REQUEST FOR PROPOSALS

FOR

COMMUNITY-BASED RENEWABLE ENERGY PROJECTS

ISLAND OF MOLOKA‘I

NOVEMBER 22, 2021

Docket No. 2015-0389

Appendix H – Interconnection Facilities Cost and Schedule Information

Maui Electric

CONTENTS

Tariff Rule No. 19, approved by the PUC, establishes provisions for Interconnection and Transmission Upgrades (https://www.hawaiianelectric.com/billing-and-payment/rates-and-regulations/). The tariff provisions are intended to simplify the rules regarding who pays for, installs, owns, and operates interconnection facilities in the context of competitive bidding. Tariff Rule No. 19 will be utilized as the basis for addressing interconnection and transmission upgrades for any projects developed through this RFP. Proposers will comply with the terms and conditions as specified therein.

SECTION 1 – COST RESPONSIBILITIES

The purpose of Section 1 is to clearly define the cost responsibilities of construction, replacements, and upgrades of Company-Owned Interconnection Facilities (COIF) and existing Company-owned facilities in compliance with Tariff Rule No. 19.

1.1 – DEFINITIONS

1. Betterment – Any upgrading to a facility made solely for the benefit of and at the election of the Company and is not required by applicable laws, codes, Company Standards, and the interconnection requirements in accordance with Tariff Rule No. 19.
2. Company – Hawaiian Electric, Maui Electric, or Hawai‘i Electric Light.
3. Company-Owned Interconnection Facilities – The equipment and devices owned by Company between the Point of Interconnection and the Grid Connection Point that are required to permit a generating facility to operate in parallel with and deliver electric energy to Company’s system and provide reliable and safe operation of, and power quality on, Company’s system.
4. Grid Connection Point – The point that the new interconnection facilities associated with the Proposer’s project interconnects to the Company’s existing electrical grid.
5. Interconnection Agreement – The executed contract between the Company and Proposer (e.g. Power Purchase Agreement, Standard Interconnection Agreement, etc.).
6. Point of Interconnection – The point of delivery of energy supplied by Proposer to Company, where the Facility owned by the Proposer interconnects with the facilities owned or to be owned by the Company.
7. Proposer – The developer proposing a renewable project in response to a Company RFP.

1.2 – ABBREVIATIONS

1. ADSS – All Dielectric Self-Supporting
2. COIF – Company-Owned Interconnection Facilities
3. CT – Current Transformer

4. DFR – Digital Fault Recorder
5. DTT – Direct Transfer Trip
6. FS – Facility Study
7. GCP – Grid Connection Point
8. HVAC – Heating, Ventilation, and Air Conditioning
9. IRS – Interconnection Requirements Study (includes both SIS and FS)
10. NDA – Non-Disclosure Agreement
11. OPGW- Optical Ground Wire
12. POI – Point of Interconnection
13. PT – Potential Transformer
14. RTU – Remote Terminal Unit
15. SCADA – Supervisory Control and Data Acquisition
16. SIS – System Impact Study
17. UFLS – Under-Frequency Load Shed

1.3 – FACILITIES AT PROPOSER SITE

1. Proposer shall be responsible for all costs related to COIF at the Proposer site required by any relevant Rule or Tariff, Request for Proposal, and/or the IRS. This may include, but is not limited to:
    a. Project management, design, permitting/regulatory fees and approvals, land rights, installation labor, inspection, construction management, and testing
    b. Site work (grading, trenching, manholes/handholes, conduits, cable trench, concrete pads/foundations, fencing, roadways/driveways, ground grid, lighting, etc.)
    c. Substation structures, design, and configuration (i.e., breaker and a half, ring bus, etc.)
    d. Control equipment enclosure/cabinet
    e. Equipment (circuit breakers, transformers, relays, switches, arresters, batteries, HVAC, RTU, DFR, DTT, meters, PTs, CTs, etc.)
    f. Telecommunication equipment (See Telecommunication Facilities section below)
    g. Electrical work (bussing, wiring, lightning protection, fiber optic cable, etc.)
    h. Security systems/equipment
2. Company shall be responsible for Betterment costs.

1.4 – STATION POWER FOR COMPANY SWITCHING STATION

1. Station power is required if a new Company switching station or substation is built to allow the interconnection of the Proposer's project. If station power is required, the Proposer shall be responsible for all costs related to the primary and backup station power sources. This may include, but is not limited to:
    a. Project management, design, permitting/regulatory fees and approvals, land rights, installation labor, inspection, construction management, and testing

   b. Overhead electrical facilities (poles, conductor, insulators, crossarms, guy wires, transformers, etc.)
   c. Underground electrical facilities (cables, splices, termination, grounding, transformers, switchgears, etc.)
   d. Step-down transformer
   e. Civil/structural work (survey, grading, trenching, conduits, manholes/handholes, concrete pads, concrete pier foundations, pole hole excavation, etc.)
   f. Vegetation trimming and traffic control
2. Options for primary station power sources for the Company's various switching station voltages are:
   a. Tap off the bus through a step-down transformer for 23kV through 69kV
   b. 12kV line extension and service transformer for 23kV through 138kV
   c. Gensets are not an allowable substitute for the above options

1.5 – REMOTE SUBSTATION FACILITIES

1. Proposer shall be responsible for all costs that are solely for the benefit of the Proposer's project, that cannot be used for future system benefit, and that does not provide any benefit to other customers. This may include, but is not limited to:
   a. Telecommunications cards for DTT (if required)
   b. Point-to-point microwave facilities between the Proposer's facility and the remote substation (if Proposer chooses that communications option) since there is no way to splice into or multi-link a microwave and it cannot be used for other purposes
2. If the project is interconnecting directly to an existing Company substation, any new equipment required at the substation to accommodate the interconnection will be considered Interconnection Facilities according to Tariff Rule No. 19 and all costs shall be the responsibility of the Proposer. This may include, but is not limited to:
   a. Project management, design, permitting/regulatory fees and approvals, land rights, installation labor, inspection, construction management, and testing
   b. Site work (grading, trenching, manholes/handholes, conduits, cable trench, concrete pads/foundations, fencing, roadways/driveways, ground grid, lighting, etc.)
   c. Substation structures
   d. New control equipment cabinet or existing enclosure expansion
   e. Equipment (circuit breakers, transformers, relays, switches, arresters, batteries, HVAC, DFR, DTT, meters, PTs, CTs, etc.)
   f. Electrical work (bussing, wiring, lightning protection, fiber optic cable, etc.)
   g. Telecommunications equipment
3. Company shall be responsible for all other costs. This may include, but is not limited to:
   a. Betterment

b. System upgrades, changes, or replacement of existing facilities (e.g. breaker replacements, relay upgrade, transformer installs, Under-Frequency Load Shed (UFLS) settings, etc.)
c. Site work associated with those system upgrades (grading, trenching, manholes/handholes, conduits, cable trench, concrete pads/foundations, fencing, roadways/driveways, ground grid, lighting, etc.)
d. Substation structures
e. New control equipment cabinet or existing enclosure expansion
f. Equipment (circuit breakers, transformers, relays, switches, arresters, batteries, HVAC, DFR, DTT, meters, PTs, CTs, SCADA equipment, telecommunications routers, etc.)
g. Electrical work (bussing, wiring, lightning protection, fiber optic cable, etc.)

1.6 – LINE EXTENSION FROM GRID CONNECTION POINT (GCP) TO PROPOSER SITE

1. Proposer shall be responsible for all costs related to the line extension between the GCP and the Proposer site. This may include, but is not limited to:
    a. Project management, design, permitting/regulatory fees and approvals, land rights, installation labor, inspection, construction management, and testing
    b. Overhead electrical facilities (poles, conductor, insulators, crossarms, guy wires, etc.)
    c. Underground electrical facilities (cables, splices, terminations, grounding, transformers, switchgears, etc.)
    d. Civil/structural work (survey, grading, trenching, conduits, manholes/handholes, concrete pads, concrete pier foundations, pole hole excavation, etc.)
    e. Company fiber (ADSS fiber, OPGW shieldwire, splice boxes, etc.)
    f. Vegetation trimming and traffic control
2. The Company shall be responsible for the following costs:
    a. Betterment
    b. Replacement of overhead and underground facilities due to certain pre-existing conditions and not caused by interconnection of the Proposer's project as follows:
        i. Asset is identified for replacement in Company's 5-year work plans
        ii. Poles (if not identified in 5-year work plans) that require replacement based on the Company's standards and practices (e.g. NESC remaining strength requirements, mechanical or insect damage, cracked, and excessive checking, leaning, or corrosion) or poles that are overloaded prior to addition of the new line
        iii. Conductors, hardware, and equipment that have issues requiring replacement for safe/reliable operation (e.g. corrosion, damage, etc.)
        iv. Facilities that meet any of these criteria will be identified by Company engineers

v. Company will pay for a one for one equivalent to current standards, and Proposer will pay for anything above that standard required for their interconnection

1.7 – T&D SYSTEM UPGRADES

1. Company shall be responsible for all costs related to system upgrades or changes required to accommodate the Proposer's project (e.g. reconductoring or recircuiting of existing lines that do not have the required ampacity, re-fusing or re-programming of protective devices upstream of the GCP, etc.)

1.8 – COMPANY-OWNED FIBER

1. If Company-owned fiber is used to satisfy the communications requirements in the IRS, then the Proposer shall be responsible for all costs related to routing the ADSS fiber or OPGW from the nearest existing splice point to the Proposer site. This may include, but is not limited to:
   a. Project management, design, permitting/regulatory fees and approvals, land rights, installation labor, inspection, construction management, and testing
   b. Company fiber-optic cable (ADSS fiber cable or OPGW shieldwire) and associated equipment/hardware (splice boxes, innerduct, vibration dampers, etc.)
   c. Splicing and Testing of fiber strands
   d. Pole replacements and additional equipment if needed for additional capacity
   e. Civil/structural work (survey, grading, trenching, conduits, manholes/handholes, concrete pads, concrete pier foundations, pole hole excavation, etc.)
   f. Vegetation trimming and traffic control
2. Company will provide the location(s) of the existing fiber splice point(s) after the Proposer has signed a Non-Disclosure Agreement (NDA).
3. Company shall be responsible for Betterment costs.

1.9 – TELECOMMUNICATION FACILITIES

1. Telecommunication Cabinet
   a. If a control equipment enclosure will not be built, the Proposer shall be responsible for all costs related to installing a telecommunication cabinet required to accommodate the telecommunication equipment at the Proposer's facility. This may include, but is not limited to equipment racks and ancillary infrastructure, 48V DC Power System (includes 48V DC Charger w/ at least 12-hr battery backup), alarming, and air conditioning
2. Telecommunication Power
   a. Proposer shall be responsible for all costs related to providing reliable 48V DC power to Company equipment at a new Company switching station or a Proposer-owned station. This may include, but is not limited to battery racks, banks, fuse panels, and associated power system equipment.

3. Fiber Termination Equipment
    a. If Company-owned fiber is used to satisfy the communication requirements in the IRS, then the Proposer shall be responsible for all costs related to terminating the ADSS fiber or OPGW at the new Company switching station and point of interconnection to Company's existing system. This may include, but is not limited to a fiber termination panel and associated equipment/hardware (fiber guide, splice trays, connectors, etc.)
4. Microwave Radio or Wireless Radio
    a. If Company-owned microwave radio (6GHz, 10/11 GHz, etc.) or Company-owned wireless radio (900MHz, 450MHz, etc.) is used to satisfy the communications requirements in the IRS, then the Proposer shall be responsible for all costs related to installing the microwave or wireless radio/link at the new Company switching station and remote site(s). This may include, but is not limited to:
        i. Pre-design requirements (path survey/engineering, FCC frequency coordination, licensing, filings, EME study if required, etc.)
        ii. Project management, design, permitting, regulatory fees and approvals, land rights, labor, inspection, construction management, and testing
        iii. Pole or tower facilities to support the microwave dish and its connection to the microwave equipment (waveguide, cables, conduit, etc.)
        iv. Civil/structural work (survey, grading, trenching, conduits, manholes/handholes, concrete pads, concrete pier foundations, pole hole excavation, etc.)
        v. Antenna system design and installation
5. Leased Service
    a. If 3rd party leased service will provide telecommunication connectivity to the new Company switching station, then the Proposer shall be responsible for all costs related to ordering and installing the leased service at the site. This may include, but not be limited to the initial cost to establish the leased line(s) required for the project, monthly recurring leased cost of the service(s), and on-going maintenance of the service(s).
6. Telecommunication Service Equipment
    a. Telecommunication equipment is required to provide circuits to support the various applications at the new Company switching station. The Proposer shall be responsible for all costs related to installing the telecommunication equipment. This may include, but is not limited to:
        i. Project management, design, installation, and testing
        ii. Telecommunication routers, multiplexors, and associated equipment/hardware

1.10 – PROPOSER PAYMENTS

1. The Company shall require upfront payment prior to the commencement of any phase of work based on an estimate of Company costs for that phase. A true-up at the end of the project shall be completed and a refund or bill shall be processed in accordance with the Interconnection Agreement when necessary.
2. Proposer is also responsible for payments to the Company related to service contracts for service power.

SECTION 2 – INTERCONNECTION COSTS

To assist Proposers in assessing the impacts of location on potential projects, the information provided in Section 2 can be used to approximate the cost for Company-Owned Interconnection Facilities (COIF), including substation, telecommunications, security, transmission or distribution lines, and project management. This information is based on typical interconnections as shown in Attachments 1 through 3 of this Appendix H. Conceptual design is not intended to cover all interconnection requirements. Final interconnection design will be subject to the results of a technical review. The per-unit cost figures below should not be used to create a detailed project estimate. A detailed project estimate typically requires a certain level of engineering to assess project site conditions and to factor in other parameters specific to the project.

The Proposer should identify the components assumed for their project and the quantity assumed for each. Each table below provides notes on the assumptions for each of the unit cost estimates. If a Proposer's project requirements are different than what is assumed in the notes, the Proposer should identify each difference and provide an estimated additional cost or savings resulting from those different requirements. Please see Attachment 4 for examples of how to apply the per-unit costs provided. All costs provided do not include costs related to Proposer responsibilities including, but not limited to, permitting, land rights, community outreach, biological and/or cultural (archeological) surveys. Proposers should do their own due diligence for these costs.

2.1 – DISTRIBUTION (12KV AND BELOW) INTERCONNECTION

Please refer to Attachment 1 (Distribution Secondary Interconnection for 250 kW and larger to less than 1 MW), Attachment 2 (Distribution Primary Interconnection for 250 kW and larger to less than 1 MW), or Attachment 3 (Pala‘au Interconnection for Projects 250kW or larger) of this Appendix H for single line diagrams depicting the required interconnection to the Company's system. Please see Attachment 4 for examples of how to apply the per-unit costs provided. All costs provided in Section 2.1 assume the COIF will be built by the Company.

A. TYPICAL DISTRIBUTION SECONDARY INTERCONNECTION FOR 250 KW PROJECTS (ATTACHMENT 1)

TYPICAL DISTRIBUTION SECONDARY INTERCONNECTION FOR 250 KW PROJECTS (ATTACHMENT 1)		
Item	**Description**	**Cost**
Substation & Meter Baseline Costs		
1	All components shown in Attachment 1 except for the T&D Baseline and Distribution line extension costs. • Includes costs for engineering, materials, construction, and testing. • Distribution line extension – See Items 2, 3, and 4 and Section 2.1D. • Telecommunications requirements – See Section 2.1E. • Security requirements – See Section 2.1F.	$468,000
Notes: a) Assumes construction in 2022. b) Civil infrastructure and space for COIF provided by Proposer. c) Substation relay protection requirements have not been identified so costs are based upon typical line protection relaying requirements. d) Does not include costs for permitting, land rights, or a Relay Coordination Study.		
T&D Baseline Costs		
2	Tap to OH (secondary interconnection) • Includes costs for engineering, materials, construction for 3ph riser fuses (100A max) or disconnects, 1 wood pole, 100ft UG line extension (1 feeder), padmount transformer, and 3ph, 4W 600V cables from transformer to Proposer switchgear	$231,000
3	Tap to UG Main (secondary interconnection) • Includes costs for engineering, materials, construction for UG tap, 100ft UG line extension (1 feeder), padmount switch (fuse 100A max), padmount transformer, cable between switch and transformer, and 3ph, 4W 600V cables from transformer to Proposer switchgear • Assumes padmount switch is within 10ft of the Company-owned transformer	$285,000
4	Tap to UG Fused Feeder (secondary interconnection) • Includes costs for engineering, materials, construction for UG tap, 100ft UG line extension (1 feeder), padmount transformer, and 3ph, 4W 600V cables from transformer to Proposer switchgear	$211,000
Notes: a) Assumes construction in 2022. b) Interconnection will typically require either Item 2, 3, or 4 depending on the existing facilities in the area and the specific route of the line extension.		

TYPICAL DISTRIBUTION SECONDARY INTERCONNECTION FOR 250 KW PROJECTS (ATTACHMENT 1)		
Item	**Description**	**Cost**
	c) Includes 100ft UG line extension of one feeder (minimum requirement). d) Proposer can request an additional backup feeder for quicker restoration if a fault occurs. Proposer should add costs for the additional feeder per Item 34. e) OH Line extension – Add applicable costs per Items 30 and/or 32. f) UG Line extension (above 100ft) – Add costs per Item 33. g) Additional OH/UG transitions – Add costs per Item 37. h) Secondary voltage from Proposer is assumed to be 480Y/277V in these scenarios. i) Maximum of 11 secondary connections is allowed on the Company-owned transformer. j) Assumes Proposer switchgear is within 10ft of the Company-owned transformer. k) OH/UG route and civil infrastructure drawings provided by Proposer. l) Civil infrastructure (pads, MH/HHs, conduits, etc.) is designed, procured, and installed by Proposer. m) Includes review of Proposer civil infrastructure designs and materials and inspection of Proposer civil infrastructure construction. n) Does not include vegetation clearing, grading, dewatering, permitting or land rights.	

B. TYPICAL DISTRIBUTION PRIMARY INTERCONNECTION FOR 250 KW PROJECTS (ATTACHMENT 2)

TYPICAL DISTRIBUTION PRIMARY INTERCONNECTION FOR 250 KW PROJECTS (ATTACHMENT 2)		
Item	**Description**	**Cost**
Substation & Meter Baseline Costs		
10	Components on the Company side of the demarcation as shown in Attachment 2 • Includes costs for engineering, materials, construction, and testing. • Distribution line extension – See Items 11, 12, and 13 and Section 2.1D. • Telecommunications requirements – See Section 2.1E. • Security requirements – See Section 2.1F.	$468,000
Notes: a) Assumes construction in 2022. b) Civil infrastructure and space for COIF provided by Proposer. c) Substation relay protection requirements have not been identified so costs are based upon typical line protection relaying requirements. d) Does not include costs for permitting, land rights, or a Relay Coordination Study.		

TYPICAL DISTRIBUTION PRIMARY INTERCONNECTION FOR 250 KW PROJECTS (ATTACHMENT 2)		
Item	**Description**	**Cost**
T&D Baseline Costs		
11	Tap to OH (primary interconnection) • Includes costs for engineering, materials, construction for 3ph riser fuses (100A max) or disconnects, 1 wood pole, 100ft UG line extension (1 feeder), and primary termination to Proposer switchgear	$110,000
12	Tap to UG Main (primary interconnection) • Includes costs for engineering, materials, construction for UG tap, 100ft UG line extension (1 feeder), padmount switch (fuse 100A max), and primary cables and terminations between switch and Proposer switchgear • Assumes padmount switch is within 10ft of the Proposer switchgear	$158,000
13	Tap to UG Fused Feeder (primary interconnection) • If Project < 100A – Includes costs for engineering, materials, construction for UG tap, 100ft UG line extension (1 feeder), and primary termination to Proposer switchgear • If Project ≥ 100A – Not allowed	$80,000

Notes:

a) Assumes construction in 2022.
b) Interconnection will typically require either Item 11, 12, or 13 depending on the existing facilities in the area and the specific route of the line extension.
c) Assumes Proposer switchgear is within 100ft of the GCP.
d) Includes 100ft UG line extension of one feeder (minimum requirement).
e) Proposer can request an additional backup feeder for quicker restoration if a fault occurs. Proposer should add costs for the additional feeder per Item 34.
f) OH Line extension – Add applicable costs per Items 30, and/or 32.
g) UG Line extension (above 100ft) – Add costs per Item 33.
h) Additional OH/UG transitions – Add costs per Item 37.
i) OH/UG route and civil infrastructure drawings provided by Proposer.
j) Civil infrastructure (pads, MH/HHs, conduits, etc.) designed, procured, and installed by Proposer.
k) Includes review of Proposer civil infrastructure designs and materials and inspection of Proposer civil infrastructure construction.
l) Does not include vegetation clearing, grading, dewatering, permitting or land rights.

C. TYPICAL DISTRIBUTION PRIMARY INTERCONNECTION TO PALA‘AU FOR PROJECTS ≥ 250KW (ATTACHMENT 3)

INTERCONNECTION AT PALA‘AU FOR PROJECTS ≥ 250 kW AND ≤ 2.5 MW (ATTACHMENT 3)		
Item	**Description**	**Cost**
Substation & Meter Baseline Costs		
21	Components at the Project Site on the Company side of the demarcation as shown in Attachment 3 • Includes costs for engineering, materials, construction, and testing. • Assumes civil infrastructure and space for COIF is provided by Proposer. • Distribution line extension – See Items 24 and 26 and Section 2.1D. • Telecommunications requirements – See Section 2.1E. • Security requirements – See Section 2.1F.	$486,000 / interconnection line
22	Company work for components at Pala‘au PP as shown in Attachment 3 • Includes engineering, materials, construction, and testing. • Local SCADA equipment is included. • Does not include excavation and fill	$600,000 / interconnection line
Notes: a) Assumes construction in 2022. b) Substation relay protection requirements have not been identified so costs are based upon typical line protection relaying requirements. c) Does not include costs for permitting, land rights, or a Relay Coordination Study.		
T&D Baseline Costs		
24	UG Termination to OH Extension • Includes costs for engineering, materials, construction for UG termination at Proposer site, 100ft UG line extension (1 feeder), 3ph riser with disconnects, and 1 wood pole • Add OH line extension – See Item 30 or 32. Line extension costs are for one line. If the project is segmented, then costs for two separate OH lines (one for each feeder) should be accounted for. • Add UG line extension (if > 100ft) – See Item 33. • If Proposer’s Facility is segmented, then add an additional UG feeder and riser – See Items 34 and 37. UG feeders can be in the same conduit and MH system.	$110,000

INTERCONNECTION AT PALA‘AU FOR PROJECTS ≥ 250 kW AND ≤ 2.5 MW (ATTACHMENT 3)		
Item	**Description**	**Cost**
	• Risers and UG line extension should also be added for termination at Pala‘au PP.	
26	UG Termination to UG Extension • Includes costs for engineering, materials, construction for UG termination at Proposer site and 100ft UG line extension (1 feeder) • Add UG line extension (if > 100ft) – See Item 33. • If Proposer’s Facility is segmented, then add an additional feeder for the entire UG length – See Item 34. UG feeders can be run in the same conduit and MH system.	$80,000

Notes:
a) Assumes construction in 2022.
b) Interconnection will typically require either Item 24 or 26 for work at the Proposer’s site in addition to any line extension above 100ft of UG.
c) Includes 100ft UG line extension of one feeder.
d) OH/UG route and civil infrastructure drawings provided by Proposer.
e) Civil infrastructure (pads, MH/HHs, conduits, etc.) designed, procured, and installed by Proposer.
f) Includes review of Proposer civil infrastructure designs and materials and inspection of Proposer civil infrastructure construction.
g) Does not include vegetation clearing, grading, dewatering, permitting or land rights.

D. DISTRIBUTION LINE EXTENSION COSTS

DISTRIBUTION LINE EXTENSION COSTS		
Item	**Description**	**Cost**
30	12kV OH accessible (200ft spans, #1/0 AAC)	$796,000 / mile
32	12kV OH inaccessible (250ft spans, #1/0 AAC)	$1,692,000 / mile
33	12kV UG (200ft spans, #4/0 AL PEICN)	$835,000 / mile
34	12kV UG add’l feeder (200ft spans, #4/0 AL PEICN)	$502,000 / mile
37	12kV 3ph riser w/ disconnects (including pole/anchor)	$46,000 each

Notes:
a) Assumes construction in 2022.
b) OH assumes wood poles and 3ph overhead conductor with neutral underbuild.
c) Accessible assumes vehicles can be used during construction.
d) Inaccessible assumes helicopters are needed during construction.
e) Includes engineering, materials, construction labor for electrical work, inspection for UG civil infrastructure, and contractor costs for pole/anchor digging.

DISTRIBUTION LINE EXTENSION COSTS		
Item	**Description**	**Cost**
	f) OH/UG route and civil infrastructure drawings provided by Proposer. g) Civil infrastructure (pads, MH/HHs, conduits, etc.) designed, procured, and installed by Proposer. h) Does not include vegetation clearing, grading, dewatering, permitting or land rights.	

E. TYPICAL TELECOMMUNICATIONS REQUIREMENTS FOR DISTRIBUTION INTERCONNECTIONS
   1. 250 KW Projects – See Section 2.4 for costs
      a. Primary communications links can consist of cellular, lease line, licensed radio, fiber, or microwave.
      b. Back-up communications links not required.
      c. Additional analog leased telephone lines are required to support revenue meters (Proposer shall do their own due diligence for costs on this).
   2. Interconnection Project at Pala‘au – See Section 2.4 for costs
      a. Primary communications links can consist of lease line, licensed radio, fiber or microwave.
      b. Back-up communications links are required (can consist of lease line, licensed radio, fiber, or microwave).
      c. Back-up communications links must be transport diverse until the “last mile”.
      d. Additional analog leased telephone lines are required to support revenue meters (Proposer shall do their own due diligence for costs on this).
   3. Requirements are subject to change based on project specific evaluations, technical reviews, or IRS.

F. SECURITY REQUIREMENTS FOR DISTRIBUTION INTERCONNECTIONS
   1. For Company-owned equipment within Proposer’s Facility, Company requires:
      a. Standard 8ft high security fence with 3-strand barbed wire V-top.
      b. Interior mounted 4’ high cattle fencing.
      c. All gates will be secured using a proprietary padlock system.
      d. Proposer-owned cabinets/enclosures housing Company equipment shall be secured with a lock provided by Company.
      e. Company requires 24/7 access to Company facilities within the Proposer facility.
   2. See Section 2.5 for more information on Security Requirements.

2.2 – [NOT USED]

2.3 – [NOT USED]

2.4 – TELECOMMUNICATIONS

Please refer to Attachment 1 (Distribution Secondary Interconnection for 250 kW and larger to less than 1 MW), Attachment 2 (Distribution Primary Interconnection for 250 kW and larger to less than 1 MW), or Attachment 3 (Pala'au Interconnection for Projects 1 MW or larger) of this Appendix H for single line diagrams depicting the required interconnection to the Company's system. Please see Attachment 4 for examples of how to apply the per-unit costs provided.

The communications equipment will require a communications channel(s). Some of the communications channel options include cellular, lease line, licensed radio, fiber, or microwave. The number of communication circuits (primary/backup) and type of communication circuits required will vary depending on the type/size of the project.

A. TELECOMMUNICATIONS BASELINE COSTS

The costs below are high level per unit costs for communications requirements in support of the Project. Sections 2.1E and 2.2B above provide typical scenarios of when these options may be utilized.

TELECOMMUNICATIONS BASELINE COSTS		
Item	**Description**	**Cost**
Communications Cabinet or Enclosure		
70	Communications Enclosure with circuits to support SCADA • Only applicable to Cellular, Lease Line, Company-owned fiber options	$52,000 / site
72	Communications Cabinet with circuits to support SCADA • Projects with SCADA and diverse communication circuits	$230,000 / site
Notes: a) Assumes construction in 2022. b) All projects that require communications will require facilities to store the communications equipment. The example above is provided but other alternatives may be available upon request. c) Cabinet is used to support Company equipment and capable of providing communications circuit for SCADA. d) Communications cabinet cost does not include fiber, microwave, radio equipment or lease circuits. e) Proposer will provide all conduits, foundations, HHs, AC power, grounding as required per Company standards.		
Cellular or Lease Line Options		
73	Cellular or Lease Line one-time and recurring costs	Will vary based on 3rd party provider

TELECOMMUNICATIONS BASELINE COSTS		
Item	**Description**	**Cost**
Notes: a) Add cost of Communications Cabinet – See Items 70-72. b) Check with Company to understand the current cellular or lease line requirements. c) Communication circuit requirements will be based on applications needed for the project. d) Company can provide communication circuit interconnection requirements and assist with review of circuit order from the 3rd party provider as needed. e) Proposer to work directly with 3rd party provider if a cellular or lease line circuit is needed. f) Cost will be the responsibility of the Proposer and is to be negotiated with the 3rd party provider.		
Licensed 900 MHz Radio Option		
74	Licensed 900 MHz Radio Equipment • Incudes 2 each antenna equipment to create a radio link	$168,000 / link
Notes: a) Assumes construction in 2022. b) Add cost of Communications Cabinet – See Items 71-72. The radio equipment will be installed within the Communication Cabinet. c) Assumes there is radio line-of-sight clearance between the communication endpoints. d) Assumes FCC licensed 900MHz Frequencies are available. e) Assumes there is an existing structure/building with space available on the Company side to mount the antenna equipment and house the radio equipment. f) Assumes Telecommunications grounding standards are up to date at both sites. g) Assumes 48 V DC power with 12-hour battery backup is available. h) Does not include special site-specific permit/approval activities that may be required including, but not limited to, Neighborhood Board(s), Conservation District Use Application, Environmental Assessment, Shoreline Management Area approval, biological (endangered species or habitat) surveys, and/or cultural (archeological) surveys or the cost of any migration required for approvals to be granted. Proposers should conduct their own due diligence for these costs. i) Proposer is responsible to install a structure to mount the antenna equipment on the Proposer side and provide any conduit required between the Communications Cabinet and the antenna mount structure.		
Fiber-Optic Cable Option		
75	New Fiber-only pole line (200’ avg spans, 60-strand ADSS) • Includes new wood poles	$472,000 / mile
76	Fiber underbuild on new or existing pole line (200’ avg spans, 60-strand ADSS)	$218,000 / mile

TELECOMMUNICATIONS BASELINE COSTS		
Item	**Description**	**Cost**
	• Assumes no replacements of existing poles are needed	
Notes: a) Assumes construction in 2022. b) Add cost of Communications Cabinet – See Items 70-72. c) Assumes no splices are needed along the route.		
Microwave Option		
77	Point-to-Point Microwave Link • Includes 2 each antenna equipment to create a radio link	$836,000 / link
78	50ft Microwave Tower	$734,000 each
79	100ft Microwave Tower	$1,066,000 each
Notes: a) Assumes construction in 2022. b) Add cost of Communications Cabinet – See Items 70-72. c) Assumes there is radio line-of-site clearance between the communication endpoints. d) Assumes FCC licensed microwave frequencies are available. e) Assumes there are existing structures/buildings with space available on both ends to house the radio equipment. f) Assumes Telecommunications grounding standards are up to date at both sites. g) Assumes 48 V DC power with 12-hour battery backup is available. h) Does not include special site-specific permit/approval activities that may be required including, but not limited to, Neighborhood Board(s), Conservation District Use Application, Environmental Assessment, Shoreline Management Area approval, biological (endangered species or habitat) surveys, and/or cultural (archeological) surveys or the cost of any migration required for approvals to be granted. Proposers should conduct their own due diligence for these costs. i) Assumes space is available at both ends to construct antenna towers or structures that are rated to survive a Saffir-Simpson category 4 hurricane. j) Other options for Microwave Towers of varying heights may be available.		

2.5 – SECURITY OF COMPANY-OWNED FACILITIES

A. PROPOSER RESPONSIBILITIES AT PROPOSER FACILITY

The Proposer shall be responsible to incorporate security components and systems for **their facilities** that consider the Security Guidelines for the Electricity Sector (CIP-014-2): Physical Security, as published by the North American Electric Reliability Corporation (NERC) and that at a minimum, meet the requirements in Sections 2.1F.

SECTION 3 – [NOT USED]

SECTION 4 – TYPICAL COMPANY DURATIONS FOR INTERCONNECTION PROJECTS

The tables below in Section 4 are to be used as a reference when developing a schedule (required in Appendix B – Proposer's Response, Section 2.14) to assist Proposers in setting realistic durations and deadlines for critical milestones. These tables represent typical durations for the Company to complete the listed critical milestones that assist in moving the interconnection project through the IRS, Engineering, Procurement, and Construction phases. The durations below do not include time for Proposer to complete items they are responsible for. These high-level typical durations are for planning purposes only and is not intended to cover all project specific requirements. Specific project details can increase or decrease these durations. The detailed project schedule will be determined after the IRS is completed.

4.1 – DISTRIBUTION PROJECTS (COMPANY-BUILD)

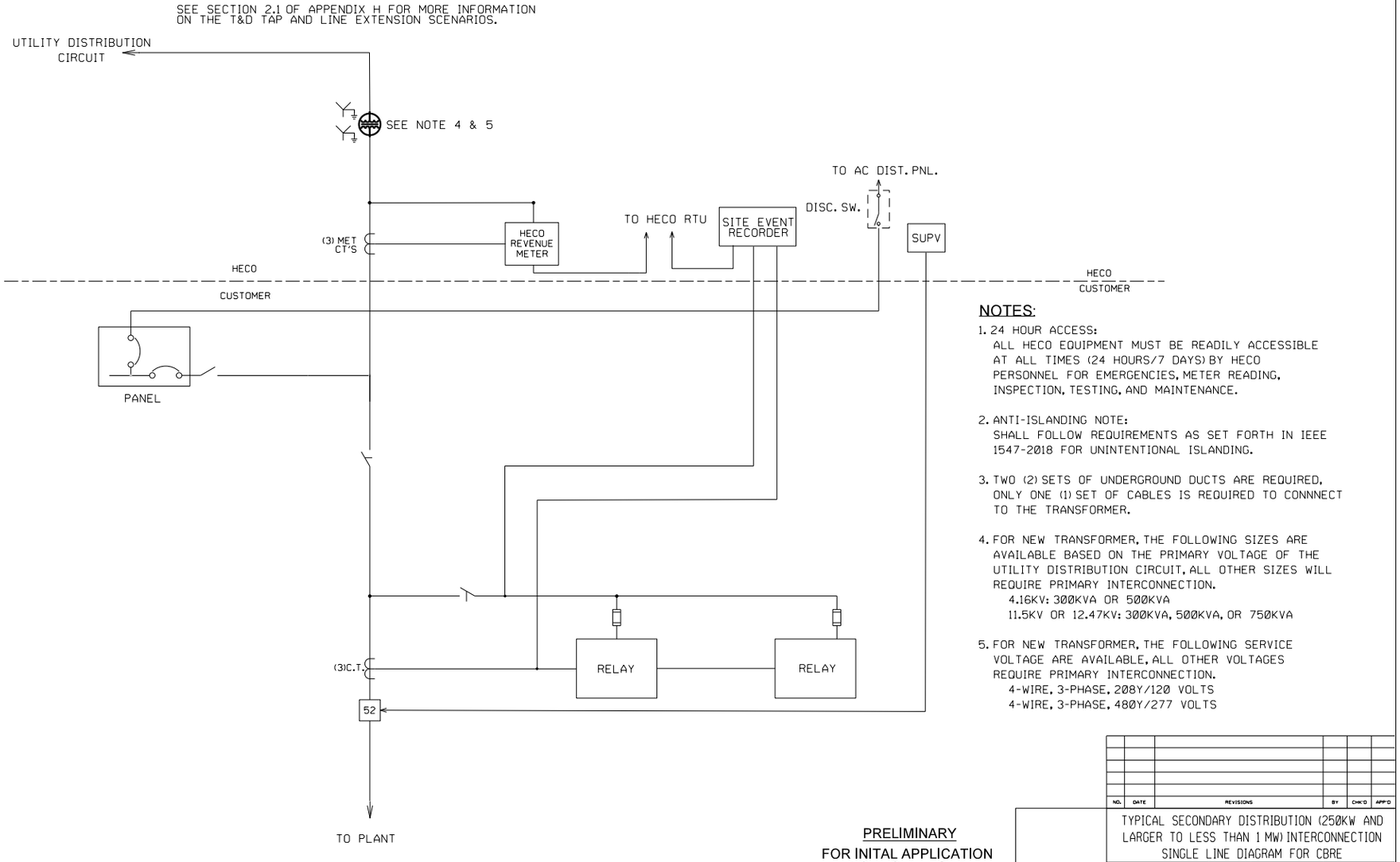
Hawaiian Electric Durations to be Considered in Schedules (12kV and Below) General Guidelines for Planning Purposes Only Hawaiian Electric Build ≥ 1 MW		
Milestone	**Duration**	**Notes**
IRS Phase		
Model Validation	2-3 months	May increase depending on # of iterations
System Impact Study (SIS)	150 calendar days	Following Model Acceptance
Facility Study (FS)	40 business days	Following completion of SIS, SLD Acceptance, and Receipt of Developer Drawings and Schedules
Engineering Phase		
30% Design & Review	40 business days	Designs & Reviews for Company-Owned Interconnection Facilities (COIF) & review of Proposer-Owned Interconnection Facilities (SOIF) supporting/impacting COIF
60% Design & Review	50 business days	Designs & Reviews for COIF & review of SOIF supporting/impacting COIF. Following 30% Design acceptance.
90% Design & Review	50 business days	Designs & Reviews for COIF & review of SOIF supporting/impacting COIF. Following 60% Design acceptance

Hawaiian Electric Durations to be Considered in Schedules (12kV and Below) General Guidelines for Planning Purposes Only Hawaiian Electric Build ≥ 1 MW		
Milestone	**Duration**	**Notes**
Issued for Construction (IFC) Design & Review	30 business days	Designs & Reviews for COIF & review of SOIF supporting/impacting COIF. Following 90% Design acceptance.
Procurement Phase		
Procurement	9 months	Procurement of materials typically happens at 60% design completion
Construction Phase		
Construction	7-8 months	Based on scope/complexity of work
Acceptance Testing	10 business days	Approximately 2 weeks after construction completion
CSAT	30 business days	To occur after commissioning of Proposer's Facility. Duration depends on Proposer's ability to meet the Performance Standards. Required for project ≥ 1 MW

4.2 – [NOT USED]

4.3 – [NOT USED]

4.4 – [NOT USED]



NOTES:

1. 24 HOUR ACCESS:
   ALL HECO EQUIPMENT MUST BE READILY ACCESSIBLE AT ALL TIMES (24 HOURS/7 DAYS) BY HECO PERSONNEL FOR EMERGENCIES, METER READING, INSPECTION, TESTING, AND MAINTENANCE.

2. ANTI-ISLANDING NOTE:
   SHALL FOLLOW REQUIREMENTS AS SET FORTH IN IEEE 1547-2018 FOR UNINTENTIONAL ISLANDING.

3. TWO (2) SETS OF UNDERGROUND DUCTS ARE REQUIRED, ONLY ONE (1) SET OF CABLES IS REQUIRED TO CONNNECT TO THE TRANSFORMER.

4. FOR NEW TRANSFORMER, THE FOLLOWING SIZES ARE AVAILABLE BASED ON THE PRIMARY VOLTAGE OF THE UTILITY DISTRIBUTION CIRCUIT, ALL OTHER SIZES WILL REQUIRE PRIMARY INTERCONNECTION.
   4.16KV: 300KVA OR 500KVA
   11.5KV OR 12.47KV: 300KVA, 500KVA, OR 750KVA

5. FOR NEW TRANSFORMER, THE FOLLOWING SERVICE VOLTAGE ARE AVAILABLE, ALL OTHER VOLTAGES REQUIRE PRIMARY INTERCONNECTION.
   4-WIRE, 3-PHASE, 208Y/120 VOLTS
   4-WIRE, 3-PHASE, 480Y/277 VOLTS

PRELIMINARY

FOR INITAL APPLICATION
NOT TO BE USED
FOR CONSTRUCTION

ALSO REFER TO SLD
DESIGN NOTES

NO.	DATE	REVISIONS	BY	CHK'D	APP'D

TYPICAL SECONDARY DISTRIBUTION (250KW AND LARGER TO LESS THAN 1 MW) INTERCONNECTION SINGLE LINE DIAGRAM FOR CBRE

DESIGNED | DRAWN | DATE 03-04-2021 | SCALE NONE
CHECKED | ELEC. | MECH. | STRUC.
APPROVAL

ENGINEERING DEPARTMENT
HAWAIIAN ELECTRIC CO., INC.
HONOLULU, HAWAII

DRAWING NUMBER | REV 0

SIGNATURE
EXPIRATION DATE OF THE LICENSE
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

Template Notes to be added to the 12kV PV/BESS (250kW and larger to less than 1MW) Project Single Line Diagram

Additional requirements may be added based on project design.

PROPOSED PROJECT NAME:	
PROPOSED PROJECT SIZE:	
CUSTOMER SLD REVISION NUMBER AND DATE:	
UTILITY SLD REVISION NUMBER AND DATE:	
UTILITY SUBSTATION:	
UTILITY 12KV CIRCUIT:	
UTILITY 12KV CIRCUIT BREAKER #:	

Section A: Planning Notes

A1. If IRS required, by operation procedure(s), the Project shall be paralleled with the utility system only when the ____(12kV circuit name) 12 kV circuit is in normal operating configuration served via breaker _____ (utility breaker number) at ____(utility substation name) Substation.

A2. Customer to ensure manual closing of Customer's main AC kV breaker CB-A (utility# XXXX) shall be allowed only for hot line (____(utility 12kV circuit) 12 kV line-side) and dead bus (Customer-side) unless otherwise allowed by the Company. There shall be no auto reclosing on Customer's main AC breaker CB-A (utility# XXXX).

Section B: System Operation Notes

B1. Utility load dispatcher shall be enabled to issue the following to the Customer via DNP 3.0, or other utility-approved protocol interface:
   a. Maximum Power Limit and Power Reference Limit (dispatch) set point control signals. Customer is not allowed to override utility's curtailment control; and

B2. The following signals provided by the Customer shall be telemetered to Utility load dispatch office:
   a. Status of Customer's main AC breaker CB-A (utility# XXXX);
   b. Distribution voltage (3 phase L-N);
   c. Facility Power Possible (kW);
   d. Facility Online/Offline Status;
   e. Facility output (kW) that is being exported to Company System;
   f. Facility's confirmation of a Company control being received and value of that control as implemented.

B3. The facility equipment should be capable of supporting, at a future date additional telemetry data requested by the Company as applicable:
   a. Distribution line amps (3 phase), frequency, NET kW, NET kVAR, and NET power factor at point of interconnection. Power factor to be a calculated value;
   b. PV kW and kVAR output;
   c. BESS kW and kVAR output/charge;
   d. Received kWh accumulator, sent kWh accumulator, received kVARh accumulator, Sent kVARh accumulator;
   e. Plane of Array Solar Irradiance in Watts/m2;
   f. kW output for each inverter;
   g. Status for each inverter (by DNP status);
   h. Facility Net Power Possible (kW);
   i. Volt-Var curve and deadband settings;
   j. Volt-Var Enabled/Disabled Status;
   k. Volt-Watt curve and deadband settings;
   l. Volt-Watt Enabled/Disabled Status;
   m. Frequency-Watt curve and deadband settings;
   n. Frequency-Watt Enabled/Disabled Status;
   o. BESS State of Charge (%);
   p. BESS Energy remaining (kWH);
   q. kW set point for each inverter

B4. The following occurrences shall initiate separate alarm to utility load dispatch office.
   a. RTU Loss of Communication;
   b. Violation of Maximum Ramp Rate Upward (Performance Standard); and
   c. Violation of Maximum Ramp Rate Downward (Performance Standard).

B5. Utility requires 24 hour access to utility-owned SCADA, communication, and utility-owned relaying and monitoring equipment.

B6. Utility shall own a high-speed digital fault recorder (DFR) (i.e., Tesla Lite Model) near the point of interconnection, which shall be in continuous service and on a rolling window basis monitoring sub-cycle voltages, currents and harmonics, as well as disturbance events and capable of remote interrogation following an event. Utility requires 24 hour access to this equipment. Customer to provide the following hard wired inputs to utility's power quality device:
   a. Status of Customer's main AC breaker CB-A (utility# XXXX);
   b. line amps (3 phase); and
   c. line-to-line voltage (3 phase)

Section C: Telecommunication Notes

C1. Secure and reliable communication is required for the following:

a. Monitoring and control to/ from Customer's facility;
b. Revenue metering for power export and consumption readings (for 1MW facility; and
c. Phone circuits as required.

C2. Customer to provide leased service from Hawaiian Telecom as required. Customer to coordinate with utility for details

Section D: Metering Notes

D1. Customer to design revenue metering facilities in accordance with the requirements in Chapter 4 of the Hawaiian Electric Company's Electric Service Installation Manual.

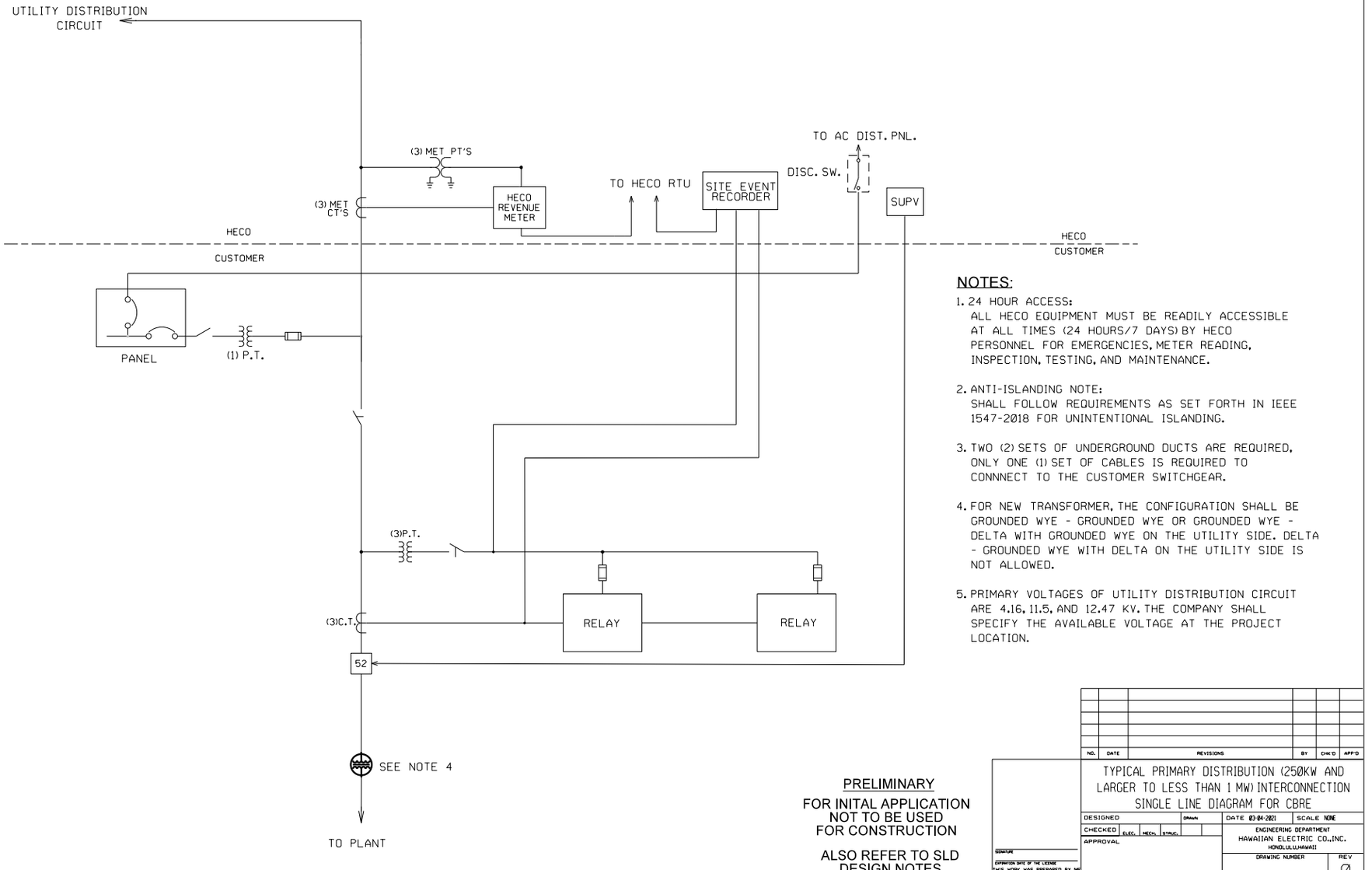
Section E: Design Notes

E1. Customer to provide a reliable DC source for 12 hour backup period; specific voltage to be determined by utility at a later date.

E2. Customer to provide a source of station service power for its facility that will remain available when Customer's main AC breaker CB-A (utility# XXXX) is opened and the facility is separated from utility's system.

E3. PTs and CTs for DFR should be the same quality as the PTs and CTs for the protective relaying.

E4. Customer to provide raw count (DNP 3.0) for analog points to utility. Customer to provide hardwired dry contact pairs for status points to utility and accept hardwired control points from utility (except for DNP control signals identified in Note B1 and DNP status points identified in Note B3.g).



NOTES:

1. 24 HOUR ACCESS:
   ALL HECO EQUIPMENT MUST BE READILY ACCESSIBLE AT ALL TIMES (24 HOURS/7 DAYS) BY HECO PERSONNEL FOR EMERGENCIES, METER READING, INSPECTION, TESTING, AND MAINTENANCE.

2. ANTI-ISLANDING NOTE:
   SHALL FOLLOW REQUIREMENTS AS SET FORTH IN IEEE 1547-2018 FOR UNINTENTIONAL ISLANDING.

3. TWO (2) SETS OF UNDERGROUND DUCTS ARE REQUIRED, ONLY ONE (1) SET OF CABLES IS REQUIRED TO CONNNECT TO THE CUSTOMER SWITCHGEAR.

4. FOR NEW TRANSFORMER, THE CONFIGURATION SHALL BE GROUNDED WYE - GROUNDED WYE OR GROUNDED WYE - DELTA WITH GROUNDED WYE ON THE UTILITY SIDE. DELTA - GROUNDED WYE WITH DELTA ON THE UTILITY SIDE IS NOT ALLOWED.

5. PRIMARY VOLTAGES OF UTILITY DISTRIBUTION CIRCUIT ARE 4.16, 11.5, AND 12.47 KV. THE COMPANY SHALL SPECIFY THE AVAILABLE VOLTAGE AT THE PROJECT LOCATION.

PRELIMINARY

FOR INITAL APPLICATION
NOT TO BE USED
FOR CONSTRUCTION

ALSO REFER TO SLD
DESIGN NOTES

NO.	DATE	REVISIONS	BY	CHK'D	APP'D

TYPICAL PRIMARY DISTRIBUTION (250KW AND LARGER TO LESS THAN 1 MW) INTERCONNECTION SINGLE LINE DIAGRAM FOR CBRE

DESIGNED	DRAWN	DATE 03-04-2021	SCALE NONE
CHECKED ELEC. MECH. STRUC.		ENGINEERING DEPARTMENT HAWAIIAN ELECTRIC CO., INC. HONOLULU, HAWAII	
APPROVAL		DRAWING NUMBER	REV Ø

SIGNATURE
EXPIRATION DATE OF THE LICENSE
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

Template Notes to be added to the 12kV PV/BESS (250kW and larger to less than 1MW) Project Single Line Diagram

Additional requirements may be added based on project design.

PROPOSED PROJECT NAME:	
PROPOSED PROJECT SIZE:	
CUSTOMER SLD REVISION NUMBER AND DATE:	
UTILITY SLD REVISION NUMBER AND DATE:	
UTILITY SUBSTATION:	
UTILITY 12KV CIRCUIT:	
UTILITY 12KV CIRCUIT BREAKER #:	

Section A: Planning Notes

A1. If IRS required, by operation procedure(s), the Project shall be paralleled with the utility system only when the ____(12kV circuit name) 12 kV circuit is in normal operating configuration served via breaker _____ (utility breaker number) at ____(utility substation name) Substation.

A2. Customer to ensure manual closing of Customer's main AC kV breaker CB-A (utility# XXXX) shall be allowed only for hot line (____(utility 12kV circuit) 12 kV line-side) and dead bus (Customer-side) unless otherwise allowed by the Company. There shall be no auto reclosing on Customer's main AC breaker CB-A (utility# XXXX).

Section B: System Operation Notes

B1. Utility load dispatcher shall be enabled to issue the following to the Customer via DNP 3.0, or other utility-approved protocol interface:
   a. Maximum Power Limit and Power Reference Limit (dispatch) set point control signals. Customer is not allowed to override utility's curtailment control; and

B2. The following signals provided by the Customer shall be telemetered to Utility load dispatch office:
   a. Status of Customer's main AC breaker CB-A (utility# XXXX);
   b. Distribution voltage (3 phase L-N);
   c. Facility Power Possible (kW);
   d. Facility Online/Offline Status;
   e. Facility output (kW) that is being exported to Company System;
   f. Facility's confirmation of a Company control being received and value of that control as implemented.

B3. The facility equipment should be capable of supporting, at a future date additional telemetry data requested by the Company as applicable:
   a. Distribution line amps (3 phase), frequency, NET kW, NET kVAR, and NET power factor at point of interconnection. Power factor to be a calculated value;
   b. PV kW and kVAR output;
   c. BESS kW and kVAR output/charge;
   d. Received kWh accumulator, sent kWh accumulator, received kVARh accumulator, Sent kVARh accumulator;
   e. Plane of Array Solar Irradiance in Watts/m2;
   f. kW output for each inverter;
   g. Status for each inverter (by DNP status);
   h. Facility Net Power Possible (kW);
   i. Volt-Var curve and deadband settings;
   j. Volt-Var Enabled/Disabled Status;
   k. Volt-Watt curve and deadband settings;
   l. Volt-Watt Enabled/Disabled Status;
   m. Frequency-Watt curve and deadband settings;
   n. Frequency-Watt Enabled/Disabled Status;
   o. BESS State of Charge (%);
   p. BESS Energy remaining (kWH);
   q. kW set point for each inverter

B4. The following occurrences shall initiate separate alarm to utility load dispatch office.
   a. RTU Loss of Communication;
   b. Violation of Maximum Ramp Rate Upward (Performance Standard); and
   c. Violation of Maximum Ramp Rate Downward (Performance Standard).

B5. Utility requires 24 hour access to utility-owned SCADA, communication, and utility-owned relaying and monitoring equipment.

B6. Utility shall own a high-speed digital fault recorder (DFR) (i.e., Tesla Lite Model) near the point of interconnection, which shall be in continuous service and on a rolling window basis monitoring sub-cycle voltages, currents and harmonics, as well as disturbance events and capable of remote interrogation following an event. Utility requires 24 hour access to this equipment. Customer to provide the following hard wired inputs to utility's power quality device:
   a. Status of Customer's main AC breaker CB-A (utility# XXXX);
   b. line amps (3 phase); and
   c. line-to-line voltage (3 phase)

Section C: Telecommunication Notes

C1. Secure and reliable communication is required for the following:

a. Monitoring and control to/ from Customer's facility;
b. Revenue metering for power export and consumption readings (for 1MW facility; and
c. Phone circuits as required.

C2. Customer to provide leased service from Hawaiian Telecom as required. Customer to coordinate with utility for details

Section D: Metering Notes

D1. Customer to design revenue metering facilities in accordance with the requirements in Chapter 4 of the Hawaiian Electric Company's Electric Service Installation Manual.

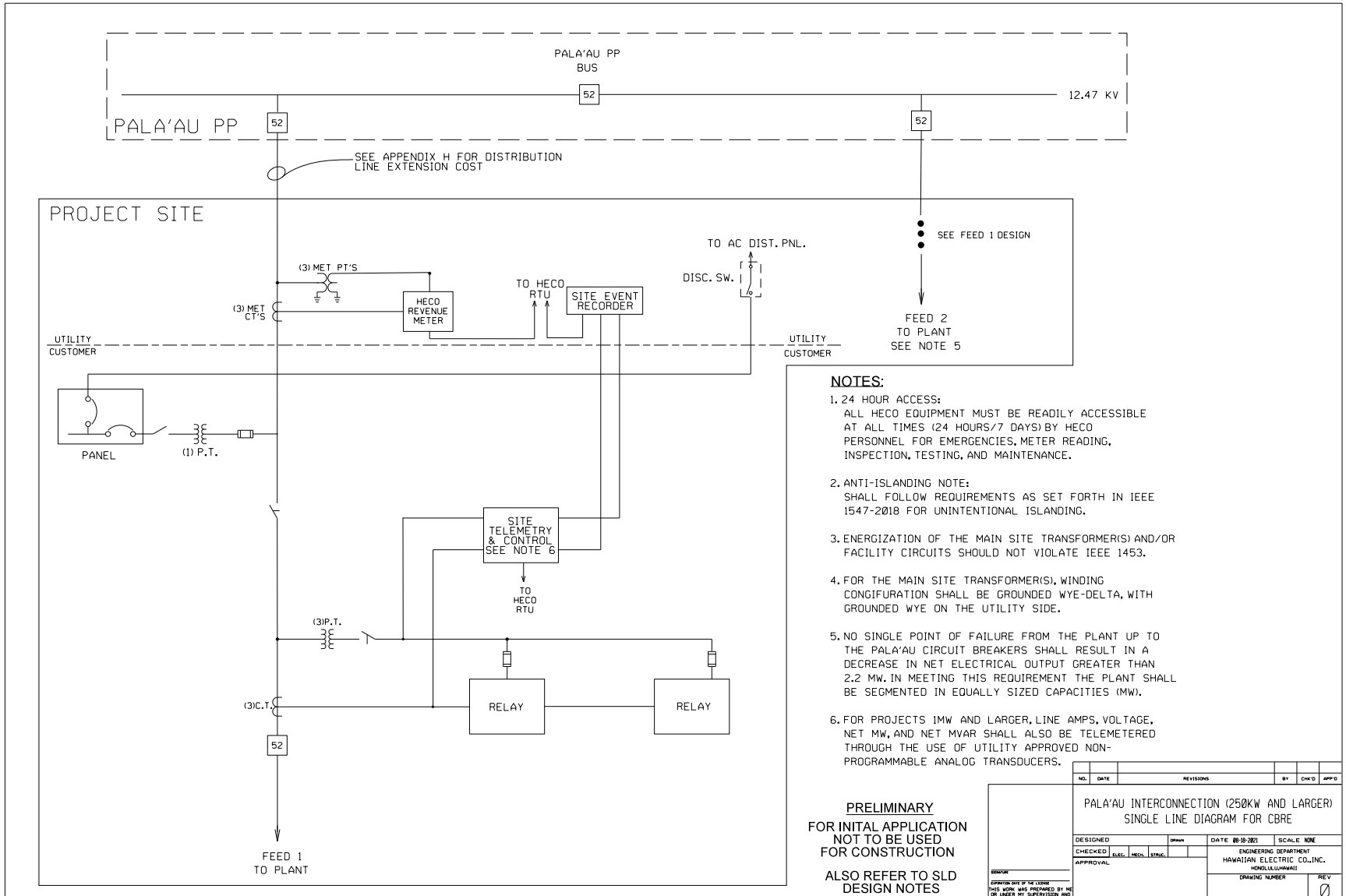
Section E: Design Notes

E1. Customer to provide a reliable DC source for 12 hour backup period; specific voltage to be determined by utility at a later date.

E2. Customer to provide a source of station service power for its facility that will remain available when Customer's main AC breaker CB-A (utility# XXXX) is opened and the facility is separated from utility's system.

E3. PTs and CTs for DFR should be the same quality as the PTs and CTs for the protective relaying.

E4. Customer to provide raw count (DNP 3.0) for analog points to utility. Customer to provide hardwired dry contact pairs for status points to utility and accept hardwired control points from utility (except for DNP control signals identified in Note B1 and DNP status points identified in Note B3.g).



NOTES:

1. 24 HOUR ACCESS:
   ALL HECO EQUIPMENT MUST BE READILY ACCESSIBLE AT ALL TIMES (24 HOURS/7 DAYS) BY HECO PERSONNEL FOR EMERGENCIES, METER READING, INSPECTION, TESTING, AND MAINTENANCE.

2. ANTI-ISLANDING NOTE:
   SHALL FOLLOW REQUIREMENTS AS SET FORTH IN IEEE 1547-2018 FOR UNINTENTIONAL ISLANDING.

3. ENERGIZATION OF THE MAIN SITE TRANSFORMER(S) AND/OR FACILITY CIRCUITS SHOULD NOT VIOLATE IEEE 1453.

4. FOR THE MAIN SITE TRANSFORMER(S), WINDING CONGIFURATION SHALL BE GROUNDED WYE-DELTA, WITH GROUNDED WYE ON THE UTILITY SIDE.

5. NO SINGLE POINT OF FAILURE FROM THE PLANT UP TO THE PALA'AU CIRCUIT BREAKERS SHALL RESULT IN A DECREASE IN NET ELECTRICAL OUTPUT GREATER THAN 2.2 MW. IN MEETING THIS REQUIREMENT THE PLANT SHALL BE SEGMENTED IN EQUALLY SIZED CAPACITIES (MW).

6. FOR PROJECTS 1MW AND LARGER, LINE AMPS, VOLTAGE, NET MW, AND NET MVAR SHALL ALSO BE TELEMETERED THROUGH THE USE OF UTILITY APPROVED NON-PROGRAMMABLE ANALOG TRANSDUCERS.

PRELIMINARY

FOR INITAL APPLICATION
NOT TO BE USED
FOR CONSTRUCTION

ALSO REFER TO SLD
DESIGN NOTES

NO.	DATE	REVISIONS	BY	CHK'D	APP'D

PALA'AU INTERCONNECTION (250KW AND LARGER)
SINGLE LINE DIAGRAM FOR CBRE

DESIGNED	DRAWN	DATE 08-10-2021	SCALE NONE
CHECKED ELEC. MECH. STRUC.		ENGINEERING DEPARTMENT HAWAIIAN ELECTRIC CO.,INC. HONOLULU,HAWAII	
APPROVAL		DRAWING NUMBER	REV Ø

SIGNATURE
EXPIRATION DATE OF THE LICENSE
THIS WORK WAS PREPARED BY ME OR UNDER MY SUPERVISION AND CONSTRUCTION OF THIS PROJECT WILL BE UNDER MY OBSERVATION

PROJECT EXAMPLES (MOLOKA'I) - APPENDIX H UNIT COST TABLE

Examples provided for illustrative purposes only and is not binding for actual facility costs.
Estimated costs represent Company costs charged to the Proposer.

250 KW Projects interconnecting to a distribution circuit (secondary interconnection)

Example 1

250kW PV system with secondary interconnection. Line extension includes tap to existing UG fused feeder and 400ft UG to Company transformer. Proposer to install 12kV civil infrastructure. Proposer site built per Attachment 1 of this Appendix H. Proposer to provide cellular communications with another provider. Company to install communications enclosure.

Appx H Item	Description	Quantity	Unit	Unit Price ($)	Total Cost ($)
1	Company work at Proposer site	1	EA	$390,000	$468,000
4	Tap to UG FF (sec interconnection)	1	EA	$211,000	$211,000
33	12kV UG	0.06	MI	$835,000	$47,443
	12kV civil infrastructure (by Proposer)	1	LS	$0	$0
70	Comm Enclosure (< 1MW)	1	EA	$43,000	$52,000
73	Cellular line (by Proposer)	1	EA	$0	$0
			ESTIMATED TOTAL =		**$778,443**

250 KW Projects interconnecting to a distribution circuit (primary interconnection)

Example 2

250kW PV system interconnecting to an existing 12kV UG circuit. Line extension includes tap to existing UG main and 200ft UG to Company switchgear. Proposer requested additional feeder. Proposer to install 12kV civil infrastructure. Proposer site built per Attachment 2 of this Appendix H. Proposer to provide cellular communications with another provider. Company to install communications enclosure.

Appx H Item	Description	Quantity	Unit	Unit Price ($)	Total Cost ($)
10	Company work at Proposer site	1	EA	$468,000	$468,000
12	Tap to UG Main (primary interconnection)	1	EA	$158,000	$158,000
33	12kV UG	0.02	MI	$835,000	$15,814
34	12kV UG add'l feeder	0.04	MI	$502,000	$19,966
	12kV civil infrastructure (by Proposer)	1	LS	$0	$0
70	Comm Enclosure (< 1MW)	1	EA	$43,000	$52,000
73	Cellular line (by Proposer)	1	EA	$0	$0
			ESTIMATED TOTAL =		**$713,780**

Pala'au Interconnection

Example 3

2.5MW project interconnecting to Palaʻau substation at a project site 1 mile away. Project interconnects with two (2) outgoing feeders to Palaʻau, sized at 1.25MW each. Each 12kV UG feeder between the Proposer's switchgear and the riser poles is 200ft. Each feeder risers to a separate OH line extension. At Palaʻau, each OH line will transition back to UG and run 100ft to terminate to the breaker. All lines are accessible. Proposer to install 12kV civil infrastructure. Proposer site built per Attachment 3 of this Appendix H (Palaʻau Interconnection for Projects 1 MW or larger). Proposer to provide leased line telecommunications with another provider; back-up communications is required. Company to install Company-owned equipment in Proposer-provided communications cabinet at Proposer site.

Appx H Item	Description	Quantity	Unit	Unit Price ($)	Total Cost ($)
21	Company work at Proposer site	2	EA	$486,000	$972,000
22	Company work at Pala'au PP	2	EA	$600,000	$1,200,000
24	UG Termination to OH Extension	1	EA	$110,000	$110,000
30	12kV OH accessible	2	MI	$796,000	$1,592,000
33	12kV UG	0.04	MI	$835,000	$31,629
34	12kV UG add'l feeder	0.06	MI	$502,000	$28,523
37	12kV 3ph riser	3	EA	$46,000	$138,000
72	Comm Cabinet (SCADA, 2 circuits)	1	EA	$230,000	$230,000
73	Primary Leased line (by Proposer)	1	LS	$0	$0
73	Backup Leased line (by Proposer)	1	LS	$0	$0
			ESTIMATED TOTAL =		**$4,302,152**

Example 4

2.2MW project interconnecting to Palaʻau substation and located at the Company's Palaʻau site. Project interconnects with one (1) outgoing feeder to Palaʻau. The 12kV UG feeder between the Proposer's switchgear and the riser poles is 100ft. The OH line extension to the Palaʻau substation is 1000ft. At Palaʻau, the OH line will transition back to UG and run 100ft to terminate to the breaker. All lines are accessible. Proposer to install 12kV civil infrastructure. Proposer site built per Attachment 3 of this Appendix H (Palaʻau Interconnection for Projects 1 MW or larger). Proposer to provide leased line telecommunications with another provider; back-up communications is required. Company to install Company-owned equipment in Proposer-provided communications cabinet at Proposer site.

Appx H Item	Description	Quantity	Unit	Unit Price ($)	Total Cost ($)
21	Company work at Proposer site	1	EA	$486,000	$486,000
22	Company work at Pala'au PP	1	EA	$600,000	$600,000
24	UG Termination to OH Extension	1	EA	$110,000	$110,000
30	12kV OH accessible	0.19	MI	$796,000	$150,758
33	12kV UG	0.02	MI	$835,000	$15,814
37	12kV 3ph riser	1	EA	$46,000	$46,000
72	Comm Cabinet (SCADA, 2 circuits)	1	EA	$230,000	$230,000
73	Primary Leased line (by Proposer)	1	LS	$0	$0
73	Backup Leased line (by Proposer)	1	LS	$0	$0
			ESTIMATED TOTAL =		**$1,638,572**