Dear Commissioners:

Subject: Docket No. 2018-0135
Addendum to Hawaiian Electric Companies’
Electrification of Transportation Strategic Roadmap

In their Electrification of Transportation (“EoT”) Strategic Roadmap (“Roadmap”) filed on March 29, 2018 in Docket No. 2016-0168 (EV-F and EV-U Pilot Extension), the Hawaiian Electric Companies\(^1\) provided an economic analysis of EoT in their service territories using light-duty vehicle electrification on Oahu as an initial case study and indicated that they would file complete analyses for other islands in the near-term future.\(^2\) The Companies have also updated their Oahu results with certain superseding information.\(^3\) Accordingly, the Companies respectfully submit within Exhibits A through C hereto the following figures and tables:

<table>
<thead>
<tr>
<th>Exhibit A</th>
<th>Exhibit B</th>
<th>Exhibit C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Updated Oahu Results</td>
<td>Maui Results</td>
<td>Hawai‘i Island Results</td>
</tr>
<tr>
<td>Figure 20</td>
<td>Figure 19</td>
<td>Figure 19</td>
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<td>Figure 21</td>
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<td>Figure 22</td>
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<td>Figure 25</td>
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<td>Figure 26</td>
<td>Figure 34</td>
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<td>Figure 27</td>
<td>Figure 37</td>
<td>Figure 37</td>
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<td>Table 11</td>
<td>Table 9</td>
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<td>Table 11</td>
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</tbody>
</table>

\(^1\) The “Hawaiian Electric Companies” or “Companies” are Hawaiian Electric Company, Inc. (“Hawaiian Electric”), Hawai‘i Electric Light Company, Inc. and Maui Electric Company, Limited.

\(^2\) See EoT Roadmap at 32-37.

\(^3\) The Oahu results were updated for several reasons, including: errors discovered when transferring the E3 model to a more user-friendly tool to be used by the Companies’ internal team for future analyses; re-calculated gasoline savings to account for differences in vehicles’ miles traveled on different islands; and updated rates due to the final decision in the Hawaiian Electric 2017 test year rate case.
The numbering format for the figures and table in Exhibit A remains the same as in the Companies’ March 29, 2018 Roadmap filing. For Exhibits B and C, the presentation of data and analyses mimics those presented for Oahu. For example, Figure 19 in Exhibit A is the personal light-duty electric vehicle adoption forecast for Oahu, while Figure 19 in Exhibits B and C provides corresponding information for Maui and Hawai‘i Island, respectively.

The updated results for Oahu do not change the overall trajectory of Hawaiian Electric’s EoT plans for Oahu. As shown in the table below, the updated analyses continue to show substantial net benefits from the energy wallet as well as customer perspective for Oahu.4

<table>
<thead>
<tr>
<th>Updated as of:</th>
<th>Oahu Energy Wallet (Figure 20)</th>
<th>Oahu Customer Perspective (Figure 21)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-Managed Charging Total Results ($MM 2017)</td>
<td>Smart Charging Total Results ($MM 2017)</td>
</tr>
<tr>
<td>March 2018</td>
<td>203</td>
<td>311</td>
</tr>
<tr>
<td>December 2018</td>
<td>291</td>
<td>385</td>
</tr>
</tbody>
</table>

If you have any questions on this matter, please contact Brennon Morioka, Hawaiian Electric’s Director of Electrification of Transportation, at (808) 543-7570.

Sincerely,

[Signature]

Kevin M. Katsura
Director
Regulatory Non-Rate Proceedings

Enclosures

cc: Division of Consumer Advocacy (with enclosures)

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4 The net benefits in Figures 20 and 21 of Exhibit A are presented in $/vehicle. The Companies have also scaled up the net benefits (Total Results $MM 2017) over the 2018-2045 timeframe.
Figure 20: Direct economic costs and benefits to O‘ahu per personal light duty electric vehicle, NPV 2018-2045

Non-managed charging

- Net benefit: $2577 per vehicle
- Cost
  - $12,000
- Benefit
  - $10,000

Smart charging

- Net benefit: $3401 per vehicle
- Cost
  - $12,000
- Benefit
  - $16,000

Electricity Demand (MW)

- Hour Beginning
  - 0 2 4 6 8 10 12 14 16 18 20 22
Figure 21: Costs and benefits to Hawaiian Electric customers per personal light duty electric vehicle adopted on O‘ahu NPV 2018-2045

<table>
<thead>
<tr>
<th></th>
<th>Non-managed charging</th>
<th>Smart charging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>$6,000</td>
<td>$5,000</td>
</tr>
<tr>
<td>Benefit</td>
<td>$9,000</td>
<td>$10,000</td>
</tr>
</tbody>
</table>

Net benefit: $3166 per vehicle (31% increase) to $4162 per vehicle

Electricity supply cost to serve EVs
Utility bills paid by EV drivers
Figure 22: Fossil fuel consumption by O‘ahu light-duty vehicles, assuming Hawaiian Electric’s EV adoption forecast.
Figure 23: Carbon dioxide emissions by O‘ahu’s light-duty vehicles assuming Hawaiian Electric’s EV adoption forecast
Table 11: Hawaiian Electric rates applied to EV charging at different locations

<table>
<thead>
<tr>
<th>Location</th>
<th>O'ahu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential (range indicates differences across years)</td>
<td>91% to 96% Schedule R</td>
</tr>
<tr>
<td></td>
<td>1% to 9% Schedule TOU-RI</td>
</tr>
<tr>
<td></td>
<td>0% to 5% TOU-EV</td>
</tr>
<tr>
<td>Workplace Level 2</td>
<td>100% Schedule J</td>
</tr>
<tr>
<td>Public Level 2</td>
<td>50% Schedule J</td>
</tr>
<tr>
<td></td>
<td>50% Schedule P</td>
</tr>
<tr>
<td>DC Fast Charging</td>
<td>100% Schedule EV-U</td>
</tr>
</tbody>
</table>
Exhibit B

Maui results
Figure 19: Maui Electric’s personal light-duty EV adoption forecast, Maui 2010-2045

% LDV on road

# of public ports

ICE and Electric Vehicle cost parity

Battery prices drop >70%

Increased # of models available, including autonomous and longer range vehicles
Figure 20: Direct economic costs and benefits to Maui per personal light duty electric vehicle, NPV 2018-2045

Non-managed charging vs. Smart charging:

- **Net benefit:** $5699 per vehicle for Non-managed charging.
- **Net benefit:** $6101 per vehicle for Smart charging, which is a 7% increase.

Bar charts showing:
- Cost and Benefit breakdowns.
- Electricity demand (MW) by hour.

Legend:
- Electricity supply cost to serve EVs
- Incremental upfront vehicle cost for EVs
- Charging infrastructure cost
- Avoided vehicle gasoline
- Vehicle O&M savings
- Federal EV tax credit
Figure 21: Costs and benefits to Maui Electric customers per personal light duty electric vehicle adopted on Maui NPV 2018-2045

Non-managed charging

Cost: $2017/vehicle
Benefit: $5000
Net benefit: $2983 per vehicle

Smart charging

Cost: $2017/vehicle
Benefit: $5000
38% increase
Net benefit: $2508 per vehicle

Cost: $2017/vehicle
Benefit: $5000

Legend:
- Electricity supply cost to serve EVs
- Utility bills paid by EV drivers
Figure 22: Fossil fuel consumption by Maui light-duty vehicles, assuming Maui Electric’s EV adoption forecast

- Million, MMBtu Fossil Fuels consumed
- % EV share of light duty vehicles
Figure 23: Carbon dioxide emissions by Maui light-duty vehicles assuming Maui Electric’s EV adoption forecast.
Figure 33: Average weekday charging load for personal, light-duty EVs, Non-Managed Charging and Smart Charging case, 2030 (Maui)
Figure 34: Forecasted electricity sales and electricity demand for Non-Managed and Smart Charging cases during peak from 2018 to 2045 (Maui)
Figure 37: Gasoline price forecast, net of state and local taxes (Maui)
Table 9: EVSE data (Maui)

<table>
<thead>
<tr>
<th>EVSE Type</th>
<th>Charging Ports per EVSE</th>
<th>Purchase and Installation Cost ($)</th>
<th>Annual Price Reduction</th>
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</thead>
<tbody>
<tr>
<td>Residential II</td>
<td>1</td>
<td>$2,300</td>
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<tr>
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<td>2</td>
<td>$8,000</td>
<td>1.9 percent</td>
</tr>
<tr>
<td>Public Level 2</td>
<td>2</td>
<td>$25,000</td>
<td>1.9 percent</td>
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<tr>
<td>DC Fast Charging</td>
<td>1</td>
<td>$193,534</td>
<td>1.9 percent</td>
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</table>
Table 11: Maui Electric rates applied to EV charging at different locations

<table>
<thead>
<tr>
<th></th>
<th>Maui</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential (range indicates differences across years)</td>
<td>95% to 99% Schedule R</td>
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<tr>
<td></td>
<td>1% Schedule TOU-RI</td>
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<td>DC Fast Charging</td>
<td>95% Schedule EV-F</td>
</tr>
<tr>
<td></td>
<td>5% Schedule EV-U</td>
</tr>
</tbody>
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Figure 19: Hawaii Electric Light’s personal light-duty EV adoption forecast, Hawai’i Island 2010-2045

- **% LDV on road**
  - ICE and Electric Vehicle cost parity
  - Battery prices drop >70%
  - Increased # of models available, including autonomous and longer range vehicles

- **# of public ports**
Figure 20: Direct economic costs and benefits to Hawai‘i Island per personal light duty electric vehicle, NPV 2018-2045

Non-managed charging

Net benefit: $6042 per vehicle

Smart charging

Net benefit: $6499 per vehicle

8% increase

Cost | Benefit
--- | ---
4,000 | 4,000
2,000 | 2,000
1,000 | 1,000
800 | 800
600 | 600
400 | 400
200 | 200
0 | 0

Cost | Benefit
--- | ---
6,000 | 6,000
4,000 | 4,000
2,000 | 2,000
1,000 | 1,000
800 | 800
600 | 600
400 | 400
200 | 200
0 | 0

Cost | Benefit
--- | ---
8,000 | 8,000
6,000 | 6,000
4,000 | 4,000
2,000 | 2,000
1,000 | 1,000
800 | 800
600 | 600
400 | 400
200 | 200
0 | 0

Cost | Benefit
--- | ---
10,000 | 10,000
8,000 | 8,000
6,000 | 6,000
4,000 | 4,000
2,000 | 2,000
1,000 | 1,000
800 | 800
600 | 600
400 | 400
200 | 200
0 | 0

Cost | Benefit
--- | ---
12,000 | 12,000
10,000 | 10,000
8,000 | 8,000
6,000 | 6,000
4,000 | 4,000
2,000 | 2,000
1,000 | 1,000
800 | 800
600 | 600
400 | 400
200 | 200
0 | 0

Electricity supply cost to serve EVs
Incremental upfront vehicle cost for EVs
Charging infrastructure cost
Avoided vehicle gasoline
Vehicle O&M savings
Federal EV tax credit
Figure 21: Costs and benefits to Hawaii Electric Light’s customers per personal light duty electric vehicle adopted on Hawaii Island NPV 2018-2045

Non-managed charging

Cost: Electricity supply cost to serve EVs
Benefit: Utility bills paid by EV drivers

Smart charging

Cost
Benefit

Net benefit: $3890 per vehicle

15% increase

Net benefit: $4492 per vehicle
Figure 22: Fossil fuel consumption by Hawai‘i Island light-duty vehicles, assuming Hawaii Electric Light’s EV adoption forecast

<table>
<thead>
<tr>
<th>Year</th>
<th>Million, MMBtu Fossil Fuels consumed</th>
<th>% EV share of light duty vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>11</td>
<td>0</td>
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<tr>
<td>2025</td>
<td>9</td>
<td>10</td>
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<td>2035</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>2045</td>
<td>7</td>
<td>45</td>
</tr>
</tbody>
</table>

- Fossil fuels used to produce electricity for vehicles
- Gasoline consumed by vehicles (oil, natural gas, coal)
Figure 23: Carbon dioxide emissions by Hawai‘i Island light-duty vehicles assuming Hawaii Electric Light’s EV adoption forecast

Million Tons of CO₂ emitted

2015: 0.8
2025: 0.6
2035: 0.6
2045: 0.5

% EV share of light duty vehicles

0 5 10 15 20 25 30 35 40 45

Carbon Dioxide from EVs  Carbon Dioxide from Gasoline

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Figure 33: Average weekday charging load for personal, light-duty EVs, Non-Managed Charging and Smart Charging case, 2030 (Hawai‘i Island)
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