Hawaiian Electric Companies' Aggregator Handbook

Revised: March 18, 2021

This handbook describes processes required to implement and maintain data exchange and control functionality between the Supplier (aka Aggregator) and the Companies. Aggregators must comply with the data exchange, control functionality, and testing requirements specified in this handbook.

This handbook may be updated from time to time as a result of operational changes. The aggregators defined Project Manager (as specified in section 3.13 or 19.3 of the GSPA) will be provided with notice that the handbook has been updated. The updated handbook and a redline version of the handbook will be provided to the aggregator.

Data Integration

Participant data will be provided to the Companies using a combination of comma-separated value (CSV) and extensible markup language (XML) files delivered to a secure file transfer protocol (SFTP) site.

The Enroller Id and Aggregator Id are used interchangeably and will be provided by the Company. If Aggregator has more than one contract with the Company, they will be required to include an additional field in each enrollment file to specify which contract the customer is being enrolled under.

All data required for enrollment may be found on a customer's bill as shown in Attachment E. Note, the Contract Account number is typically referred to as the customer's account number while the Utility Contract number is typically referred to as their contract number.

The Company will not share any customer data with Aggregators except in those instances when it may be required to troubleshoot enrollment errors.

Data File Transfers

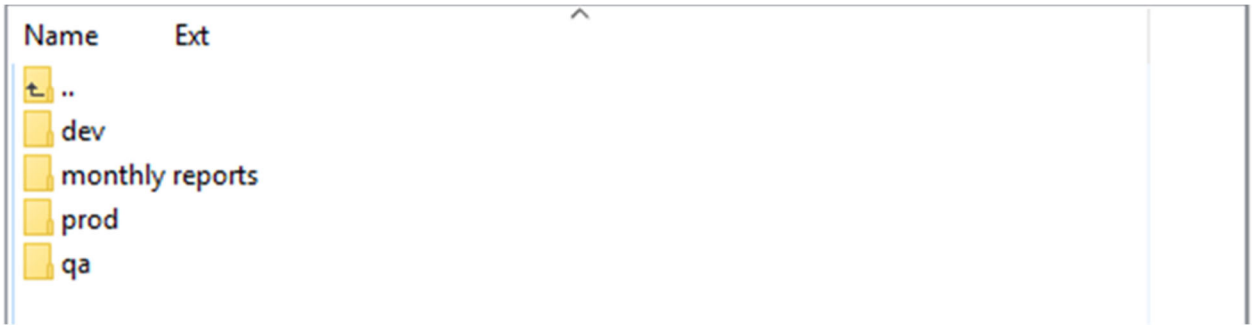
Company will provide SFTP file locations and credentials to Aggregator. The Company will maintain SFTP folders.

SFTP Structure

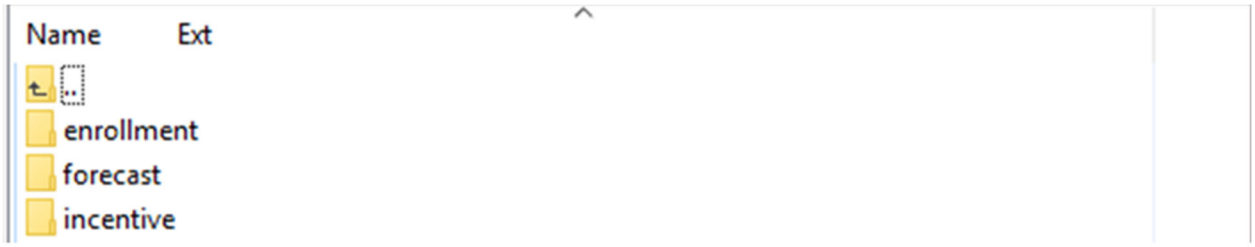
The SFTP location is unique to each Aggregator and as such will be provided in advance of integration testing. The top SFTP directory will include access to each of the Company's environments. Initial testing will be performed in Quality Assurance system ("QA") or Development DERMS ("DEV"). The prod directory will be used for production.

Monthly Reports or Reports folder is a repository for various reports or data that must be exchanged between the Company and Aggregator. Under the Reports folder are four additional folders:

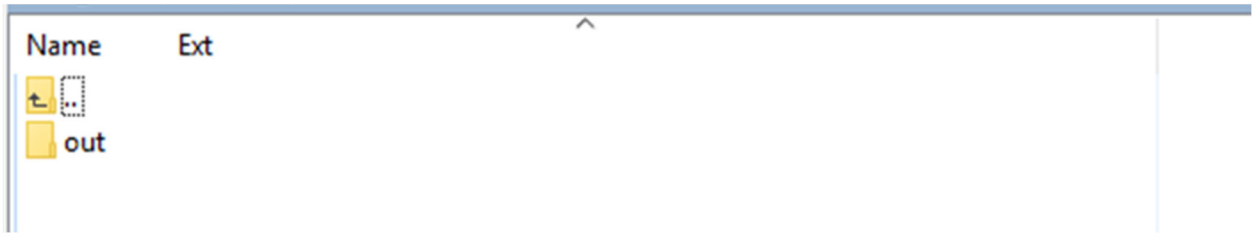
Settlement: All data supporting monthly invoicing should be placed here.
Meter Data: Repository for any ad hoc requests for data
Enrollment Errors: The Company will provide any data related to enrollment errors in this folder
Move Outs: The Company will provide regular updates indicating which customers have moved out, that the Aggregator must subsequently unenroll from their programs.



Each environment has the following subdirectories for enrollment transactions, Operational Forecast and Incentive files:



Each subdirectory contains an "out" file where the data files will be deposited:



Participant Enablement Status

This section describes processes required to implement and maintain data exchange and control functionality between the Aggregator and the Companies.

Aggregator will provide the Participant Enablement File in XML format. The data contained in the Participant Enablement File describes Participants that have been enabled and enrolled, i.e.

are ready to be included in the dispatch or scheduling of Aggregator's Capability.[1] A file will be provided via SFTP to the Company daily, except weekends and holidays, and will reflect enrollment changes since the previous file was provided, i.e. incremental changes. The file will also include any Participant removal (un-enrollment) from participation and during the allowed period, changes to Enabled Capability, Minimum Incentive (as impacted by Enabled Capability), and Incentive Adder (Additional Incentive).

File naming convention for enrollment data is as follows: {EnrollerId}_HECO_{Date:yyyy-MM-dd_HH-mm-ss}_enrollment.xml, for example, 100001_HECO_2018-07-13_16-59-03_enrollment.xml. HH represents hour in military time (0-23). In the future, if an aggregator has Participants that are customers of Maui Electric or Hawaii Electric Light, MECO or HELC respectively, a separate file would be submitted where MECO or HELC replaces HECO.

Participant Enablement Status files will be updated to the Company weekdays by 8pm HST.

The file details, including the XML Schema Definition (XSD) are specified in Attachment A. Grid Service Program Names are specified in Attachment B.

Enrollment Transactions

There are four basic types of transactions:

1. Participant Enrollment: Customer enrolls in DR
2. Participant Un-enrollment: Customer unenrolls from DR
3. Participant Changes: Modifications to a customer's enrollment, i.e. incentives or capability
4. Participant Moves: Special case for customer move outs and move ins

Special Cases

For customers with a "master meter", enrollment transactions should only be submitted for the account associated with the Company meter. If it is a multi-tenant facility, but the tenants do not have a Company meter, then the tenants would not be included in enrollment transactions.

Participant Enrollment

Each Participant must be enrolled via the Participant Enablement File. Each program or Grid Service that Participant is enabled to participate in requires its own separate enrollment. Each meter or meters that will be impacted by participation must be enrolled in a separate enrollment with enabled capability and incentives assigned appropriately.

A typical enrollment transaction would be a customer with one meter. For this typical scenario, all start dates will be the same, i.e. on the day that the customer is enrolled, the device (if applicable) is also enrolled, incentives are started, and the resource capability is available. However, it is not unusual for a customer to have two meters or require a second device to be enrolled in DR. For example, if a Participant has two meters at a single location and both meters

[1] An enrollment (or un-enrollment) is an "EnrollmentDetailsType" as specified in Attachment A.

will be impacted (i.e. participating in events for Grid Services) and the Participant will be participating in two Grid Services, four (4) separate enrollments will be required. See Table 1 for a conceptual representation of required enrollments.

Table 1: Conceptual enrollment for single participant with two meters, enrolled in two Grid Services

Enrollment 1	Participant 1	Meter 1	Grid Service 1
Enrollment 2	Participant 1	Meter 2	Grid Service 1
Enrollment 3	Participant 1	Meter 1	Grid Service 2
Enrollment 4	Participant 1	Meter 2	Grid Service 2

The total minimum and adder incentive for the Participant should be split appropriately between the meter enrollments for each Grid Service. All dates must be specified in "yyyy-MM-dd" format. If the Enrollment End Date is populated, when that date is reached, the Participant will be considered to no longer be participating and incentives will no longer be paid.

Participant Minimum Incentive, additional incentive, and enrollment start date must be the same for a new enrollment. Participant enrollment end date is not required for enrollment.

Participant Un-enrollment

If a Participant will no longer be participating an un-enrollment must be submitted via the Participant Enablement File. Enrollment End Date must be populated; this is the Participant's un-enrollment date. All dates must be specified in "yyyy-MM-dd" format.

Incentive payment will automatically be prorated from the un-enrollment date. If a Participant changes address (Participant Move), but wishes to continue participating, an un-enrollment and new enrollment (with Participant's new address) must be submitted.

All unenrollments must be submitted prior to the last day of the Settlement Month to ensure agreement between the Company's DERMS and Aggregator's MIRs.

Monthly (or more frequently) the Company will provide the Aggregator with a list of customers that have moved out. Each of these customers should be unenrolled from the program associated with their vacated address.

Participant Changes - Updates to Participant Information

The following information may only be updated within 36 hours of initial enrollment:

- Enrollment Start Date
- Enrollment End Date
- Incentive Name
- Incentive Value
- Incentive Start Date
- Resource Capability

- Resource Capability Effective Start Date

If changes are made outside of the 36-hour window, it will be flagged as an error. As background, the short window is specified to attempt to guarantee that any changes to customer information that will impact their bill credit will be performed within the customer's billing cycle. If changes are received outside of the customer's billing cycle, a manual reconciliation must be performed and approved. This is a safeguard to ensure validity of customer billing.

Outside of the 36-hour window, the following Participant information may be updated at any time prior to the 25th of each month:

- Incentive update: Incentive Name, Incentive Value, Incentive Start Date
- Enrolled kW: Resource Capability, Resource Capability Effective Start Date. Enrolled kW updates must be aligned to the start of month.
- W4 Email
- Customer Name

Any change to Participant Information must use original meter and program combination Enrollment Start Date. Note that any updates to Participant Enrolled kW that cumulatively results in a change to Aggregator's Capability will be processed as applicable during the monthly settlement process.

An exception to this rule is for multi-family units with a single meter. In this case, the account for the single meter is the enrolled participant and subsequent enrollments or unenrollments for this type of premise will be permitted. For this type of premise, the following enrollment transactions would be performed:

- Initial enrollment with the sum of the enabled capability and incentive that correctly reflects the capability of the enabled participants.
- Future enrollments require a change to the total aggregated enabled capability and incentives (with accompanying Date updates) to reflect the increased kW, however the enrollment start date shall remain the same.
- Subsequent unenrollments shall result in a reduction to the total aggregated enabled capability and incentive by the amount of kW unenrolled. The enrollment end date shall not be populated until the last resident is unenrolled and the single meter is unenrolled.

Participant Moves

A Participant move is treated like a un-enrollment. When a participant moves out of their premise, they should notify their Aggregator, who would then execute a Participant un-enrollment transaction. There must be a 24 hour period between a Participant move out un-enrollment and a new Participant move in enrollment to allow for assignment of a new Participant's Contract Account to the premise in the Companies' customer information system.

To ensure move outs are expeditiously processed as unenrollment transactions, on a weekly basis, the Company will provide to Aggregators a list of customers that have moved out during the previous week. Aggregators should then unenroll each moved out customer as quickly as possible to ensure that their enrollments reflect actual customer occupancy.

Enrollment Transaction Assumptions

Enrollment and Un-enrollment transactions must adhere to the following assumptions:

1. All un-enrollment transactions precede enrollment transactions in the Participant Enablement File. Enrollment and un-enrollment entries are in chronological order.
2. The original Participant Enrollment Start Date is the same for each successive enrollment transactions effecting any paired meter and program enrollment.
3. For any resource participating in the delivery of Grid Services, the load and/or generation's corresponding meter is enrolled in a Grid Service program.
4. Transactions are submitted on the date that they occur or on the next business day; this is the only future dating of transactions that is permitted. Billing cycles differ for all customers, if a transaction, e.g. enrollment, unenrollment or incentive change transaction is posted after a customer is billed, then correcting the bill becomes unnecessarily complicated and confusing to the customer.
5. There must be a 24 hour period between a Participant move out un-enrollment and a new Participant move in enrollment.
6. If ending an additional incentive for a Participant, a new $0 incentive with new start date is required. A minimum incentive for a Participant should never be discontinued unless Participant is un-enrolling.
7. The Participant Enrollment Start Date is the date that the Participant can take part in Grid Service events.
8. An unenrollment date is required only when a Participant unenrolls.
9. A Participant that will be opted out for lengthy period should be unenrolled to stop incentive payments.

Error Handling

The Company will contact the Aggregator regarding any failed enrollments within 48 hours of submission. The following items will result in an error and failed enrollment:

- Incorrect meter id and Contract Account pairing will result in a failed enrollment
- Incorrect meter id
- Enrollment with another aggregator – Participant must not be enrolled with another aggregator when enrollment is received.
    - The customer's electric bill will show a demand response bill credit if they are currently enrolled in a DR program.
- Submitted file name or contents are not in the required format.

Aggregated Operational Forecast

After the receipt and processing of the Participant Enablement File, Company expects the Resource Capability to be included in Aggregator's Operational Forecast; likewise, if a Participant is un-enrolled, the Resource Capability should no longer be included in Aggregator's Operational Forecast.

Aggregator will submit an Operational Forecast file in CSV format as specified. The Operational Forecast represents Aggregator's Total Capability by Grid Service for the given period. If the Aggregator's resources are offline or dispatched to support another Grid Service, the Operational Forecast for the Grid Service(s) dispatched and any Grid Services impacted by the dispatch shall be updated to reflect the reduction in available resources within 10 minutes. If during an active or scheduled event, the event is extended, any impacted Operational Forecasts must be updated.

An Operational Forecast must be submitted in a separate file for kW and kWh for each Grid Service that Aggregator is contracted to provide. The Operational Forecast shall be submitted in accordance with the following attributes:

Attributes	FFR	Capacity Build	Capacity Reduction
Forecast Capability	kW/kWh	kW/kWh	kW/kWh
Forecast Term	Min 4 days	Min 4 days	Min 4 days
Data Resolution (Interval)	15 Minute	15 Minute	15 Minute
Update Timing	Hourly	1am/1pm	1am/1pm
Update Frequency	Hourly	12 hours	12 hours

Aggregator's Operational Forecast will be provided to the Companies using a comma-separated value (CSV) file delivered to a secure file transfer protocol (FTP) site. File naming convention for the Operational Forecast is as follows: {EnrollerId}_{HawaiianElectricCompanyCode}_{VEN_ID}_{Date:yyyy-MM-dd_HH-mm-ss}_forecast.csv, for example, 100001_HECO_VENID_2018-07-13_16-59-03_forecast.csv. HH represents hour in military time (0-23). In the future, if an aggregator has Participants that are customers of Maui Electric or Hawaii Electric Light, MECO or HELC respectively, a separate file would be submitted where MECO or HELC replaces HECO.

Table 2 shows the fields included in the file to be submitted by the Aggregator with the Aggregated Operational Forecast. There should be one row for each Forecast Interval End Time entry, e.g. 384 entries for 15 minute interval data for four (4) days. A separate file must be submitted for each VEN representing a Grid Service, further kW and kWh must be in separate files, i.e. there cannot be two VENs in one Operational Forecast file. The values/columns shall be in the order specified in Table 2.

Table 2: Operational Forecast Format

Field Name	Format	Values/Comments
VEN ID	String	ID of the Aggregator's VEN for this Grid Service Program. Assigned by the VTN to the VEN at the time of provisioning.
Enroller Id	Char 16	ID for the Aggregator who is providing the forecast. ID will be provided by the Companies.

Company Name	String	HECO, MECO, or HELCO
Grid Service Program Name	String	Grid Service program name as provided by the Companies in Attachment B. Aggregator will have 1 VEN per Grid Service.
Forecast Unit of Measure	String	Identifier of the type of forecast value being provided. Two (2) possible values: • Aggregate Operational Forecast KWH 15 Minute • Aggregate Operational Forecast KW 15 Minute
Forecast Interval End Time	Date/Time	End of interval timestamp for the forecast value. MM/DD/YYYY HH:MM where HH is a 24 hour (0-23) format.
Forecast Value	Real	Aggregator's operational forecast capability (shed) aggregated for all their enrolled customers in this Grid Service. This will be reported as a positive number and accurate to three decimal points.

Forecast Assumptions

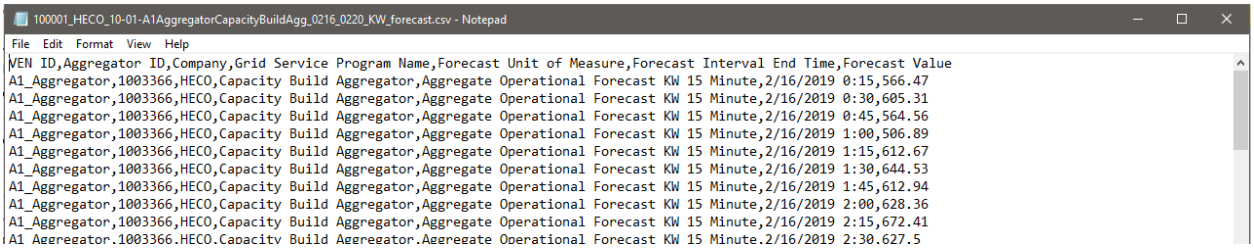
Operational Forecast must adhere to the following assumptions:

1. Forecast interval end times are aligned to the interval length and hour. For example, 1:15, not 1:17 for a 15 minute interval forecast.
2. Forecast intervals will be interval ending, e.g. at 00:15 would represent the forecast for the 00:00-00:15 period.
3. Grid Service forecast updates required as the result of event dispatch should update available capability of dispatched resources after the event, not during or prior.
4. If event dispatch impacts available capability of other Grid Services, i.e. for dual enrolled resources, forecast updates to that availability capability should update available capability during and after event.
5. The Field Names are required as headers in each file submitted.
6. No spaces are allowed in the title of the files.
7. Forecast kW and kWh should be accurate to three decimal places, i.e. x.xx, and always positive, or zero.
8. No leading spaces are allowed in any of the files.

Error Handling

The import of the aggregator operational forecast will fail if the VEN ID and Enroller Id pairing is incorrect or the submitted file name or contents are not in the required format. If there is an error, the last submitted operational forecast will be used as the current Operational Forecast.

Example Operational Forecast File


100001_HECO_10-01-A1AggregatorCapacityBuildAgg_0216_0220_KW_forecast.csv - Notepad

File Edit Format View Help

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VEN ID,Aggregator ID,Company,Grid Service Program Name,Forecast Unit of Measure,Forecast Interval End Time,Forecast Value
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 0:15,566.47
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 0:30,605.31
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 0:45,564.56
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 1:00,506.89
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 1:15,612.67
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 1:30,644.53
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 1:45,612.94
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 2:00,628.36
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 2:15,672.41
A1_Aggregator,1003366,HECO,Capacity Build Aggregator,Aggregate Operational Forecast KW 15 Minute,2/16/2019 2:30,627.5
```

Participant Energy Reduction Incentive Data

For Participants receiving an Energy Reduction Incentive (ERI), Aggregator will submit a Participant Incentives File in CSV format as specified herein. ERI should only be calculated and provided for Participant's that participated in events in the previous month. Participants who are enrolled but did not participate in any events in the previous month should not be included in the Participant Incentives File, i.e. no $0 incentive payments should be included in the file. Aggregator must submit the incentive file by 8pm HST of 7th day of the month for Participant energy reduction in the previous month.

File naming convention for enrollment data is as follows: {EnrollerId} {HawaiianElectricCompanyCode}_{Date:yyyy-MM-dd_HH-mm-ss}_incentive.csv, for example, 100001_HECO_2018-07-13_16-59-03_incentive.csv HH represents hour in military time (0-23). In the future, if an aggregator has Participants that are customers of Maui Electric or Hawaii Electric Light, MECO or HELC respectively, a separate file would be submitted where MECO or HELC replaces HECO.

Table 3 shows the fields to be included in the file submitted by the Aggregator with the monthly ERI payments to be made for their Participants. The format will be a CSV file. The values/columns shall be in the order described in following table.

Table 3: Participant Incentives File Format

Field Name	Format	Values/Comments
EnrollerID	Char 16	ID for the Aggregator who has enrolled the customer. ID will be provided by the Companies.
Contract Account	Char 12	Participant's Account No. to which this incentive should be applied. Must match account number supplied with Participant's enrollment.
Utility Contract	Char 10	Contract No. from Participant bill. **Utility Contract number is typically 8 characters, leading zeroes must be inserted until string is 10 characters long.** Contract Account to which this incentive applies.
Grid Service Program Name	String	Grid Service program name as provided by the Companies in Attachment B. Program Name must match the value sent by the Aggregator with Participant's enrollment.

Incentive Type	String	Must be Energy. This indicates the type of incentive.
Incentive Month	Date	Month to which the incentive applies in the following format: MM/YYYY.
Incentive Amount	Real	Monthly incentive amount for this incentive type to be paid to customer. No currency sign should be provided.

ERI Assumptions

ERI must adhere to the following assumptions:

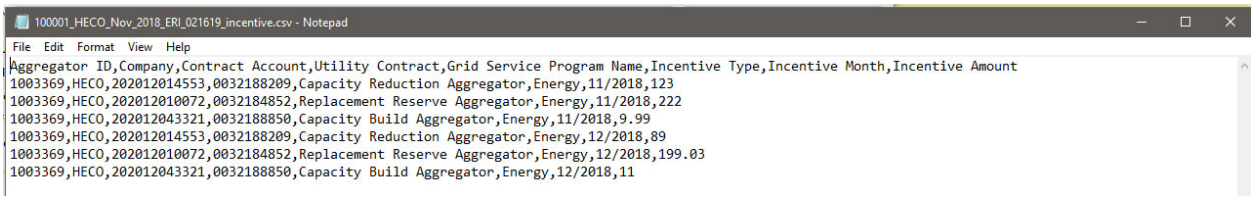
1. Customer Utility Contract number must be 10 digits, if Utility Contract number is fewer than 10 digits, it must be padded with preceding zeroes.
2. The Field Names are required as headers in each file submitted.
3. No spaces are allowed in the title of the files.
4. A customer must be enrolled in a Grid Service Program.

Error Handling

The Company will contact the aggregator regarding any failed enrollments within 48 hours of submission. The following items will result in an error and failed import:

- Participant's Contract Account provided is not enrolled.
- Participant Account and Utility Contract No. pairing are invalid or does not match an enrolled Participant.
- Participant is not enrolled in Grid Service program that allows energy payment, e.g. FFR.
- The Participant's Contract Account is not associated with the Aggregator as of the Incentive Month.
- Submitted file name or contents are not in the required format.

Example Energy Incentive File



FFR Certification and Monthly Testing

Aggregator must demonstrate to the Company compliance with FFR timing and accuracy requirements as defined in GSPA FFR Exhibit/Attachment. Demonstration may be performed through observed testing using appropriate testing equipment, manufacturer documentation, or a report documenting operation that resources are activated within the specified period. FFR data submitted to the Company for FFR Certification must include:

- A list of all equipment tested, including model and firmware version.
- Description of testing methodology used to show compliance with FFR requirements.

- Test data and/or graphs that show compliance with UF setpoint and response accuracy as specified in GSPA FFR Exhibit/Attachment.
- Screenshot of setting(s) that has been applied to all field equipment.
- A statement on official Aggregator company letterhead stipulating that
    1) all field equipment that will be delivering FFR is identical in model and firmware version, etc. to the equipment whose test results are included in the FFR Certification submission,
    2) the screenshots of equipment setting(s) is of the equipment that was tested for FFR Certification and installed in the field, and
    3) the equipment delivering FFR is in compliance with the GSPA FFR exhibit/attachment Response Timeframe and Accuracy requirement.

  That is, the equipment that was tested to demonstrate FFR compliance is the exact same equipment that is installed in the field, the screenshot(s) are of the same equipment, and the equipment complies with the FFR requirements.
- The following statement, "I certify on behalf of [Supplier corporation], that [Supplier corporation] is in full compliance with the Exhibit/Attachment A-1 and the authority to sign such certification has been assigned to me in accordance with corporate procedures." Must be included.
- Statement must be signed by an officer of Aggregator's corporation.

All equipment will have to follow this same certification process for eligibility to participate in FFR. A single stipulation letter is acceptable if different equipment is providing FFR, however a demonstration of successful test results is required for each different model/firmware version of the equipment. If during the course of the GSPA term, equipment and/or firmware is updated, Aggregator must re-submit for FFR Certification.

A monthly FFR manual dispatch test event will be performed by the Companies. This test will be performed at the end of the month provided an FFR event has not already occurred in the Settlement Month. For the test, resources enrolled in FFR must be activated using the same method as the autonomous frequency response. The FFR test event duration will be a minimum of 15 minutes and a maximum of 30 minutes. This test does not require activation of the resources within 12ms. At the end of the test event, the aggregated resource must ramp out of the event as required for FFR.

OpenADR Provisioning

The Companies rely on OpenADR 2.0b to signal Grid Service events. If Aggregator has more than one GSPA with the Company, they will be required to implement a second set of VENs for each Grid Service Specific to that GSP. Further, each Hawaiian Electric company will have their own VTN, for example the VTN URL for Hawaiian Electric is drmsvtn.hawaiianelectric.com and the VTN URL for Maui Electric is drmsvtn.mauielectric.com.

OpenADR Requirements

The Companies' VTN is OpenADR 2.0 B profile (OpenADR2.0b) certified. The Companies require that all VENs connecting to the Companies VTN be OpenADR 2.0b certified. OpenADR Certification means that VTNs and VENs have undergone OpenADR testing and conform to the current OpenADR interface specification. The OpenADR Alliance manages the

OpenADR certification process[2] and the OpenADR 2.0 (A and B) Profile Specification (OpenADR Specification).[3] One OpenADR 2.0b VEN is required to enable delivery of Grid Services. The Companies require one VEN for each Grid Service to be delivered. The VEN may be a software or hardware VEN. The Company VTN uses aN RSA certificate.

Security and Security Certificates

OpenADR requires VTN and VEN digital certificates to authenticate communication links. VEN certificates will be embedded on the VEN by the manufacturer or the VEN purchaser will be required to contact the manufacturer to obtain the certificate. The Certificate Authority for OpenADR is Kyrio (previously NetworkFX).[4] The fingerprint file for the VEN which is provided with the VEN zip package from Kyrio, must be provided to the Companies for each VEN prior to provisioning. The same VEN certificates will be used on the Production and QA DERMS.

Ven Naming Conventions

Below are the naming conventions for VENs associated with Aggregators for each island and Grid Service:

Island	VEN Id - Capacity Build	VEN Id - Capacity Reduction	VEN Id - FFR
Hawaii Island	AGGX-CB02	AGGX-CR02	AGGX-FFR02
Maui	AGGX-CB03	AGGX-CR03	AGGX-FFR03
Oahu	AGGX-CB01	AGGX-CR01	AGGX-FFR01

Data and Event Signal Details

Capability in kW shall be made available for polling by the DERMS every five (5) minutes using the OpenADR 2.0b Data Reports TELEMETRY_USAGE. During a GS Event, TELEMETRY _USAGE shall reflect Available Capability or other telemetry data that is representative of available resources, accommodations may be discussed during integration.. The OpenADR SignalPayload will be SIMPLE, specific SignalPayload value will depend on the finalization of the design and implementation of the DERMS. Table 4 presents OpenADR parameters/configuration is required:

Table 4: OpenADR Parameters

	Configuration/ Parameter	**DERMS Value**
Event Signals	**SignalPayload**	**1 (MODERATE)**
	SignalName	**SIMPLE**
	SignalType	**level**
	marketContext	**Name of Grid Service program**

[2] https://www.openadr.org/certification-process
[3] https://www.openadr.org/specification
[4] https://www.openadr.org/cyber-security

	Priority	**1**
VEN Information	**Resource ID**	**N/A, Defaults to wildcard**
	Poll rate for event signal	**1 minute**
	Report Update Rate	**5 minute**
	VTN URL	**https://drmsvtn.hawaiianelectric.com**
	VTN ID	**DERMS**
	VEN ID	**Provided by Company**
Opt Responses	**optType**	**Optin**
Reporting	**Report type**	**Usage**
	ReportName	**TELEMETRY_USAGE**
	Rid	**powerReal**
	Rid	**energyReal**

Provisioning Process

The VEN ID is defined in advance by the Companies and provided to Customer/Manufacturer. The Customer/Manufacturer must provide the VEN Fingerprint to the Companies prior to provisioning. The VEN Fingerprint is SHA-256, the last 10 octets in the fingerprint text file from Kyrio.

VEN from new manufacturer or new model

The VEN will initially be provisioned for testing against the Companies test VTN, https://testdrmsvtn.hawaiianelectric.com using a test OpenADR certificate. The VEN test certificate SHA-256 fingerprint (provided by Manufacturer or Kyrio) must be provided in advance to the Companies. Upon registration request from the VEN, the fingerprint information is validated with the test DERMS. The Companies will configure the VEN on the test DERMS to participate in events and will issue events to the VEN.

Provisioning steps:

1. Aggregator will provide the fingerprint information to the Companies. The Companies will provide the VEN ID to the Aggregator.
2. Aggregator will configure and connect the VEN to the internet. Aggregator will ensure network connectivity to the internet.
3. The Companies will add the VEN to the test DERMS and coordinate the performance of a test event where Grid Services are not delivered. The Aggregator must demonstrate (e.g. provide logs from the VEN) to the Companies that the VEN received the event. The Companies will also request the following tests to be performed/demonstrated:
    a. Power cycle or loss of VEN communications and re-establishment connection to the VTN, including during an event
    b. Opt out of event when opt out requested
    c. Delivery of Telemetry_Usage reports
4. After a successful testing in step 3, the Aggregator and the Companies will coordinate the connection of the VEN to the production DERMS. The Companies will then perform a Grid Service Dispatch Test in accordance with the Program Rules or contract.

VEN model previously provisioned

The VEN will be provision against the production DERMS VTN. Upon registration request from the VEN, the fingerprint information is validated with the VTN. The VEN must be configured in accordance with Table 1 above unless specified below. If the Aggregator has successfully provisioned their VEN to the production DERMS and is provisioning a VEN for a different Grid Service, the following steps would be used.

Provisioning steps:

1. The Aggregator will provide the fingerprint information to the Companies. The Companies will provide the VEN ID to the Aggregator.
2. Aggregator will configure and connect the VEN to the internet. The Aggregator will test network connectivity to the internet.
3. The Companies will add the VEN to the DERMS and coordinate the performance of a performance of a test event where Grid Services are not delivered. The Aggregator must demonstrate (e.g. provide logs from the VEN) to the Companies that the VEN received the event and would have controlled the appropriate customer resources.
4. After a successful testing in step 3, the Aggregator and the Companies will coordinate the connection of the VEN to the production DERMS. The Companies will then perform a Grid Service Dispatch Test.

VEN Provisioning Assumptions

VEN provisioning must adhere to the following assumptions:

1. The VEN must re-register on power cycle.
2. Each Grid Service delivered by the Aggregator is represented by its own VEN

Other Data and Reporting Requirements

As specified in the GSPA Exhibits/Attachments for Advance metering(E/B) and Reporting(J/G), Aggregators are required to provide the data necessary to validate the Grid Service delivery.

FFR Data Requirements

Aggregator must provide 5-minute interval data for each Resource participating in an FFR GS Event to verify event response. Aggregator will submit this data to Company at the end of each month with the monthly invoice. Files shall be in .CSV format. One file per event, each file shall include the first full interval before the event, the event duration, and the first full interval after the event. The file shall include the following columns:

Date	Time	Contract Account Number	Segment (Res, SMB, C&I) Value

End-use or Whole House Data

Upon request from the Company, the Aggregator may also be required to deliver the following data:

- All data (on an aggregated level) used for the calculation of performance factors for the Settlement Month; including,
    - Baseline calculations
    - Demand values preceding events (as applicable)

End device data and associated baseline calculations from all participating Resources used for the calculation of any performance factors.

Advanced Metering and Test Plan

Metering equipment shall be tested for accuracy by Aggregator prior to or during installation. In addition, Aggregator must define a Test Plan that is designed to their test metering equipment at or prior to installation and monitor a reasonable percentage of the installed metering equipment to verify the metering equipment's accuracy and performance during the Term. Aggregator shall define the Test Plan so that it is appropriate for the type of metering equipment they use. The Test Plan shall document Aggregator's test, calibration and maintenance procedures of Aggregator's installed metering equipment. The Test Plan shall be delivered to Company for review and the plan must be approved by Company prior no later than the System Integration Date.

Service Level Agreement

The GSDS must be available for Grid Service dispatch at least 85% of the time during the month, excluding Maintenance and Unscheduled Downtime. Aggregators must report GSDS availability to the Company. This report will be included in Aggregators' monthly invoice reporting and include Available Uptime, Unscheduled Downtime, Maintenance Downtime, and any Emergency Downtime, the date, time, duration and reason for each downtime. Further, Aggregator must report on the follow:

- All problem resolution request reported to the Aggregator by the Company and their resolution. A report from Aggregators' problem reporting system is sufficient provided it includes the necessary information, such as dates reported and resolved.
- Modifications to the GSDS during the month that did not require downtime. The report may be in narrative form with date, time, and description.
- Any errors or inconsistencies identified in metering and the actions taken to resolve. Metering inconsistency reporting must include the location of the metering equipment, date of failure, date of remediation and remediation actions taken.

It is acceptable to combine reporting for downtime, problem resolutions, system modifications into one report provided the required information is easily identifiable

DERMS Grid Service Delivery System ("GSDS") Integration Testing

As specified in Exhibit G/Attachment D of the GSPA, integration of Aggregator's GSDS requires two tests: A) Data Integration Test and B) Grid Service Dispatch Test.

Test Plans

Data Integration and Grid Services Test Plans will be developed in coordination with Companies and agreed to by the Aggregator and the Company prior to commencing testing. The test plan for Data Integration and Grid Services Test may be combined. The Test Plan should include the testing schedule and tests to be conducted and maybe modified during the testing process. Further, the Aggregator must provide a Go Live plan/schedule 2 weeks prior to Go Live for one (1) week before and after Go Live. The Go-Live plan should also include any additional support required.

One week prior to Go Live, the Company will make a Go No-Go Decision for cutover. An example of Go-Live Readiness Criteria is attached as Attachment F. Final testing for certification must follow production behavior, e.g. periodicity of transfer of enrollment and forecast files, etc. Aggregator must provide documentation that final testing for approval is performed on Aggregators production system.

Testing Process Overview

Meetings should be set prior to pre-testing commencing and possibly prior to each testing scenario and prior to sign off testing. The following is high level test process to be used as a guide:

1. Determine Test data – aggregator must provide data for testing; Company will not share customer information
2. Company provides Enroller/Aggregator ID
3. Company provides SFTP location and credentials
4. Aggregator tests access to SFTP site
5. Aggregator generates enrollment files, incentive and forecast files, DR reviews prior to processing
6. Files processed manually
7. Iterate until successful
8. Aggregator generates ERI, DR reviews prior to processing
9. Files processed manually
10. Iterate until successful
11. Aggregator generates Operational Forecast, DR reviews prior to processing
12. Files processed manually
13. Iterate until successful
14. Company initiates OpenADR event and telemetry testing
15. Iterate until successful
16. Perform final testing for sign-off (this testing must be from Aggregators production system).

Data Integration Test

The Data Integration Test requires testing each enrollment transaction and each program Aggregator is participating in. Attachment C specifies each enrollment transaction that must be tested. The Data Integration Test also includes processing of the Energy Reduction Incentive and Operational Forecast files. Operational Forecast for each Grid Service must be submitted twice a day, i.e. at 1am and 1pm.

Grid Services Dispatch Test

The Grid Services Dispatch Test will be performed using OpenADR 2.0b. The following transactions will be tested for each Aggregator VEN:

1. Dispatch Grid Service for each Grid Service delivering (including telemetry and Operational Forecast update for dispatched Grid Service and any other impacted Grid Service)
2. Extend Scheduled Grid Service dispatch
3. Cancel Scheduled Grid Service dispatch
4. Stop Active Grid Service dispatch
5. Extend Active Grid Service dispatch
6. Simulate a failed VEN will be performed: Take Grid Service VEN offline, receive email notification (70 minutes), return to online, receive email notification (30 minutes)

Final Testing & Sign Off

The environment of the final testing for sign off will be dependent on the configuration of the Aggregator's and the Company's systems. For example, final testing for sign off for the data integration, enrollment transaction, incentive file, forecast may be done on the Company's QA so that no test data is inputted into the Company's Production system. However final testing must be completed using Aggregator's production GSDS[5] and the Aggregator must demonstrate that testing has been completed on their production GSDS. Grid Services Dispatch final test will be performed on production.

It is highly recommended that Aggregator consider performing a Mock Go-Live on their production system to fulfill testing requirements. Further, the Company will require a require a one week "burn-in" period to monitor the flow of enrollments, Operational Forecasts, and VEN connectivity and telemetry. The "burn-in" period may occur before or after the Grid Services Dispatch final test, depending on the status and progression of prior testing.

Conditional certification may be considered in circumstances where successful completion of certain tests that the Company deems non-critical or not immediately required are delayed until after the System Integration Date.

Monthly Settlement

[TBD]

[5] Enrollment transactions and Operational Forecasts will flow unattended, the Company will process enrollment and unenrollment files and notify Aggregator of customer that has moved out.

Support Obligations

General Company support is available by calling the Help Desk at 808-543-7894 which is available 24 hours a day. For issues related to sftp access, please contact 808-543-5678 and select #4 for the Enterprise System Administrator.
Aggregator will be provided with access to DERMS Portal where VEN's may be scheduled out of service and event notifications can be configured. For Maintenance and Emergency Downtime, affected VENs should be scheduled as unavailable (opted out) via the DERMS Portal.

If a VEN is not reachable for all or part of an event, event performance shall be prorated accordingly.

Aggregator must operate their GSDS in accordance with Service Level Agreement. As such, Aggregator is required to submit a monthly report that includes the following items:

1. Problem Report: All problem resolution requests submitted by Company and their respective resolutions, to include unique identifier, description, priority, date submitted, status, and date closed.
2. Modifications to the GSDS, such as minor updates or other modifications that did not require downtime, but resulted in changes to the GSDS, including but not limited to software, firmware, hardware and communication protocols.
3. Errors or inconsistencies in measurements and corrective action taken to resolve such errors to Aggregator installed metering equipment as specified in Exhibit E/Attachment B (Advanced Metering).

Aggregator must also provide street address and phone number for business, plus information to contact help desk.

Production Export Approval

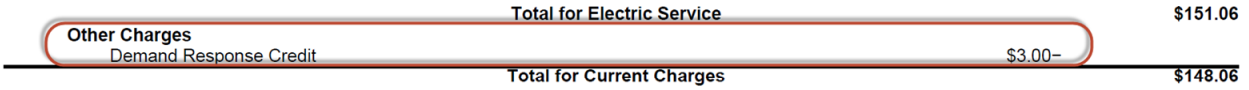
Using the Company's Customer Interconnection Tool ("CIT") customers and/or their verified vender that have been registered in CIT and designated by the customer through the submission of a Grant of Authority to the Companies, a request for DR Export can be submitted. Any export request of less than 3kW will be expeditiously approved.

Ad-Hoc Reporting

Reporting other than settlement report, such as requirements define in Exhibit E/Attachment B: Advanced Metering shall be in the format of device identifier, date, time (HST), kW, Hz.

Customer Bill Incentive

Below is a snapshot of what the Aggregator & EnergyScout Program incentive credits will look like on a customer bill. If a customer has this on their bill prior to your enrollment of the customer you will need to work with that customer or their current aggregator to have them unenroll in their current program in order for you to enroll them in your program.



Hawaiian Electric EnergyScout Incentive: