The Hawaiian Electric Companies
Next Steps for Procurement of Grid-Scale Energy Resources

February 7, 2019
Agenda

♦ Status of Stage 2 RFP for Variable Renewable Dispatchable Generation
♦ System Needs by Island
♦ Comparison and Tradeoffs of Different Procurement Approaches
♦ Proposed Procurement Plan by Island
  ♦ Target launching RFPs in May/June
Status of Stage 2 RFP for Variable Renewable Dispatchable Generation
Stage 2 Variable RFP: draft to be issued in 1 month

♦ RFP
  ♦ Updates are in progress
  ♦ Incorporating lessons learned from Stage 1

♦ Model PV + Storage PPA
  ♦ Updates are in progress
  ♦ Changes to include takeaways from Stage 1 project negotiations
  ♦ Pursue grid charging options

♦ Draft Documents to be shared for market input in 1 month
System Needs By Island
O‘ahu – December 2016 Plan

Current Changes to O‘ahu Resource Plan

- West Loch Battery 70MW
- 180 MW PV
- 30 MW Wind
- 426 MW Load Shift Battery
- 40MW PV
- AES PPA Expires 9/2022
- Install 100 MW JBPHH Plant
- West Loch Battery
- Contingency & Regulating Reserve Battery
- 127 MW PV + Storage
- AES PPA Expires 9/2022
- Palehua Wind
- Stage 2 RFP
- Approximate 700 MW DGPV
- Approximately 114 MW of Demand Response
- Install 54 MW KMCBH Plant
O‘ahu Needs

♦ Continue to execute the PSIP to acquire renewable energy. Acquire the 160,000 annual MWh that was not acquired in Stage 1 in order to meet the 2022 PSIP target.
  ♦ Renewables and Renewables + Storage can meet need.

♦ AES purchased power contract expires in September 2022. AES, a coal-fired unit, is the largest generator on the Hawaiian Electric system at 180 MW and 16% of our system peak. The energy MWh and capacity MW supplied by AES must be replaced in order to meet customer energy requirements.
  ♦ Part will come from Stage 1 RFP projects, but more is needed

♦ The PSIP called for 426 MW load shifting storage in 2022 to increase system hosting capacity and economically facilitate integration of renewable energy on the O‘ahu system.
  ♦ Standalone storage, Renewables + Storage that can be grid charged, and Renewables + Storage can meet the need. Estimated need is about 200 MW and 1,200 MWh per day (equiv to 438,000 MWh/year).
Maui – December 2016 Plan

Contingency Battery 9 MW

Kahului Power Plant Retirement -36 MW

60 MW Wind

40 MW Biomass

Two 9 MW Internal Combustion Engines

2019

2020

2021

2022

2023

2024

Approximately 100 MW of DGPV Currently Installed

75 MW PV + Storage

Kahului Power Plant Retirement -36 MW

Stage 2 RFP

 Approximately 140 MW DGPV

Approximately 5 MW of Demand Response Currently Available

Approximately 13 MW of Demand Response

Current Changes to Maui Resource Plan
Maui Needs

♦ Continue to execute the PSIP to acquire renewable energy. Acquire the 65,000 annual MWh that was not acquired in Stage 1 in order to meet the 2022 PSIP target.
  ♦ Renewables and Renewables + Storage can meet need.

♦ Kahului Power Plant retirement is expected by end of 2024. The energy MWh and capacity MW supplied by KPP must be replaced in order to meet customer energy requirements.

♦ The PSIP called for additions of Biomass units and internal combustion engines in 2022 to support the MWh and MW needs of the Maui system.
  ♦ Standalone storage, Renewables + Storage that can be grid charged, and Renewables + Storage can meet the need. Estimated need is about 40 MW and 160 MWh per day (equivalent to 58,400 MWh per year).
Hawai‘i – December 2016 Plan With Hu Honua

- **2019**: Hu Honua 21.5 MW
- **2020**: 20 MW Wind + 9 MW Storage
  - Contingency
  - Battery 9 MW
- **2021**: Estimated PGV Return to Service
  - 60 MW PV + Storage
- **2022**: 30 MW Wind
  - Stage 2 RFP
  - Approximately 120 MW DGPV
  - Approximately 13 MW of Demand Response

Currently Installed:
- Approximately 100 MW of DGPV

Current Changes to Hawai‘i Resource Plan
Hawai‘i Island Needs

♦ Continue to execute the PSIP to acquire renewable energy. Acquire the 70,000 MWh that was not acquired in Stage 1 in order to meet the 2022 PSIP target.
   ♦ Renewables or Renewables + Storage can meet need.

♦ PSIP assumes that PGV is online and Hu Honua comes online in 2019. May need to consider alternative scenarios in the near future.
Comparison and Tradeoffs of Different Procurement Approaches
Procurement Approaches Considered

♦ Stage 2 of Variable, similar to Stage 1 (with and without grid charging options)
♦ Storage-only (grid charged)
♦ Combined single RFP for variable generation MWH and energy storage MW need
♦ All-Resource (variable generation, energy storage, firm, aggregators, and other technologies)
♦ Firm RFP
Some Options Do Not Meet Timing Constraints
### Assessment of Options – O‘ahu

<table>
<thead>
<tr>
<th></th>
<th>Stage 2 (similar to Stage 1)</th>
<th>Stand-alone storage</th>
<th>Firm</th>
<th>Parallel (Stage 2, Stand-alone storage)</th>
<th>Combined (Stage 2, Stand-alone storage)</th>
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## Assessment of Options - Maui

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Note: The green checkmark (✓) indicates a positive assessment, the yellow circle (มือ(606,588),(680,640)) indicates a neutral assessment, and the red circle (✗) indicates a negative assessment.

Hawaiian Electric
Maui Electric
Hawai‘i Electric Light

2/7/2019
## Assessment of Options – Hawai‘i Island

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Proposed Procurement Plan by Island
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<tr>
<th>Proposed RFPs</th>
<th>Hawai‘i Island Stage 2</th>
<th>O‘ahu Stage 2</th>
<th>Maui Combined</th>
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<tr>
<td>Need</td>
<td>• ~70,000 annual MWh of renewables</td>
<td>• ~160,000 annual MWh of renewables</td>
<td>• ~65,000 annual MWh of renewables</td>
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<td>• ~160,000 annual MWh of renewables</td>
<td>• ~200 MW capacity with ~1,200 MWh per day (equivalent to 438,000 MWh/year)</td>
<td>• ~40 MW capacity with ~160 MWh per day (equivalent to 58,400 MWh per year)</td>
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<td>Technologies</td>
<td>• Variable renewables • Variable renewables paired with storage</td>
<td>• Variable renewables • Variable renewables paired with storage</td>
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<td></td>
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<td>Bids can include any combination of MW and MWh resource needs</td>
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<td>Grid Charging of BESS</td>
<td>Options: • None • Available for grid charging 100% after bidder determined date</td>
<td>Options: • None • Available for grid charging 100% after bidder determined date</td>
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<td>Options for paired systems: • None • Available for grid charging up to 25% • Available for grid charging 100% after bidder determined date</td>
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<td>GCOD</td>
<td>December 2022 (preferred in evaluation)</td>
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<td>RFP Launch</td>
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Mahalo!
Appendix

Supplemental Materials
MAUI COUNTY

Generating Facilities
These maps show existing and planned generating facilities in our service area and the maximum potential power in megawatts (MW) they can produce.

FIRM GENERATION:
Energy available on demand, which can be adjusted as needed.

VARIABLE GENERATION:
Energy that may not always be available or controllable.

RENEWABLE DISPATCHABLE GENERATION
BESS: Battery Energy Storage System

HYDRO
GRID-SCALE SOLAR
STORAGE
WIND
OIL
BIOFUELS