Grid System Technologies Advanced Research Team

Enabling Efficient DER Interconnection
Through Advances in Codes, Processes, and Analytics

Pacific Power Association 32nd Annual Conference, Engineers Workshop | Palau, September 23, 2025 |

Marc Matsuura, PE

Sr. Smart Grid Program Manager
HNEI Grid***START***

Hawaiʻi Natural Energy Institute
School of Ocean & Earth Science & Technology
University of Hawaiʻi at Mānoa
1680 East-West Road, POST 109
Honolulu, Hawaii 96822

How Much DG PV can we Connect on a Feeder?

A Lot!

Circuit	Posted Hosting Capacity (kW)	Type of Violation	Posted Hosting Capacity %
196	6,520	Operational Circuit Limit	2030%
92	3,064	Operational Circuit Limit	1725%
132	2,082	Operational Circuit Limit	1587%
353	5,222	Low Voltage	1543%
173	531	Operational Circuit Limit	1526%
213	1,471	Operational Circuit Limit	1454%
11	585	Operational Circuit Limit	1420%
107	816	High Voltage	1133%
-			
-			
79	706	High Voltage	49%
359	949	High Voltage	43%
74	841	Low Voltage	38%
327	511	High Voltage	31%

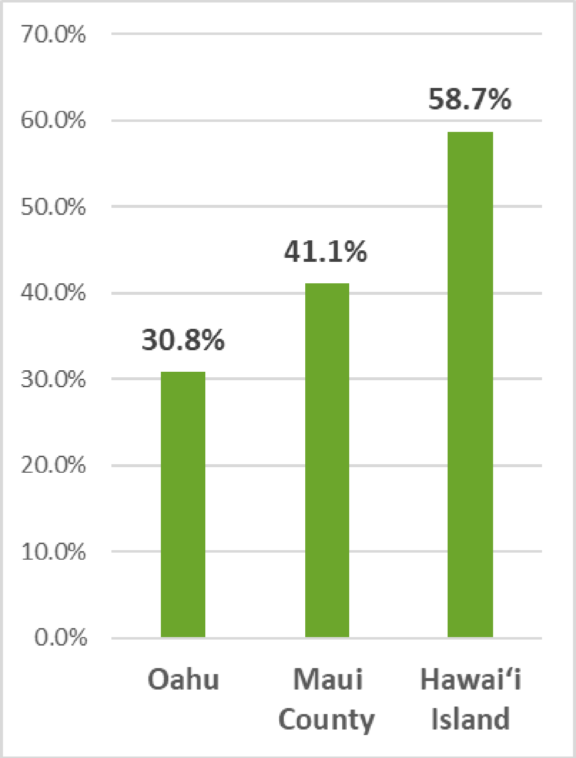
- It depends on the feeder characteristics
- Many lessons already learned – leverage it
- Grid Codes are **key**
- PV inverters have matured
- Reverse Power Flow is the new normal
- Distributed battery systems play an increasing role at high DG PV penetrations

Hawaiian Electric Renewable Energy & Distributed Solar

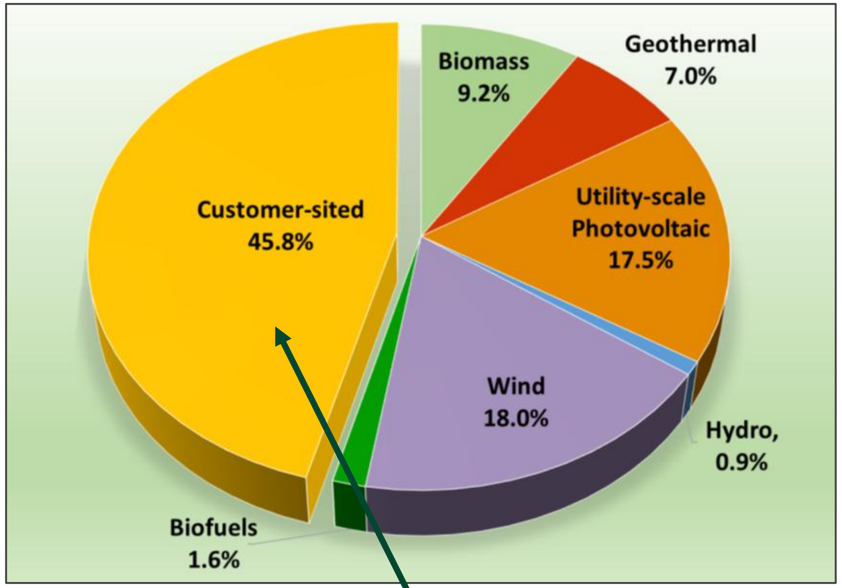
At Year End 2024

In 2024, Hawaiian Electric achieved a consolidated RPS of 35.8%

Percentage of Generation from Renewable Energy (by grid)



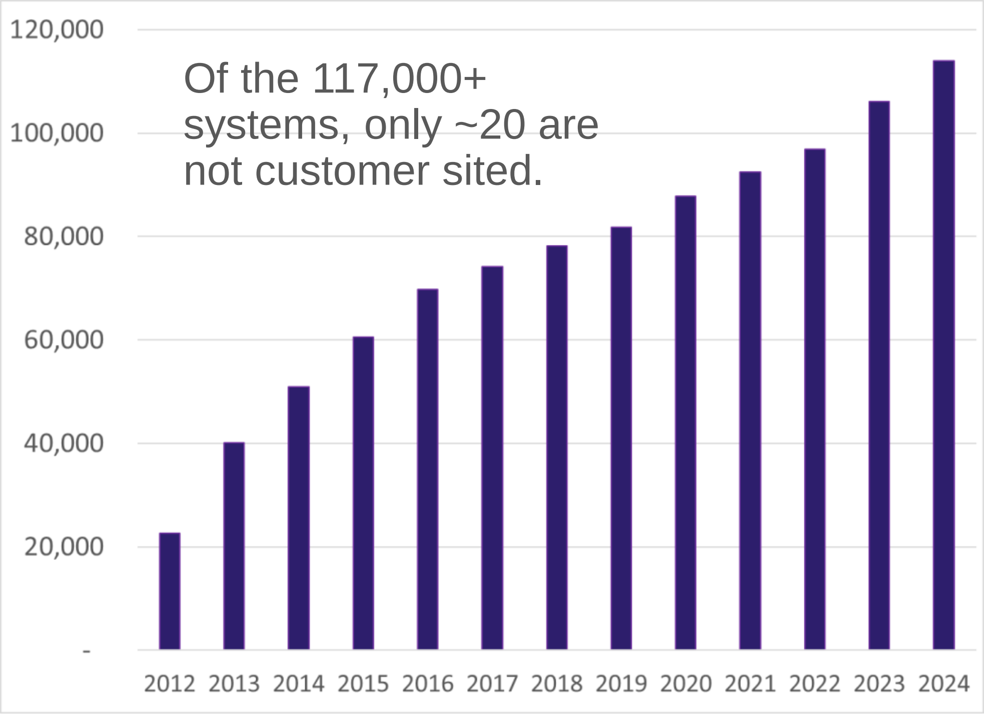
Renewable Energy Source Breakdown (all grids)



43% of single-family homes in Hawaii have rooftop solar systems

~90% of new systems include BESS

Number of PV Systems Installed (all grids)



Grid Codes & Pre-qualified Inverters

The Foundation

Hawaiian Electric
Maui Electric
Hawai'i Electric Light

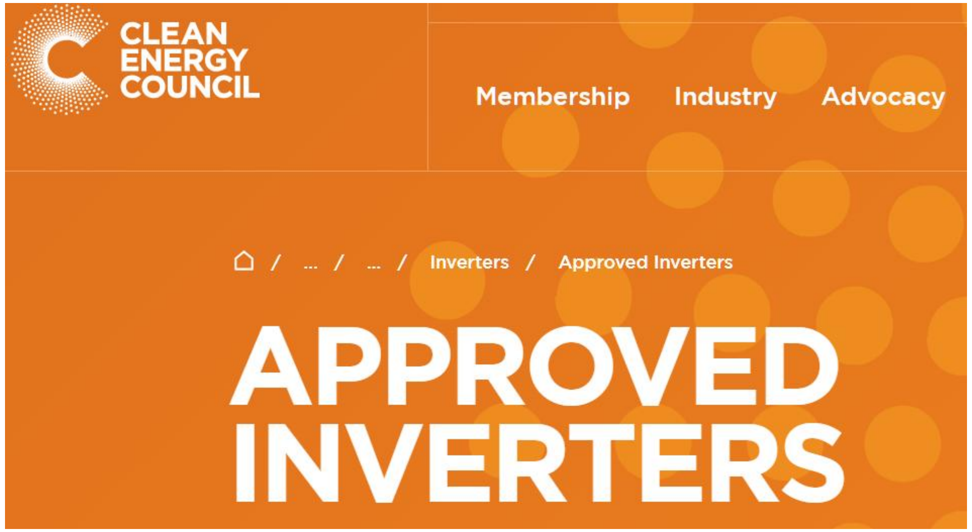
QUALIFIED GRID SUPPORT UTILITY INTERACTIVE INVERTERS AND CONTROLLERS MEETING MANDATORY FUNCTIONS SPECIFIED IN RULE 14H

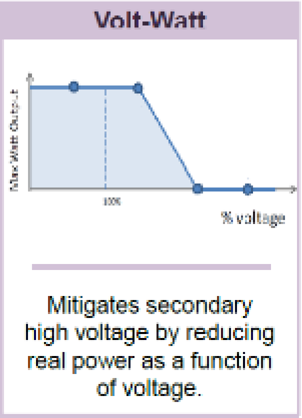
(EQUIPMENT THAT MEETS CUSTOMER GRID SUPPLY AND STANDARD INTERCONNECTION AGREEMENT (SIA))

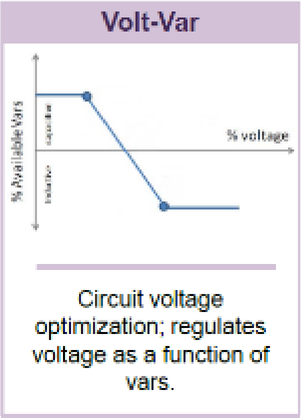
Technology Type:	Manufacturer:	HI SRD Certification	Model:
Inverter	Apparent Energy	No Information Submitted	SG424 (120V/208V/240V)
Inverter	Canadian Solar	No Information Submitted	CSI-36KTL-CT (DSP FW Ver 0.30)
Inverter	Chilicon Power LLC	No Information Submitted	CP-250-60/72-208/240-MC4-MTC (FW 232 or greater)
Inverter	Chilicon Power LLC	No Information Submitted	CP-250-60-208/240-MC4 (FW 232 or greater)

https://www.hawaiianelectric.com/Documents/clean_energy_hawaii/list_of_advanced_legacy_equipment.pdf

Proven Advanced Inverter Functions Enable Higher PV Circuit Penetration







Interconnection Standards and Regulations

- "Grid Codes" establish the rules governing the actions of all active participants in the power system
- Utilities without established Grid Codes should focus on **interconnection procedures and requirements** first.
- Utilities with established Grid Codes should review and update their requirements for inverter-based resources to the current **IEEE or AS/NZS standards**.
- The more legacy DER systems that are installed without adequate performance requirements make it more difficult to reach higher penetration levels in the future.

Hawaiian Electric

Rule 14, Section H

Interconnection Of Distributed Generating Facilities With The Company's Distribution System

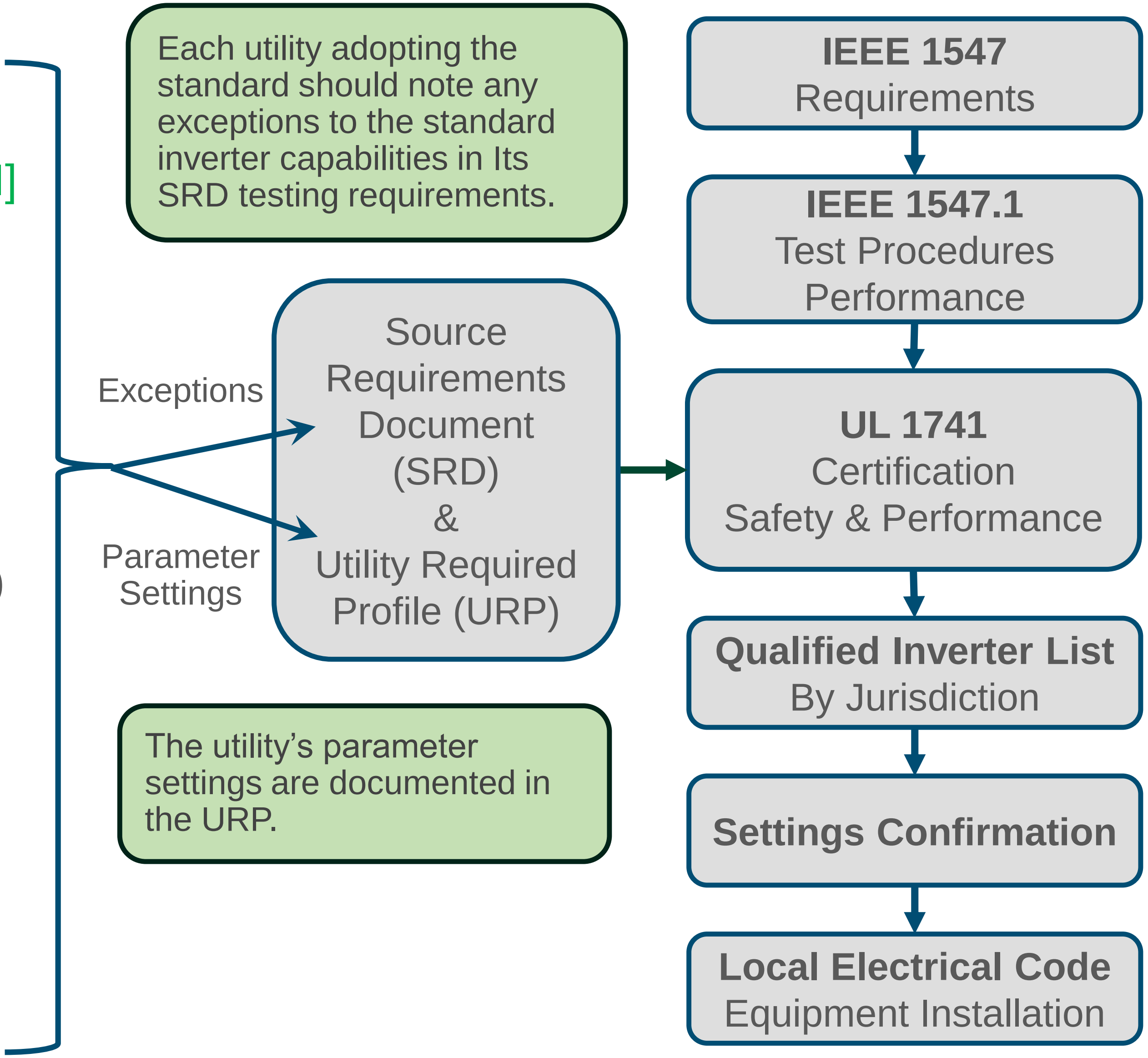
Palau Public Utilities Corporation

DER Interconnection Standards Technical Requirements

Key IEEE 1547-2018 Sections (Distributed Energy Resource (DER) Interconnections)

- Normal performance Categories (B.3.2) [Category B]
- Abnormal performance categories (B.3.3) [Category III]
- Reference point of applicability (§4.2)
- Prioritization of DER responses (§4.7)
- Entering Service (§4.10)
- Voltage-reactive power mode (§5.3.3)
- Voltage-active power mode (§5.4.2)
- Voltage and Frequency Ride-through (§6.4.2 & §6.5.2)
- Rate of Change of Frequency Ride-through (§6.5.2.5)
- Frequency-droop (§6.5.2.7)
- Voltage flicker limits (§7.2.3)
- Harmonics - Current distortion limits (§7.3)
- Limitation of Overvoltage (§7.4)
- Islanding – Unintentional (§8.1) and Intentional (§8.2)

(Key requirements for high PV penetrations on island systems)



Key AS/NZS 4777-2020 Sections (Distributed Inverter Interconnections)

- Reactive power capability (§2.6)
- Harmonic current (§2.7)
- Voltage fluctuations and flicker (§2.8)
- Transient voltage limits (§2.9)
- Measurement accuracy (§2.13)
- Prioritization of protection & operational modes (§2.14)
- Volt-watt response mode (§3.3.2.2)
- Volt-var response mode (§3.3.2.3)
- Power rate limit modes (§3.3.4.3)
- Active & passive anti-islanding (§4.3 & §4.4)
- Frequency & voltage withstand limits (§4.5.3 & §4.5.4)
- Rate of Change of Frequency (§4.5.6)
- Frequency response (§4.5.3.2 & §4.5.3.3)
- Inverter marking and documentation (§7)
- Test and reporting requirements (Appendixes)

(Key requirements for high PV penetrations on island systems)

The Clean Energy Council maintains a publicly available Approved Inverter List.

The standard provides four regional default settings. The New Zealand settings have more stringent requirements for volt-var, volt-watt and frequency withstand capabilities.

Regional Settings
Australia A
Australia B
Australia C
New Zealand
+
Utility Customizations

AS/NZS 4777.2 & IEC 92109
Requirements

Clean Energy Council
Testing and Certification AS/NZS 4777.1 & 4777.2

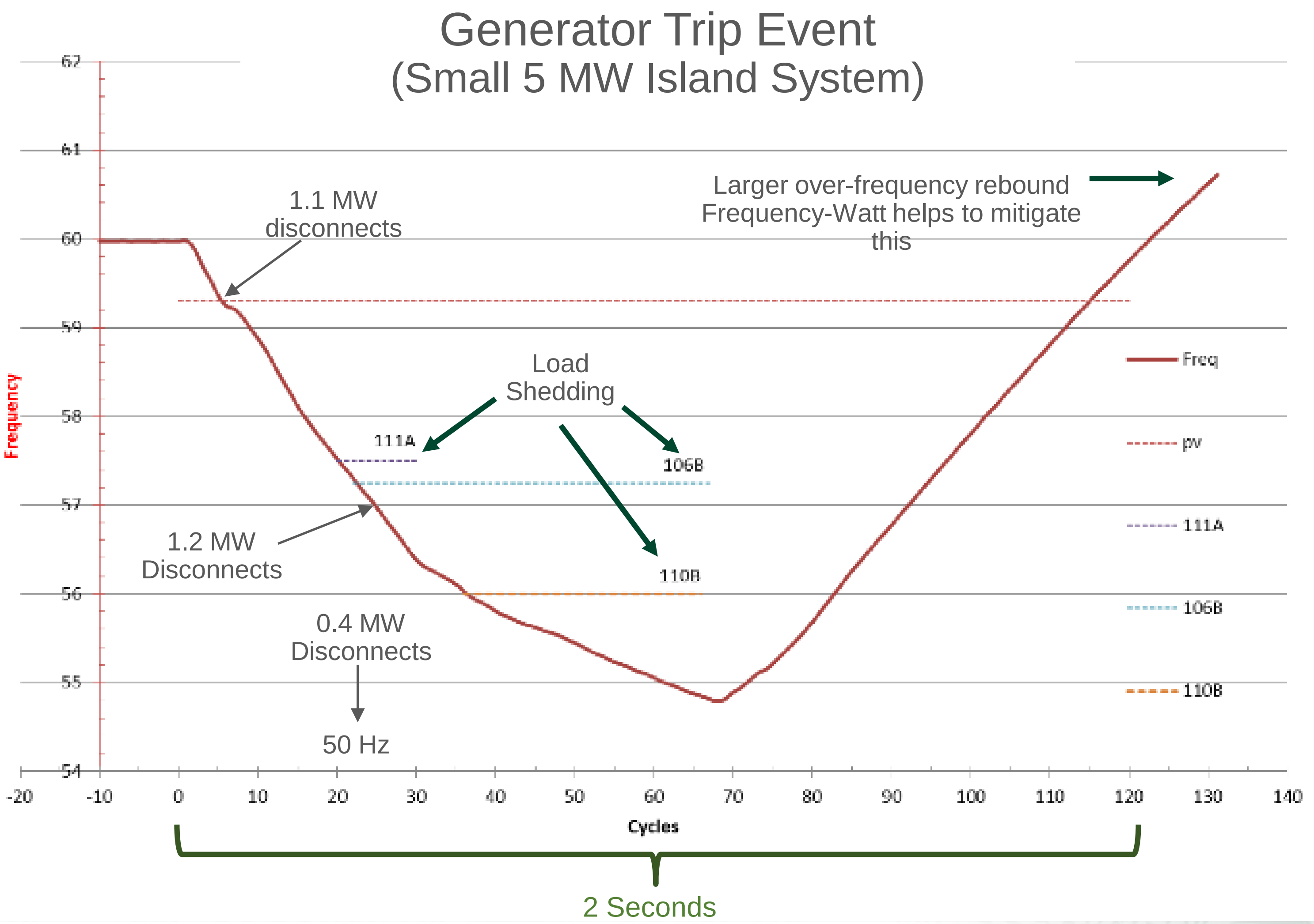
Clean Energy Council
Approved Inverters List

Utility Parameter Settings
Select Settings

Local Electrical Code
Equipment Installation

Frequency Ride-Through Requirements for Island Systems

Small Island Grid Example



Two sets of legacy PV systems with insufficient ride-through settings trip at 59.3 and 57 Hz, require more load to be shed.

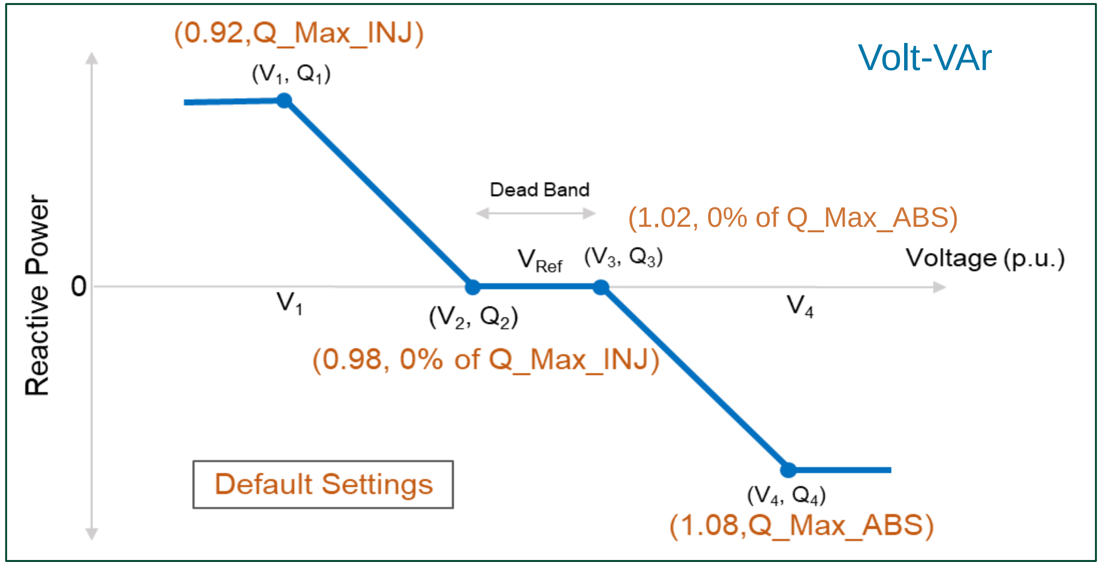
New systems are required to ride-through **down to 50 Hz and up to 63 Hz**.

IEEE 1547 Standard:
57 Hz to 62 Hz.

AS/NZS 4777 Standard
New Zealand Requirements:
45 Hz to 55 Hz

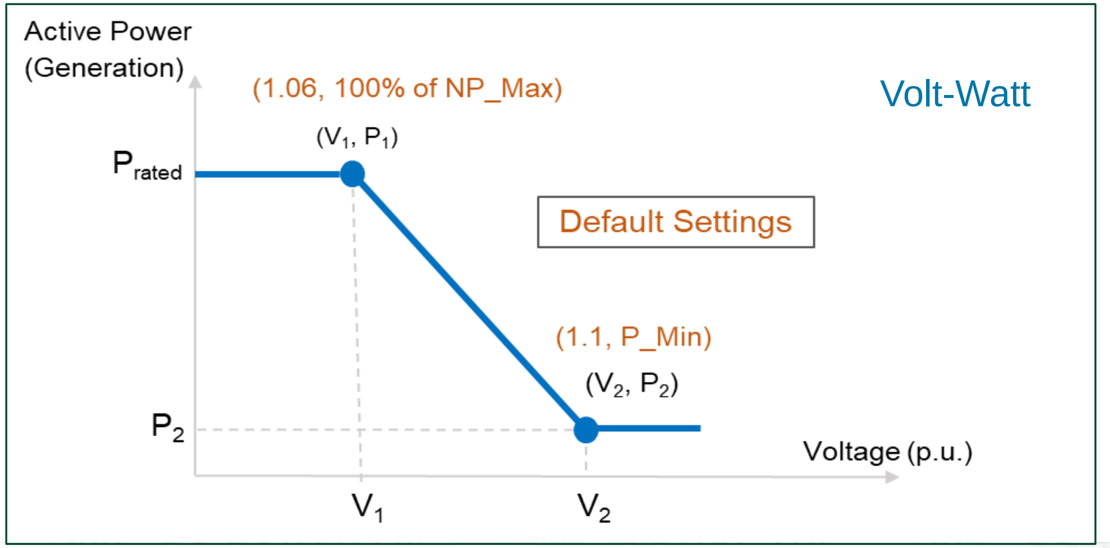
Grid Interactive Functions

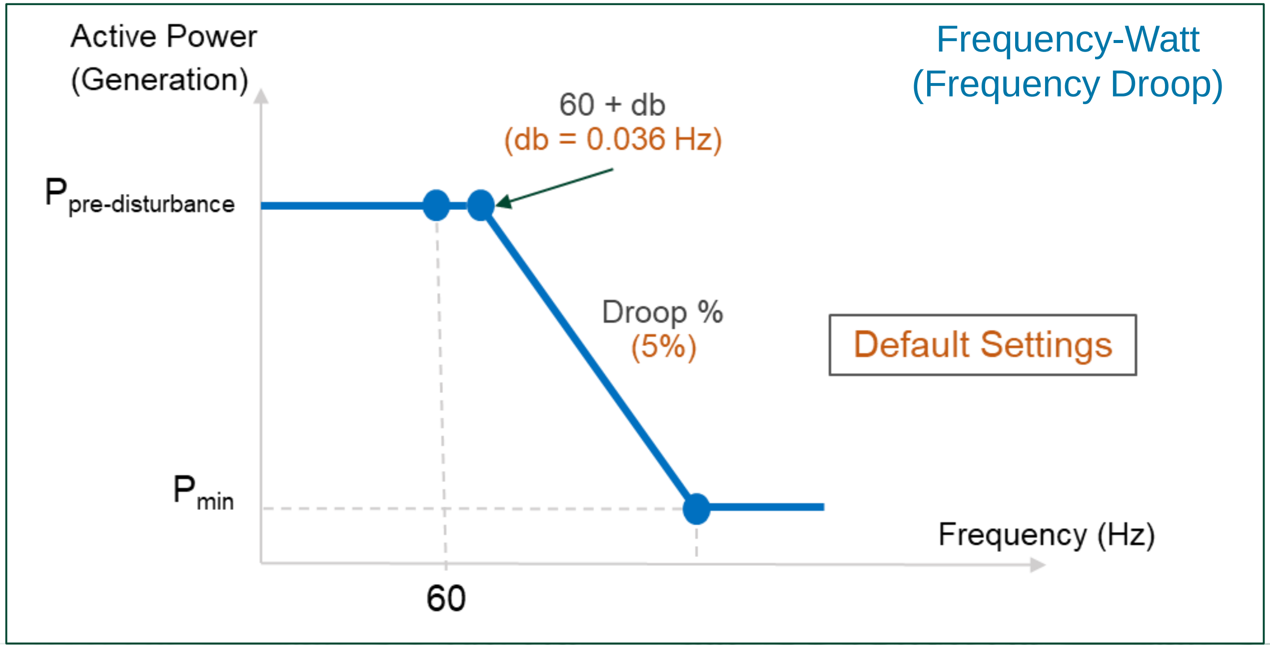
IEEE 1547 (§5.3.3, §5.4.2, §6.5.2.7) similar AS/NZS 4777.2 section (§3.3.2.2, §3.3.2.3, §4.5.3.2 & §4.5.3.3)



Grid interactive functions enable distributed resources to support the grid's needs and mitigate some of the DER's negative impacts.

This enables the grid to accommodate (host) more DER resources.



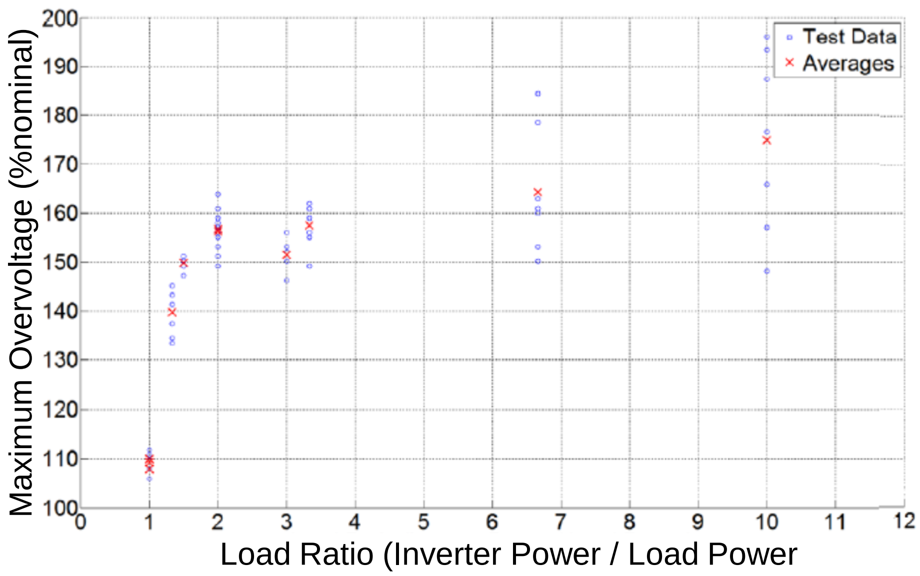


Limiting Overvoltage Contribution

IEEE 1547 (§7.4)   Similar AS/NZS 4777.2 section (§2.9)

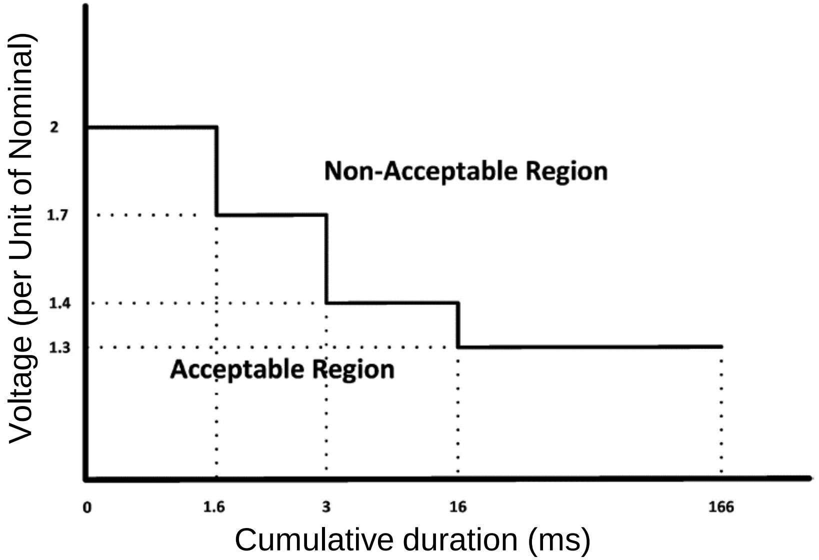
Limitation of overvoltage over one fundamental frequency period

The DER shall not cause the line-to-ground or line-line voltage on any portion of the power system to **exceed 138%** of its nominal voltage for a duration exceeding **one fundamental frequency period**.



Limitation of cumulative instantaneous overvoltage

The DER shall not cause the instantaneous voltage on any portion of the power system to exceed the magnitudes and cumulative durations shown in the figure. The **cumulative duration** shall only include the sum of durations for which the instantaneous **voltage exceeds the respective threshold over a one-minute time window**.



Entering service criteria and performance during entering service

IEEE 1547 (§4.10), Similar AS/NZS section (§3.3.4.3)

A delayed and gradual ramp-up after connection helps to keep the grid in balance following disturbances.

Especially when recovering from systemwide outages

Entering service criteria
The DER shall not energize the power system until the applicable voltage and system frequency are within specified ranges and the permit service setting is set to "Enabled"

Enter service criteria		Default settings	Allowable range
Applicable voltage within range	Minimum value	≥ 0.917 p.u.	0.88 p.u. to 0.95 p.u.
	Maximum value	≤ 1.05 p.u.	1.05 p.u. to 1.06 p.u.
Frequency within range	Minimum value	≥ 59.5 Hz	59.0 Hz to 59.9 Hz
	Maximum value	≤ 60.1 Hz	60.1 Hz to 61.0 Hz

Performance during entering service
IEEE 1547 provides two options:

1. DER returns to services after a randomized delay between 1 second and 1,000 seconds.
2. DER returns to service after a specified delay at a maximum ramp rate.

Hawaiian Electric & PPUC require DER to return to service after a delay of 300 seconds at a maximum ramp rate of 0.33% / second, i.e. over a period of 300 seconds

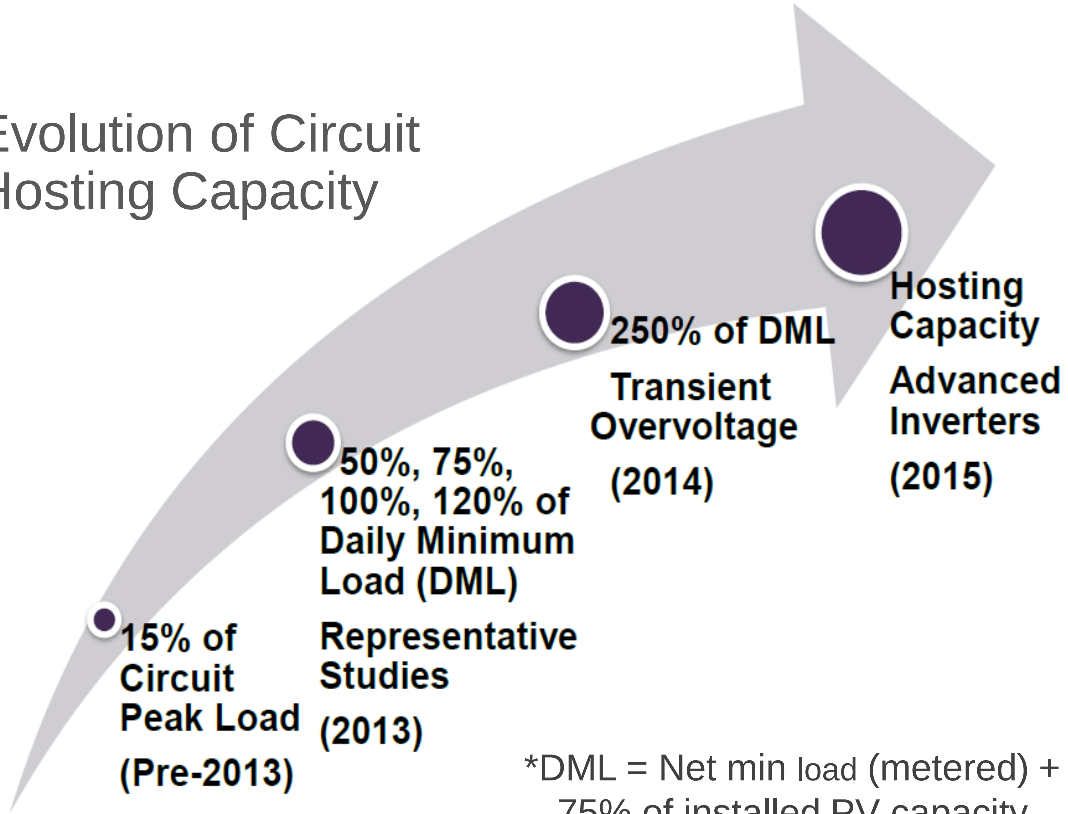
Incorporating IEEE 1547-2018 by Reference

IEEE 1547-2018 Compliant, Source Requirements Document (SRD) and Utility Required Profile (URP)

- Unless otherwise mutually agreed upon by the parties to the relevant Interconnection Application, all DER shall be certified to IEEE 1547- 2018 requirements using the Company's equipment certification process at the time of the Interconnection Application.
  - DER 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 (SRD)***.
  - In the event of conflict between these Standards and IEEE 1547-2018, these Standards 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 ***Utility Required Profile (URP) for default settings***.
    - The applicable ***URP will be assigned to the DER 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.
    - DER settings different than the URP shall be allowable with mutual agreement between the parties to the relevant interconnection agreement.

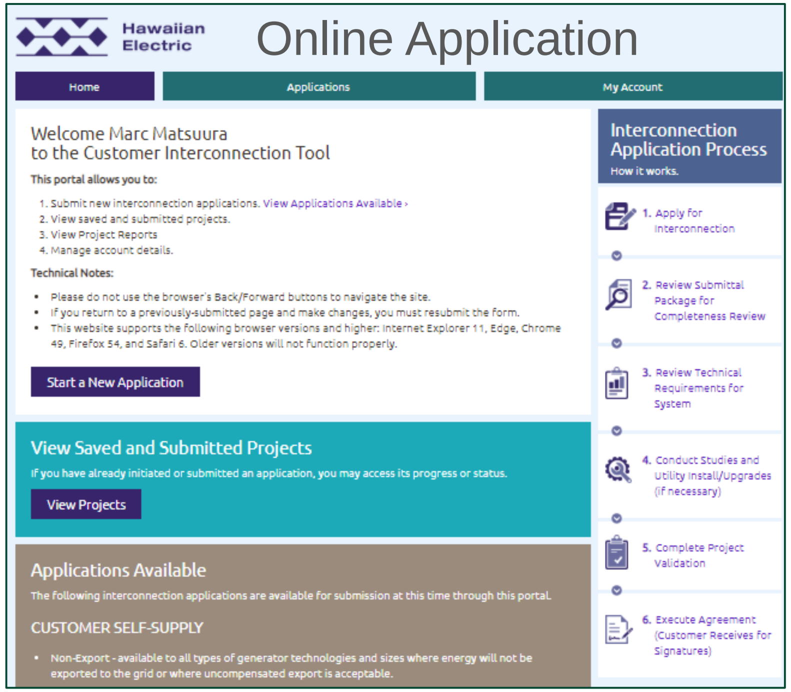
Interconnection Tools & Processes

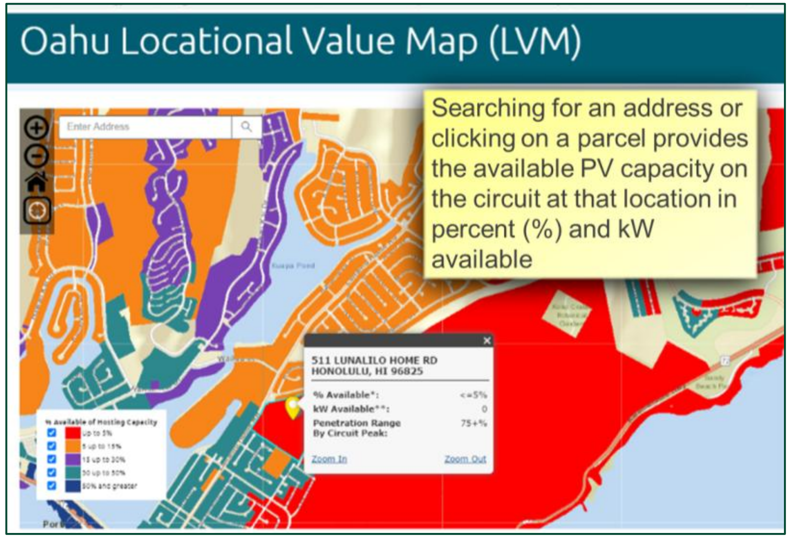
Evolution of Circuit Hosting Capacity



*DML = Net min load (metered) + 75% of installed PV capacity

Hawaiian Electric
Maui Electric
Hawai'i Electric Light





Removing Project-Specific Modeling Requirement if Below Hosting Capacity Limit

Representative Studies

Revealed that these four limiting technical issues were unlikely to cause significant negative impacts:

1. Voltage flicker
2. Life reduction or maintenance increase of substation and line devices
3. Voltage imbalance across phases, limited to less than 3%
4. Protective device operation, which includes reverse current flow on any phase, short circuit currents exceeding the interrupting ratings of devices, improper coordination of fault sensing of interrupting devices

Transient Overvoltage Testing

Revealed that these three limiting technical issues are addressed with qualified inverters and other measures:

1. Islanding is likely not an issue with IEEE 1547-2018 compliance
2. Load rejection transient overvoltage (TOV) is not an issue with IEEE 1547-2018 compliance
3. Ground fault overvoltage can be mitigated with zero-sequence overvoltage sensing, isolating line reclosers and application of grounding transformers

Advanced Inverter Voltage Regulation Capability

Revealed that the limiting technical issue of adequate voltage regulation on distribution *secondary* circuits (120/208V) is addressed by requiring volt-var control by PV inverters (advanced inverter functionality)

Remaining Circuit Hosting Capacity Issues

Based on the understanding gained from the Representative Studies, Transient Overvoltage Testing, and use of voltage regulating capability of advanced inverters, there are only two issues left to analyze in the hosting capacity studies:

1. **Thermal Over Loads**: Ensure PV production will not overload line segments in normal and N-1 configurations.

2. **Voltages**: Primary voltage constraints using planning criteria of +/- 2.5% from nominal. This assumes there will be an additional +/- 2.5% from the primary system to the customers' secondary service entrance.

Process of completing a stochastic HC analysis

HNEI methodology

Step 0 — Assign daytime minimum load and existing PV at each node (transformer or customer)

Step 0 — Assign each node a ghost PV system

Step 1 — Set all ghost PV power to zero

Step 2 — Randomly select a ghost PV

Step 2 — Randomly increase kW power of above ghost PV

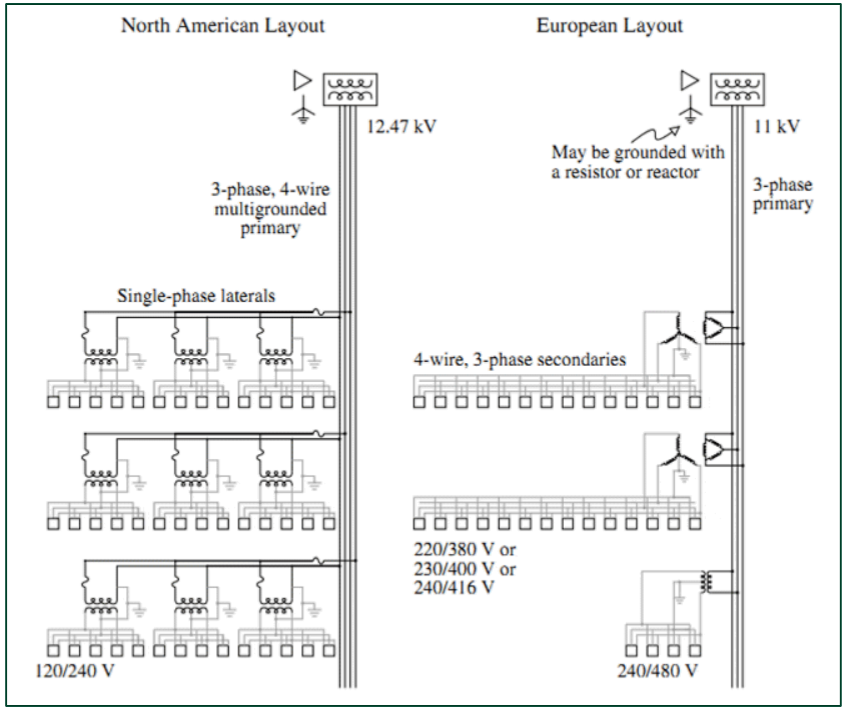
Repeat X times to adjust X ghost PVs per iteration

Step 3 — Load flow is run in PowerFactory, total PV penetration, maximum voltage, and maximum thermal loading are recorded

Repeat M times for M simulation steps

Repeat N times for N simulation resets

The goal is to analyze the every potential PV location and size, within practical limits.



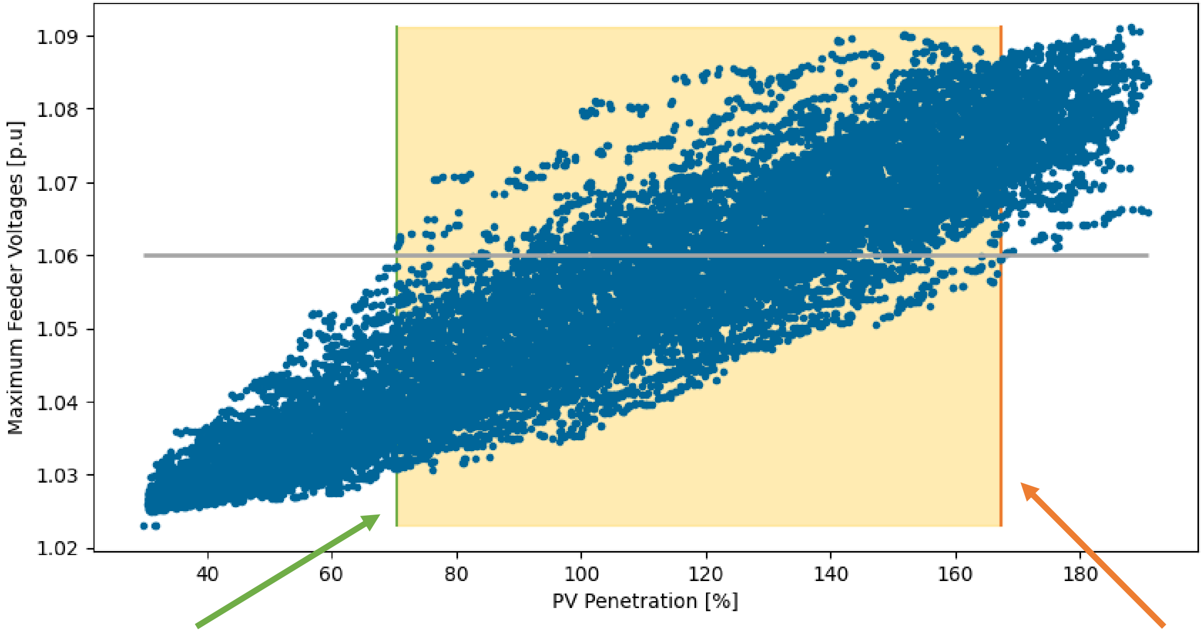
The finer details depend on the type of system being analyzed. European systems add another layer of complexity.

A hosting capacity can reduce workload of interconnection studies

Big Picture

- For a given feeder, a hosting capacity is **the level of distributed PV that can be installed without any violations**
  - Typically consider voltage and thermal violations, but other characteristics can also be considered
  - HC level is given as a percentage, PV penetration relative to feeder *minimum daytime load*
- Reduces workload by cutting the number of supplemental reviews the utility company needs to complete
  - If a proposed DPV project is below the hosting capacity limit, the project can proceed without a more detailed review

Example hosting capacity output plot for voltage



Any projects below the green line can proceed without an interconnection study

Supplemental reviews are reduced to only the yellow region

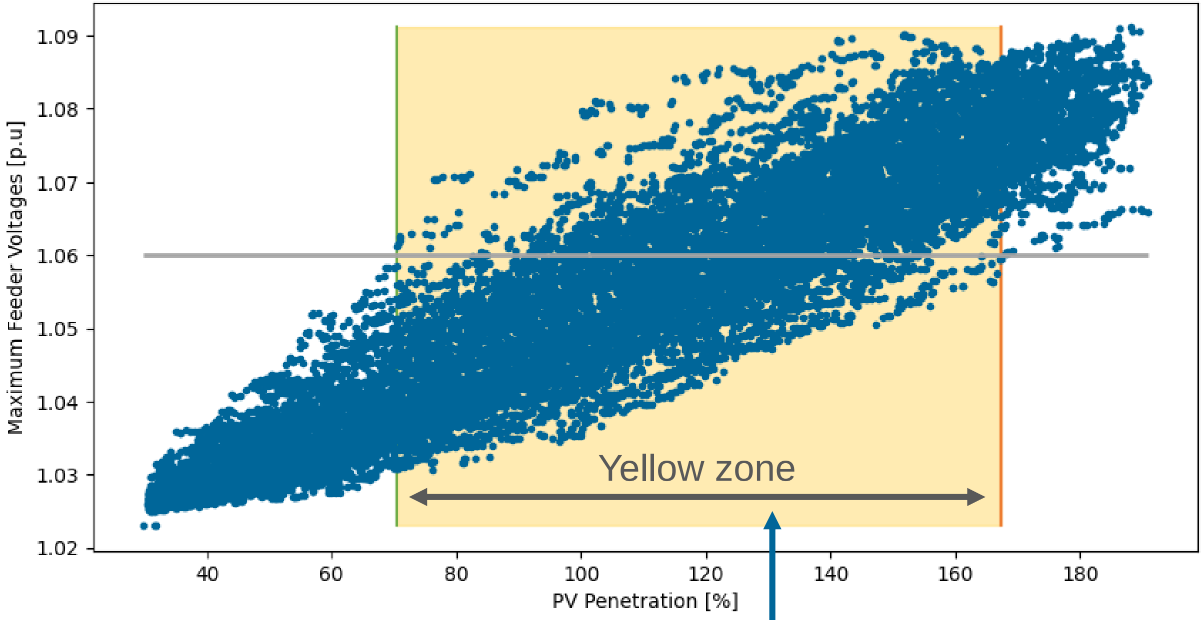
Any projects above the orange line can immediately be rejected

HC limit is determined from all the potential future configurations

"Yellow zone" requires more study

3. Yellow zone:
   - Some potential configurations of PV in this zone of PV penetration cause violations; some do not cause violations
   - Based on the stochastic hosting capacity analysis, we can not readily determine if a project in this zone will cause violations on the feeder
   - Further analysis (e.g., supplemental review or interconnection study) is needed; application could either be accepted or rejected
     - Even though an interconnection study might be needed for applications in this region, you are still drastically cutting down your workload
     - **HNEI is working on new methods to quickly determine application feasibility within yellow zone**

Example hosting capacity output plot for voltage

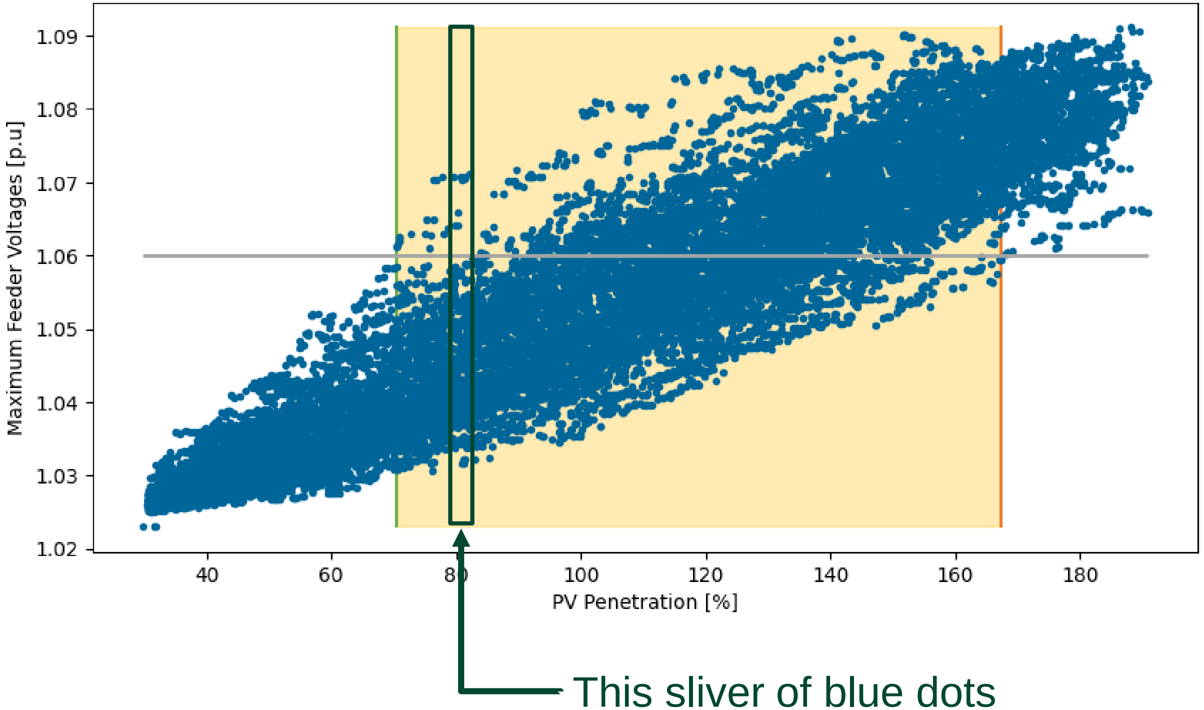


Some blue dots in the yellow zone are *above* the max voltage limit, some blue dots are *below* the max voltage limit

How HNEI plans to narrow in on yellow zone

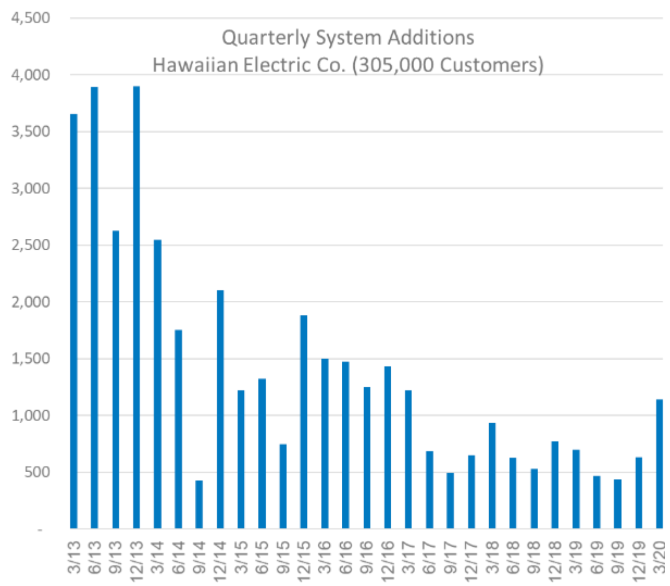
Overview

- When an application is submitted, it raises the PV penetration on the feeder to a certain %
  - Using 80% as an example, you can then pull out similar cases from your HC analysis that have already been run
- The application can then be compared to similar configurations of PV that have already been analyzed via a load flow
- If all of the “close” PV configurations are clear of violations, then the application can be accepted without further study
- Using the analysis results to Identify locations on the feeder that have a limited PV hosting capacity can also help to streamline the review process.



This sliver of blue dots represent the potential configurations of 80% PV penetration

Steps in the Interconnection Process



If required, IRS completed within **150 calendar days**

I'd like to avoid this ….

Ms. Customer

Step 1

Upon request, Company provides Interconnection Application, technical standards, and an appropriate interconnection agreement to the Customer.

Provide information within **5 business days** of request

Step 2

Customer submits a completed Interconnection Application (Exhibit A) along with supporting materials.

Completeness Review within **15 business days** of application

Step 3

Company conducts technical review, which may include Initial Technical Review, Supplemental Review, and Interconnection Requirement Study.

Initial Technical Review within **15 business days** after Step 2; Supplemental Review within **20 business days** after its start

Step 4

Customer works with Company to finalize single-line diagram, relay list, trip scheme and settings, and three-line diagram (if needed) so that the Customer can complete Facility Equipment List, which will become Exhibit B to the interconnection agreement.

Days to complete depends on PV system installer experience; can be very fast

Step 5

Company identifies any interconnection facilities that will be needed that will be owned by the Company and lists and describes those on the Company Interconnection Facility List, which will become Exhibit C to the interconnection agreement; Customer also completes Exhibit D (Customer Insurance Coverage).

Interconnection Facilities defined within **15 business days** after Step 4.

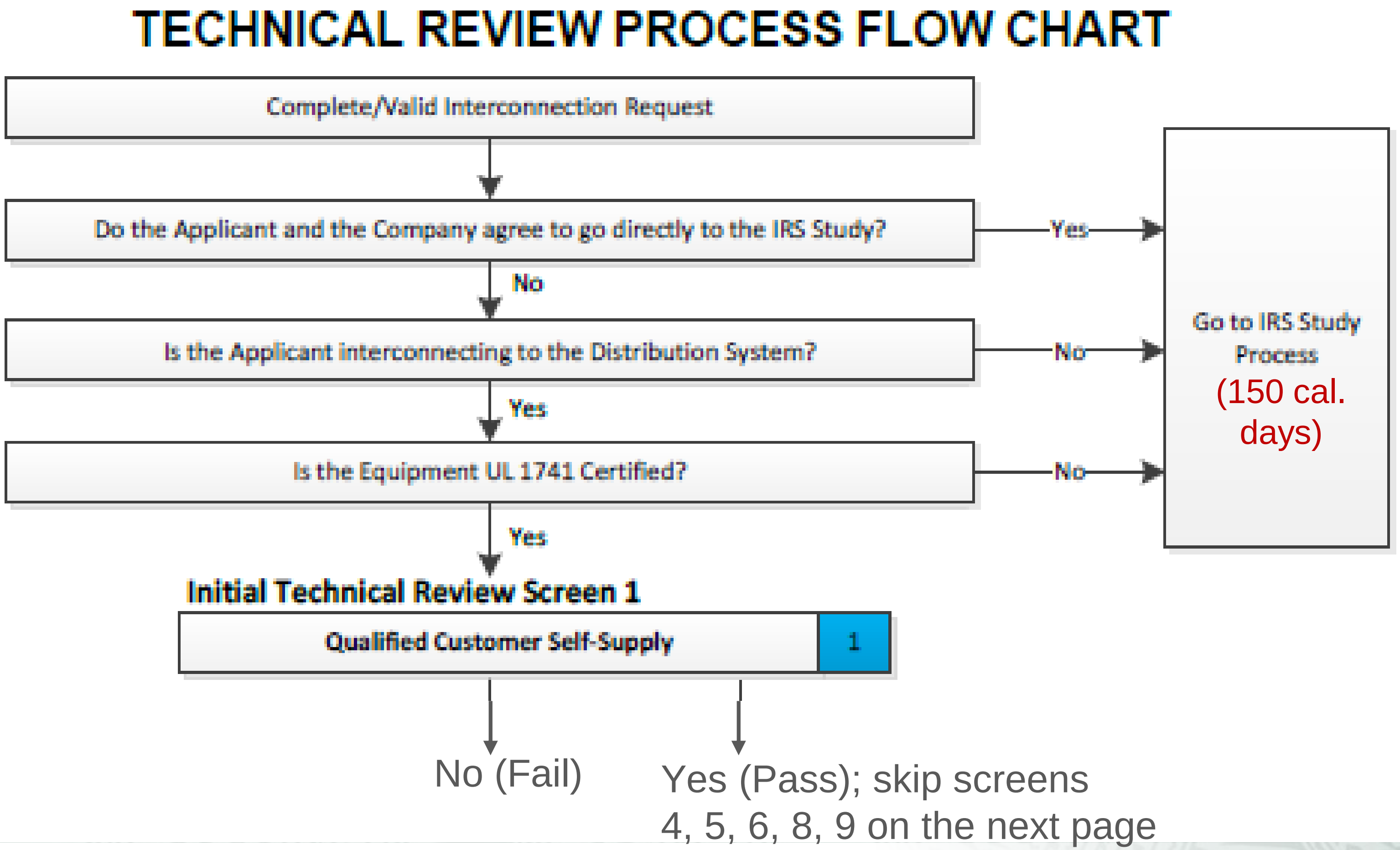
Step 6

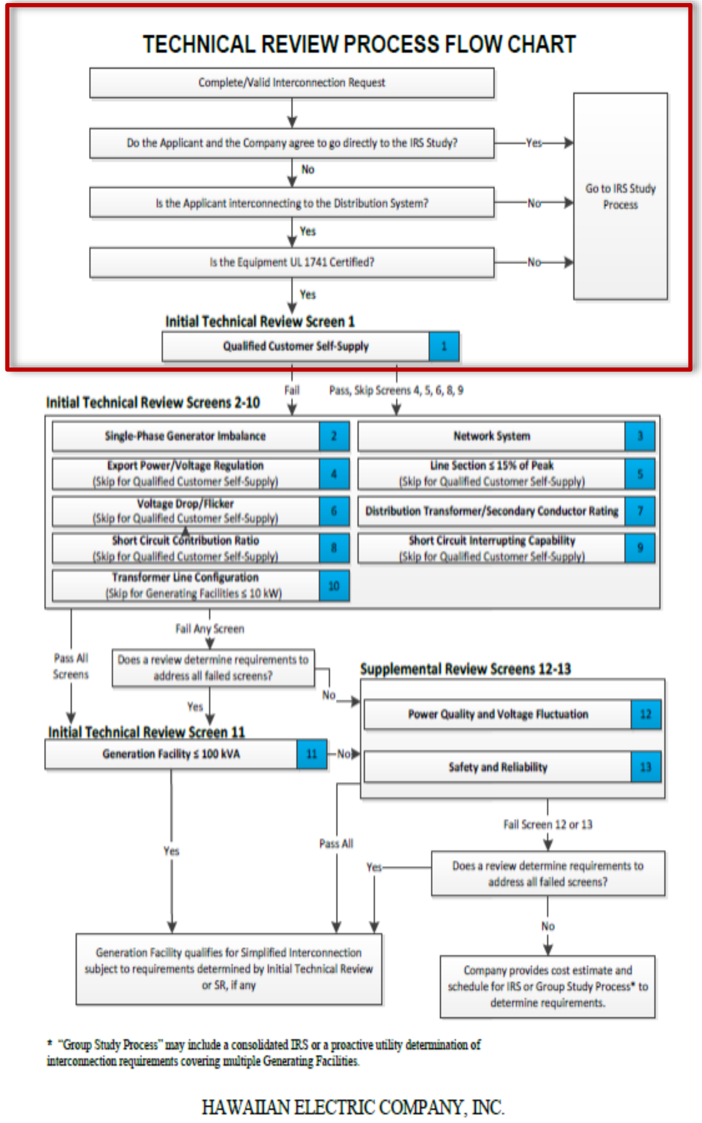
Customer and Company execute an interconnection agreement.

Interconnection Agreement signed within **5 business days** after Step 5.

Application and Technical Screen Process Flow

Once all the application information has been submitted, the information is used to complete the technical review process below. Inverters are confirmed to be on the approved inverter list and appropriate for the power system they are connecting to before proceeding.





Hosting Capacity Analysis Expedites Technical Screening of PV systems

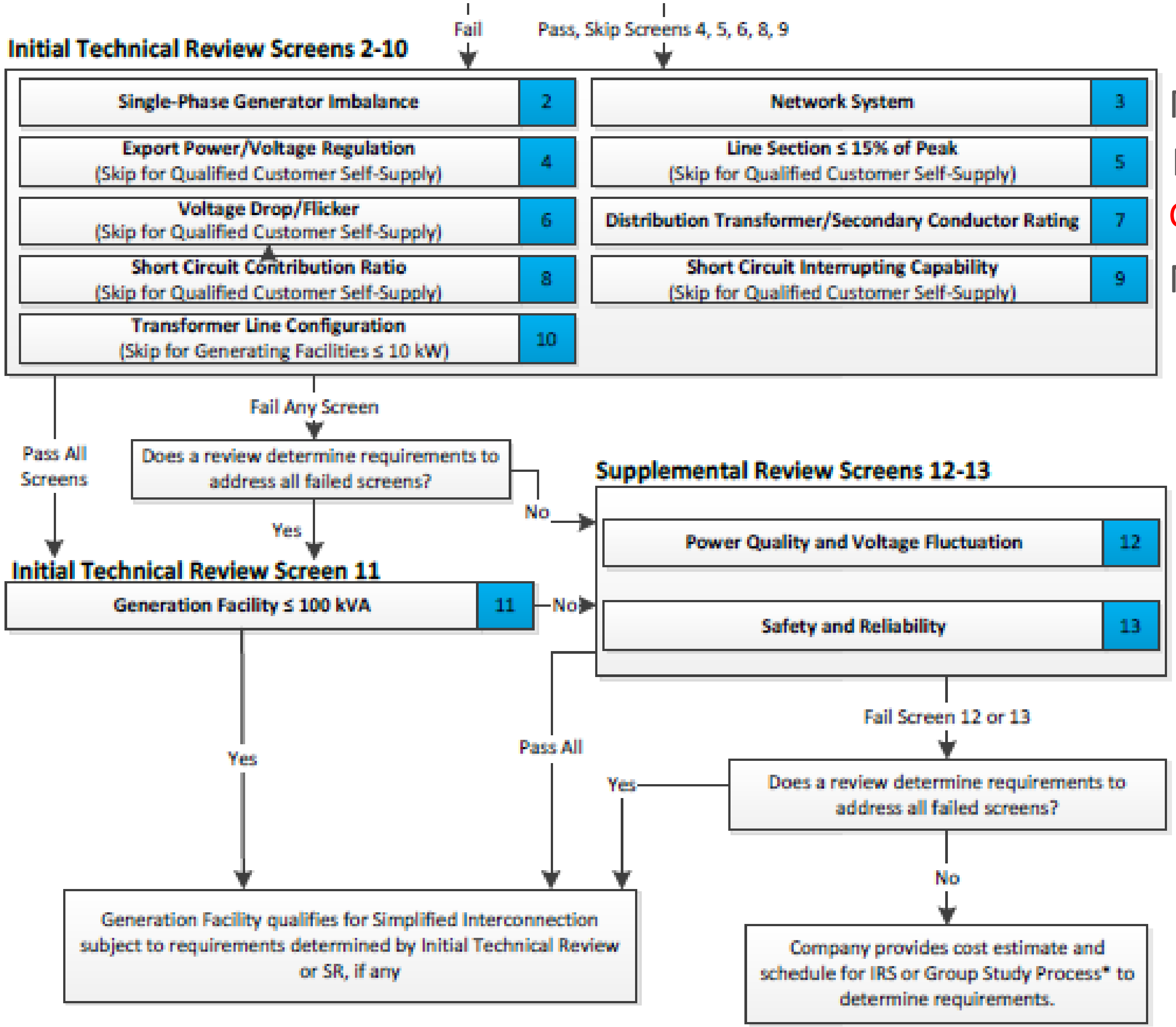
Phase to Neutral Connections

Hosting capacity results

Not an issue for rooftop PV

Not an issue with PV

For large 3-phase PV systems



Mitigation Identified

Not an issue for PV

Check Service Trans Size vs PV Cap.

Not an issue for PV

Distributed PV Programs in Hawaii through 2023

DPV programs need to evolve as the utility's system and markets change

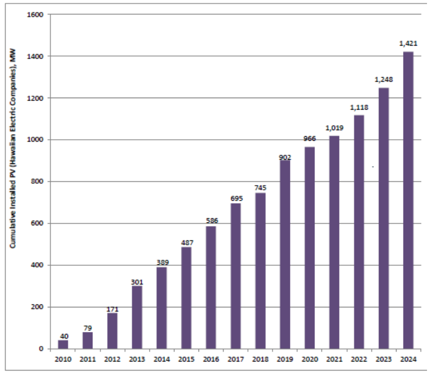
- **Retail Rate Net Energy Metering (NEM)** was created in 2001 and closed to new applicants in 2015.
- **Customer Grid-Supply (CGS)** participants receive a PUC-approved credit (less than full retail rate) for electricity sent to the grid and are billed at the retail rate for electricity they use from the grid. Program is fully subscribed today; the program only remained open until the installed capacity was reached in 2017.
- **Customer Grid-Supply Plus (CGS Plus)** systems must include grid support technology to manage grid reliability and allow the utility to remotely monitor system performance, technical compliance and, if necessary, control the system for grid stability. Closed to new applicants in 2024.
- **Smart Export (SE)** customers with a renewable system and battery energy storage system have the option to export energy to the grid from 4 p.m. – 9 a.m. Systems must include grid support technology to manage grid reliability and system performance. Closed to new applicants in 2024.
- **Customer Self-Supply (CSS)** is intended only for private rooftop solar installations that are designed to not export any electricity to the grid. Utility verifies non-export controls enabled for the system.
- **Standard Interconnection Agreement (SIA)** is designed for larger customers who wish to offset their electricity bill with on-site generation. Customers are not compensated for any export of energy. Closed to new applicants in 2024

Evolution of Customer-Sited RE Export Programs Today

(Oahu rates)

2001 | 2015 | 2017 | 2024 | 2031

Full Retail NEM (~40¢)



Customer Grid Supply (CGS) (15¢) ← 7 years →

CGS+ (10¢) ← 7 years →

Smart Export (15¢, 4pm-9am) ← 7 years →

Smart DER Export*
9pm - 9am (18.9¢)
9am - 5pm (13.5¢)
5pm - 9pm (32.9¢)

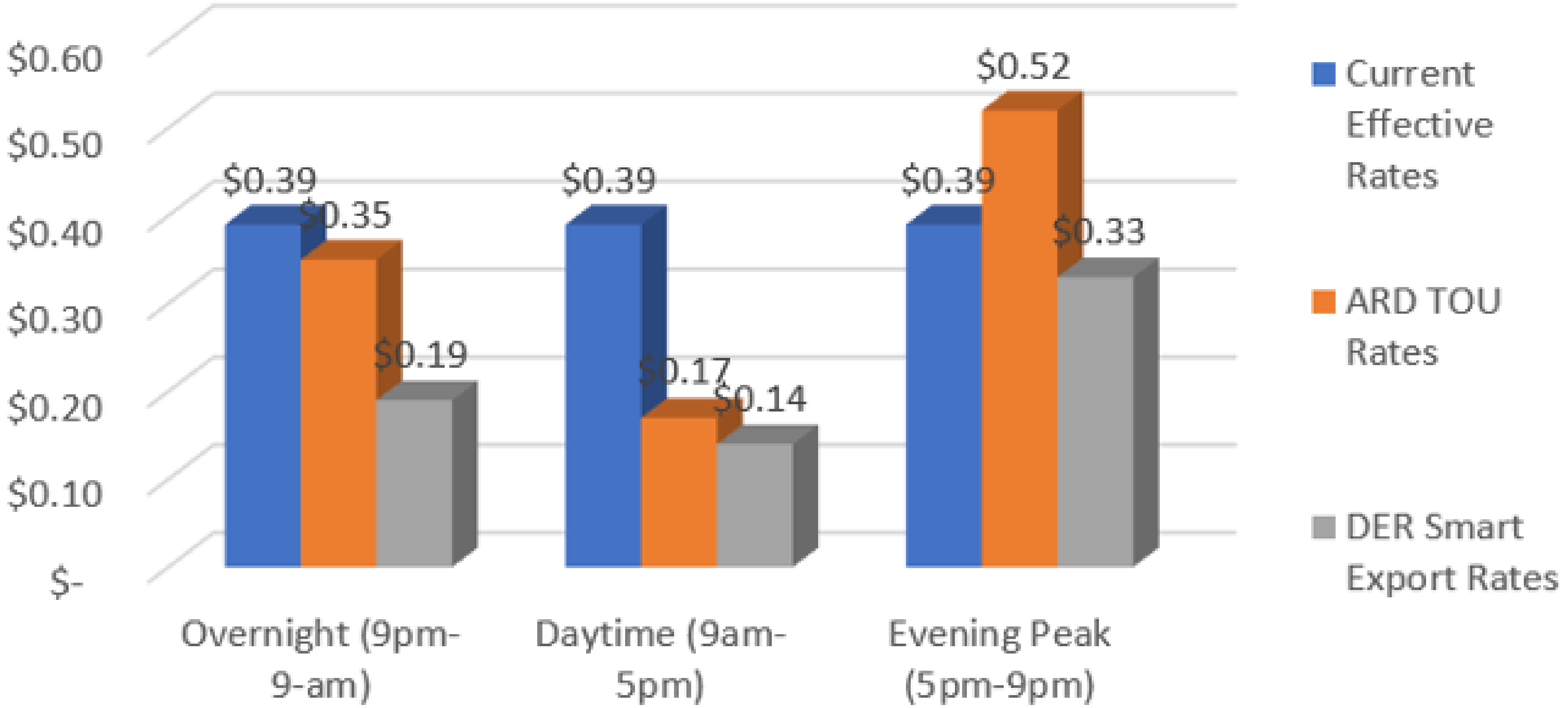
*Requires enrollment in new Advanced Rate Design (ARD) Time-of-Use (TOU) rates. Non-exporting interim tariff customers (e.g., CSS, SIA) may, but are not required to, transition to the Smart DER Tariff.

"While other states are in the process of determining appropriate NEM successor tariffs, [Hawaii is] establishing a 'second round' of successor tariffs to replace the initial NEM successor tariffs. Hawaiian Electric has the opportunity to utilize the high penetration of DERs on its grid to provide energy and grid services to an extent shared by few other utilities."

Docket No. 2019-0323, Decision and Order No. 40418 (**Haw. P.U.C., Dec. 4, 2023**).

HECO Advanced Rate Design (ARD) Time-of-Use (TOU) and Smart DER Tariff Export Rates

(Oahu, Q4 2023)



Residential Current Effective Rates and ARD TOU Rates as of November 2023.

Mahalo!

(Thank you)

For more information, contact:

Leon R. Roose, **Esq.**
Principal & Chief Technologist
HNEI Grid***START***

Grid*START*
Hawai'i Natural Energy Institute | University of Hawai'i
Grid System Technologies Advanced Research Team

Office: (808) 956-2331
Mobile: (808) 554-9891
E-mail: lroose@hawaii.edu
Website: www.hnei.hawaii.edu

Hawai‘i Natural Energy Institute
School of Ocean & Earth Science & Technology
University of Hawai‘i at Mānoa
1680 East-West Road, POST 109
Honolulu, Hawaii 96822

Leon R Roose

Chief Technologist

Mr. Roose is a tenured faculty member of the Hawaiʻi Natural Energy Institute (HNEI), University of Hawaiʻi at Mānoa, where he formed and has led for over a decade HNEI's Grid***START*** (Grid System Technologies Advanced Research Team), a team of professionals focused on energy transition enabling policy and regulation, advanced grid architectures, grid modernization technologies, and novel methods to achieve reliable grid integration of RE resources, power system optimization and energy resilience goals.

He served in numerous leadership roles at the Hawaiian Electric Company for 19 years prior including management of renewable energy planning and integration, generation resource planning and competitive procurement, negotiation and administration of all power purchase agreements for the utility, transmission and distribution system planning, smart grid planning and projects, system relaying and protection, and fuel purchase and supply to all utility generating plants. He is a licensed attorney, formerly in private law practice in Hawaiʻi and served as Associate General Counsel at Hawaiian Electric. He holds a B.S. in Electrical Engineering and a J.D. from the University of Hawaiʻi at Mānoa.

Marc M. Matsuura

Sr. Smart Grid Program Manager

Mr. Matsuura joined HNEI, at the University of Hawaiʻi at Mānoa in 2013 as its Senior Smart Grid Program Manager. He is a founding member of HNEI's Grid***START***.

Prior to joining HNEI, he worked with the Hawaiian Electric Company for 21 years. His career at Hawaiian Electric included leadership positions in transmission and distribution (T&D) engineering, T&D standards and technical services, system operation, transmission planning, smart grid planning, and system integration. Marc is a licensed professional electrical engineer in Hawaiʻi. He holds a B.S. in Electrical Engineering and an M.B.A. from the University of Hawaiʻi at Mānoa.

Contact Information:
marc.matsuura@hawaii.edu
+1 (808) 321-8928

Damon L. Schmidt

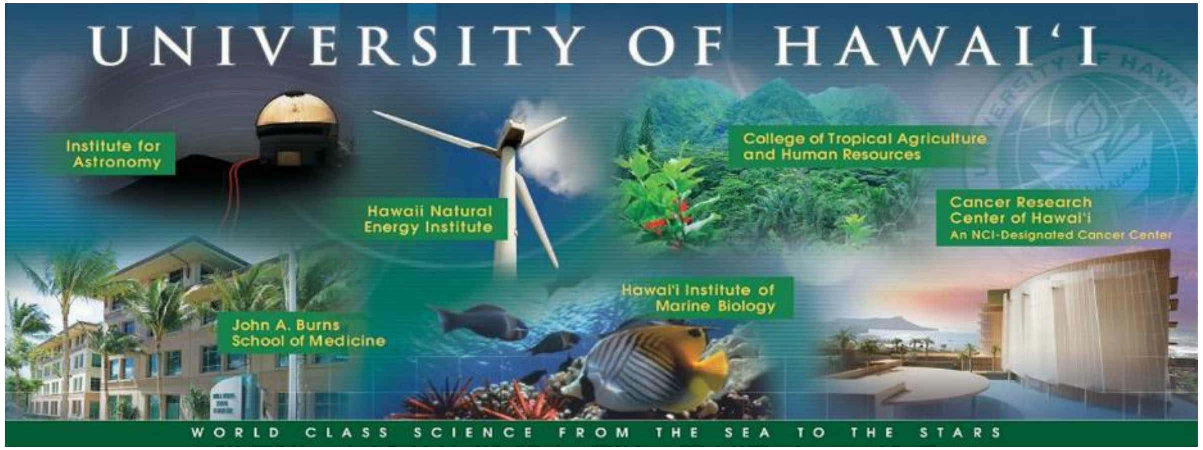
Sr. Energy Regulatory/Policy Analyst

Mr. Schmidt is a Senior Energy Regulatory/Policy Analyst with Grid***START***. He has over 15 years of experience in the energy sector. Prior to joining HNEI, he served as the Director/Manager of Hawaiian Electric Company's Regulatory Non-Rate Proceedings group. He also worked in outside regulatory counsel and financial consulting roles for Hawaiian Electric, both as a solo practitioner, and with the law firm of Goodsill Anderson Quinn & Stifel. Mr. Schmidt delivered key regulatory and financial guidance to shape Hawaiian Electric's positions in numerous proceedings before utility regulators.

Mr. Schmidt is a licensed attorney in the State of Hawaiʻi. He holds a B.S. in Finance from the University of Hawaiʻi, an M.B.A. with an international business focus from Pepperdine University in California, and a J.D. from the University of Hawaiʻi William S. Richardson School of Law.

University of Hawaiʻi

- Founded in 1907, the ***University of Hawaiʻi System*** includes 3 universities and 7 community colleges with approximately 50,000 students.
- ***University of Hawaiʻi at Mānoa*** is the flagship campus (the largest and oldest) of the system.
  - 14,576 undergraduate student enrollment
  - 4,680 graduate student enrollment
- ***School of Ocean and Earth Science and Technology (SOEST)*** is the largest research unit on the Mānoa campus.
  - Bring in more than $100 million extramural funding per year



UNIVERSITY of HAWAIʻI® SYSTEM

UNIVERSITY of HAWAIʻI® MĀNOA

SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY
UNIVERSITY OF HAWAIʻI AT MĀNOA

Hawai’i Natural Energy Institute (HNEI)

SOEST, University of Hawai’i at Mānoa

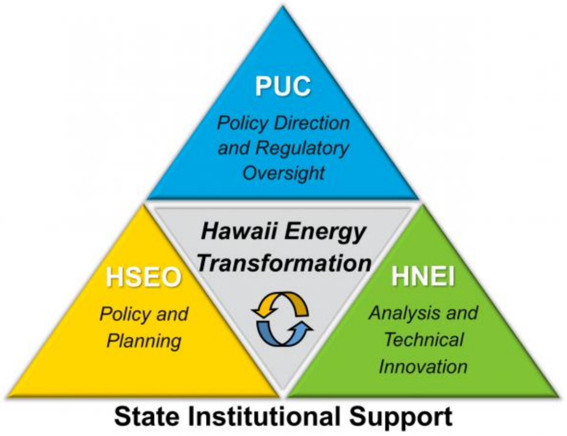
- Organized Research Unit in School of Ocean and Earth Science and Technology (SOEST), University of Hawai‘i.
- Founded in 1974, established in Hawai‘i statute in 2007 (HRS 304A-1891).
- Conduct RDT&E to accelerate and facilitate the use of resilient alternative energy technologies and reduce Hawai‘i’s dependence on fossil fuels.

Areas of Focus

- **Grid Integration (Grid*START*)**
- Energy Policy and Analysis
- Electrochemical Power Systems
- Alternative Fuels
- Advanced Materials
- Ocean Energy

Core Functions

- State Energy Policy Support
- Testing and Evaluation
- Education and Capacity Building
- Research and Development
- Modeling and Validation



Grid System Technologies Advanced Research Team (GridSTART)

HNEI, SOEST, University of Hawai'i at Mānoa

Grid*START* delivers comprehensive power system solutions through a unique blend of technical expertise and industry insights.

Diverse staff of engineers, lawyers, MBAs, postdoctoral fellows, students, and visiting scholars.

We excel in:

- **Clean Energy Transition**: Integrating renewable energy (RE), developing smart grid technologies, and modernizing power systems to accelerate the low-carbon energy/transportation transition.
- **Scalability**: Addressing challenges across diverse project scales, from grid-edge solutions to grid-wide modeling and analytics.
- **Applied Research**: Bridging the gap between research and real-world applications to solve pressing power grid issues.
- **Regional and Global Impact**: Providing specialized technical support, energy policy and regulatory guidance and energy sector advisory services and training with a focus on the Asia-Pacific region.

Lead for many public-private demonstration projects.

Established to develop and test advanced grid architectures, new technologies and methods for effective integration of renewable energy resources, power system optimization and resilience, and enabling policies and regulations.

Expertise & Focus:

- Energy Policy and Regulation
- Clean Energy Transition Technology Solutions
- Power Systems Planning
- Power Systems Operation
- RE Resource Procurement
- Energy Sector Capacity Building
- Project Management and Execution

Grid*START* Core Team Members, Sponsors, and Partners

Core Team Members

Leon Roose *	Specialist & Chief Technologist
Marc Matsuura *	Senior Smart Grid Program Manager
Damon Schmidt *	Senior Energy Regulatory/Policy Analyst
Quynh Tran	Power System Engineer II
Sawyer Poel	Power System Engineer
Saeed Sepasi	Assistant Researcher – Power systems
Sarah Demsky	Junior Researcher
Brian Griswold	Junior Power System Engineer
Ai Oyama	Research Technical Writer/Translation Specialist
Harun Or Rashid Howlader	Postdoctoral Researcher
Md Musabbir Hossain	Postdoctoral Researcher
Nattapat Praisuwanna	Postdoctoral Researcher
Spencer Kerkau	Graduate Research Assistant
Adewale Adegboyega	Graduate Research Assistant
Jamilyn Mooteb	Graduate Research Assistant
Zhuocheng “Joe” Gan	Graduate Research Assistant
Samantha Nakahira	Undergraduate Research Assistant
Jordan Fujita	Undergraduate Research Assistant

* Prior electric utility company senior management

Sampling of Sponsors & Partners

Team members combine for 75+ years of utility and regulatory experience