New Requirements for Advanced Inverters in Hawaii

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Ride-through standards were established to assist during system disturbances.

**Low/High Frequency Ride-Through**

Inverter will ride-through system contingencies (i.e. loss of large load or generating unit)

**Low/High Voltage Ride-Through**

Inverter will ride-through system or circuit disturbances (i.e. short circuit faults)
Adoption of autonomous advanced inverter voltage functions may mitigate voltage issues

**Volt-Watt**

Mitigates secondary high voltage by reducing real power as a function of voltage.

**Fixed Power Factor**

Provides voltage support; mitigate high voltages. May increase system losses.

**Dynamic Volt-Var**

Circuit voltage optimization

Source: EPRI Report 3002001246
Advanced inverters may provide system support

**Frequency-Watt**

![Frequency-Watt Graph](image)

May assist in over-frequency due to loss of load/excess energy

**Soft-Start**

Gradually raises the inverter power output to coordinate with the ramping capabilities of the bulk generating system. Mitigates frequency swings during system restoration.

**Remote Connect/Disconnect**

Utility sends command to inverter to disconnect or reconnect system. To be used during system emergencies or system restoration.

**Communications**

**Remote Configurability**

**Measurement/Visibility**

![Diagram](image)

Source: EPRI Report 3002001246
Fixed power factor can mitigate localized high voltage and reduce voltage fluctuations
## Nation leading adoption schedule for advanced inverter technical standards

*Required: All applications received after January 1, 2016 must comply with dates or updated to comply after UL Cert*

<table>
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<th>Advanced Inverter Functions</th>
<th>Hawaiian Electric Priority</th>
<th>Effective Date of Implementation</th>
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<tr>
<td>Anti-Islanding TrOV-2</td>
<td>Mandated – High Implemented</td>
<td>February 9, 2015</td>
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<tr>
<td>Low High Volt Ride-Through</td>
<td>Mandated – High Implemented</td>
<td>Full Settings October 1, 2015</td>
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<tr>
<td>Low-High Frequency Ride-Through</td>
<td>Mandated – High Implemented</td>
<td>Full Settings October 1, 2015</td>
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<tr>
<td>Volt-Var Control</td>
<td>Mandated – Low</td>
<td>12 Months after UL 1741 Supplement A is Approved by UL</td>
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<tr>
<td>Ramping</td>
<td>Mandated – Low</td>
<td>12 Months after UL 1741 Supplement A is Approved by UL</td>
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<td>Fixed Power Factor</td>
<td>Mandated – High</td>
<td>January 1, 2016</td>
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<tr>
<td>Soft-Start Reconnection</td>
<td>Mandated – High</td>
<td>12 Months after UL 1741 Supplement A is Approved by UL</td>
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<tr>
<td>Frequency-Watt</td>
<td>Mandated – High</td>
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<tr>
<td>Voltage-Watt</td>
<td>Mandated – High</td>
<td>12 Months after UL 1741 Supplement A is Approved by UL</td>
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<tr>
<td>Remote Reconnect/Disconnect</td>
<td>Mandated – High</td>
<td>No UL Certification Required</td>
</tr>
<tr>
<td>Remote Configurability</td>
<td>Mandated – High</td>
<td>12 Months after UL 1741 Supplement A is Approved by UL</td>
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The Hawaii Public Utilities Commission recognized the urgent need for accelerated adoption of advanced inverters

The Hawaii PUC recently ruled on Hawaiian Electric’s proposed advanced inverter implementation plan:

- To ensure safety and reliability in our high PV penetration environment, the Companies may propose to accelerate the activation of other advanced inverter functions prior to the implementation of UL-1741 test standards.

- The Companies shall collaborate with inverter manufacturers to develop a reasonable self-certification process for advanced inverters until national standards (UL-1741) are established.

- Phase 2 of the proceeding to focus on communication standards to enable the remote connect/disconnection and inverter configurability functions
  - Commission recognized that these functions are desirable