can adversely impact the utility’s system voltage. Corrective step-switched capacitors or other techniques may be necessary if the voltage fluctuations measured at the Point of Interconnection are not within the visible flicker limits as defined by IEEE 1453-2015 (or latest version). These measures can, in turn, cause ferroresonance. If these measures (additional capacitors) are installed on the customer’s side of the Point of Interconnection, the utility will review these measures and may require the customer to install additional protective relaying equipment, provided that the utility provides the customer with written notice of the additional equipment required and the reasons for such determination. The Company will determine whether additional equipment is required to protect the Company’s system.

c. Inverter Systems: Inverter interfaced distributed generators that are to be installed in parallel with the utility Distribution System must employ a non-islanding synchronous inverter. The inverter design shall comply with the requirements of IEEE Std 1547 and UL 1741 standards (or latest versions) and be certified to have anti-islanding protection such that the synchronous inverter will automatically disconnect upon a utility system interruption.

Self-commutated inverters of the utility-interactive type shall synchronize to the utility. Inverters capable of stand-alone operation shall not attempt to control the voltage while operating in parallel with the utility Distribution System, except through volt-var and volt-watt control as specified above. Line-commutated, thyristor-based inverters are not recommended and will require Supplemental Review or IRS to determine harmonic and reactive power requirements. All interconnected inverter systems shall comply with the harmonic current limits of IEEE Std 519-2014 and/or IEEE Std 1547 (or latest versions).
6. **Protection, Synchronizing, and Control Requirements**

a. **Protection Requirements:** The generating facility shall, at a minimum, provide adequate protective devices which include over/under voltage trip, over/under frequency trip, reverse power relay (for non-export generating facilities), and a means for automatically disconnecting the generating facility from the utility distribution system whenever a protective device initiates a trip. Based upon the results of the Initial Technical Review and/or Supplemental Review by the Company, additional protective devices may be required. Photovoltaic generating systems are to follow the guidelines set by UL 1741 standard (or latest version). Typical equipment and protective device requirements for large synchronous, induction, and inverter generators are illustrated in Figures 1, 2, and 3 respectively in Exhibit A.

b. **Suitable Equipment:** All protective devices (described in this document) for generating facilities ≥ 30 kW shall be utility-grade except for inverter-based generating facilities which shall comply with UL 1741 standard (or latest version) and IEEE 1547 (or latest version). The generating facility shall be responsible for identifying the specific models of their protective devices. All protective devices shall be used in accordance with their intended application.

c. **Review of Design Drawings:** The following engineering drawings/documents are required for review and approval by the utility prior to construction of the generating facility interconnection. Prior to being submitted to the utility, all drawings/documents shall be approved by a Professional Electrical Engineer registered in the State of Hawaii for generating facilities ≥ 30 kW. That approval shall be indicated by the presence of the Engineer’s Professional seal on all drawings and documents.

- A single-line diagram, relay list, trip scheme and settings of the generating facility, which identifies the Point of Interconnection, circuit breakers, relays, switches, synchronizing equipment, monitoring equipment, and control and protective devices and schemes.

- A three-line diagram which shows the Point of Interconnection, potential transformer (PT) and current transformer (CT) ratios, and details of the generating facility configuration, including relays, meters and test switches (Not required for generating facilities < 30 kW).
EXHIBIT A

Typical Equipment and Protective Device Requirements
for Large Synchronous, Induction, and Inverter Generators
Large Synchronous Generator (Non-export)

Typical Equipment and Protective Device Requirements

Superseding REVISED SHEET NO. 38B-22
Effective February 20, 2018

REVISED SHEET NO. 38B-24
Effective November 16, 2021

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[Sheet not used]
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Superseding REVISED SHEET NO. 38B-28
Effective February 20, 2018

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HAWAI'I ELECTRIC LIGHT COMPANY, INC.

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HAWAI'I ELECTRIC LIGHT COMPANY, INC.

HAWAI'I ELECTRIC LIGHT COMPANY, INC.

HAWAI'I ELECTRIC LIGHT COMPANY, INC.

HAWAI'I ELECTRIC LIGHT COMPANY, INC.

Maui Electric Company, Limited

Final Revised
Rule No. 14H, Appendix I Tariff Sheets
APPENDIX I
Distributed Generating Facility Interconnection Standards
Technical Requirements

The following interconnection standards are intended to provide general technical
guidelines and procedures to facilitate the interconnection and parallel operation of
distributed generating facilities with Maui Electric Company, Limited's (MECO, Company
or utility) electrical distribution system. If there is a conflict between the technical
specifications set forth in this Appendix I with any technical specifications set forth
elsewhere in MECO’s Distributed Generating Facility Interconnection tariff, the
specifications of this Appendix I shall prevail. The specific characteristics or needs of
each distributed generating facility may reduce or increase its interconnection
requirements. The degree of technical review required for a request for interconnection,
and the extent to which an Interconnection Requirements Study (IRS) will be needed,
will depend on factors such as the size of the generating facility, the type of technology
and the point on the utility’s system at which the generating facility will be
interconnected. (See Interconnection Process Overview, Appendix III.) These technical
interconnection requirements have been established to maintain safety, reliability, and
power quality standards for all utility customers and personnel under the objectives
described below:

Objectives of Good Interconnection Practice

- **Safety** – To protect the safety of utility personnel, utility customers, and the
  public.
- **Reliability** – To maintain the reliability of the utility system for all utility
  customers.
- **Power Quality** – To provide for acceptable power quality\(^1\) and voltage regulation
  on the utility system and for all utility customers.
- **Restoration** – To facilitate restoration of power on the utility system.
- **Protect Utility and Customer Equipment** – To protect utility and customer
  equipment during steady state and faulted system operating conditions.
- **Protect Generating Facilities** – To protect generating facilities from operation of
  utility protective and voltage regulation equipment.
- **Utility System Overcurrent Devices** – To maintain proper operation of the utility
  system’s overcurrent protection equipment.
- **Utility System Operating Efficiency** – To ensure operation at appropriate
  power factors and minimize system losses.

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\(^1\) “Acceptable” power quality is power delivered to customers that does not impair operation of the
customers’ equipment or cause visible light flickering due to voltage fluctuations under normal operating
conditions. One element of power quality is voltage flicker, which is a function of the magnitude of voltage
fluctuation and the frequency at which the fluctuation occurs.

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Consistency with Codes and Standards

These technical interconnection standards are based on the requirements of IEEE\textsuperscript{2} 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces (or latest version, including amendments such as, IEEE 1547a-2020). MECO intends to maintain consistency between its requirements for interconnection of distributed generating facilities and IEEE interconnection standards to the extent feasible, considering the specific design and operating requirements of MECO's electric power system.\textsuperscript{3} MECO will evaluate all future revisions to IEEE standards directly related to interconnection of distributed generating facilities, if any, and if, as a result of reviewing such revised or new IEEE standards, MECO determines that an update to its Rule 14H is required, MECO shall file a request with the Commission to modify its interconnection tariff. If, as a result of reviewing such revised or new IEEE standards MECO determines that an update to its Rule 14H is not required, MECO will provide a written explanation of its determination in its Rule 14H annual report to the Commission. MECO will also provide a written explanation of its determinations concerning IEEE distributed generation interconnection standards to interested parties upon request, or will make such information available on a publicly accessible website.

Customers are encouraged to review and discuss these technical interconnection standards with the utility before proceeding with their design and procurement of distributed generating facility equipment.

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\textsuperscript{2} IEEE\textsuperscript{2} refers to the Institute of Electrical and Electronics Engineers. IEEE standards or products referred to herein are trademarks owned by The Institute of Electrical and Electronics Engineers, Incorporated. IEEE publications are made available at https://standards.ieee.org/.

\textsuperscript{3} IEEE 1547-2018 does not address planning, designing, operating, or maintaining the area electric power system (IEEE 1547-2018, Section 1.4).
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Exhibit A – Typical Equipment & Protective Device Requirements for Large Synchronous, Induction, and Inverter Generators ................................................................. 23
1. **Definitions**

For the purposes of this Rule, the following terms and definitions apply. The *IEEE Standards Dictionary Online* should be consulted for terms not defined in this Appendix. If there is a conflict between the *IEEE Standards Dictionary Online* and the definitions provided in this section, the definitions provided in this section shall prevail.

a. **Applicable Voltage**: Electrical quantities that determine the performance of a Local Electric Power System (EPS) or Distributed Energy Resource (DER) specified with regard to the reference point of applicability, individual phase-to-neutral, phase-to-ground, or phase-to-phase combination and time resolution. Applicable voltages are used as a synonym for applicable frequency, which can be derived from the applicable voltages.

b. **Dedicated Transformer**: A transformer that provides electrical service to a single customer.

c. **Direct Transfer Trip**: Automatic remote trip of a generating facility’s circuit breaker or interrupting device by means of a communication channel that is acceptable to the utility.\(^4\)

d. **Facility Equipment List**: Identifies equipment, space, and/or data at the Generating Facility location to be provided by the Customer for use in conjunction with the Company’s Interconnection Facilities. The Facility Equipment List will be included in an exhibit to any interconnection agreement entered between the Company and the Customer.

e. **Induction Generator**: A rotating machine generator that converts mechanical power to electrical power, in which the rotor current creating the magnetic field is supplied by an external AC source, usually the electric utility system.

f. **Initial Technical Review**: Pursuant to Appendix III, Section 2, the review by the Company following receipt of an Interconnection Application to determine the following: a) if the Generating Facility qualifies for Simplified Interconnection; or b) if the Generating Facility can be made to qualify for interconnection with a Supplemental Review determining additional requirements, if any.

g. **Interconnection Application**: Completion of one of the two applicable Commission-approved forms in Exhibit A of Appendix II or II-A hereto, or other Company-approved application for interconnection of a Generating Facility governed by Rule 14H submitted to the Company for interconnection of a Generating Facility.

h. **Interconnection Facilities**: The electrical wires, switches and related equipment that are required in addition to the facilities required to provide electric distribution service to a Customer to allow interconnection. Interconnection Facilities may be located on either side of the Point of Interconnection as

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\(^4\) Acceptance of the communications channel depends upon the speed of the operation, availability (up time), reliability, security, and type of electrical interface equipment used. The criteria for selecting the type of acceptable communications are the levels of guaranteed priority for restoration response, maintenance, and system upgrades in order to maximize availability, reliability, and security. Other technical communications channel requirements are determined by the manufacturers of the electrical interface equipment used.

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appropriate to their purpose and design. Interconnection Facilities may be
integral to a Generating Facility or provided separately.

i. **Interconnection Requirements Study (or “IRS”):** Pursuant to Appendix
   III, Section 4, a study to establish the requirements for interconnection of
   a Generating Facility with the Company’s Distribution System.

j. **Inverter System:** A machine, device, or system that changes direct-current
   power to alternating-current power.

k. **Island:** A condition in which a portion of an Area EPS is energized solely by
   one or more Local EPS through the associated Point of Common Coupling
   (“PCC”) while that portion of the Area EPS is electrically separated from the
   rest of the Area EPS on all phases to which the DER is connected. When an
   island exists, the DER energizing the island may be said to be “islanding”.

l. **Line Section:** The portion of the Company’s Distribution System connected to a
   Customer bounded by automatic sectionalizing devices, or the end of a
   distribution line. Where a radial distribution circuit does not have automatic
   sectionalizing devices, the whole circuit is considered one line section. A fuse
   must be manually replaced and is therefore not considered an automatic
   sectionalizing device.

m. **Maximum Site Load Without Generation:** maximum amount of load at the
   premises where the Generating Facility is interconnected, irrespective of any
   offsetting generation.

n. **Minimum Site Load Without Generation:** minimum amount of load at the
   premises where the Generating Facility is interconnected, irrespective of any
   offsetting generation.

o. **Network System:** An electrical system in which two or more utility feeder sources
   are electrically tied together on the primary or secondary voltage level to form one
   power source for one or more customers. The network system is designed to
   provide higher reliability for customers connected to it.

p. **Open Loop Response Time:** See, also, Response Time.

q. **Point of Interconnection:** The point at which the utility and the customer interface
   occurs.
Superseding REVISED SHEET NO. 36B-7
Effective October 22, 2018

Program System Size: Program Size as used herein applies to photovoltaic inverter-based generation. Program Size for all other types of Generating Facilities will be handled on a case-by-case basis. A photovoltaic inverter-based Generating Facility's Program Size is calculated as the sum of all inverter strings. Each inverter string is calculated as the sum of the photovoltaic kWdc capacity per inverter string or the inverter kWac capacity per inverter string, whichever is less. Program Size is used for program administration and to determine insurance requirements.

Response Time (or Open Loop Response Time): The time duration between a control signal input step change (reference value or system quantity) and the point in time when the output reaches 90% of its final change (before an overshoot). For example, in volt-watt mode, the Response Time is the time from a change in voltage till the corresponding change in Advanced Inverter output power.

Short Circuit Contribution Ratio ("SCCR"): The SCCR evaluates the short circuit current contribution of the Generating Facility in two ways. First, the SCCR looks at the ratio of the Generating Facility short circuit contribution to the short circuit contribution of the utility system for a three-phase fault at the high voltage side of the customer or utility transformer connecting the generating facility to the utility (aggregate SCCR must be less than or equal to 10%). Second, it compares the Generating Facility short circuit current to the interrupt rating of the customer's service panel to ensure that the customer's equipment will not be overloaded.

Simplified Interconnection: Interconnection conforming to the Initial Technical Review requirements of Appendix III, Sections 2 and 3.

Source Requirements Document ("SRD"): A document that includes the required parameters for Advanced Inverter testing that differ from IEEE 1547.1 testing parameters.

Supplemental Review: Pursuant to Appendix III, Section 3, a process wherein the Company further reviews an Interconnection Application that fails one or more of the Initial Technical Review screens. The intent of the Supplemental Review is to provide a slightly more detailed review of only the conditions that cause the Generating Facility generator to fail the Initial Technical Review. The Supplemental Review may result in one of the following: a) approval of Simplified Interconnection; b) approval of interconnection with additional requirements beyond those required for Simplified Interconnection (together with non-binding, good faith estimate of the Company's portion of the costs for such additional interconnection requirements); or c) a determination that an IRS is required and a good faith estimate and schedule for the same.

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x. **Technical System Size**: Technical System Size as used herein applies to photovoltaic inverter-based generation, including those paired with energy storage systems. Technical System Size for all other types of Generating Facilities will be handled on a case-by-case basis. Technical System Size refers to the maximum possible simultaneous generation (including discharge of energy storage systems) of the Generating Facility, and is calculated as the lesser of the sum of all inverter strings of the aggregate system or the maximum amount of export as permitted by the existence of an on-site limiting element that caps the amount of the Generating Facility's export at the PCC. Each inverter string is calculated as the sum of all simultaneous kWdc per inverter string or the inverter kWac per inverter string, whichever is less. Technical System Size is used as part of the technical review process described herein.

y. **Utility-Required Profile ("URP")**: Full set of configuration parameters that establish the behavior of a DER arranged in a single electronic file in a standardized format.

2. **General Interconnection Guidelines**

a. **Compliance with Laws and Codes**: The generating facility, protection, interconnection equipment, design, and design drawings shall meet all applicable national, state, and local laws, including construction and safety codes. The following construction and safety codes shall be followed for the design and construction of all distributed generating facility installations to ensure the safety of the public, customer, and utility personnel. These codes include, but are not limited to, the following:

   - National Electric Code (NEC)
   - National Electrical Safety Code (NESC)
   - National Fire Protection Association (NFPA) Building Code
   - Maui County Building Code
   - Uniform Building Code (UBC)
   - American Concrete Institute (ACI)
   - American Institute of Steel Construction (AISC)
   - American Association of State Highways & Transportation Officials (AASHTO)
b. **Export of Power:** Generating facilities intending to export power to the utility that will cause a reversal of power flow at any voltage regulation device that is not bi-directional may require Supplemental Review or an IRS that will be completed by the Company to evaluate the impacts on equipment ratings and protective relay settings. If an IRS is required, analyses such as a Feeder Load Flow, Dynamic Stability Analysis, Transient Overvoltage, Short Circuit and Relay Coordination may need to be performed in order to evaluate the impacts of the export of power on equipment ratings and protective relay settings. Generating facilities that export power to the utility system may change the direction of power flow on the utility system. The magnitude of the change in power flow will be a function of the aggregate amount of export power on a feeder, the location of the generating facilities exporting power on a feeder, the feeder load, and the location of loads on a feeder. The need for an IRS will depend on these factors.

c. **Utility Feeder Penetration:** As the penetration of generating capacity increases on the utility distribution feeder, there is increased risk of voltage regulation problems, adverse interactions with the utility’s protection system, and unintentional islanding. Therefore, Supplemental Review to examine the risk of voltage regulation problems, protection malfunction from reverse power flow, and unintentional islanding may be required when the aggregate generating capacity per distribution line section exceeds 15% of the annual peak KVA load of the line section. If an IRS is required, analyses such as a Feeder Load Flow, Dynamic Stability Analysis, Transient Overvoltage, Short Circuit and Relay Coordination may need to be performed in order to evaluate the risk of voltage regulation problems, protection malfunction from reverse power flow and unintentional islanding. The need for an IRS will be identified by the Company during Supplemental Review.

To avoid excessive unbalanced loading on the utility distribution feeder, interconnection of 1-phase generating facilities with a capacity greater than 10 kW shall be reviewed by the Company in its Initial Technical Review. Based upon the results of the Initial Technical Review, the Company may determine that Supplemental Review is necessary.

d. **Short Circuit Contribution Ratio ("SCCR"):** A generating facility’s short circuit current contribution to the utility distribution feeder can affect operation of existing utility protective devices. A good indicator of the potential impact of a generating facility’s short circuit contribution is the Short Circuit Contribution Ratio. To ensure the operation of existing utility protective devices is not compromised, Supplemental Review will be required if the sum of the SCCR of all Generating Facilities on the Distribution System circuit exceeds 10% when measured at the primary side of a dedicated distribution transformer, or the short circuit contribution of the proposed generating facility is greater than 2.5% of the interrupting rating of the Customer-Generator’s Service Equipment when measured at secondary side of a shared distribution transformer. Analyses such
as Short Circuit and Relay Coordination may need to be performed. The need for such analysis will be identified by the Company during Supplemental Review.

e. **Network Interconnection**: Connection of generating facilities on utility distribution network systems shall be reviewed by the Company in its Initial Technical Review of the impact of the distributed generating facility on the Company’s system. Based upon the results of the Initial Technical Review, the Company may determine that Supplemental Review of the network interconnection is necessary.

f. **Interconnection of Generating Facility**: Once any generating facility has been interconnected to the Company’s system, the Company reserves the right to require the installation of, or modifications to, equipment determined by the utility to be necessary to facilitate the delivery of reliable electric service to its customers, provided that the costs associated with such post-interconnection installations or modifications shall be paid by the utility or through other mechanisms approved by the Commission.

3. **Design Requirements**

a. **Integration with Utility Grounding and Ground System Protection**: The grounding scheme and the ground fault protection of the generating facility shall be coordinated with the utility system to ensure a ground fault is properly cleared on the utility system. Any ground faults detected by the utility protection scheme (for faults on the utility feeder between the utility substation and the generating facility) must also be detected by the protection scheme of the generating facility. For a single line to ground fault on the connecting utility feeder, the generating facility’s ground fault protection must be sufficient to prevent damage to the utility system and other customer equipment due to overvoltage caused by ferroresonance, displaced neutral, or self-excitation. The generating facility must disconnect before the utility breaker recloses automatically.

b. **Transformer Winding Configuration**: The transformer winding configuration of the customer or utility distribution transformer serving the generating facility shall be reviewed by the Company in its Initial Technical Review to determine the potential impact to the utility system and generating facility, and subsequent interconnection requirements. Refer to typical single-line diagrams in Figures 1-3 in Exhibit A. Based upon the results of the Line Configuration Screen of the Initial Technical Review, the Company may determine that Supplemental Review of the transformer winding configuration is necessary.

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c. **Isolation Device:** The customer shall furnish and install a manual isolation device that has a visible break to isolate their generating facility from the utility distribution system. The isolation device shall either be a disconnect switch or a breaker with rack-out capability. The device must be accessible to utility personnel and be capable of being locked by utility personnel in the open position. For generating facilities that do not have a circuit breaker or interrupting device, the isolation device must be capable of interrupting load. An existing service disconnect device may be used if it meets these requirements. Attach a label indicating “Customer Generating Facility” to the generator isolation device.

d. **Interrupting Device:** Applicable circuit breakers or interrupting devices at the generating facility must be capable of interrupting the maximum available fault current at the site, including any contribution from the generating facility. For generating facilities that are greater than 10 kW, the interrupting device must be accessible to utility personnel at all times.

e. **Dedicated Transformer:** The utility may require the generating facility to install a dedicated transformer, where the generating facility is served from the same transformer secondary as another utility customer and if inverter-based technology is used that does not meet IEEE 1547-2018 (or latest versions) specifications. A dedicated transformer or other current-limiting device is needed for any type of generating facility where the increase in available short circuit current could adversely impact other utility customers on the same secondary circuit (i.e., the short circuit contribution of the generating facility must not increase the available short circuit current to the other utility customers on the same secondary circuit such that the ratings of their equipment and protective devices are exceeded). Based upon the results of the Initial Technical Review or Supplemental Review, the Company shall determine whether an adverse impact may occur and whether a dedicated transformer is necessary. In accordance with Section 1.c of Appendix III, the Company shall provide the customer with final results of all technical screenings and Supplemental Review in writing upon request, and shall notify the customer of such determination and the reasons for such determination as part of the written results.

f. **SCADA:** For generating facilities with an aggregate capacity greater than 250 kW, computerized SCADA shall be required to ensure the safety of working personnel and prompt response to system abnormalities in case of islanding of the generating facility. SCADA shall not be required for generating facilities with an aggregate capacity of 250 kW or less. SCADA shall include monitoring of: (a) gross generation by the generating facility; (b) feedback of Watts, Vars, WattHours, current and voltage; (c) Vars furnished by the utility; and (d) status of the interrupting device. In addition, the SCADA will allow the utility to trip the interrupting device during emergency
conditions. Monitoring will be performed by system dispatchers or operators at the Company’s control center.

g. **Surge Capability:** The generating facility interconnection equipment and relays shall have the capability to withstand voltage and current surges in accordance with IEEE/ANSI Standard C62.41 or IEEE Standard C37.90.1 as appropriate.

h. **Equipment Testing:** The generating facility shall provide to the utility the manufacturer’s brochures/instruction manuals and technical specifications of their proposed generating facility equipment, and test reports for evaluation by the utility.

In addition, verification tests of customer-owned equipment shall be performed on-site by the customer to verify protective settings and functionality to ensure that the equipment will not adversely affect the utility distribution system and that it will cease providing power to the system under abnormal conditions. A verification test shall be performed upon initial parallel operation of the generating facility, or whenever interface hardware or software is changed that can affect the protective functions. These tests shall be done by a qualified individual (hired or employed by the customer) in accordance with the manufacturer’s recommended test procedure and in concurrence with the utility. Qualified individuals include professional engineers, factory trained and certified technicians, and licensed electricians with experience in testing protective equipment. To ensure that verification tests of customer-owned equipment are performed correctly, the utility may request to witness the tests and receive written certification of the results from the qualified individual. The customer must inform the Company in writing of proposed changes in the customer’s interconnection hardware or software that are related to the performance, operation, or timing of the protective functions not later than fifteen (15) business days prior to implementation of such changes. Upon receiving notice of such proposed changes from the customer, the Company must notify the customer in writing of any concerns regarding the proposed changes within fifteen (15) business days, in which case the changes shall not be implemented until the customer and Company resolve the concerns to their mutual satisfaction and document the resolution in writing.

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5 Emergency conditions refer to the need for immediate action in response to a situation that has caused injury, loss of life or property damage. Emergency conditions include, but are not limited to:

1. A system emergency or forced outage;
2. A potential hazard to Company personnel or the general public; A hazardous condition relating to the generating facility;
3. The generating facility is interfering with the Company’s equipment or equipment belonging to other customers (including non-utility generating equipment);
4. The generating facility’s protective devices have been tampered with by the customer and/or owner and/or operator of the generating facility; or
5. A need for immediate action in response to a situation that has caused (or has the potential to cause) injury, loss of life or property damage.

6 Also see the Standard Interconnection Agreement, Exhibit B, paragraph 2.a.
All interconnection-related protective functions and transfer trip schemes, if applicable, shall be periodically tested at intervals specified by the manufacturer, or in accordance with industry practice. (When the interval is not specified by the manufacturer or by the Company, protective functions should be tested every four years.) The customer shall submit or make available for inspection by the utility, test reports of such testing. Periodic testing conforming to the utility test intervals for the particular line section can be specified by the utility under special circumstances (e.g., where the generating facility is connected to a utility feeder that has experienced high frequency of outages due to natural or unnatural causes such as in coastal areas where there are high winds). The Company will determine whether special circumstances exist, and must inform the customer in writing of any such determination and the reasons for that determination. A system that depends upon a battery for trip power shall be checked and logged once per month for proper voltage, or monitored continuously.

4. Operating Requirements

This Section 4 (Operating Requirements) shall apply for interconnection of all non-inverter-based Generating Facilities, which, unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, shall be certified to IEEE 1547-2018 requirements beginning October 1, 2022 (“Certification Deadline Date”) using the Company’s equipment certification process described in the Interconnection Guidebook at the time of the Interconnection Application. Non-inverter-based Generating Facilities are required to be certified to the entirety of the IEEE 1547-2018 requirements, except as otherwise provided within this section or as indicated in the Company’s latest Source Requirements Document.

Until July 1, 2021, or other time period ordered by the Hawaii Public Utilities Commission, non-inverter-based Generating Facilities may be formally certified to UL-1741 Supplement SA using the Company’s Source Requirements Document version 1.1 with any modifications to accommodate non-inverter-based generation by mutual consent between the Customer-Generator and the Company.

The non-inverter requirements are intended to be consistent with ANSI/IEEE 1547-2018 Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces. In the event of conflict between this Rule and IEEE 1547-2018, this Rule shall take precedence. Refer to the Company’s latest Source Requirements Document for equipment certification for all certification exceptions to IEEE 1547-2018 and to the Company’s latest URP for default settings. The applicable URP will be assigned to the Generating Facility by the Company as the result of the application technical reviews or Interconnection Requirements Study, or other mutually agreed upon method between the parties to the relevant interconnection agreement The URP is determined from URP’s approved by the Hawaii Public Utilities Commission. Updates to the URP’s will be hosted on the Company’s website and will occur no more frequently than annually. Generating Facility settings different than the URP shall be allowable with mutual agreement

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated April 8, 2022.
between the parties to the relevant interconnection agreement.

a. **Disconnection of Generating Facility for Utility Reasons:** Upon providing reasonable notice (generally not to be less than ten (10) business days for scheduled work), the utility may require the generating facility to temporarily disconnect from the utility’s system when necessary for the utility to construct, install, maintain, repair, replace, remove, investigate, test, or inspect any of its equipment or other utility customer’s equipment, or any part of its system. The generating facility shall not energize a de-energized utility line under any circumstances, but may operate isolated from the utility system with an open tie point in accordance with Section 4.d.

If the utility determines that such disconnection is necessary because of unexpected system emergencies, forced outages, operating conditions on the utility’s system, or compliance with good engineering practices as determined by the Company’s engineers and/or operations personnel, the Company will immediately attempt to notify, in person, by telephone, by electronic mail, or by facsimile, the customer’s designated representatives of the need to disconnect the customer’s generating facility. Unless the emergency condition requires immediate disconnection as determined by the utility, the Company shall allow sufficient time for the generating facility operator to manually disconnect the generator (As stated in Section 4.b below, there are circumstances where the utility may disconnect the generating facility without prior notice to the Customer). Following the completion of work and/or rectification of the emergency conditions by the utility, the utility shall reset the Customer’s isolation device, if open, as soon as practicable and shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence and nature of the utility’s work and/or emergency condition, and the disconnection of the customer’s generating facility.

The utility shall take reasonable steps to minimize the number and duration of such disconnections. The utility may disconnect the customer from the utility’s system for failure by the customer to disconnect their generating facility under this Section 4.a, until such time that the utility work or emergency condition has been corrected and the normal system condition has been restored.

The generating facility may be disconnected by the utility at the facility location or remotely by SCADA, if available.

b. **Personnel and System Safety:** The utility may disconnect the generating facility from the utility’s system, without prior notice to the customer: (a) to eliminate conditions that constitute a potential hazard to the utility’s personnel or the
general public; (b) if pre-emergency\(^7\) or emergency conditions\(^5\) exist on the utility system; (c) if a hazardous condition relating to the generating facility is observed by the utility's inspection; (d) if the generating facility interferes with the utility's equipment or equipment belonging to other utility customers (including non-utility generating equipment); or (e) if the customer or a party with whom the customer has contracted for ownership and/or operation of the generating facility has tampered with any protective device. The generating facility shall remain disconnected until such time as the utility is satisfied that the endangering condition(s) has been corrected, and the utility shall not be obligated to allow parallel operation of the generating facility during such period. If the utility disconnects the generating facility under this Section 4.b, it shall as soon as practicable notify the customer in person, by telephone, by electronic mail, or by facsimile and provide the reason(s) why the generating facility was disconnected from the Company's system. Following the rectification of the endangering conditions, the utility shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence and nature of the endangering conditions, and the disconnection of the customer's generating facility.

The generating facility may be disconnected by the utility at the facility location or remotely by SCADA, if available.

c. **Voltage Disturbances**: Upon mutual agreement between the Customer-Generator and the Company, the Volt-Watt (voltage-active power) function may be activated. The Default Values shall be as specified in the URP.

d. **Inadvertent Energization, Operation During Utility System Outage**: The generating facility shall not energize a de-energized utility circuit for any reason. The generating facility may be operated isolated from the utility system during a utility outage or system emergency only with an open tie breaker or disconnect device which isolates the generating facility from the utility system. This shall generally be done through manual opening and lockout of the Customer's service breaker or isolation device (required under Section 3.c) by utility personnel prior to starting the generating facility.

Where customers desire the ability to manually or automatically isolate their generating facility from the utility system by themselves, the utility will consider alternative designs proposed by the Customer that will prevent inadvertent energization of a de-energized utility circuit. Such alternative design proposals shall be reviewed and approved in writing by the Company prior to implementation. The utility shall not unreasonably withhold such approval. Upon implementation of an alternative design approved by the Company, the Customer may isolate itself from the utility system during a utility outage and

\(^7\) Pre-emergency conditions refer to the need for immediate action in response to a situation that has the potential to cause injury, loss of life, or property damage.
operate its generating facility. Customers’ alternative designs may, subject to review and approval by the Company, enable customers to manually or automatically reconnect back to the utility system upon restoration of utility system power, provided that the utility has not locked out the customers’ service as described below and subject to the delay requirements specified in the enterservice requirements of IEEE 1547-2018.

In certain situations, including any time that utility personnel will be performing work on the distribution system serving the point of interconnection between the utility and Customer, the utility may determine the need to actively verify the open tie point, and to install a Company lock to ensure the safety of utility personnel.

The Customer shall provide access to the isolation device required under Section 3.c for utility personnel to visually confirm the open tie point and install a Company lock if necessary. Following restoration of grid power or rectification of the emergency condition, the utility personnel shall, as soon as practicable, remove the Company lock to allow reconnection of the generating facility with the utility system.

Generators that are not interconnected to the utility’s distribution system at any time and which are therefore not covered under an interconnection agreement may be operated by Customer at their discretion.

e. Required Delay on Reconnection: The generating facility shall be equipped with automatic means to prevent reconnection of the generating facility with the utility distribution system until the utility service voltage and frequency are within the utility tariff normal operating ranges and stable for at least 5 minutes, unless earlier directed by the utility.

f. Loss of Protection: Failure of the generating facility interconnection protection equipment, including loss of control power, shall result in the automatic disconnection of the generating facility from the utility distribution system until such time that the interconnection protection equipment has been restored. Such failure shall initiate a signal to trip a generating facility circuit breaker or shutdown an inverter. In the case of failure of Company-owned protection equipment, following the rectification of the loss of protection, the utility shall provide, within fifteen (15) business days or such other period as is mutually agreed upon in writing by the utility and the customer, written documentation of the occurrence, and the disconnection of the customer's generating facility.

g. Reclosing Coordination: The generating facility shall be coordinated with the utility system reclosing devices, by disconnecting from the utility distribution system within the first reclose interval and remaining disconnected until the voltage and frequency have stabilized, consistent with the enter service criteria specified in IEEE 1547-2018.

h. Alternative Settings for Microgrids: Electrical islands and microgrids may need different settings from those in the default URP.

i. Overvoltage Test Data: The non-inverter-based system shall meet the limitation of overvoltage contribution requirements of IEEE 1547-2018 Subclause 7.4. Overvoltage test data (IEEE 1547.1-2020 Subclause 5.17) may be requested for evaluation purposes as part of Supplemental Review or IRS.

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j. **Disconnection of Customer Generating Facilities:** Except as otherwise provided herein, the disconnection of a customer’s generating facility shall not be subject to standby charges, provided that the disconnection was caused by the utility or by the failure of the utility’s equipment, or the disconnection was requested or required by the utility due to reasons other than problems caused by the customer’s generating facility. The procedure for determining the applicability of standby charges to a disconnection event shall be specified in the Company’s Schedule SS Standby Service tariff.

k. **Limited Export:** The Generating Facility may be designed to minimize the transfer of power to a limited value from the Generating Facility to the utility. The Generating Facility shall not export power across the Point of Interconnection in excess of the limited value, except to provide grid support, including during emergency conditions where DER functions, including functions that result in excess power export, shall be provided pursuant to Section 4. Unless otherwise mutually agreed between the Customer-Generator and the Company, Limited Export Generating Facilities must utilize one or more of the following options:

Option 1 (Directional Power Protection): To ensure power is never exported across the Point of Interconnection beyond the limited value, a reverse power relay may be provided. The default setting for this Directional Power Protection shall be 0.1% (export) of the service transformer’s rating, with a maximum 2.0 second time delay.

Option 2 (Minimum Power Protection): To ensure at least a minimum amount of power is imported across the Point of Interconnection at all times (and, therefore, that power is not exported, other than for the short time periods noted), an under-power protective function may be provided. The default setting for this Minimum Power Protection shall be 5% (import) of the Generating Facility’s total gross rating, with a maximum 2.0 second time delay.

Option 3 (Certified Non-Islanding Protection): To ensure the inadvertent export of power is limited to acceptable levels, this option requires that all of the following conditions be met: a) the total gross capacity of the Generating Facility must be no more than 25% of the nominal ampere rating of the Customer-Generator’s dedicated service equipment; b) the total gross capacity of the Generating Facility must be no more than 50% of the Customer-Generator’s dedicated service transformer capacity rating (this capacity requirement does not apply to Eligible Customer-Generator taking primary service without an intervening transformer); and c) the Generating Facility must be certified as non-islanding.

The ampere rating of the Eligible Customer-Generator’s service equipment to

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be used in this evaluation will be that rating for which the Eligible Customer-Generator’s utility service was originally sized or for which an upgrade has been approved. It is not the intent of this provision to allow increased export simply by increasing the size of the Eligible Customer-Generator’s service panel, without separate approval for the resize.

Option 4 (Relative Generating Facility Rating): This option, when used, requires the net rating of the Generating Facility to be small enough in comparison to its host facility’s minimum load such that the use of additional protective functions is not required to ensure that power will not be exported to the Company’s Distribution System. This option requires the Generating Facility capacity to be no greater than 50% of the Eligible Customer-Generator’s verifiable minimum Host Load over the past 12 months. This option only applies to Eligible Customer-Generators with load profile metering with at least 12 months of historical data.

Option 5 (Certified Power Control Systems): To prevent reverse power flow beyond the limited value from the Customer’s Generating Facility across the Point of Interconnection, the use of a certified Power Control System\(^8\) is required. The magnitude of Inadvertent Export shall be less than the Generating Facility’s Nameplate Rating and the Open Loop Response Time shall be less than 30 seconds for any single event. There are no limits to the number events.

I. **Default Activation States for Functions:** Unless otherwise provided by the utility, the default activation status for IEEE 1547-2018 functions shall be given in the URP and shall be consistent with IEEE 1547-2018, except as stated below:

- Voltage-active power – Mandatory activation
- Voltage-reactive power – Mandatory activation
- Soft-Start Ramp Rate – Mandatory activation (randomized delay deactivated)
- Constant power factor – Mandatory deactivation

Default activation states may also be modified by mutual agreement between the utility and Customer-Generator.

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\(^8\) Certification shall be to UL 1741 Certification Requirement Decision (CRD) for Power Control Systems (PCS), issued March 8, 2019 (or latest version).

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4A. **Inverter-Based Generating Facility Operating Requirements**

This Section 4A (Inverter-Based Generating Facility Operating Requirements) shall apply for interconnection of all inverter-based Generating Facilities, which, unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, shall be certified to IEEE 1547-2018 requirements beginning on the Certification Deadline Date using the Company’s equipment certification process described in the Interconnection Guidebook at the time of the Interconnection Application. Inverter-based Generating Facilities are required to be certified to the entirety of the IEEE 1547-2018 requirements, except as otherwise provided within this section or as indicated in the Company’s latest Source Requirements Document.

Until July 1, 2021, or other time period ordered by the Hawaii Public Utilities Commission, inverter-based Generating Facilities may be formally certified to UL-1741 Supplement SA using the Company’s Source Requirements Document version 1.1.

The inverter requirements are intended to be consistent with ANSI/IEEE 1547-2018 *Standard for Interconnection and Interoperability of Distributed Energy Resources with Associated Electric Power Systems Interfaces*. In the event of conflict between this Rule and IEEE 1547-2018, this Rule shall take precedence. Refer to the Company’s latest Source Requirements Document for equipment certification for all certification exceptions to IEEE 1547-2018 and to the Company’s latest URP for default settings. The URP is determined through a collaborative stakeholder process using values from within the URP Ranges of Adjustment approved by the Hawaii Public Utilities Commission. Updates to the URP will be hosted on the Company’s website and will occur no more frequently than annually. Generating Facility settings different than the URP shall be allowable with mutual agreement between the parties to the relevant interconnection agreement.

**Prevention of Interference**

Customer-Generator shall not operate Inverter-based Generating Facilities that superimpose a voltage or current upon the utility’s Distribution System that interferes with utility operations, service to utility Customers, or communication facilities. If such interference occurs, Customer-Generator must diligently pursue and take corrective action at its own expense after being given notice and reasonable time to do so by utility. If Customer-Generator does not take corrective action in a timely manner, or continues to operate the facilities causing interference without restriction or limit, utility may, without liability, disconnect Customer-Generator’s facilities from the utility’s Distribution System.

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System, in accordance with Section 4.b. of this Rule. To eliminate undesirable interference caused by its operation, each Advanced Inverter shall meet the following criteria:

a. **Disconnection of Generating Facility for Utility Reasons:** See Section 4.a.

b. **Personnel and System Safety:** See Section 4.b.

c. **Voltage Disturbances:** See Section 4.c.

d. **Inadvertent Energization, Operation During Utility System Outage:** See Section 4.d.

e. **Required Delay on Reconnection:** See Section 4.e

f. **Loss of Protection:** See over existing provision from Section 4.f.

g. **Reclosing Coordination:** See Section 4.g.

h. **Alternative Settings for Microgrids:** See Section 4.h.

i. **Overvoltage Test Data:** See Section 4.i.

j. **Disconnection of Customer Generating Facilities:** See Section 4.j.

k. **Limited Export:** See Section 4.k.

l. **Default Activation States for Functions:** Unless otherwise provided by the utility, the default activation status for IEEE 1547-2018 functions shall be given in the URP and shall be consistent with IEEE 1547-2018, except as stated below:

- Voltage-active power – Mandatory activation
- Voltage-reactive power – Mandatory activation
- Soft-Start Ramp Rate – Mandatory activation (randomized delay deactivated)
- Constant power factor – Mandatory deactivation

Default activation states may also be modified by mutual agreement between the utility and Customer-Generator.

5. **Technology Specific Requirements**

a. **Three-Phase Synchronous Generators:** The generating facility circuit breakers shall be 3-phase devices with electronic or electromechanical control. The customer shall be responsible for properly synchronizing its generating facility with the utility distribution system by means of either a manual or automatic synchronizing function. Automatic synchronizing is required for all synchronous generators which have an SCCR greater than 5%. For a generating facility whose SCCR exceeds 5%, the customer shall provide protective equipment suitable for detecting loss of synchronism and automatically disconnecting the system, in accordance with Section 4.b. of this Rule.

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generating facility from the utility distribution system. Unless otherwise agreed to in writing between the utility and customer, synchronous generators shall automatically regulate power factor, not voltage, while operating in parallel with the utility system.

b. **Induction Generators:** Induction generators may be connected and brought up to synchronous speed (as an induction motor) if it can be demonstrated that the initial voltage drop measured at the Point of Interconnection is within the visible flicker limits as defined by IEEE 1453-2015 (or latest version). The same requirements also apply to induction generation connected at or near synchronous speed because a similar voltage dip is present due to an inrush magnetizing current. The customer shall submit number of starts per specific time period and maximum starting kVA draw data for the utility to verify that the voltage dip due to starting is within the visible flicker limits and does not degrade the normal voltage provided by the utility.

Induction generators do not require separate synchronizing equipment. Starting or rapid load fluctuations on induction generators can adversely impact the utility's system voltage. Corrective step-switched capacitors or other techniques may be necessary if the voltage fluctuations measured at the Point of Interconnection are not within the visible flicker limits as defined by IEEE 1453-2015 (or latest version). These measures can, in turn, cause ferroresonance. If these measures (additional capacitors) are installed on the customer's side of the Point of Interconnection, the utility will review these measures and may require the customer to install additional protective relaying equipment, provided that the utility provides the customer with written notice of the additional equipment required and the reasons for such determination. The Company will determine whether additional equipment is required to protect the Company's system.

c. **Inverter Systems:** Inverter interfaced distributed generators that are to be installed in parallel with the utility Distribution System must employ a non-islanding synchronous inverter. The inverter design shall comply with the requirements of IEEE Std 1547 and UL 1741 standards (or latest versions) and be certified to have anti-islanding protection such that the synchronous inverter will automatically disconnect upon a utility system interruption.

Self-commutated inverters of the utility-interactive type shall synchronize to the utility. Inverters capable of stand-alone operation shall not attempt to control the voltage while operating in parallel with the utility Distribution System, except through volt-var and volt-watt control as specified above. Line-commutated, thyristor-based inverters are not recommended and will require Supplemental Review or IRS to determine harmonic and reactive power requirements. All interconnected inverter systems shall comply with the harmonic current limits of IEEE Std 519-2014 and/or IEEE Std 1547 (or latest versions).

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6. Protection, Synchronizing, and Control Requirements

a. Protection Requirements: The generating facility shall, at a minimum, provide adequate protective devices which include over/under voltage trip, over/under frequency trip, reverse power relay (for non-export generating facilities), and a means for automatically disconnecting the generating facility from the utility distribution system whenever a protective device initiates a trip. Based upon the results of the Initial Technical Review and/or Supplemental Review by the Company, additional protective devices may be required. Photovoltaic generating systems are to follow the guidelines set by UL 1741 standard (or latest version). Typical equipment and protective device requirements for large synchronous, induction, and inverter generators are illustrated in Figures 1, 2, and 3 respectively in Exhibit A.

b. Suitable Equipment: All protective devices (described in this document) for generating facilities ≥ 30 kW shall be utility-grade except for inverter-based generating facilities which shall comply with UL 1741 standard (or latest version) and IEEE 1547 (or latest version). The generating facility shall be responsible for identifying the specific models of their protective devices. All protective devices shall be used in accordance with their intended application.

c. Review of Design Drawings: The following engineering drawings/documents are required for review and approval by the utility prior to construction of the generating facility interconnection. Prior to being submitted to the utility, all drawings/documents shall be approved by a Professional Electrical Engineer registered in the State of Hawaii for generating facilities ≥ 30 kW. That approval shall be indicated by the presence of the Engineer's Professional seal on all drawings and documents.

- A single-line diagram, relay list, trip scheme and settings of the generating facility, which identifies the Point of Interconnection, circuit breakers, relays, switches, synchronizing equipment, monitoring equipment, and control and protective devices and schemes.

- A three-line diagram which shows the Point of Interconnection, potential transformer (PT) and current transformer (CT) ratios, and details of the generating facility configuration, including relays, meters and test switches (Not required for generating facilities < 30 kW).
EXHIBIT A

Typical Equipment and Protective Device Requirements for Large Synchronous, Induction, and Inverter Generators

MAUI ELECTRIC COMPANY, LIMITED

Superseding REVISED SHEET NO. 36B-22
Effective February 20, 2018

REVISED SHEET NO. 36B-24
Effective November 16, 2021

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Superseding REVISED SHEET NO. 36B-24
Effective February 20, 2018

REVISED SHEET NO. 36B-26
Effective November 16, 2021

Figure 3

Large Static Inverter (Non-export)
Typical Equipment and Protective Device Requirements

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Superseding REVISED SHEET NO. 36B-28  
Effective February 20, 2018

REVISED SHEET NO. 36B-30  
Effective November 16, 2021

[Sheet not used]
Superseding REVISED SHEET NO. 36B-31  
Effective February 20, 2018

REVISED SHEET NO. 36B-33  
Effective November 16, 2021

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Superceding SHEET NO. 36B-35
Effective February 20, 2018

REVISED SHEET NO. 36B-37
Effective November 16, 2021

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Superseding SHEET NO. 36B-36
Effective February 20, 2018

REVISED SHEET NO. 36B-38
Effective November 16, 2021

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Superseding SHEET NO. 36B-37
Effective February 20, 2018

REVISED SHEET NO. 36B-39
Effective November 16, 2021

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CERTIFICATE OF SERVICE

I hereby certify that on this date, a copy of the foregoing document, together with this Certificate of Service, were duly served upon the following parties as set forth below:

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DATED: Honolulu, Hawai‘i, April 8, 2022.

/s/ Blaine Watanabe
Blaine Watanabe
HAWAIIAN ELECTRIC COMPANY, INC.
The foregoing document was electronically filed with the State of Hawaii Public Utilities Commission's Document Management System (DMS).