BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of the Application of HAWAIIAN ELECTRIC COMPANY, INC. HAWAI'I ELECTRIC LIGHT COMPANY, INC. MAUI ELECTRIC COMPANY, LIMITED dba HAWAIIAN ELECTRIC For approval to commit funds in excess of $2,500,000 for the Public Electric Vehicle Charger Expansion Project, to Recover the Capital and Operations and Maintenance Expense Costs through the Exceptional Project Recovery Mechanism, and Related Requests.	)	DOCKET NO.

HAWAIIAN ELECTRIC APPLICATION

VERIFICATION

EXHIBITS "A"–"J"

AND

CERTIFICATE OF SERVICE

Joseph P. Viola
Vice President, Regulatory Affairs
Hawaiian Electric Company, Inc.

Vice President
Hawai'i Electric Light Company, Inc.
Maui Electric Company, Limited

P. O. Box 2750
Honolulu, Hawai'i 96840-0001

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APPLICATION

TO THE HONORABLE PUBLIC UTILITIES COMMISSION
OF THE STATE OF HAWAI'I:

Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawai'i Electric Light Company, Inc. (hereinafter collectively "Hawaiian Electric" or the "Company")[1] respectfully request Commission approvals necessary to implement a Public Electric Vehicle Charger Expansion Project ("Project") and to recover the Project costs through the Exceptional Project Recovery Mechanism ("EPRM").

[1] Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawai'i Electric Light Company, Inc. are each doing business as "Hawaiian Electric" and have jointly registered "Hawaiian Electric" as a trade name with the State of Hawai'i Department of Commerce and Consumer Affairs, as evidenced by Certificate of Registration No. 4235929, dated December 20, 2019.

I. EXECUTIVE SUMMARY

The proposed Project builds upon the Company's experience gained from providing public fast charging for over seven years under the EV-U Pilot ("Pilot")[2] program. During that time, the electric vehicle ("EV") market in Hawai'i has grown markedly and continues to accelerate. This has created the need to significantly expand public EV charging stations to meet demand. The Project is aggressive and historic and will be critical in helping to satisfy need. However, additional third-party public charging station development will still be required.

The proposed Project aligns with the Company's *Electrification of Transportation Strategic Roadmap* ("Roadmap")[3] and *Critical Backbone Study: Planning Methodology* ("Backbone Study).[4] It also incorporates significant customer and stakeholder feedback and draws from industry best practices and perspectives from other jurisdictions. Justifications for the Project include:

- Public charging is needed to achieve Hawaii's aggressive decarbonization goals;
- Private sector fast charger buildout has not occurred in Hawai'i. Unless and until this changes, Hawaiian Electric is well-suited to build out and maintain this critical infrastructure for the near and long term;
- EV load growth will promote affordable electric rates for all; and
- The Project will create a geographically diverse and equitably accessible network.

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[2] Transmittal No. 13-07, Decision and Order No. 31338 filed July 1, 2013. Pilot extension in Docket No. 2016-0168, Decision and Order No. 34592 filed June 2, 2017.
[3] Docket No. 2016-0168, Electrification of Transportation Strategic Roadmap filed March 29, 2018.
[4] Docket No. 2018-0315, Electrification of Transportation Electric Vehicle Critical Backbone Study: Planning Methodology filed July 30, 2019.

The total estimated cost of the Project is approximately $79 million to install and operate 150 single-port Direct Current fast charging ("DCFC") and 150 dual-port Level 2 charging stations across the Company service territories from 2023 through 2030. The Project cost includes maintenance of the charging stations and public education and outreach.

The Company is also proposing revised EV-U tariffs designed to be roughly cost-competitive with gasoline and which encourage charging during the middle of the day when solar energy is abundant. Pricing at public charging is also an important equity consideration given that this charging can act as the primary transportation "fill-up" point for those without access to private charging, including many residing in multi-unit dwellings ("MUDs").

Decarbonization is an imperative that will be served by electrification of transportation ("EoT"). Hawaiian Electric is proud to play a role in this critical effort by proposing a Project that will promote continued and sustainable EoT growth.

II. REQUESTED APPROVALS

Hawaiian Electric hereby submits the Requested Approvals for the Project and respectfully request a decision and order ("D&O") approving:

(a) Implementation of the proposed Project at an estimated total cost of $79 million as further described in Exhibit F (*Estimated Project Costs*);

(b) A commitment of funds in excess of $2.5 million for the capital costs of the Project, currently estimated at $58 million ("Capital Costs") pursuant to Paragraph 2.3(g)(2) of the Commission's General Order No. 7, as modified by D&O No. 21002, filed May 27, 2004, in Docket No. 03-0257 ("G.O. 7");

(c) The proposed revised Schedule EV-U tariffs contained in Exhibit B (*Proposed Rate Design*) including the revised tariff language and charging rates and the allowance of the proposed rates to become effective three months after approval of the Project;

(d) Termination of Schedule EV-MAUI, while leaving the shared savings mechanism ("SSM") in place for the applicable charging stations installed under EV-MAUI;

(e) The proposed accounting and ratemaking treatment for the Project, as further described in Exhibit D (*Accounting and Ratemaking Treatment*), including:

1) Accrual of an AFUDC, as appropriate;

2) Recovery of the Capital Costs, as described in Exhibit F (*Estimated Project Costs*);

3) Recovery of the installation and post-installation incremental O&M costs, as described in Exhibit F (*Estimated Project Costs*) in the year following when costs are incurred;

4) Recovery of total Capital and incremental O&M costs described above, net of the related EV-U revenues from the Project chargers, through the Exceptional Project Recovery Mechanism ("EPRM") established in D&O 37507, as described in Exhibit E (*Exceptional Project Recovery*);

(f) Such other and further relief as may be just and equitable in the premises.

III. APPLICANTS

Hawaiian Electric, whose principal place of business and whose executive offices are located at 1001 Bishop Street, Suite 2500, Honolulu, Hawai‘i, is a corporation duly organized under the laws of the Kingdom of Hawai‘i on or about October 13, 1891, and now exists under and by virtue of the laws of the state of Hawai‘i. Hawaiian Electric is an operating public utility engaged in the production, purchase, transmission, distribution, and sale of electricity on the island of Oahu.

Hawai‘i Electric Light, whose principal place of business and whose executive offices are located at 1200 Kilauea Avenue, Hilo, Hawai‘i, is a corporation duly organized under the laws of the Republic of Hawai‘i on or about December 5, 1894, and now exists under and by virtue of the laws of the state of Hawai‘i. Hawaii Electric Light is an operating public utility engaged in the production, purchase, transmission, distribution, and sale of electricity on the island of Hawai‘i.

Maui Electric, whose principal place of business and whose executive offices are located at 210 Kamehameha Avenue, Kahului, Maui, Hawai‘i, is a corporation duly organized under the laws of the Territory of Hawai‘i on or about April 28, 1921, and now exists under and by virtue of the laws of the state of Hawai‘i. Maui Electric is an operating public utility engaged in the production, purchase, transmission, distribution, and sale of electricity on the island of Maui; the production, transmission, distribution, and sale of electricity on the island of Moloka‘i; and the production, purchase, distribution, and sale of electricity on the island of Lana‘i.

IV. CORRESPONDENCE

Correspondence and communications with regard to this Application should be addressed to:

Kevin M. Katsura
Director, Regulatory Non-Rate Proceedings
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, Hawai'i 96840-0001

Kevin.Katsura@hawaiianelectric.com
Regulatory@hawaiianelectric.com

V. STATUTORY PROVISION OR AUTHORITY

This Application is filed pursuant to Sections 269-6, 269-7, and 269-16 of the Hawai'i Revised Statutes ("HRS"), Sections 16-601-74 and 16-601-86 of the *Rules of Practice and Procedure Before the Public Utilities Commission*, Title 16, Chapter 601 of the Hawai'i Administrative Rules, G.O. 7 Paragraph 2.3(g)(2), D&O 18365, D&O No. 34514, issued on April 27, 2017, in Docket No. 2013-0141, and D&O No. 37507, issued December 23, 2020, in Docket No. 2018-0088.

VI. EXHIBITS

The following exhibits are provided in support of this Application:

Exhibit A	–	Project Development
Exhibit B	–	Proposed Rate Design
Exhibit C	–	Project Justification with Business Case Support
Exhibit D	–	Accounting and Ratemaking Treatment
Exhibit E	–	Exceptional Project Recovery

Exhibit F	–	Estimated Project Costs
Exhibit G	–	Revenue Requirements and Bill Impacts
Exhibit H	–	Greenhouse Gas Analysis
Exhibit I	–	Best Practices Review
Exhibit J	–	Lessons Learned Survey Results

VII. PROJECT JUSTIFICATION

As noted above, there are five key reasons the Company is seeking to expand the public EV charging network it its service territories.

A. PUBLIC CHARGING IS NEEDED TO ACHIEVE HAWAII'S DECARBONIZATION GOALS

Hawaii's climate and energy independence goals aim to make the Aloha State a national leader in clean energy. On June 8, 2015, Hawai'i became the only state with a legislative goal of 100% renewable energy by 2045 with the signing of HB 623. In 2017, Governor Ige signed Act 32, making the state the first to align its energy and environmental policy with the 2016 Paris Climate Agreement's emission reduction targets. With Act 15 (HB2182), the state pledged to become carbon neutral by 2045.[5] Hawaii's four counties in 2017 pledged to eliminate fossil fuel use from ground transportation by 2045.[6] Advancing clean transportation will be a necessary component to achieve these goals. As shown in Table 1 below, in 2017 (the latest year data is

[5] See https://governor.hawaii.gov/newsroom/latest-news/governors-office-news-release-governor-david-ige-signs-bills-to-set-carbon-neutral-goal-and-combat-climate-change/

[6] Business Journal, 2017, "Hawai'i counties pledge to eliminate fossil fuels from ground transportation." https://www.bizjournals.com/pacific/news/2017/12/12/hawaii-counties-pledge-to-eliminate-fossil-fuels.html

available), ground transportation accounted for 25 percent of total greenhouse gas emissions (excluding sinks, excluding aviation) in Hawai‘i.

Table 1. Hawai‘i Greenhouse Gas Emissions for 2017 (MMT CO_2 Eq.)[7]

Summary from Table 2-1: Hawai‘i GHG Emissions (MMT CO_2 Eq.)	
Sector/Category	**2017**
Energy	**17.64**
Stationary Combustion	8.09
Transportation	8.98
Incineration of Waste	0.23
Oil and Natural Gas System	0.31
Non-Energy Uses	0.04
AFOLU (Sources)	**0.83**
AFOLU (Sinks)	**1.26**
Waste	**0.82**
Total Emissons (Excluding Sinks)	**20.56**
Net Emissions (Including Sinks)	**17.87**
Aviation	4.10
Net Emissions (Including Sinks, Excluding Aviation)	**13.77**
Net Emissions (Excluding Sinks, Excluding Aviation)	**16.46**

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Summary from Table 3-1 for GHG Emissions from Energy Sector (MMT CO2 Eq.)	
Transportation	**8.98**
Ground	4.19
Domestic Marine	0.49
Domestic Aviation	3.46
Military Aviation	0.64
Military Non-Aviation	0.2

Electric vehicles can play a significant role to reduce these emissions and boost energy independence: a study recently published by the University of Hawai‘i found that on O‘ahu, average passenger EVs consumed seven times less fossil fuel than their gasoline-powered counterparts in 2020 and cut carbon emissions in half.[8] As shown in Figure 1, these benefits are expected to increase significantly as Hawaii’s electricity production increasingly relies on renewable sources: the average EV is projected to emit only 3.2% of the carbon emissions of the average gasoline vehicle by 2040, when Hawaiian Electric forecasts it will reach 100 percent renewable energy. In addition to reduced carbon emissions, EVs also produce fewer Nitrogen

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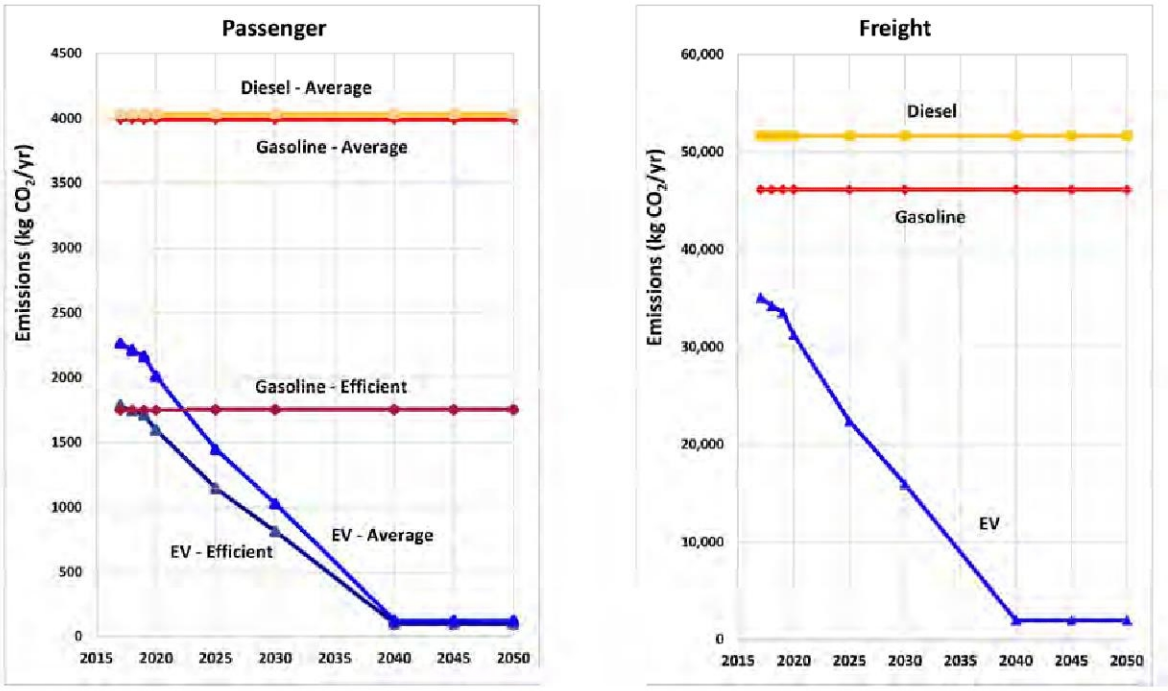
[7] Hawaii Greenhouse Gas Emissions Report for 2017, Final Report (dated April 2021), available at https://health.hawaii.gov/cab/files/2021/04/2017-Inventory_Final-Report_April-2021.pdf

[8] McKenzie, K.A. 2021, “Sun, Wind and Waves: EV Fossil Fuel Use and Emissions on an Isolated, Oil-Dependent Hawaiian Island”, World Electric Vehicle Journal 2021, 12(2), 87; available at https://doi.org/10.3390/wevj12020087.

Oxide ("NOx"), Sulfur Dioxide ("SO_2"), particulates, and volatile organic compound emissions, all of which impact human health[9] and produce far less noise pollution, contributing to quieter streets and more pleasant urban soundscapes.[10]

Figure 1. Annual CO_2 Emissions Per A) Passenger and B) Freight Vehicle on O'ahu from 2017 through 2020 and projected to 2050 [11]



The 2021 Legislative Session passed landmark clean transportation policies for the state, boosting momentum for EV adoption. Act 73[12] and Act 74[13] bolster the State's commitment to EV adoption by requiring travelling state employees to rent EVs where available, and the

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[9] EPRI, September 2015, "Environmental Assessment of a Full Transportation Portfolio, Volume 3: Air Quality Impacts", https://www.epri.com/research/products/3002006880

[10] Walker, I. et al., 2016, "How Might People Near National Roads Be Affected by Traffic Noise as Electric Vehicles Increase in Number? A Laboratory Study of Subjective Evaluations of Environmental Noise," PLoS One. 2016; 11(3): e0150516.

[11] McKenzie, K.A. 2021, "Sun, Wind and Waves: EV Fossil Fuel Use and Emissions on an Isolated, Oil-Dependent Hawaiian Island", World Electr. Veh. J. 2021, 12(2), 87; available at https://doi.org/10.3390/wevj12020087.

[12] https://www.capitol.hawaii.gov/measure_indiv.aspx?billtype=HB&billnumber=424

[13] https://www.capitol.hawaii.gov/measure_indiv.aspx?billtype=HB&billnumber=552&year=2021

prioritization of zero-emission vehicles when purchasing or leasing light, medium, and heavy-duty motor vehicles for all state agencies. Act 75[14] supports the continued establishment of EV charging infrastructure at MUDs and commercial facilities by allocating a portion of "barrel tax" revenues to maintain the Hawaii Energy[15] EV Charging System Rebate program. The Act also supports EV charging drivers by adding county enforcement to the EV public parking spaces designation,[16] as well as requiring that each new EV charging system installed is at least a level 2 network-capable charging station maintained in working order.

Despite these efforts and strides made, there is still a long way to go. There are 16,693[17] EVs registered in the Company's service territories as of September 2021 – just 1.6 percent of the total passenger vehicles registered. The steep ramp needed to meet the state's clean transportation goals will not be possible without an expansion of public EV charging in the state. Public charging, especially reliable fast charging, is needed to a) support the daily travel needs of individuals and fleet drivers that exceed current vehicle ranges, b) enable inclusive EV ownership beyond those with access to home charging, and c) overcome range anxiety to enable drivers and governments to purchase EVs.[18]

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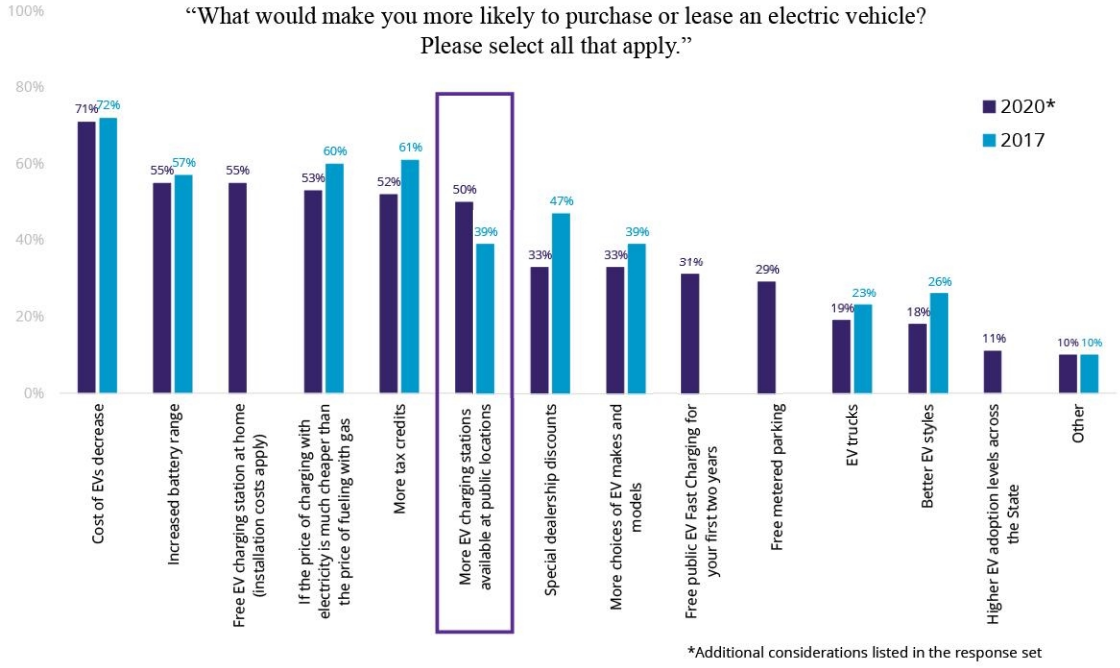
[14] https://www.capitol.hawaii.gov/measure_indiv.aspx?billtype=HB&billnumber=1142&year=2021
[15] https://hawaiienergy.com/for-business/rebates/electric-vehicle-charging-stations
[16] Hawaii Revised Statute §291-71 Designation of parking spaces for electric vehicles; charging system. http://www.capitol.hawaii.gov/hrscurrent/Vol05_Ch0261-0319/HRS0291/HRS_0291-0071.htm
[17] Department of Business, Economic Development & Tourism, Research & Economic Analysis, Monthly Energy Trends, Monthly Energy Data: Historical data from January 2006 to September 2021, accessed October 22, 2021. http://dbedt.hawaii.gov/economic/energy-trends-2/
[18] See, for example Tweed, K. 2013, "Fast Charging Key to Electric Vehicle Adoption, Study Finds," https://www.greentechmedia.com/articles/read/fast-charging-key-to-electric-vehicle-adoption-study-finds
Li et al., 2015, "The Market for Electric Vehicles: Indirect Network Effects and Policy Impacts," University of Chicago Press Journals, https://www.journals.uchicago.edu/doi/full/10.1086/689702,

The need for public charging appears to be increasing in importance as other barriers are reduced (see Figure 2). Studies have also demonstrated that adoption barriers must be overcome simultaneously for drivers to make the switch to an EV,[19] suggesting that expected reductions in other barriers will not fully unlock EV adoption if progress in public charging buildout lags.

Figure 2. Responses to panel survey of randomly selected residential customers (2020 n = 2,031; 2017 n = 2,247)[20]



The International Council on Clean Transportation, 2019, "Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas," https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf, Hardman, S. et al, 2018, "A review of consumer preferences of and interactions with electric vehicle charging infrastructure," Transportation Research Part D: Transport and Environment, 62:508-523, https://www.sciencedirect.com/science/article/abs/pii/S1361920918301330?via%3Dihub

[19] Krishna, G. 2021, "Understanding and identifying barriers to electric vehicle adoption through thematic analysis," Transportation Research Interdisciplinary Perspectives, https://www.sciencedirect.com/science/article/pii/S2590198221000713

[20] Results compared from 2017 and 2020 Hawaiian Electric Electrification of Transportation Baseline and Tracking Surveys. Figure prepared in February 2021.

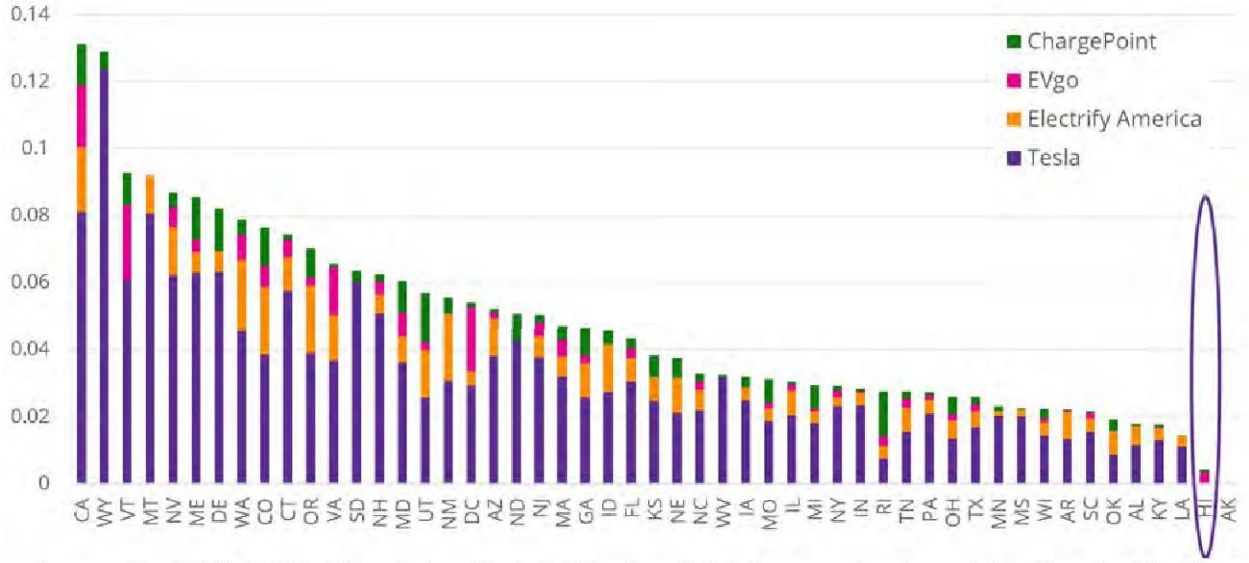
Among those customers surveyed by the Company[21] who already drive an EV, 76 percent indicated that the availability of public fast charging was influential in their decision to purchase an EV. National and local surveys indicate the lack of a reliable and geographically complete network of public charging, especially convenient fast charging, as a significant barrier to EV adoption.

B. PRIVATE SECTOR FAST CHARGER BUILDOUT HAS NOT OCCURRED IN HAWAI‘I

Despite the significant need for fast charging buildout and continual increase of EV adoption in Hawai‘i, very little third-party investment has taken place. The state is currently home to only six fast chargers that are not owned by Hawaiian Electric, giving it the second-lowest rate of DCFC port installs per capita by the dominant fast charging networks (see Figure 3). At this point, the private sector planning for public fast charger installations appears to be limited and focused primarily on the Honolulu area.

[21] See Exhibit J (*Lessons Learned Survey Results*) for full survey results

Figure 3. Current DC Fast Charger Ports Installed per 1,000 Residents by Major DC Fast Charging Networks



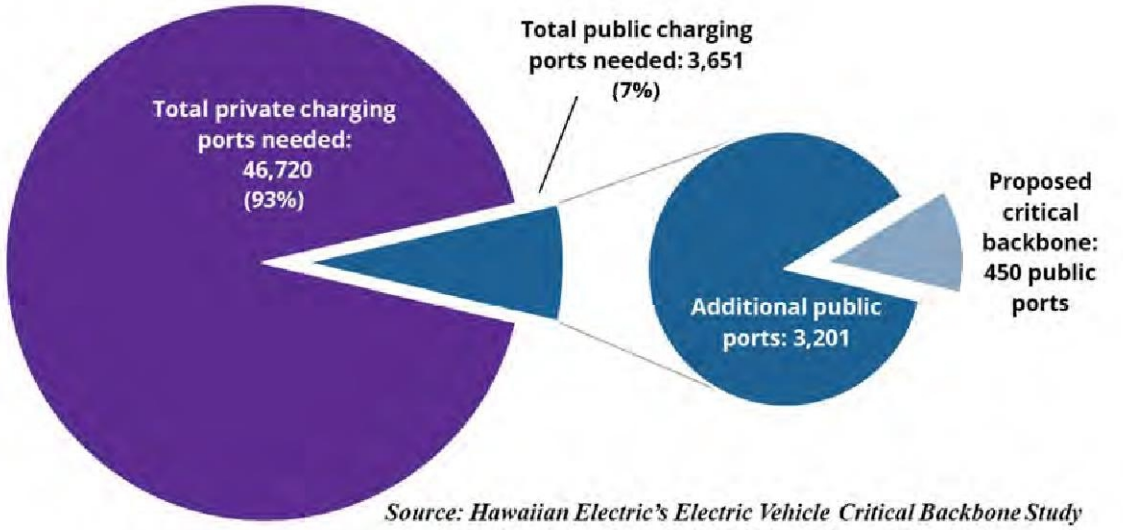
Source: Atlas EV Hub. Note: HI ports do not include EVgo-branded stations owned and operated by Hawaiian Electric.

Importantly, Hawaii's isolation adds additional challenges for charging companies that can be particularly material at low installation volumes - in particular, requiring a dedicated on-island installation, maintenance, and repair team (or significant travel costs and delays) and longer delivery times for parts. This isolation is unique among U.S. states and has likely made early-stage development of public charging on the islands uniquely challenging, despite residents' high interest in EVs and the beneficial lower average driving distances in Hawai'i compared to the rest of the U.S.

Installing a reliable backbone of public infrastructure can accelerate momentum in EV adoption in Hawai'i and help create sufficient demand for a competitive DCFC market. With this filing, the Company is proposing to install just 12 percent of the projected public charging ports needed on the islands by 2030, which is less than one percent of total needed charging ports (see Figure 4). The Company's intent is to provide public charging sufficient to spur the EV customer

base to an inflection point where adoption levels and utilization rates can support a healthy, lasting competitive market that will provide the vast majority of investment needed.

Figure 4. Electric vehicle charging ports needed in Hawai'i by 2030



Source: Hawaiian Electric's Electric Vehicle Critical Backbone Study
Total ports include DCFC, Level 2, and Level 1

C. HAWAIIAN ELECTRIC CAN PROVIDE RELIABILITY FOR THE LONG TERM

In order to support EV adoption and meet the state's goals, drivers need charging to be well-maintained, reliable, and there for the long haul. Drivers are accustomed to easy, reliable re-fueling of gasoline vehicles that fits simply into their busy lives, and EVs must strive to meet this standard. Experiences and stories of broken charging or inadequate maintenance can easily dissuade drivers from purchasing EVs.[22] Researchers from the University of California, Davis recently found that California's 18 percent "discontinuance" (the percent of drivers who initially

[22] See, for example, Sensiba, J. April 21, 2021, "Charger Reliability Is The Next Challenge For The EV Industry," *Cleantechnica,* https://cleantechnica.com/2021/04/21/charger-reliability-is-the-next-challenge-for-the-ev-industry/ Bushey, C. Aug 16, 2021, "Lack of EV charging scuppers no-emission road trips," *Financial Times,* https://www.ft.com/content/44581065-e58b-48a8-b87f-db6ccdad005e

bought a fully-electric vehicle but then chose not to buy an EV in subsequent vehicle purchases) was significantly related to a lack of charger convenience.

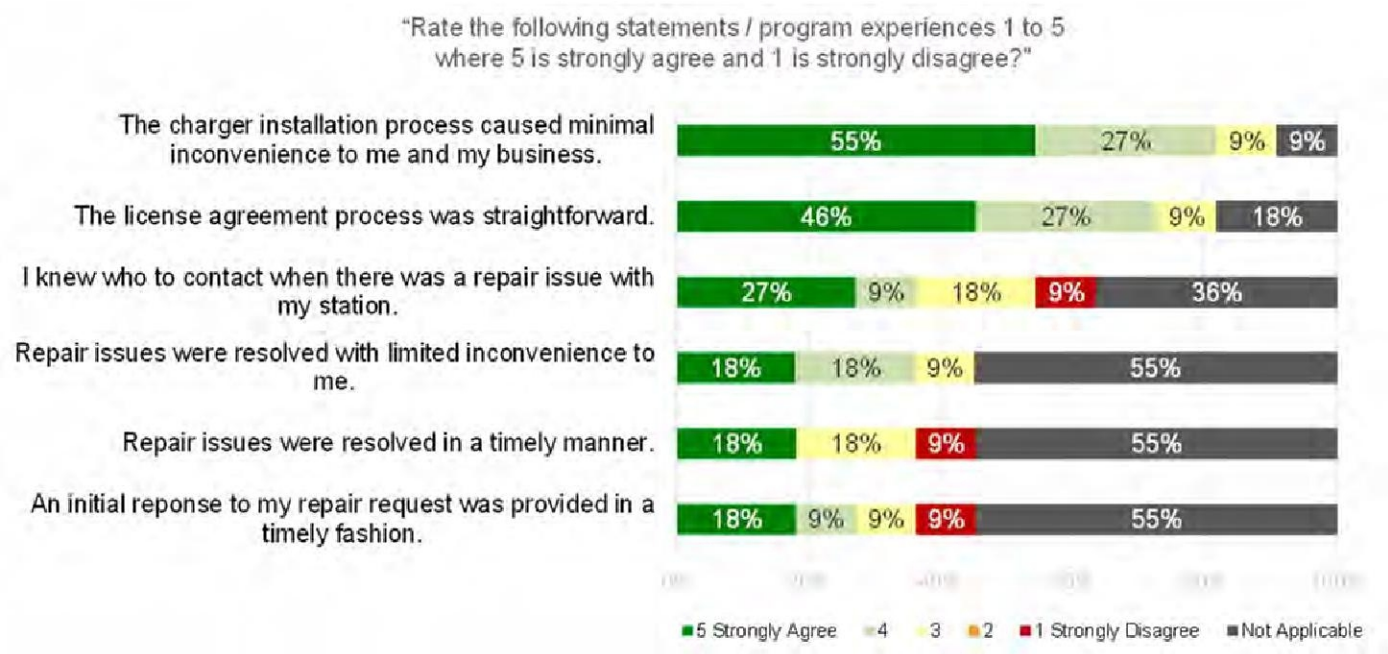
Unfortunately, business model and isolation challenges have led to issues in keeping non-utility charging providers active in Hawai‘i. As noted in the Roadmap, the majority of EV-F accounts and associated charging stations were developed on Maui, under a project called JUMPSmart Maui, a short-term research pilot project subsidized by the New Energy and Industrial Technology Development Organization of Japan. The JUMPSmart Maui stations were slated to be retired after the six-year project term, at which point Hawaiian Electric acquired four of the thirteen stations in order to ensure some public fast charging remained on Maui. Feedback from Drive Electric Hawaii ("DEH") members and EV driver surveys suggested a significant desire for the ongoing development of more public fast charging sites on Maui. Elsewhere in the Company's service territories, there has been very little third-party investment in fast charging infrastructure. On O‘ahu for example, only three customer accounts on Schedule EV-F providing third-party operated DC fast charging existed at the start of the pilot rate in 2013. By 2016, all three accounts were closed, and the charging stations were removed. On Hawai‘i Island in 2018, the Company assumed operation of a DCFC station at the Shops at Mauna Lani from a third-party that no longer wished to be involved in the EV infrastructure business.

Hawaiian Electric intends to be a long-term, trusted partner in the EV charging space. Unlike previous providers that have left the islands, disrupting customers' vital transportation needs, Hawaiian Electric can ensure a measure of consistency and ongoing support to its backbone of charging infrastructure well into the future. The Company has shown its commitment to EV charging and will continue to prove its role as a trusted partner in the EV

charging landscape. To that point, the eleven responses to our survey of site host participants in our existing EV-U and EV-MAUI pilots provided overwhelmingly positive feedback on their relationship with the Company, as seen in Figure 5. Site hosts additionally provided written comments that

- *"[T]he contractors and Hawaiian Electric teams were very accommodating, always kept us up to date and were very easy to work with,"*
- *"ME[C]O was fast and efficient with the install," and*
- *"They were awesome to work with."*

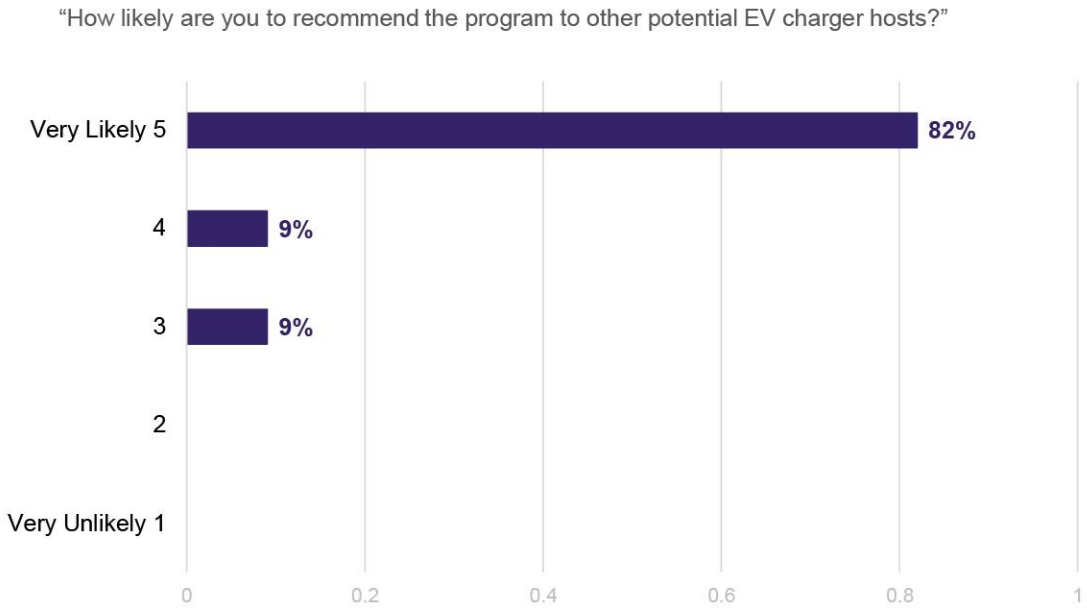
Figure 5. Ratings of Site Hosting Program Experience (n= 11 of 20 existing DCFC sites participating in EV-U and EV-MAUI pilot programs)



In addition to these positive experiences working with Hawaiian Electric, many site hosts cited the positive experiences and benefits associated with being able to provide charging services for their customers. As shown in Figure 6, all eleven respondents answered the question

"How likely are you to recommend the program to other potential EV charger hosts?" with a three or above out of five, with the majority (9 out of 11) of hosts giving a 5: Very Likely.

Figure 6. Responses of Site Hosts to the question "How likely are you to recommend the program to other potential EV charger hosts?" (n= 11 of 20 existing DCFC sites participating in EV-U pilot program)



Despite the generally positive experiences, EV driver and site host surveys and feedback from DEH members reveal that ongoing charger repair speed remains an issue. The greatest challenge to faster fix times has been the speed with which the Company can receive replacement parts from the contiguous U.S. Charger parts are ordered once a repair is needed, and Company staff must then wait days to months for delivery before providing repair service. Hawaii's remote location means this is a challenge faced by the Company and by private sector charging companies alike. One of the key lessons learned from the Pilot is to explore ways to mitigate these delays by increasing on-hand stock of key components, parts, and equipment. The Company has begun changing its internal maintenance and repair approach by stocking key replacement parts locally in order to more quickly respond to equipment issues, significantly

reducing repair times and reducing the impact of outages for site hosts and drivers. If the Project is approved, the Company will continue to leverage these changes and explore additional methods to mitigate charge station outages and reduce repair times. An additional benefit of Project approval would be the increased bargaining power that a larger deployment beyond the pilot phase can provide. The approved Project scope can potentially provide the Company with additional leverage when seeking equipment, service, and parts. If approved, the Company will strengthen contract terms with suppliers related to delivery times for parts and customer service under the Project. Another Company step towards improving the maintenance and repair functionality in the near-term, is to contract with third-party service providers to resolve issues in a timely manner.

Taken as a whole, the Company expects that this Project has the potential to support an economic recovery from the COVID-19 pandemic by creating green industry construction opportunities for infrastructure installation, and workforce development opportunities for EV and charging station maintenance. The Project would also allow the Company to continue supporting the development of a local workforce in charging infrastructure installation and maintenance. California and other industry-leading states have flagged a lack of technical EV charging expertise as a key workforce development issue that warrants near-term focus.[23] The Project can

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[23] See, for example, California Energy Commission, "Staff Workshop on Electric Vehicle Charging Infrastructure Training Requirements for CALeVIP," https://www.energy.ca.gov/event/workshop/2020-07/staff-workshop-electric-vehicle-charging-infrastructure-training

Brown, A. et al, 2021, "Driving California's Transportation Emissions to Zero," https://escholarship.org/uc/item/3np3p2t0#article_main[24] The "managed" charging EV load shape was developed, in which drivers are assumed to optimize their charging behavior according to price signals (i.e., time-of-use rate periods) at their charging locations, while still being able to meet their travel needs. See Section IV.A.3. of Exhibit C for more details.

assist in growing such expertise in Hawai‘i, helping to ensure the state has the local technical knowledge needed to ramp quickly enough to meet the state's clean transportation goals.

D. EV CHARGING LOAD GROWTH WILL PROMOTE AFFORDABLE RATES

The proposed Project is forecasted to provide significant financial benefits to all Hawaiian Electric's customers over time. As shown in Exhibit C (*Project Justification with Business Case Support*), a Ratepayer Impact Measure ("RIM") test was performed for three main scenarios:

1) the Project's energy supply costs, implementation costs, and benefits through additional utility bill revenue, considered alongside broader EV adoption forecasted by the Company;
2) the Project's energy supply costs, implementation costs, and benefits through additional utility bill revenue; and
3) the Project's energy supply costs and benefits through additional utility bill revenue only.

A summary of the benefit-cost ratio results for the managed charging case[24] on the proposed EV-U rate are shown below in Table 2 below.

[24] The "managed" charging EV load shape was developed, in which drivers are assumed to optimize their charging behavior according to price signals (i.e., time-of-use rate periods) at their charging locations, while still being able to meet their travel needs. See Section IV.A.3. of Exhibit C for more details.

Table 2. Cost-Benefit Assessment Results Summary

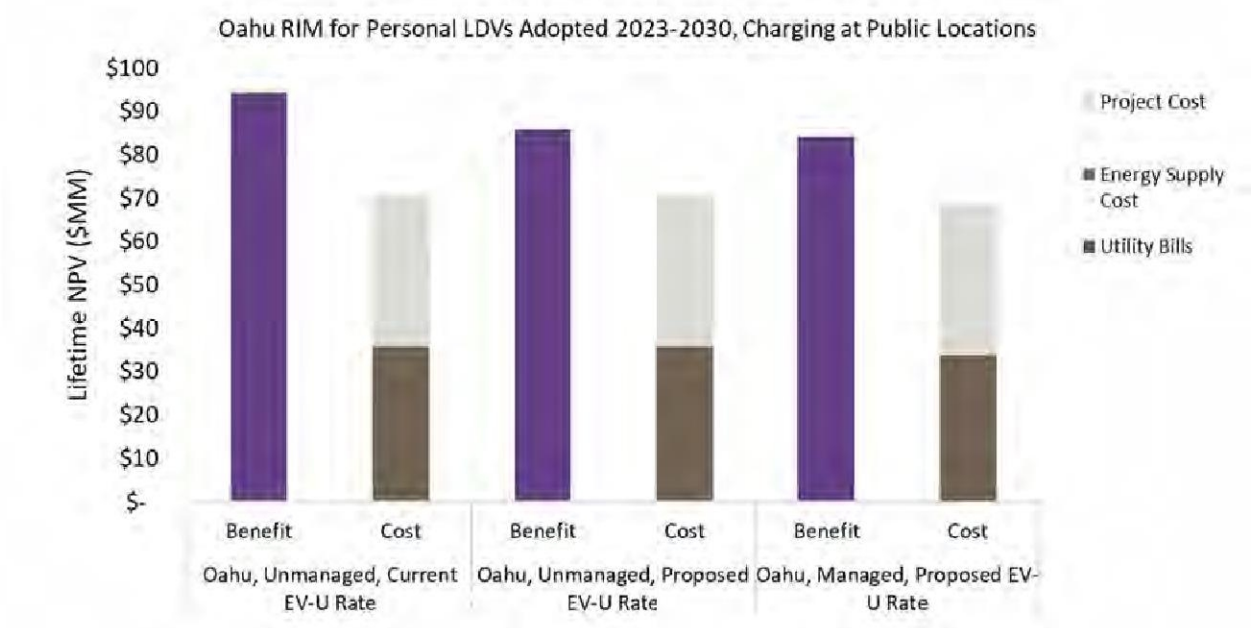
	RIM Benefit-Cost Ratio Results for the Managed Charging Case on Proposed EV-U Tariff		
	O‘ahu	Maui County	Hawai‘i Island
Scenario 1: Full EV Forecast	1.23	1.38	1.26
Scenario 2: Total Project Costs and Benefits	0.30	0.40	0.42
Scenario 3: Project Energy Costs and Revenue Only	2.76	4.05	5.22

Scenario 1 shows the Project costs and benefits alongside the energy supply costs and utility revenue for all public charging associated with the Company's EV adoption forecast. This scenario shows that this Project is a crucial and justifiable step to help accelerate deployment of third-party investment in additional public charging infrastructure and to accelerate broader EV adoption. Scenario 1 above shows a benefit-cost ratio of 1.23-1.38 when considering the project's impacts in spurring EV adoption and the private sector public charging market - see Figure 7 below for Oahu's results as an example, and Exhibit C for the detailed results. This analysis demonstrates that the wide-spread EV adoption enabled by this project will generate significant revenue beyond the cost of the project and the cost of supplying vehicles with electricity. By unlocking investment from the private sector and spreading system costs over an increased demand for electricity, this project can create significant expected net benefits to the

Company's customers, putting downward pressure on utility costs and therefore on the price of electricity.

Specifically, because the Company is revenue decoupled, increased electricity sales revenue due to incremental adoption of EVs will not result in increased profits to the Company, but rather increase contributions to recovery of fixed costs. Increased contributions to fixed cost recovery resulting from increased EV electricity sales will, over time, apply downward pressure on electricity rates for all customers. Indeed, electric sales revenues in excess of the Companies' target revenues will be credited back to customers the following year and as discussed in section XI.C below, this Project, combined with other EV public charging load growth, can contribute to scenarios in which typical residential electric bills decrease (all else being equal). Thus, ultimately, this investment in EV adoption is expected to support affordability for all. Exhibit C expands upon the cost-benefit analysis, showing potential benefits in support of this Application under the full EV forecast in the next decade.

Figure 7. Full EV Forecast RIM Results for O'ahu



In addition, the Addendum to Hawaiian Electric Companies' Electrification of Transportation Strategic Roadmap ("Roadmap Addendum"), filed in Docket No.2018-0135 on November 29, 2018, shows a longer-term analysis indicating continued customer benefits at even higher EV adoption levels. The analysis in the Roadmap Addendum shows that each EV purchased when an internal combustion engine ("ICE") is retired improves the "energy wallet" for O'ahu – the amount residents spend on transportation – by an average of approximately $2,600.[25]

Scaling these 'Un-managed charging' results to Hawaiian Electric's adoption forecast reveals a net benefit of $291 million to O'ahu "energy wallet" for personal light duty vehicles

[25] Net present value in 2017 dollars, when the analysis took place. As the upfront cost of EVs comes down over the next several years (E3 assumed 2025 parity with ICE vehicles, in line with Bloomberg's projections), the gasoline and maintenance savings from EVs are projected to outweigh the costs to buy the vehicles and charging equipment, make electricity system upgrades, and provide electricity to fuel the vehicles.

("LDVs") over the 2018 – 2045 period.[26] These economic benefits can be increased even further by incentivizing "smart" managed charging – charging during hours of higher renewable penetration and lower system cost – through rates and/or demand response programs, resulting is a 32 percent increase in net benefits, to $3,401 per vehicle. Scaling these results to Hawaiian Electric's adoption forecast reveals a net gain of $385 million ($2017 NPV) to the O'ahu "energy wallet" for personal LDVs over the 2018 – 2045 period. The Company intends to update its forecast and reevaluate long-term costs and benefits in the 2022-2023 timeframe.

E. HAWAIIAN ELECTRIC CAN SUPPORT A GEOGRAPHICALLY DIVERSE AND EQUITABLY ACCESSIBLE NETWORK

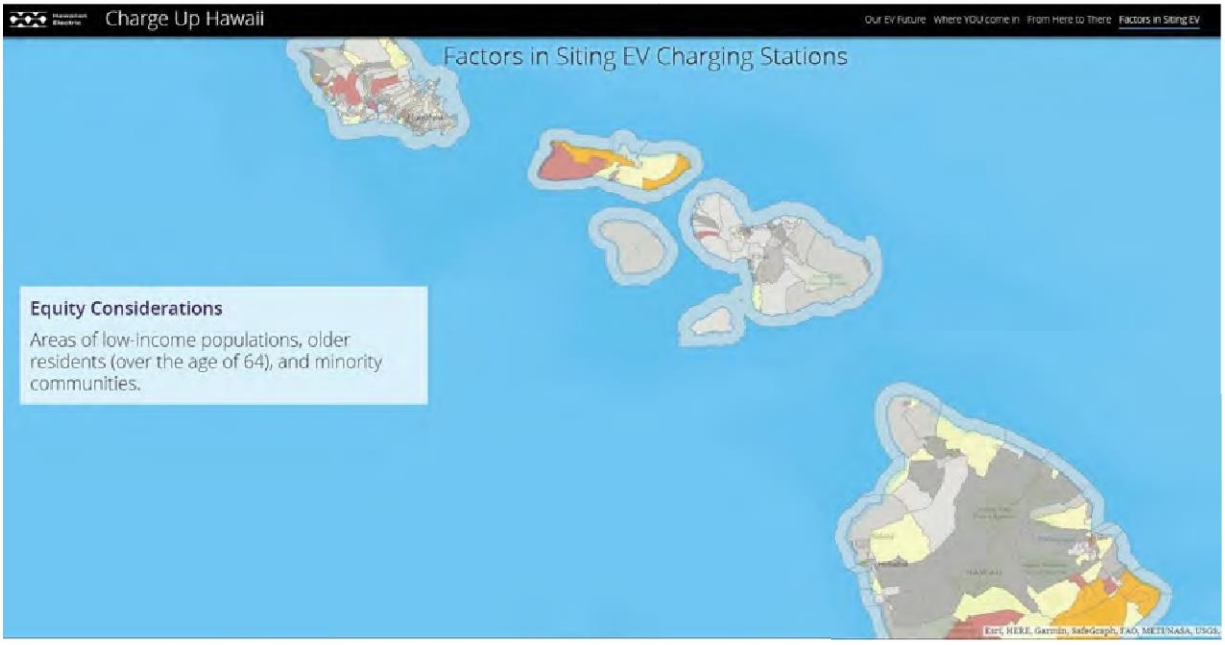
Hawaiian Electric has an obligation to serve all customers connected to the grid. This puts the Company in a unique position to jumpstart a geographically diverse and equitably accessible charging backbone needed to support EV adoption in rural and urban areas. The proposed Project can create access to clean mobility options for underserved communities, provide solutions to help reduce household transportation expenses, and mitigate environmental impact in neighborhoods with higher exposure to air pollutants. Recognizing that transportation equity is multifaceted and involves considerations beyond income designations, meaningful community engagement is critical to ensure that public EV chargers are desired and utilized by the communities they are intended to benefit. As an integral part of the community, Hawaiian Electric continues to pursue meaningful engagement with the local community by building on relationships with trusted community-based organizations, gathering input from stakeholder

[26] Net present value in 2017 dollars.

meetings, and developing surveys and tools to identify underserved communities, understand their mobility preferences, and determine the most beneficial sites for EV charging.

Throughout the design and implementation of the Project, Hawaiian Electric intends to continue outreach efforts and explore creative ways to engage customers. The Company has begun engagement to understand community preferences through the development of the "Charge Up Hawaii" website and interactive mapping tool.[27] Charge Up Hawaii was designed to encourage our customers and community partners to provide insight into their preferred EV charging locations. In addition, Charge Up Hawaii attempted to identify a number of infrastructure, traffic, environmental, socio-economic, and health variables that may be of high-priority to customers as it relates to transportation and mobility.

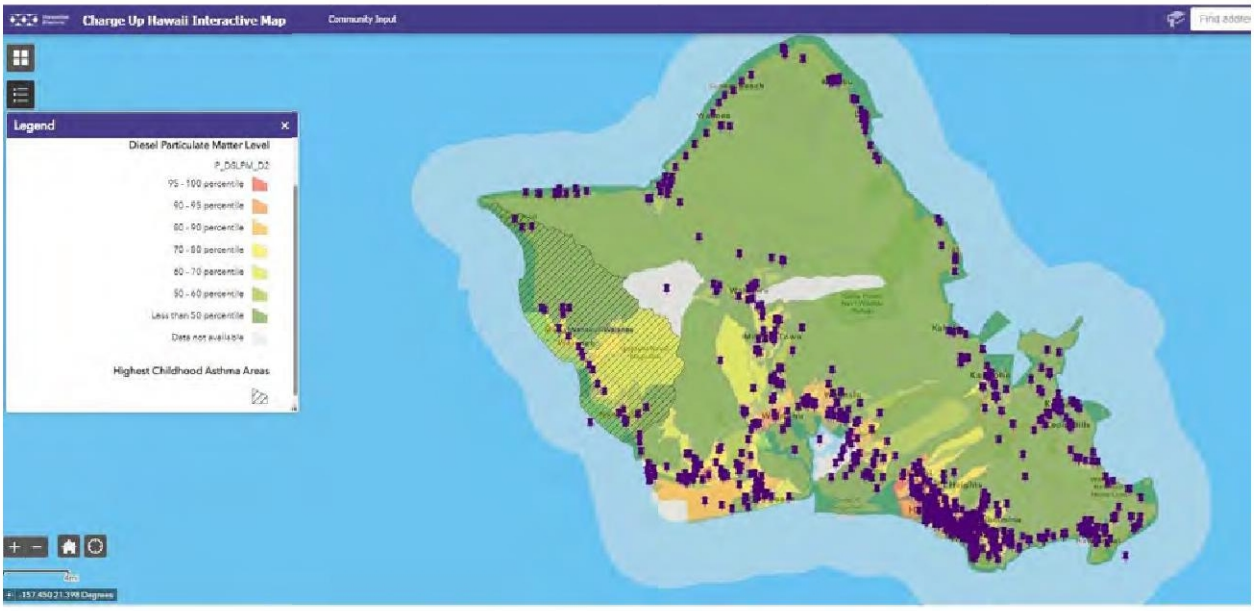
Figure 8. Charge Up Hawaii Equity Considerations Overview



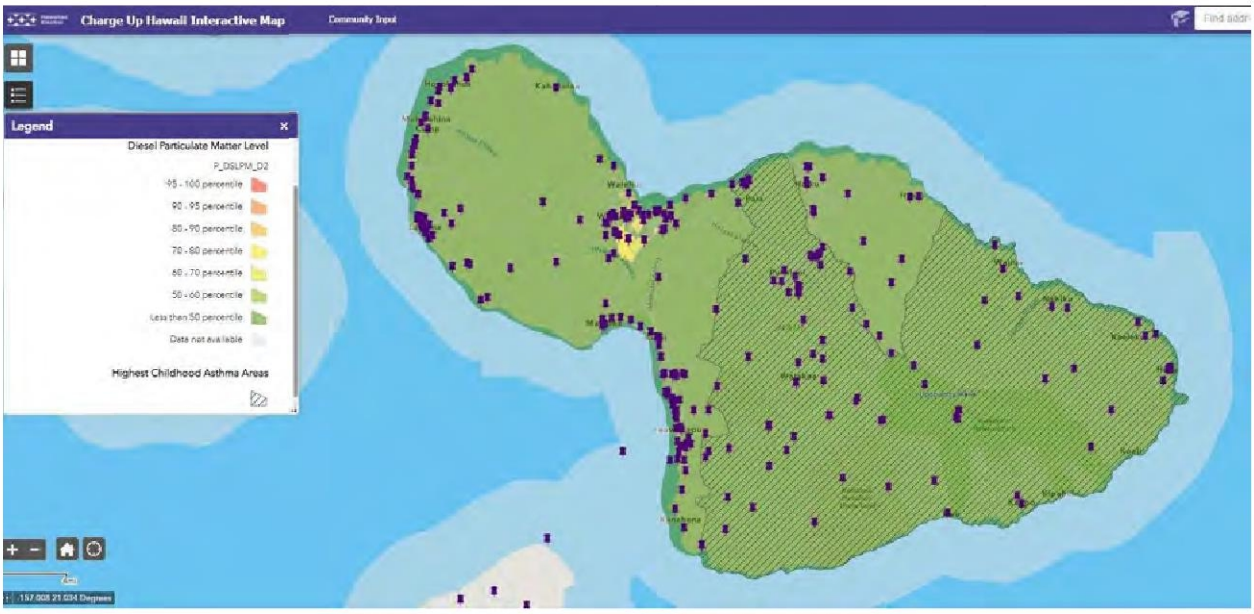
[27] www.chargeuphi.com

The Charge Up Hawaii map layers displaying areas with high diesel particulate matter levels and high childhood asthma, shown in Figure 9, is an illustrative example of the islands of O'ahu and Maui and how the reduction in vehicle emissions through EV adoption could have major impacts within local communities. These preliminary findings help the Company gain an understanding of customer suggested charging locations within disproportionately affected communities. Moving out of a pilot phase will assist the Company in ensuring charging is available in disadvantaged communities where electric transportation options would bring significant local air quality and health benefits.

Figure 9. O'ahu and Maui Diesel Particulate Matter and Childhood Asthma Map Layers[28]



[28] The islands of O'ahu and Maui have the highest levels of diesel particulate matter within the state.



As detailed in Exhibit A (*Project Development*), Charge Up Hawaii received significant participation from the community with a suggested 1,812 preferred locations of future charging sites. The highest concentration of suggested charging sites was located in both highly urban neighborhoods, like Ala Moana and Kakaako, and rural communities, such as Ka'u and Hana. These findings support the broad community desire for EV charging and the need for a geographically diverse and equitably accessible network. The Company has and will continue to, engage with a wide range of stakeholders in order to support the diverse Project goals of ensuring a distributed geographic charging network sufficient to overcome range anxiety barriers, minimizing costs, and supporting equitable accessibility.

VIII. PROJECT DESCRIPTION

A. PROJECT DEVELOPMENT

The Company developed this Project by (1) building on the work from the Roadmap and Backbone Study, (2) considering lessons learned from the Pilot, (3) conducting a review of best

practices of invester-owned utilities' public EV charging infrastructure filings, and (4) performing stakeholder outreach, as detailed in Exhibit A (*Project Development*).

B. SCOPE AND SIZE

The Company sized the Project to be a modest but meaningful portion of the 2030 public EV charging need identified in the Backbone Study in order to spur the EV adoption needed to enable the private sector and in line with utility best practices and Backbone Study findings. See Exhibit A (*Project Development*) for more details. This Project aims to install and maintain 150 DCFC ports, representing 28% of 2030 DCFC public charging ports projected to be needed to serve Backbone Study Reference Case EV adoption of about 8 percent of light-duty vehicle stock in 2030.

The preferred configuration for each site is two (2) DCFC ports and one (1) dual-port Level 2 charging station. This configuration is based on stakeholder feedback received and best practices from commission decisions around the country. Customers and DEH members have provided feedback on the Pilot stating the desire to have more than one DCFC at the sites in case of maintenance issues and/or to reduce queuing – including at some sites that are already seeing long wait times. This is consistent with commission decisions around the country.[29] Stakeholder

[29] See, for example, decisions in the following utility-owned DCFC programs (detailed in Exhibit I *(Best Practices)*):

- Southern California Edison (docket A1807022) and Pacific Gas & Electric (docket 18-07-020), in which the California Public Utilities Commission (CPUC) describes the benefits of a port minimum and states that they encouraged the utilities to install at least two ports per site. The CPUC explains, "In the interest of minimizing costs and maximizing overall benefits, we encourage the utilities to install at least 2 ports per site to ensure more than one person can utilize charging at a particular location."

feedback also requested additional Level 2 charging to provide backup options at lower installation cost. DCFC installations will support both CCS and CHAdeMO connectors: each site will host at least one combination CHAdeMO / CCS station and the Company will track the evolution of market forces and customer preferences to determine the right ratio of connectors at each site as the Project continues into the future.

The preferred allocation set forth above identifies approximately 75 sites as potential new locations across the service territories. This preferred configuration leaves 75 Level 2 charging stations remaining. The Company requests flexibility in both the deployment of charging infrastructure as well as in some of the anticipated Project expenses. With regard to siting, it is important to have the flexibility in determining the configuration of the charging stations to meet the specific needs of each site and community they are serving. For example, some communities may need more or less DCFC or more or less Level 2 charging stations at a given location. The opportunity to right-size charging locations is crucial to the success of the Project going forward to meet the needs and expectations of the current and future EVs. With an eye towards flexibility, the Company asserts that the remaining 75 Level 2 chargers represent a potential contingency in the budget, allowing for either a) deployment of additional charging

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- The Florida Public Service Commission decision on Tampa Electric's program (docket 20200220-EI) notes that the utility intends to install two Level 2 Ports at each of the four DCFC locations to provide redundancy, and that their program will require a minimum of 2 and a maximum of 6 ports to be installed at each public site.
- The Oregon Public Utilities Commission decision on Portland General Electric's program (docket UM-1811) requires four dual-connector DC fast chargers and one dual-port Level 2 charger at each site.
- Puget Sound Energy's program (docket Number UE-180877), which has no explicit port minimum, but specifies that there will be 32 DCFC ports at only eight locations.

infrastructure, b) increased O&M expenses, or c) any unforeseen costs that may arise as a result of scaling and/or needed expenditures to improve customer satisfaction or ease of us above.

After accounting for the private charging installations demanded by a healthy EV market, the proposed number of ports to be deployed in this Project represents less than one percent of total needed ports in the 2030 Reference Case (see Figure 4 above). The intent is to provide public charging sufficient to enable purchase decisions and spur the EV customer base to an inflection point where adoption levels and utilization rates can support a lasting competitive market that will provide the vast majority of needed investment.

C. PROJECT SCHEDULE

1. Estimated Project Implementation Schedule

The Project's estimated implementation schedule shown in Figure 10 below, assumes beginning in 2023 following Commission approval (assumed in 2022) through the end of 2030. The Company acknowledges the immensely heavy workload of the Commission to manage many dockets and priorities, therefore, the allocated time for Commission review and approval is for illustrative purposes only in the Project Implementation Schedule.

Figure 10. Estimated Project Implementation Schedule

Public EV Charger Expansion	2021			2022				2023	2024	2025	2026	2027	2028	2029	2030
	10	11	12	Q1	Q2	Q3	Q4								
File Application with PUC															
PUC Review															
PUC Approval															
Deploy 5 sites															
Deploy 10 sites															
Deploy 10 sites															
Deploy 10 sites															
Deploy 10 sites															
Deploy 10 sites															
Deploy 10 sites															
Deploy 10 sites															

The targeted number of sites to be deployed in each year is shown in Table 3 below. This target reflects the Company's best estimated deployment schedule at the time of filing, however, the Company requests flexibility in the actual number of sites per year and on which islands, in order to address actual implementation conditions and Project uptake across service territories. The implementation process is described in Exhibit A (*Project Development*).

Table 3. Targeted Annual Number of Sites

Annual Number of Sites	2023	2024	2025	2026	2027	2028	2029	2030	Total
O'ahu	2	6	6	6	6	6	6	6	44
Hawai'i Island	1	2	2	2	2	2	2	2	15
Maui County	2	2	2	2	2	2	2	2	16
Total	**5**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**75**

2. Proposed Reporting

The Company currently files annual reports for Schedule EV-U and EV-F,[30] and Schedule EV-MAUI[31] by March 31st of the following year. The Company proposes to file a single annual report covering all existing Company owned charging stations and new installations under this Project with the following information:

a. Number of installations

b. Actual Project costs by site (Capital and O&M)

c. Actual O&M costs for maintenance and repair (in aggregate for all charging stations)

[30] Transmittal No. 13-07 (non-docketed) – Schedule EV-F and EV-U Hawaiian Electric's Annual Report
[31] Docket No. 2018-0422 Maui Electric Company, Limited Schedule EV-MAUI Tariff Annual Report

d. Actual O&M costs for Education and Outreach, including any future data analytics that may be required for data reporting

e. Actual revenues collected from Project sites

f. Aggregated Utilization of chargers in kWh by TOU period

g. Aggregated Utilization of chargers in number of sessions

These reporting metrics and frequency is in line with best practices from around the country as shown in Exhibit I (*Best Practices Review*).

D. RATE DESIGN

The Company proposes revisions to the EV-U TOU rates and rate design to provide charging opportunities for customers at stations operated by the Company that are generally cost-competitive with gasoline and that offer an incentive to utilize the charging stations during the day. The Company's proposed revised EV-U rates include: 1) the removal of charging O&M costs and network fees from the EV-U rate design itself, 2) an update of the underlying basis of the rate to be the proposed EV-J rate for each Company, 3) an update of the design basis of the rate such that it is revenue neutral for a corresponding EV-J customer based on average historical EV-U usage by time period and by Company, and 4) an update of the baseline surcharges incorporated in the rate to June 2021 surcharges. These updates are intended to make the EV-U charging rates more attractive to the end-charging customer and more competitive with the cost of gasoline; the existing EV-U charging rates generally exceed the equivalent cost of gasoline in all time periods. These rates would be applicable to both DCFC charging customers and Level 2 charging customers.

The existing Schedule EV-U provides the Company with the option to update its rates once per quarter. The Company proposes to retain the option to update its rates once per quarter with rate updates that are consistent with the methodology used to develop Schedule EV-U.

The Company used both EV-MAUI and EV-U historical data in the development of its revised EV-U rates for Maui. See Exhibit B (*Proposed Rate Design*) for more detail on the Company's proposed EV-U rate design.

1. Plans for Schedule EV-MAUI

In this Application, the Company proposes to terminate Schedule EV-MAUI and to have the existing EV-MAUI meters served under the revised Schedule EV-U for Maui island when the revised Schedule EV-U takes effect. The Company contends that having a uniform rate offering for public charging at the Company owned sites will lessen confusion for customers (see Exhibit A), improve internal administrative efficiency, and improve utilization of all Company DCFC on the island.

Notwithstanding the proposal to replace the EV-MAUI rate with the proposed EV-U rate for Maui island discussed herein, the Company proposes to maintain the Commission-established shared savings mechanism treatment set forth in Docket No. 2018-0422, D&O 36943, for those four existing EV-MAUI charging stations (i.e., the existing EV_MAUI DCFC at Pukalani, Lahaina Aquatic Center, Queen Kaahumanu Center, Piilani). The Company proposes to continue the shared savings mechanism until the end of the useful life of those charging station units or when they are replaced if prior to the end of their useful life. Once those stations are replaced,

the Company proposes that the replacement chargers will no longer be subject to the shared savings mechanism.

2. Plans for Schedule EV-F

Pilot tariff Schedule EV-F has been closely associated with Schedule EV-U since its original combined Commission approval in 2013. However, in the fall of 2020, the Company proposed a successor to Schedule EV-F, in the proposed pilot Schedules EV-J and EV-P, currently under review with the Commission.[32] In that application, the Company requested that upon approval of Schedules EV-J and EV-P, the Commission close EV-F to new enrollment on O'ahu, Hawai'i Island, and Maui and allow existing EV-F customers to continue service under EV-F until the rate's pilot period expires, or they transition to another rate, whichever comes first. The Company intends to continue monitoring both pilot Schedule EV-F, and if approved pilot Schedules EV-J and EV-P, to determine the effectiveness of the rate designs and applicability of larger-scale deployment beyond the pilot phase.

IX. RELATED PROGRAMS AND INITIATIVES

Since the time that the Company filed the Roadmap, Backbone Study, and Workplan,[33] the number of interrelated dockets, programs, and proceedings have increased. The Company continues to progress in parallel with efforts in other proceedings while moving forward to electrify transportation. The related programs and activities have included, for example, implementing the eBus Make-Ready Infrastructure Pilot, developing EV tariff Schedules EV-J

[32] The Company proposed an approach for the EV-F Pilot rate in its Application for Approval of Schedules EV-J and EV-P, filed in Docket No. 2020-0152, filed September 20, 2020.
[33] Docket No. 2018-0135, Electrification of Transportation Workplan filed October 29, 2019.

and EV-P, developing the initial design for the innovation pilot framework, developing the Charge Ready Hawai‘i Pilot to provide make-ready infrastructure for commercial customers, exploring advanced rate design,[34] establishment of a new pursuing performance-based regulation ("PBR") framework,[35] and implementing the Integrated Grid Planning ("IGP") process.[36]

- eBus Make-Ready Infrastructure Pilot (Docket No. 2020-0098) was approved by the Commission in Decision and Order No. 37769 on May 7, 2021.
- Final Pilot Process (Docket No. 2018-0088) was filed July 28, 2021 in accordance with Commission Decision and Order No. 37769 on July 9, 2021.
- Charge Ready Hawai‘i Pilot (Docket No. 2020-0202), the commercial make-ready infrastructure Pilot filed December 4, 2020, is ready for regulatory decision-making.
- The new PBR Framework (Docket No. 2018-0098) includes new reporting metrics and scorecards for EoT.
- Integrated Grid Planning (Docket No. 2018-0165) is on-going with the planning forecasts and assumptions being updated as ordered by the Commission. This impacts the Cost-Benefit Analysis for the project.

X. PROJECT COSTS

As detailed in Exhibit F (*Estimated Project Costs*), the Company estimates the total Capital and O&M costs of the Project to be $79 million. These costs include $58 million in

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[34] See Docket No. 2018-0141 - Advanced Rate Design Strategy; and Data Access & Privacy Policy, filed September 25, 2019, and Docket No. 2019-0323. Instituting A Proceeding To Investigate Distributed Energy Resource Policies Pertaining to the Hawaiian Electric Companies.

[35] See Docket No. 2018-0088, Instituting A Proceeding To Investigate Performance-Based Regulation, opened by the Commission on April 18, 2018, via D&O No. 35411.

[36] See Docket No. 2018-0165, Order No. 37927 Establishing a Procedural Schedule for the Updated Revised Inputs and Assumptions

Capital costs and $21 million in O&M expenses expected to be incurred beginning in 2023 following Commission approval (assumed in 2022) through the end of 2030.

The Capital and O&M costs for the Project's implementation include costs for: (1) outside services; (2) materials; (3) AFUDC, (4) maintenance and repair, and (5) education and outreach, as described in Exhibit F (*Estimated Project Costs*). These include costs for products and services to be supplied by third-party vendors. Although the Project costs shown in Exhibit F are broken down by service territory and year, the Company respectfully notes that the Project will require flexibility to address actual implementation conditions and Project uptake across service territories. Such flexibility may require reallocation of budgeted amounts between the three service territories, between the years, and between capital and O&M, while remaining within the $79 million total cost.

In addition to the $79 million in implementation costs, the Company estimates incurring approximately $1.57 million per year after 2030 in ongoing, incremental O&M expenses annually for maintenance and repair of the EV charging stations installed.

XI. ACCOUNTING AND RATEMAKING TREATMENT

The Company is requesting approval to recover the estimated Capital and O&M costs of the Project totaling $79 million plus the on-going incremental O&M expenses of approximately $1.57 million per year after 2030, net of related EV-U revenues (less revenue taxes) through the EPRM until new rates become effective that provide cost recovery for the Project or as otherwise provided by the Commission. The accounting and ratemaking treatment proposed to be applied to the Project is detailed in Exhibit D (*Accounting and Ratemaking Treatment*) and in Exhibit E (*Exceptional Project Recovery*).

A. ACCOUNTING TREATMENT

The proposed accounting for the Project generally follows the accounting for capital expenditure approved by the Commission in the past. In general, the cost of equipment and hardware will be capitalized and depreciated based on depreciation rates in place at the time of this filing. Such treatment is in accordance with Generally Accepted Accounting Principles ("GAAP") and consistent with the Company's current accounting for such costs.

The proposed accounting for each of the components of the Project is described in Exhibit D (*Accounting and Ratemaking Treatment*).

B. EXCEPTIONAL PROJECT COST RECOVERY

The Company seeks recovery of the Capital and O&M Costs of the Project net of related EV-U revenues (less revenue taxes) through the EPRM adjustment mechanism until new rates become effective that provide cost recovery for the Capital and O&M Costs for the Project for each respective company.

The purpose of the EPRM is to provide a mechanism for recovery of revenues for net costs of approved "Eligible Projects" placed in service during a Multi-Year Rate Period that are not provided by other effective tariffs, the Annual Revenue Adjustment, Performance Incentive Mechanisms, or Shared Savings Mechanisms. As noted in Exhibit E (*Exceptional Project Recovery*), the Company maintains that the Project qualifies as an eligible project under Sections III.B.1(b) (projects that make it possible to accept more renewable energy); III.B.1(c) (projects that encourage clean energy choices and/or customer control to shift or conserve their energy use); and III.B.1(d) (approved or accepted plans, initiatives, and programs) of the EPRM Guidelines. In addition, as further discussed in Exhibit E (*Exceptional Project Recovery*), the

Company submits that the business case in Exhibit C (*Project Justification with Business Case Support*) satisfies the criterion set forth in the EPRM Guidelines.

C. REVENUE REQUIREMENTS AND BILL IMPACTS

As shown in Exhibit G (*Revenue Requirements and Bill Impacts*), the Company estimates that, in isolation, the average monthly bill impact of the Project for a typical residential customer using 500 kWh would be:

- $0.26 at Hawaiian Electric
- $0.65 at Hawai‘i Electric Light
- $0.63 at Maui Electric

However, the impact of revenues from increased EV load in general should also be considered. The Company estimates that the simple average monthly bill impact of the Project offset with (net of) the incremental sales revenues for a typical residential customer using 500 kWh would be (See Exhibit G):

Scenario 2 – Project with “Base - Unmanaged” Incremental Revenues

- $0.19 for Hawaiian Electric
- $0.39 for Hawai‘i Electric Light
- $0.38 for Maui Electric

Scenario 3 – Project with “Base - Managed” Incremental Revenues

- $0.19 for Hawaiian Electric
- $0.39 for Hawai‘i Electric Light
- $0.38 for Maui Electric

Scenario 4 – Project with “Full EV Forecast - Unmanaged” Incremental Revenues

- $(1.27) for Hawaiian Electric

- $(1.78) for Hawai‘i Electric Light
- $(2.69) for Maui Electric

Scenario 5 – Project with “Full EV Forecast - Managed” Incremental Revenues

- $(1.25) for Hawaiian Electric
- $(1.72) for Hawai‘i Electric Light
- $(2.61) for Maui Electric

XII. GREENHOUSE GAS ANALYSIS

The Company conducted an analysis to estimate the projected greenhouse gas (“GHG”) emissions that would result from the proposed installation of this Project. This GHG emissions analysis is being provided pursuant to Hawai‘i Revised Statute (“HRS”) § 269-6(b). This analysis evaluates the potential GHG emissions directly attributable to the installation of the proposed infrastructure and charging station equipment, as well as GHG emissions that may be produced at earlier stages in the production process, such as component and raw material production and transport. This analysis also evaluates GHG emissions during operations by including indirect emissions during EV charging from the grid and the avoided emissions based on the amount of diesel fuel that would be displaced by EVs. In addition, this analysis evaluates the potential GHG emissions related to the downstream processes, such as decommissioning and disposal. Thus, this analysis evaluates Upstream, Downstream, and Operational GHG emissions that would result from the Project for the duration of its lifetime.

Based on this quantitative GHG analysis, **the Project will result in a net overall GHG emissions reduction**. The detailed report is in Exhibit H (*Greenhouse Gas Analysis*).

XIII. CONCLUSION

Wherefore, Hawaiian Electric respectfully requests a D&O approving the Requested Approvals as detailed in Section II, above.

DATED: Honolulu, Hawai‘i, October 29, 2021.

HAWAIIAN ELECTRIC COMPANY, INC.
HAWAI‘I ELECTRIC LIGHT COMPANY, INC.
MAUI ELECTRIC COMPANY, LIMITED

By /s/ Joseph P. Viola

Joseph P. Viola
Vice President, Regulatory Affairs
Hawaiian Electric Company, Inc.

Vice President
Hawai‘i Electric Light Company, Inc.
Maui Electric Company, Limited

VERIFICATION

STATE OF HAWAI‘I)
) ss.
CITY AND COUNTY OF HONOLULU)

JOSEPH P. VIOLA, being first duly sworn, deposes and says: That he is Vice President Regulatory Affairs of Hawaiian Electric Company, Inc., and Vice President of Hawai‘i Electric Light Company, Inc., and Maui Electric Company, Limited, Applicants in the above proceeding; that he makes this verification for and on behalf of said Applicants, and is authorized so to do; that he has read the foregoing Application, and knows the contents thereof; and that the same are true of his own knowledge except as to matters stated on information or belief, and that as to those matters he believes them to be true.

/s/ Joseph P. Viola

Joseph P. Viola

Exhibit A

Public Electric Vehicle Charger Expansion Application

Project Development

PROJECT DEVELOPMENT

I. OVERVIEW

The Intergovernmental Panel on Climate Change's ("IPCC") *Climate Change 2021: The Physical Science Basis*[1] issued an urgent warning that "global warming of 1.5°C and 2°C will be exceeded during the 21st century unless deep reductions in carbon dioxide ("CO_2") and other greenhouse gas emissions occur in the coming decades." Addressing sources of carbon emissions is crucial to mitigating the worst impacts of climate change, and one of the most significant sources of carbon emissions is the transportation sector. According to the United States Environmental Protection Agency, "[g]reenhouse gas (GHG) emissions from transportation account for about 29 percent of total U.S. greenhouse gas emissions, making it the largest contributor of U.S. GHG emissions. Between 1990 and 2019, GHG emissions in the transportation sector increased more in absolute terms than any other sector."[2] Recognizing this, President Biden recently signed Executive Order 14037,[3] setting an ambitious target that 50 percent of all new vehicles sold in 2030 be zero emission vehicles. Consistent with these government efforts, automakers are increasing EV model development with some, like Ford and GM, setting carbon neutrality goals and committing to halting the production of internal combustion engine vehicles altogether.[4]

Still, there is much work to be done. Electric vehicles make up only 1.6 percent of the total registered passenger vehicles in the Company's service territories, this is a far cry from the

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[1] Intergovernmental Panel on Climate Change, Working Group I contribution to the Sixth Assessment Report, Climate Change 2021: The Physical Science Basis (August 2021). https://www.ipcc.ch/assessment-report/ar6/
[2] https://www.epa.gov/transportation-air-pollution-and-climate-change/carbon-pollution-transportation.
[3] President Biden Announces Steps to Drive American Leadership Forward on Clean Cars and Trucks (August 2021). https://www.govinfo.gov/content/pkg/FR-2021-08-10/pdf/2021-17121.pdf
[4] Automaker's EV Plans Through 2035 and Beyond (July 2021). https://www.forbes.com/wheels/news/automaker-ev-plans/

100 percent by 2045 sought by the counties and the carbon neutrality goals of the state. EV adoption is critical to meeting these targets as the average passenger EVs in Hawai‘i today consume seven times less fossil fuel than their gasoline-powered counterparts and emit half the carbon emissions.

With the support of the Commission, Hawaiian Electric has steadily expanded its leading role in supporting Hawai‘i's clean transportation goals. Beginning in 2013, the EV-U Pilot was intended to support the growing EV market by allowing the Company to install and operate public EV charging facilities in strategic locations to address range anxiety, support the rental EV market, and increase EV acceptance by residents in MUDs. Alongside the EV-U Pilot, the Commission also approved the EV-F pilot tariff rate, which was designed to enable non-utility customers interested in providing EV charging services at a time-of-use rate similar in design to EV-U. In 2016, the Company requested to extend the EV-U and EV-F Pilot[5] with the Commission approving the Company's request to extend the Pilot for an additional five years[6] authorizing fast charging stations under 25 accounts for the EV-U Pilot.

In 2018, the Company undertook an extensive planning and stakeholder process to develop the Roadmap which outlined ten initiatives designed to help achieve clean transportation goals, support customer mobility options, and realize the significant ratepayer benefits of electric transportation while leveraging the utility's strengths and supporting joint actions with partners across the space. In line with that Roadmap, the Company subsequently sought and

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[5] On June 27, 2016, the Company filed a request to extend the termination date for Schedule EV-F and Schedule EV-U from June 30, 2018 to June 30, 2028. On July 5, 2016, the Commission issued Order No. 33783 and opened Docket No. 2016-0168 for the purpose of reviewing the Company's request. On September 15, 2016, the Commission issued Order No. 33918, establishing the procedural schedule. On November 18, 2016, the Company filed its Reply Statement of Position thereby completing the procedural schedule.

[6] Docket No. 2016-0186, Decision & Order No. 34592 filed June 2, 2017. The original pilot was scheduled to end in 2018.

was granted approval for its eBus Make-Ready Pilot subsequently named "Charge Up eBus".[7] The Company has also submitted proposed EV-J and EV-P tariffs,[8] and the Charge Ready Hawai'i Pilot for commercial make-ready infrastructure focused on MUDs (i.e., apartment complexes, condominiums, and townhomes), workplaces, commercial buildings, and fleets.[9]

With this Application, the Company seeks to implement a Roadmap initiative that will increasingly be in short supply without intervention: Initiative #7 – Expanding the availability of public charging. This Project seeks approval for the installation and ongoing maintenance of 150 DCFC ports, or 28% of Reference Case 2030 interim need, plus 150 co-sited Level 2 ports dual-port charging stations (10% of 2030 need) to provide lower-cost redundancy and congestion relief in line with national best practices and driver and stakeholder preferences that seek to ensure drivers aren't ever left stranded. The Project will cover approximately 75 sites across the City and County of Honolulu, County of Maui, and County of Hawai'i. The preferred configuration for each site is to install two (2) single-port DCFCs and one (1) dual-port Level 2 charging station.

The Project is designed to enable a kick-start to the islands' EV charging industry. The Company is best positioned to provide this kickstart thanks to its position as a trusted, long-term energy partner committed to providing service to all connected customers. Business model and isolation challenges have led to issues in keeping charging providers active in Hawai'i. Unlike other fast charging providers that have left the islands, Hawaiian Electric can ensure a critical

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[7] Docket No. 2020-0098 Decision and Order No. 37769 issued May 7, 2021 for Approval of the eBus Make-Ready Infrastructure Pilot Project.

[8] Filed in Docket No. 2020-0152 on September 30, 2020 for Approval to Establish Electric Vehicle Tariffs for Schedule EV-J – Electric Vehicle Charging Service – Demand ("EV-J") and Schedule EV-P – Electric Vehicle Charging Service – Large Demand ("EV-P"), on a Pilot Basis.

[9] Filed in Docket No. 2020-0202 on December 4, 2020 for Approval of the Charge Ready Hawai'i Pilot Project and to Recover Costs through the Renewable Energy Infrastructure Program Surcharge.

backbone of charging that consistently and reliably meets residents' transportation needs as the industry develops to a stable state. The Company is already proving its role as a trusted partner in EV charging and its ongoing commitment to charging sites: all respondents to a survey of site host participants in the existing Pilot answered the question "How likely are you to recommend the program to other potential EV charger hosts?" with a three or above out of five, with the majority (9 out of 11) of hosts giving a 5: Very Likely.

The proposed Project is forecasted to provide significant financial benefits to all Hawaiian Electric's customers over time. Revenues from the Project sites' energy consumption on the proposed EV-U tariff are not presently expected to cover the "all-in" cost of implementing this Project. However, as shown in Exhibit C (*Project Justification with Business Case Support*), a RIM test shows a benefit-cost ratio of 1.23-1.38 when considering the project's impacts in spurring EV adoption and the private sector public charging market.[10] This analysis demonstrates that the wide-spread EV adoption enabled by this project will generate significant revenue beyond the cost of the project and the cost of supplying vehicles with electricity. By unlocking investment from the private sector and spreading system costs over an increased demand for electricity, this project can create significant expected net benefits to the Company's customers, putting downward pressure on utility costs and therefore on the price of electricity.

As discussed in Exhibit B (*Proposed Rate Design*), the proposed EV-U tariff was designed to provide EV charging that will provide EV drivers with cost savings compared to gasoline and to encourage charging during the middle of the day when solar energy is abundant. Thanks to higher upfront cost of EVs electric "re-fueling" must be less costly than gasoline to

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[10] Benefit-cost ratios provided are for managed charging scenarios and vary by island: 1.23 for O'ahu, 1.38 for Maui County, and 1.26 for Hawai'i island. See Exhibit C (*Project Justification with Business Case Support*) for details.

make the economic case for EV purchases pencil out and enable the clean transportation transition that the charging is intended to support. Pricing at public charging is also an important equity consideration given that this charging will act as the primary transportation fill-up point for those without access to electrified off-street parking, often those residing in MUDs.

This Project will result in a net overall GHG emissions reduction based on the quantitative analysis performed in Exhibit H (*Greenhouse Gas Analysis*) and is the next step in the Company's efforts to support the state in achieving its climate goals, provide value for all customers, and enable equitable access to Hawaii's clean transportation future.

In addition, this Project can support needed economic recovery from the COVID-19 pandemic[11] and aligns with the Commission's policy prioritizing action in areas that *Achieve Clean Energy and Climate Goals* and *Support Economic Recovery from the COVID-19 Emergency*.[12] Hawaiian Electric contends that this Project should be considered a priority project as it will support the achievement of near-term targets and long-term transformation of the energy system, will support and expand clean energy job opportunities, and will promote economic recovery.[13]

Hawaiian Electric's standing as a trusted, long-term partner means the Company is well suited to spur a healthy, stable, competitive charging industry in Hawaii's isolated market. The design of this Project is a result of the Company's experience and lessons learned from the Pilot, founded upon extensive stakeholder outreach, and reflects industry best practices as shown in

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[11] Hawai'i Department of Business Economic Development and Tourism, 2020 *Outlook For The Economy*, accessed 30 October 2020, https://dbedt.hawaii.gov/economic/qser/outlook-economy/#:~:text=The%20outlook%20of%20Hawaii's%20economy,the%20non%2Dtourism%20intensive%20industries.

[12] March 24, 2020 Statement from Hawaii Public Utilities Commission on COVID-19 Emergency.

[13] *See id.*

Exhibit I (*Best Practices Review*). This exhibit evaluates the context into which the proposed Project comes into focus before discussing the Project's design and scope, drawing upon the elements identified above. Realizing these clean transportation benefits will require upfront investment, but as experts attest, the climate costs of inaction will likely be far greater.[14] Hawaiian Electric's standing as a trusted, long-term partner means the Company is best suited to spur a healthy, stable, competitive charging industry in its isolated market. The Company stands ready to meet the moment for its customers and for the climate.

II. PROJECT CONTEXT

A. ELECTRIFICATION OF TRANSPORTATION ROADMAP

The Company's Roadmap offered a vision of the future of clean transportation and identified ways in which the electric utility could best support that transformation. Part of that effort was to identify the financial benefits to all customers that could result from a large-scale transition to EVs. Establishing net customer benefits through reduced electricity rates in the future is a foundational outcome that justifies the Company's continued engagement in the electrified transportation space. The Roadmap also identified a strategic vision for the Company that would serve to support and amplify the transition to clean transportation, establishing ten strategic initiatives in furtherance of that vision.

The proposed Project most directly furthers strategic initiative #7 which outlines the Company's goal to "expand [the] availability of reliable public charging." Despite progress being made on a number of EV barriers, Hawaii's still lacks a reliable, geographically diverse

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[14] See, for example, Nunn et. al, 2019, "Ten facts about the economics of climate change and climate policy," https://www.brookings.edu/research/ten-facts-about-the-economics-of-climate-change-and-climate-policy/
Sanderson, B. and O'Neill, B. 2020, "Assessing the costs of historical inaction on climate change," *Scientific Reports* 10

network of fast charging, which has shown to be a threshold need for purchase decisions and one of the largest barriers to widespread, equitable EV adoption.[15] Initiative #7 recommends remedying this market failure by providing "a critical backbone of reliable, public utility-owned chargers as the launching point from which the broader electric transportation and third party charging market in Hawai'i can expand and solidify."[16] By expanding current public charging availability, the Company seeks to reduce barriers to adoption and increase access to charging that can enable potential EV drivers and fleets to make the switch to electric.

In addition, strategic initiative #5 looks to "expand access to charging infrastructure for residents of multi-unit dwellings." As identified in the Roadmap, providing additional public charging resources will enable more MUD residents to drive electric, by providing increased opportunities to charge their vehicles, especially where they may not otherwise have charging facilities at their current residence.

Part of the proposed Project development included a comprehensive review of the Commission's comments on the Roadmap, as well as stakeholder feedback and comments submitted in the Roadmap filing. Many commenters responded to the Commission's request to prioritize the Company's proposed initiatives by listing the expansion of public charging as a high-priority, unmet need to be undertaken by the Company.

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[15] See, for example Tweed, K. 2013, "Fast Charging Key to Electric Vehicle Adoption, Study Finds," https://www.greentechmedia.com/articles/read/fast-charging-key-to-electric-vehicle-adoption-study-finds
Li et al., 2015, "The Market for Electric Vehicles: Indirect Network Effects and Policy Impacts," University of Chicago Press Journals, https://www.journals.uchicago.edu/doi/full/10.1086/689702,
The International Council on Clean Transportation, 2019, "Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas," https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf,
Hardman, S. et al, 2018, "A review of consumer preferences of and interactions with electric vehicle charging infrastructure," Transportation Research Part D: Transport and Environment, 62:508-523, https://www.sciencedirect.com/science/article/abs/pii/S1361920918301330?via%3Dihub

[16] See Roadmap, at 7.

B. ELECTRIC VEHICLE CRITICAL BACKBONE STUDY

In the year following the filing of the Roadmap, the Company filed the Backbone Study which was designed to identify the landscape of charging infrastructure needs over the coming decade. More specifically, the Backbone Study sought to forecast public and private EV charging demand in 2025 and 2030. The Company commissioned Guidehouse (formerly, Navigant Consulting Inc.) to analyze data from the Company's service territories and develop a methodology that could potentially be used to help identify siting priorities for a critical backbone of public charging infrastructure. The Backbone Study shows that there is a significant need for both public and private charging infrastructure to support the growing adoption of EVs[17] and served as the basis to help inform the size of this Project Application.[18]

The Backbone Study identified that by 2030, the Company's service territories need 557 public DCFC ports and 3,068 Level 2 public charging ports to support the Reference Case of 8 percent of vehicles on the road being electric by 2030 (a level that would require a steep uptick thereafter to reach the counties' goal of 100 percent by 2045 or the state's goal of carbon neutrality by that year).[19] As of September 2021, the Hawaiian Electric's service territories had 31 public DCFC ports (25 of which are owned and operated by Hawaiian Electric) and 662

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[17] Docket No. 2018-0315, Electrification of Transportation Electric Vehicle Critical Backbone Study: Planning Methodology filed July 30, 2019.

[18] All company-owned sites and installations since January 2020 fall within need-identified census tract locations in the Backbone Tool.

[19] Docket No. 2018-0315, Electrification of Transportation Electric Vehicle Critical Backbone Study: Planning Methodology filed July 30, 2019, Table 4 on page 28. Since January 2020, all EV-U charging station installations reflect census tract locations identified in the Backbone Study showing a need for chargers in those locations.

public Level 2 charging ports.[20] This current state of DCFC infrastructure (31 of 557) is less than 6 percent of what is needed to get to the interim EV adoption level.

The Universe of private and public chargers required by 2025 and 2030 and categorized according to use case, technology, and ownership (public and private) was forecasted. The 2025 forecast is shown in Appendix G, Table G1 of the Backbone Report. The 2030 forecast is shown in Table 3 of the Backbone Report on page 28. The Critical Backbone is a subset of the public charging ports within the full Universe.

C. EV-U PILOT AND EV-MAUI LESSONS LEARNED

A critical step in designing the Project was capturing lessons learned from the EV-U Pilot and EV-MAUI and identifying systems and experiences that are working well and areas that can be improved to increase effectiveness, efficiency, and customer experience. The Company evaluated experiences, successes, challenges, and opportunities related to a range of aspects of the programs, including:

- Driver experience;
- Site host experience;
- Implementation (including maintenance performance, relationships with suppliers, and potential improvements to supplier agreements);
- Pricing;
- Opportunities for customer communication and education;
- Opportunities for equitable distribution; and

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[20] Data from U.S. Department of Energy, Alternative Fuels Data Center, Electric Vehicle Charging Station Locations, accessed September 29, 2021, indicated 746 EVSE ports (84 DCFC and 662 Level 2) at 363 locations. The DCFC count includes EVohana locations which are no longer in operation. https://afdc.energy.gov/fuels/electricity_locations.html#/analyze?fuel=ELEC

- Ongoing interactions with other programs at the Company.

To evaluate the experiences and forward-looking preferences of participants, an online survey was distributed to current site hosts of public chargers installed under the Company's EV-U Pilot and EV-MAUI programs. This survey collected feedback from site hosts on their overall experience participating in the programs, benefits from participation, challenges encountered, and any insights that could impact design of the Project. The Company's key account managers reached out to current site hosts through email to provide the online survey and received 11 survey responses out of the 18 participating hosts.[21] The Company also conducted virtual interviews with 2 of the 11 survey participants who were willing to provide additional feedback on their experience.

The Company also issued a separate EV driver survey, which was designed to assess customer awareness, usage, experiences using the fast charging stations, as well as provide any preferences for future buildout of Hawaiian Electric's public charging network. The survey received responses from 462 EV drivers in the Company's service territories.[22] The full results of the site host survey and EV driver survey are provided in Exhibit J (*Lessons Learned Surveys Results*) and have in part, informed the design of the proposed Project (see additional information in Section III.B. Stakeholder Outreach and III.D. Implementation Process below).

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[21] Some participating hosts own or manage multiple locations. At the time of the survey, the Pilot consisted of 20 third party locations with 18 participating hosts.

[22] The EV driver survey was delivered through two channels: (1) An online panel survey conducted with randomly selected Hawaiian Electric Company residential customers who had self-identified as EV drivers on O'ahu, Maui County, and Hawai'i Island. This survey was fielded from May 26 to June 11, 2021 and received 146 completed surveys from 195 invited contacts; and (2) An online survey of Hawaiian Electric Company residential customer EV program participants on O'ahu, Maui County, and Hawai'i Island. This survey was fielded June 16 – 18, 2021 and received 316 completed surveys through this channel from 1,399 invited contacts.

In addition to these surveys, the Company engaged Atlas Public Policy ("Atlas") to facilitate a one-hour workshop with members of DEH. Company staff were not present during the workshop discussion as it was designed and facilitated by Atlas to seek candid feedback from DEH members on the Company's EV-U Pilot and EV-MAUI programs, and to solicit input from members on the design of the Project (see additional information in Section III.B. Stakeholder Outreach below).

From this collection of lessons learned some key themes emerged as shown in Table 1 below:

Table 1. Lessons Learned

Program Category	Lesson Learned	Program Design Solution
SITING **Identifying locations and interested site hosts was a challenge in the EV-U and EV-MAUI programs**	Lack of program awareness as site intake has been conducted on a one-on-one basis with site owners with 82% of current site hosts learning about the Pilot through direct outreach from the Company.	The Project will continue to prioritize direct outreach efforts and intends to implement a broader communication and outreach strategy to help identify more potential site hosts. Further details are provided in **Section III.D.3. Education and Outreach**
	Lack of understanding of the benefits of EV charging to site hosts, or a belief that these benefits are not sufficient to outweigh the costs of giving up an internal combustion engine parking stall.	The Project will continue to prioritize direct outreach efforts and intends to implement a broader communication and outreach strategy to help identify more potential site hosts. Further details are provided in **Section III.D.3. Education and Outreach**
	Many sites have barriers that prevent a low-cost and minimally complex charger installation.	A larger number of potential sites hosts or multi-site agreements need to be identified so the Company can create a large group of eligible sites to meet its annual Project installation targets Further details are provided in **Section III.D.1.b Installation Cost Minimization & Sizing**
	Concerns with portions of the **License Agreement** caused installation delays or site host dropping out	The Company is striving to execute a standard License Agreement and additional resources to help address in site host concerns earlier in the process. Further details are provided in **Section III.D.1. Siting**
OPERATIONS AND MAINTENANCE **Quick maintenance response and repair times are necessary to support a reliable charging network**	The Company faces challenges in having the necessary spare parts stocked to complete timely repairs of chargers	The Company will strengthen contract terms with suppliers related to delivery times for parts and look to stock key replacement parts on island. Further details are provided in **Section III.D.2. Operation and Maintenance.**
	Roles & responsibilities are not clearly delineated between the EV supply equipment ("EVSE") manufacturer and EV network service provider ("EVSP") making troubleshooting difficult	Company is transitioning the O&M function to a service level agreement with a third-party maintenance contractor that specifies adherence to measurable performance metrics. Further details are provided in **Section III.D.2. Operation and Maintenance**
	Difficulty in detecting and identifying equipment failures across the different charger components	Company is transitioning the O&M function to a service level agreement with a third-party maintenance contractor that specifies adherence to measurable performance metrics. Further details are provided in **Section III.D.2. Operation and Maintenance**

Program Category	Lesson Learned	Program Design Solution
EDUCATION AND OUTREACH Increased focus on customer experience with fast chargers	Lack of EV driver awareness of the Company's fast charger Pilot	Additional signage and advertising is incorporated into the Project's Awareness Campaign to ensure charger locations are well-known. Further details are provided in **Section III.D.3. Education and Outreach.**
	EV driver challenges with understanding how to properly use fast chargers	The Company has recently updated the webpages and online resources, developed promotional videos, and designed preliminary concepts for instructional decals for fast chargers. The Company aims to dedicate additional resources to advertising, signage, and easy to understand operating instructions for the fast chargers. Further details are provided in **Section III.D.3. Education and Outreach.**

Further details on the identified program categories are discussed below:

1. <u>Siting</u>

A number of lessons learned during the Pilot relate to siting and the site acquisition process. The Company has learned the challenge with finding interested and willing site host partners in locations that co-optimize driver needs and cost mitigation. Among the various barriers and constraints that limit the availability of potential sites include:

- Lack of awareness of the Company's programs by potential site hosts;
- Lack of understanding of the benefits of EV charging to site hosts, or a belief that these benefits are not sufficient to outweigh the costs of giving up an internal combustion engine parking stall;[23]
- Many sites have barriers that prevent low-cost and minimally complex charger installation; and
- Concerns with portions of the License Agreement, such as the indemnification clause and the desire for revenue sharing.

[23] This issue can be exacerbated by the Company's goal to install accessible stalls in compliance with the Americans with Disabilities Act ("ADA"), as ADA stalls are generally closest to the building and ensuring ADA compliance can mean more than one parking space is needed.

Hawaiian Electric has made improvements throughout the pilot to address these issues and proposes to continue to do so in the proposed Project. The Company has increased its outreach to potential site hosts through key account managers and through direct outreach from the EoT Department, to share information and insights into the benefits of hosting. In the site host survey, 9 of the 11 site hosts indicated that they had heard about EV-U or EV-MAUI thanks to direct outreach from Hawaiian Electric. The Company intends to implement a broader outreach strategy to potential site hosts, both through broad-based education materials and targeted outreach in key locations. Further details on Project education and outreach are provided in Section III.D.3.

Moving out of a pilot phase will also assist the Company in attracting site hosts by providing increased program certainty. As stated in Hawaiian Electric's prior DCFC Extension filing, some potential site hosts have expressed concerns that the Company will terminate the pilot program and are reluctant to investment their time and access to their property if the pilot terminates in the future.[24]

Additional siting lessons learned relate to suitability and cost. Many sites lack a configuration that allows for minimally complex and low-cost charger installation. Factors that hinder suitability and therefore increase cost include lack of power availability, a lengthy distance from the proposed charging stall to the electrical service connection, lack of space for charging stations and electrical equipment (i.e., for Americans with Disability Act compliance), and public safety issues, such as remote, non-lit locations or proximity to a flood zone. Suitability of sites can also be impacted by working clearances and scheduling issues, such as

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[24] Docket No. 2016-0168 "For Approval to Extend Schedule EV-F, Commercial Public Electric Vehicle Charging Facility Service Pilot, and Schedule EV-U, Commercial Public Electric Vehicle Charging Service," Transmittal No. 13-07 filed June 27, 2016 Attachment 1 at 2.

site renovation plans that may complicate the project. Engaging potential site hosts through the mechanisms mentioned previously will assist in providing the Company with an increased choice of sites and therefore allow for the selection of lower-cost and higher-suitability sites.

Despite the challenges in finding eligible site hosts, the majority of those sites who did participate in the Pilot provided positive feedback with respect to the license agreement negotiation and charger installation process. Nine of 11 surveyed site hosts were "very likely" to recommend the program to other potential EV charger hosts. Eight out of 11 agreed or strongly agreed that the License Agreement process was straightforward. This feedback reinforces the overall effectiveness and success of the current implementation process once a site has been approved into the program.

A final lesson learned regarding siting is the need for continued engagement with stakeholders on the siting of stations to help achieve the various goals of public charging. In particular, it will be crucial to engage community groups and other partners to ensure that the needs of historically underserved communities are being heard and met at the outset, that charging buildout serves the communities in which it is sited, and that it is synergistic with other clean transportation programs being developed on the islands. Hawaiian Electric plans for continued engagement with the Low-Moderate Income ("LMI") Advisory Council, Energy Equity Hui, Hawaii Energy, and other community-based organizations as suggested by DEH members to continue discussions and explore ways to gain a deeper understanding of community priorities and mobility needs/preferences. Further details are provided in Section III.B. and section III.C.2.

The Company proposes to seek siting input from researchers, charging companies, automakers and fleets in order to strive for the development of a geographically diverse

backbone network that also alleviates congestion and leverages any existing plans for installations by third parties. The Company also continues to seek feedback from EV drivers on their preferences for siting. The Company included in the EV driver survey the question "At what locations would you like to see the next Hawaiian Electric public chargers be built?," and received more than 16 pages of bulleted responses of general and specific locations that it proposes to incorporate into Project planning.

2. Operation and Maintenance ("O&M")

The site host, EV driver, and DEH surveys and interviews indicate that having a reliable network of chargers supported by rapid repair times is important to these stakeholder groups and critical to the successful expansion of the Pilot. Site hosts generally reported having a positive maintenance experience with the Company. Site hosts provided freeform survey comments such as "[T]he contractors and Hawaiian Electric teams were very accommodating, always kept us up to date and were very easy to work with"; "ME[C]O was fast and efficient with the install"; and "They were awesome to work with." All 11 respondents answered the question "How likely are you to recommend the program to other potential EV charger hosts?" with a three or above out of five, with the majority (9 out of 11) of hosts giving a five, indicating they were very likely to recommend the program.

Site host survey respondents expressed challenges with slow repair times, resulting in customer complaints, and occasional system downtime. Up to 82 percent of the surveyed drivers who have used a Hawaiian Electric public charger indicated that they had arrived at a charging station to find it not functioning, with 56 percent indicating that this happened "sometimes" or "always." A driver surveyed noted that "Reliability is the key for me. I find that in general many charging stations, especially in the resort areas, very often don't work. This isn't just the

[Hawaiian Electric] charges, but all of them, though the [Hawaiian Electric] chargers at Mauna Lani were down for a long time. It looks like the elements, especially the sun, take a toll on the chargers, making the displays hard to read. Most of the time, I can check the app to see whether a station is working, but overall EV drivers need to know that they'll likely be able to charge, both that the machine is working, able to be used (seeing the display) and not occupied for really long times." A member from DEH noted that "charging station connectors tend to rust and do not connect to the vehicle, screens are difficult to see, especially during the day with the glare" and one member in the County of Hawai'i noted that "2 out of 6 stations are down currently on the west side."

The Company's O&M process has changed over time, as the growth of the Pilot required increasing internal resources. The Company currently performs annual maintenance on each Pilot charger, and has at times, required third-party assistance to meet increased demand. Drawing from the Pilot, the primary lessons learned regarding O&M include: the ability to detect and respond to issues in a timely manner; having the necessary spare parts stocked to complete a timely repair; having the right internal expertise who can troubleshoot issues among the different components of the chargers; and clearly understanding and delineating the responsibility for O&M issues between the multiple stakeholders and vendors involved.

In terms of replacement equipment, the Company currently keeps a limited stock of replacement parts on hand; however, due to the limited nature of the Pilot, it was impractical to store all charge station components. Notably, parts differ between different EVSE vendors or even between different models of the same vendor. In addition, some EVSE components require customer-specific pre-programming, such as circuit boards and modems, which cannot be purchased "off the shelf." When the Company does not have charger parts locally in stock,

Company staff must wait days to months for parts to be delivered, typically from the contiguous U.S., before providing repair service. Hawaii's remote location means this is a challenge faced by the Company and by private sector charging companies alike.

Under the Pilot, the Company's charge stations employed an EVSP that is different than the charge station equipment manufacturer. In application, charge station outages can be the result of equipment failures and/or network service issues. As a result, the Company must initially determine the root cause of the failure prior to determining which party to coordinate repair with. This lack of coordination between the EVSE manufacturers and EVSP, adds time to the repair process. A key takeaway from the Pilot is that because the charge station system includes both the charging equipment and the network, there must be interoperability and collaboration between the EVSE manufacturer and the EVSP.

Another key takeaway from the Pilot is the need to improve the issue notification process. The equipment can provide automatic detection and notification of certain failures through the EVSP, however, there are other equipment failures which cannot be detected. For example, a broken display screen will not be identified by the EVSP. The challenges arising out of outage identification and communication will continue to be a challenge as the Project scales up.

3. Education and Outreach

In the EV driver survey, 36 percent of respondents indicated they were unaware that Hawaiian Electric provides public fast chargers. Written feedback from EV drivers, signaled that the Company should provide additional signage and advertising at fast charger locations. Some of these comments included, "mak[ing] sure the locations are well advertised and clearly visible..." Other comments said, "Where are the fast charging stations?", and "The only one that

I have knowledge of is tucked away in a parking lot, and not particularly easy to find." Both site hosts who were interviewed were supportive of the idea of additional advertising and would appreciate if more people know about the fast chargers. One DEH member had additionally suggested to "advertise at used car sales locations [to] incentivize people to buy used EVs."

In addition to charger visibility, fast charger customers struggle to understand fast charger operability and vehicle compatibility. The EV driver survey and DEH workshop noted challenges with understanding how to properly use the fast chargers with a DEH member noting that "the instructions at the site are challenging to use", and surveyed drivers noting that "the process should be far more intuitive and function with good displays, chargers in good condition and well maintained. Swipe and go like a gas station."

Publicly available EV charging should provide a beneficial and streamlined offering for EV drivers and sites hosts. The Company has recently updated the webpages and online resources, developed promotional videos, and designed preliminary concepts for instructional decals for the fast chargers. However, this customer feedback encourages the Company to dedicate additional resources to advertising, signage, and easy to understand operating instructions for the fast chargers to increase public awareness and ensure a positive user experience. Further information on these efforts is provided in Section III.D.3. Education and Outreach below.

4. <u>EV-MAUI Program</u>

Among the many lessons learned throughout the Company's public charging experience, the EV-MAUI program has created a few unique lessons that impact the overall program request herein. Importantly, the opportunity to leverage existing charging site locations in an effort to mitigate development costs was an important one given the limited development of fast charging

facilities in the Company's service territories. The Company viewed the EV-MAUI program as an attempt to maintain vital public charging resources on Maui in spite of the differences in technology between the existing charging facilities and the Company's replacement units. The desire to move quickly and alleviate the financial and operational burdens of the transitional agencies involved in maintaining the charging network after the departure of Hitachi resulted in a less than ideal program proposal under EV-MAUI. The most significant lesson from the EV-MAUI experience has been the unfavorable customer experience created by having two distinct fast charging rates in effect on the same island. The proposal seeks approval to terminate EV-MAUI and to have the charging stations currently served under EV-MAUI to be served under EV-U when the revised EV-U rates take effect. All other aspects of the shared savings mechanism for the EV-Maui rate would be continued.

III. PROJECT DESIGN

A. BEST PRACTICES REVIEW

The Company engaged Atlas to undertake a 'Best Practices Review' ("Review") of investor-owned utilities' public EV charging infrastructure filings. This review sought to collect best practices in the design of utility-owned public EV charging programs, as determined by the approval of specific design elements by state regulatory commissions. These best practices are organized under 14 public charging infrastructure program design elements developed by Atlas Public Policy and shown in Table 2. The results of the Review were used to inform the program, as indicated throughout the Project Design section of this Exhibit. The full method and results of the Review are included as Exhibit I (*Best Practices Review*).

Table 2. Public EV Charging Program Design Elements Reviewed for Best Practices

1. Utility ownership use cases and siting	8. Equipment vendor selection
2. Program size	9. Installation cost minimization
3. Inclusion of underserved communities	10. Installation sizing
4. Program outreach and education	11. Pricing, rate structures and metering
5. Operations, maintenance & repair	12. Cost recovery
6. Reporting and evaluation	13. Communications and payments
7. Procurement of design and build work	14. Power level

B. STAKEHOLDER OUTREACH

As noted previously, the Company conducted stakeholder outreach utilizing different communication channels to collect feedback from 11 site hosts, 462 EV drivers, DEH members (invitees are listed in Figure 1), and 2,045 Charge Up Hawaii participants.

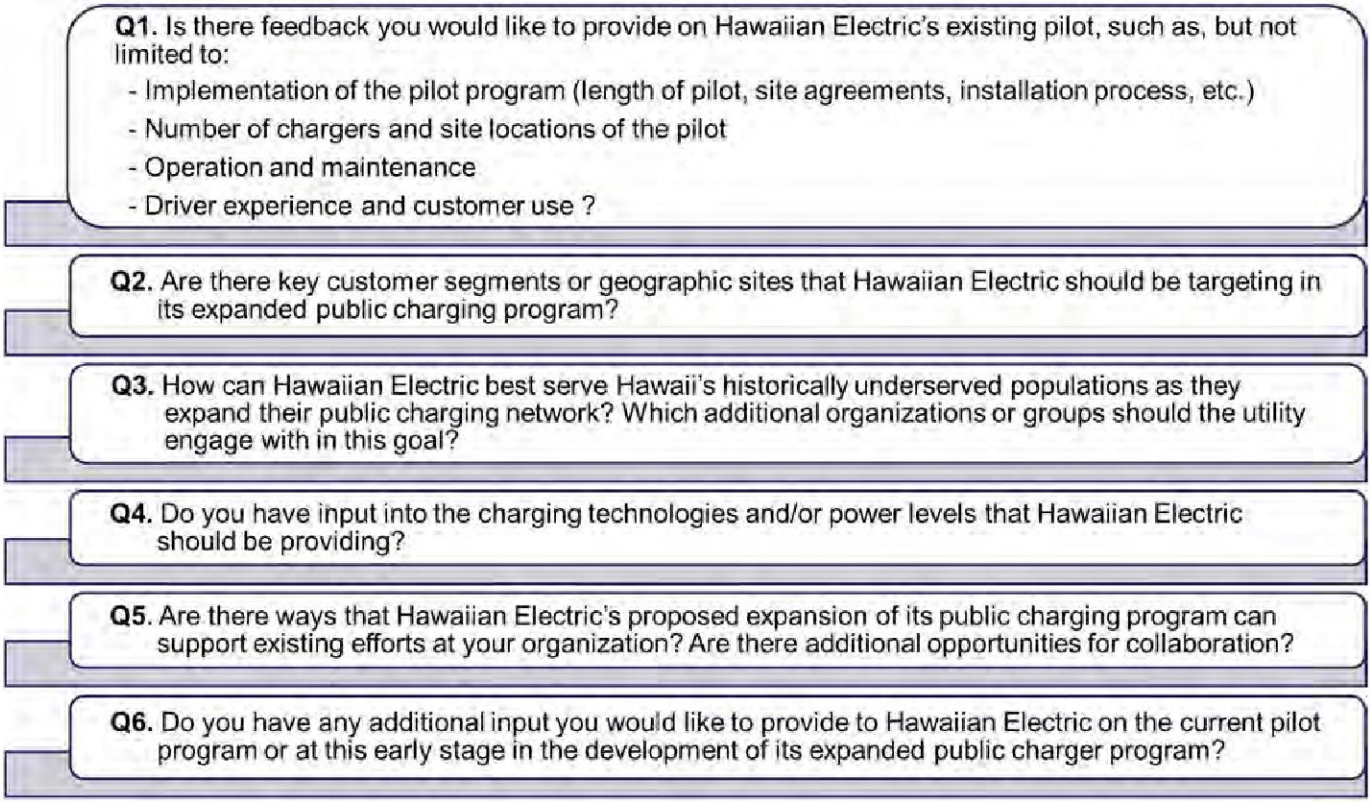
Figure 1. DEH members invited to participate in June 14, 2021 Drive Electric Hawai'i workshop

County of Kauai*
County of Honolulu*
County of Hawaii*
County of Maui*
Consumer Advocate*
Hawaii Energy*
Blue Planet Foundation*
Ulupono Initiative
Hawaii State Department of Transportation
Hawaii State Energy Office

* Indicates one or more representatives of this organization attended June 14, 2021 workshop, and/or provided written responses via email

The six survey questions shown in Figure 2 were sent to DEH members ahead of the meeting. Questions one through four and resulting discussion tangents were covered during the facilitated workshop and further comments were invited via email after the workshop. Key findings from the workshop are reflected in relevant sections of this Application.

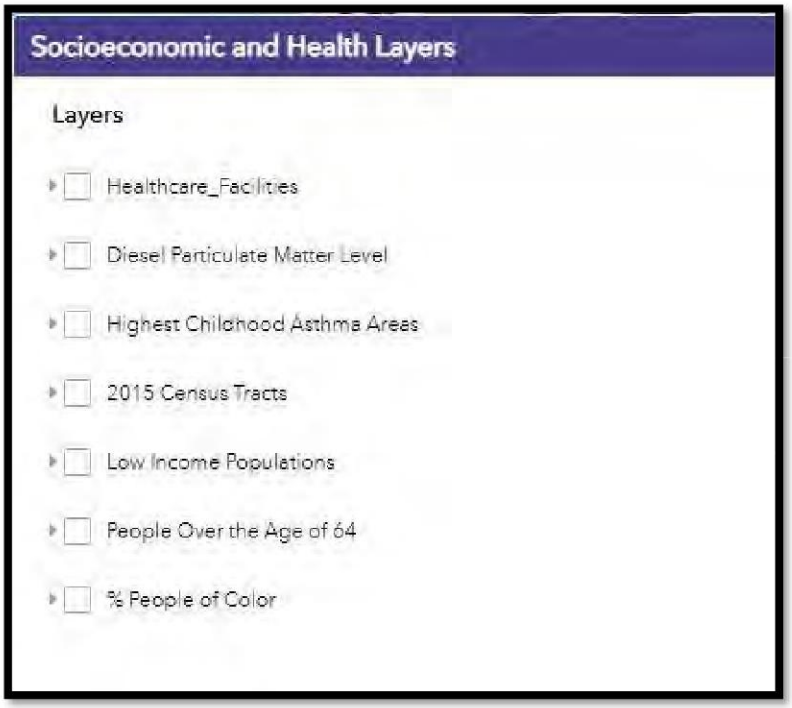
Figure 2. Questions provided to DEH members ahead of June 14, 2021 workshop



The Company has also sought community input on the siting of public charging stations. A key resource in seeking this input is the Charge Up Hawaii webtool, which was developed with SSFM International as a new way for the community to gain EV charging information and provide feedback about their desires for future charging sites. Charge Up Hawaii includes a story map designed to help educate customers about electric transportation, a brief survey to gain understanding of community mobility needs, and an interactive ArcGIS map to efficiently collect community input on public charger location preferences. Within the interactive map, users can filter for various infrastructure, traffic, environmental, socio-economic, and health variables, displaying how these factors relate to specific communities or potential charging sites.

Figure 3. Filter Selections for Infrastructure, Traffic, and Environmental Layers

Figure 4. Filter Selections for Socioeconomic and Health Layers



Charge Up Hawaii launched for public engagement between August 25, 2021 to October 2, 2021, and was promoted by the Company utilizing multiple communications and outreach channels to garner robust participation and input such as:

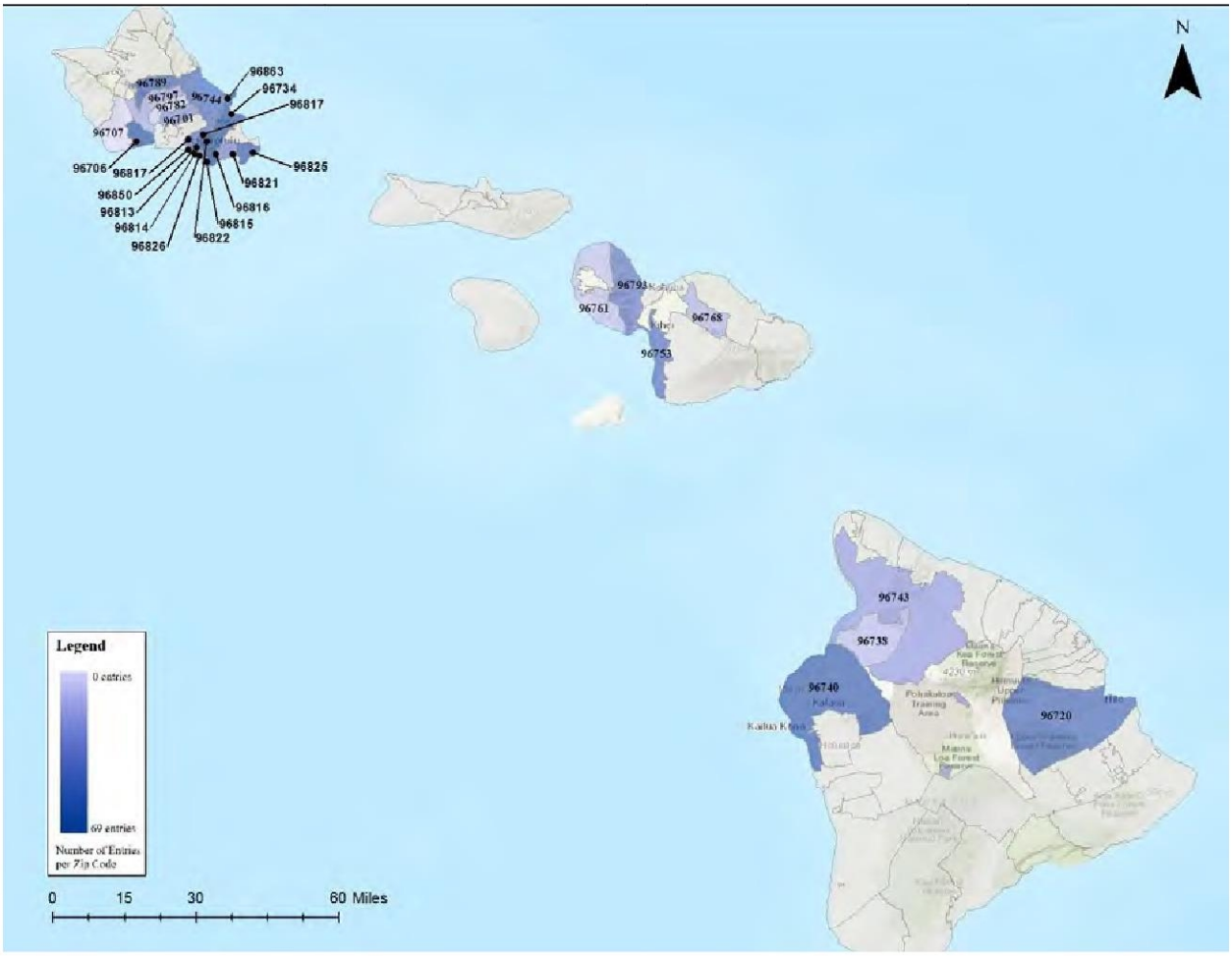
- Email outreach to customers and EoT stakeholders
- Press release to media outlets
- Social media posts (LinkedIn, Facebook, twitter, Instagram)
- Email outreach to neighborhood boards
- Email outreach and 1-1 tutorials to State Legislators
- Presentation to Energy Equity Hui
- Outreach to Hawaiian Electric LMI Advisory Council
- Sweepstakes promotion from August 3 – September 10 raffling $100 grocery store gift cards to customers
- Engagement with Hawaiian Electric Company employees

The six-week launch of Charge Up Hawaii comprised the Company's initial testing of the tool and collection of broad input and feedback on the story map and interactive map. Charge Up Hawaii received significant participation from the community with 2,045 survey responses and 1,812 pins suggesting future charging sites. The map Figure 5 corresponds to survey results[25] (not the interactive map pins) and highlights the census tracts that had the highest number, between 20-69, of survey entries. The map areas that are not highlighted had fewer than 20 responses. The majority, 69 percent, of survey respondents use a personal vehicle as their

[25] The Charge Up Hawaii survey was developed to track participation with the interactive map as the pins on the interactive map cannot correspond to or collect participant information at this phase in development of the Charge Up Hawaii webtool.

primary mode of transportation and 49 percent live in a single-family home and 45 percent live in a MUD or townhouse.

Figure 5. Census tracts with 20-69 survey entries



Charge Up Hawaii participants suggested public charger locations across the Company's service territories dropping pins at 1,136 locations on Oʻahu, 335 locations on Hawaiʻi Island, 297 locations on Maui, 32 locations on Lanaʻi, and 12 locations on Molokaʻi as shown in Figure 6 to Figure 10.

Figure 6. Charge Up Hawaii – O‘ahu pins

Figure 7. Charge Up Hawaii – Hawai‘i Island pins

Figure 8. Charge Up Hawaii – Maui pins

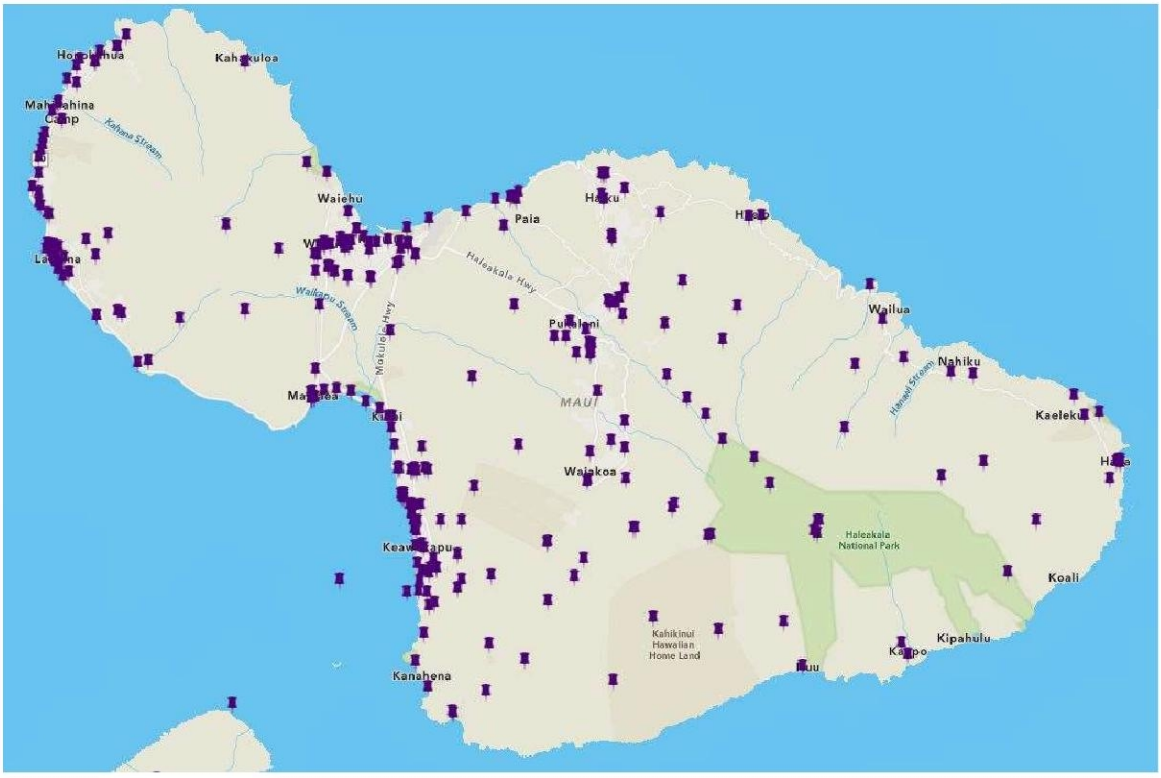


Figure 9. Charge Up Hawaii – Lana‘i pins

Figure 10. Charge Up Hawaii – Moloka‘i pins

A high concentration of pins was placed in neighborhoods listed in Table 3. These high concentration census tracts may indicate areas for the Company to prioritize site host outreach.

Table 3. Charge Up Hawaii – Census tracts with highest number of pins

Neighborhood	Census Tract	Number of Pins
Ala Moana	37	69
Kakaako	38	38
Ka‘u	212.02	37
Kula	303.01	35
Kawaihae-Waikoloa	217.04	32
Lana‘i	316.01	32
Hawaii Kai Marina	1.08	29
Civic Center	39	29
Hilo: Keaukaha-Pana‘ewa	206	27
Hana	301	26
Pa‘auhau-Pa‘auilo	220	26

As the Company looks to utilize Charge Up Hawaii for future outreach and education efforts, specific focus will be given to customers and community groups who were limitedly represented

in this first set of data collection such as, but not limited to, Kapalama, Waipio, Wailuku, neighborhoods within Hilo, and Holualoa.

The Company plans to continue to update data, revise usability, and outreach to additional customer segments throughout the life of the Project in order to update its understanding of community mobility needs. The Company believes that further stakeholder and community engagement is needed to ensure the equitable distribution of EV chargers throughout its service territories.

C. SCOPE AND SIZE

1. Project Size

The Backbone Study identified a clear need to accelerate the deployment of DCFC and public Level 2 charging infrastructure within the state to meet the projected 2025 and 2030 charging port needs. Tables 5 and G1 in the Backbone Study summarize the forecasted charging port needs within Hawaiian Electric's service territories by 2030 and 2025, respectively, to meet 2030 Reference Case EV adoption of approximately 8 percent of light-duty vehicles on the road in Hawaiian Electric's service territories. The results are shown in Figure 11 below for reference. The study shows a total need of 23,403 charging ports by 2025 with the vast majority (22,143 or 95%) of need being for privately accessible charging ports and just 1,260 or 5% being for publicly-accessible ports. By 2030, a total charge port need of 50,371 is forecasted, again with a clear majority identifying private (46,720 or 93%) versus 3,651 or 7%, public. As of September 2021, approximately 31 DCFC and 662 Level 2 charging ports at over 300 sites are in operation in the state, which includes areas outside Hawaiian Electric's service territories. This indicates a need for a more than five-fold increase in public charging ports alone needed in the Company's

service territories 2030 Backbone Study Reference Case, and a great deal more to scale from that Case's 8 percent EVs on the road to a fully electric future.

Figure 11. Number of Ports from Backbone Study for 2025 and 2030

2025				2030			
Technology Type	Private	Public	% of Total Public	Technology Type	Private	Public	% of Total public
Level 1	5,870	3	0%	Level 1	4,044	26	1%
Level 2	15,935	1,072	85%	Level 2	41,757	3,068	84%
DCFC	338	185	15%	DCFC	919	557	15%
Total Ports	22,143	1,260		Total	46,720	3,651	
% of Total ports	95%	5%		% of Total Ports	93%	7%	
Total Public & Private Ports	23,403			Total Public & Private Ports	50,371		

As noted above, the Company's service territories are currently home to only six fast chargers that are not owned by the Company. This reinforces the urgent need for utility-ownership of charging infrastructure to stimulate sufficient EV adoption and support the private market, which can then provide the vast majority of additional investment needed to fulfill the charging needs of the state in 2030 and beyond.

To size the Project, the Company looked at program sizing methodologies of other utility-owned charging programs across the U.S. and performed a sensitivity analysis using 12 different scenarios under the Backbone Study 2030 Reference Case. As noted in Exhibit I (*Best Practices Review*), Baltimore Gas & Electric is the only utility program reviewed that gave specifics on program sizing. In this case, the utility sized their proposed program to meet 1/3 of the charging infrastructure need identified to meet the state's EV adoption goals. The scenario analysis consisted of adjusting the Backbone Study filters to select only census tracts in the top quintile (80% or higher) or bottom quintile (20% or lower) for each of the selection filters. The Company averaged the sizes of the resulting scenarios to determine port counts of DCFC and Level 2 ports for each scenario as shown in Figure 12 below.

Figure 12. Project Sizing Scenario Analysis

Scenario Name	Charger Type	Hawaii	Maui	Oahu	Lanai	Molokai	Total	% of Public Universe
MUD at Top Quintile (top 20%)	DCFC	0	0	61	0	0	61	11.55%
	Level 2	0	2	381	0	0	383	12.49%
MUD at Bottom Quintile (bottom 20%)	DCFC	24	13	71	0	0	108	20.45%
	Level 2	147	69	380	0	0	596	19.43%
Low Income at Top Quintile (top 20%)	DCFC	13	5	43	0	2	63	11.93%
	Level 2	85	39	282	0	14	420	13.69%
Low Income at Bottom Quintile (bottom 20%)	DCFC	9	0	87	0	0	96	18.18%
	Level 2	51	0	434	0	0	485	15.81%
Utilization at Top Quintile (top 20%)	DCFC	28	28	124	0	0	180	34.09%
	Level 2	151	166	732	0	0	1049	34.20%
Utilization at Bottom Quintile (bottom 20%)	DCFC	1	5	17	0	0	23	4.36%
	Level 2	8	30	108	5	0	151	4.92%
Range Support at Top Quintile (top 20%)	DCFC	71	38	16	0	2	127	24.05%
	Level 2	413	222	96	0	14	745	24.29%
Range Support at Bottom Quintile (bottom 20%)	DCFC	0	0	78	0	0	78	14.77%
	Level 2	0	0	478	0	0	478	15.59%
Development Cost at Top Quintile (top 20%)	DCFC	3	0	46	0	0	49	9.28%
	Level 2	25	0	269	0	0	294	9.59%
Development Cost at Bottom Quintile (bottom 20%	DCFC	10	54	27	0	0	91	17.23%
	Level 2	58	323	178	0	0	559	18.23%
Local Grid Support at Top Quintile (top 20%)	DCFC	10	54	27	0	0	91	17.23%
	Level 2	58	323	178	0	0	559	18.23%
Local Grid Support at Bottom Quintile (bottom 20%	DCFC	3	0	46	0	0	49	9.28%
	Level 2	25	0	269	0	0	294	9.59%
Average DCFC Backbone % of Public Universe							**85**	**16.04%**
Average L2 Backbone % of Public Universe							**501**	**16.34%**

On average, the resulting scenarios consisted of 85 DCFCs and 501 Level 2 charging ports, for approximately 16% of the 2030 DCFC and Level 2 public charging need in the Reference Case.[26]

Using both the Best Practices Review and Scenario Analysis information above, the Company triangulated on a Project size of 150 DCFC ports and 150 dual-port Level 2 charging stations. This Project size would provide approximately 28% of the 2030 public DCFC ports needed in 2030 to reduce range anxiety, provide charging for those who cannot charge at home, and support government and other fleets. The Level 2 ports in the Project equate to about 10% of the 2030 public Level 2 charging need in the Backbone Study. In total, the proposed Project

[26] Table 5 of the Backbone Study provides High and Low Scenarios for 2030 and Table G2 provides High and Low Scenarios for 2025.

represents 13 percent of public charging need in the Backbone Study Reference Case. Based on stakeholder feedback received and best practices review[27], the preferred configuration for each site is two (2) DCFC stations and one (1) dual-port Level 2 charging station. The preferred allocation set forth above identifies approximately 75 sites as potential new locations. This preferred configuration leaves 75 dual-port Level 2 charging stations remaining to allow the Company flexibility in both the deployment of charging infrastructure as well as in some of the anticipated Project expenses. As discussed previously, it is important to have the flexibility in determining the configuration of the charging stations to meet the specific needs of each site and community they are serving. For example, some communities may need more or less DCFC or more or less Level 2 charging stations at a given location. The opportunity to right-size charging locations is crucial to the success of the Project going forward. With an eye towards flexibility, the Company asserts that the remaining 75 Level 2 chargers represent a potential contingency in the Project budget, allowing for either a) deployment of additional charging infrastructure, b) increased O&M expenses, or c) any unforeseen costs that may arise as a result of scaling and/or needed expenditures to improve customer satisfaction or ease of use. Customers and DEH members provided feedback on the Pilot stating the desire to have more than one charger at the

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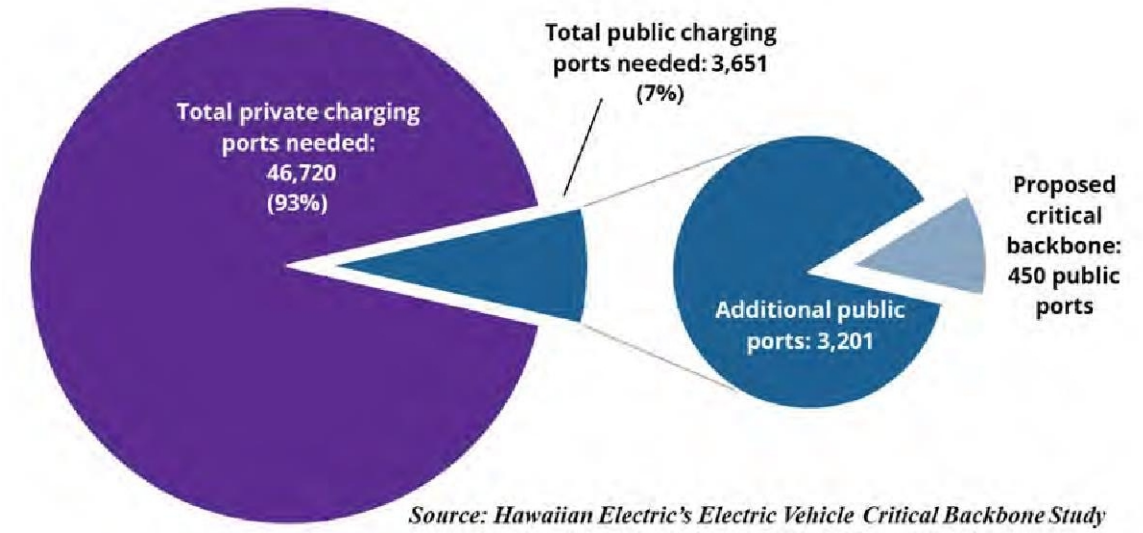
[27] See, for example, decisions in the following utility-owned DCFC programs detailed in Exhibit I (*Best Practices Review*):

- Southern California Edison (docket A1807022) and Pacific Gas & Electric (docket 18-07-020), in which the California Public Utilities Commission (CPUC) describes the benefits of a port minimum and states that they encouraged the utilities to install at least two ports per site. The CPUC explains, "In the interest of minimizing costs and maximizing overall benefits, we encourage the utilities to install at least 2 ports per site to ensure more than one person can utilize charging at a particular location."
- The Florida Public Service Commission decision on Tampa Electric's program (docket 20200220-EI) notes that the utility intends to install two Level 2 Ports at each of the four DCFC locations to provide redundancy, and that their program will require a minimum of 2 and a maximum of 6 ports to be installed at each public site.
- The Oregon Public Utilities Commission decision on Portland General Electric's program (docket UM-1811) requires four dual-connector DC fast chargers and one dual-port Level 2 charger at each site.
- Puget Sound Energy's program (docket Number UE-180877), which has no explicit port minimum, but specifies that there will be 32 DCFC ports at only eight locations.

sites in case of maintenance issues and/or to reduce queuing. DCFC installations will support both CCS and CHAdeMO connectors: each site will host at least one combination CHAdeMO / CCS station and co-sited Level 2 charging provides backup charging to customers with lower install cost.

After accounting for the private charging installations demanded by a healthy EV market, the ports that are part of this Project represent less than one percent of total needed ports to support the interim 2030 Backbone Study EV adoption Reference Case of approximately 8 percent of light-duty vehicles on the road in Hawaiian Electric's territory (see Figure 13), and an even smaller percent of the total charging universe needed beyond 2030. The Project is designed to enable a kick-start to the islands' EV charging industry and support a lasting competitive market to provide the majority of the needed investment.

Figure 13. Electric vehicle charging ports needed in Hawai'i by 2030



Source: Hawaiian Electric's Electric Vehicle Critical Backbone Study
Total ports include DCFC, Level 2, and Level 1

Table 4. Project Size Summary

Category	Project Charger Quantity	Project Port Quantity	2030 Port Need Quantity	% of 2030 Need
DCFC	150	150	528	28%

Category	Project Charger Quantity	Project Port Quantity	2030 Port Need Quantity	% of 2030 Need
Level 2	150	300	3,067	10%
Total	300	450	3,595	13%

2. Project Social Equity Considerations

As Hawai‘i moves toward a cleaner transportation future, it is imperative that diverse community needs are recognized and built into the Company's policies, products, and services. Hawaiian Electric is an integral part of the community and endeavors to develop a public charging program that reflects the unique needs across its service territories. A program that acknowledges customers and households who may not own personal vehicles, supports electric transportation options such as carsharing, ridesharing, and transportation network companies, where appropriate. Further, electrified rental car fleets and tour buses, can also help to mitigate the environmental impact of tourism on the state and can lessen the cost for all with increased utilization of public charging stations.

To best meet the mobility needs of our diverse communities, Hawaiian Electric has proposed several pilots, programs, and rates aimed to serve different customer needs, such as the Charge Up eBus Pilot, the proposed Charge Ready Hawai‘i commercial make-ready Pilot, the proposed EV-J and EV-P rates, and the public charging program. The proposed Project can provide solutions for multiple customer use cases and can help reduce household transportation expenses, mitigate environmental impact in neighborhoods with higher exposure to air pollution from vehicle emissions, and create clean mobility options to underserved communities.

However, nationwide and within Hawai‘i, there is no common definition for LMI community. Equity considerations vary in how communities in-need are defined, the type of investment that serves them best, and the equitable distribution of public EV chargers.

Identifying underserved communities in the transportation sector may require consideration of household income as defined by the Federal Poverty Level, Asset Limited, Income Constrained, Employed households, or how the Backbone Tool uses the Department of Housing and Urban Development definition of "low income" which includes household incomes less than $75,000 per year on O'ahu or less than $80,000 per year for the counties of Kauai, Maui, and Hawai'i. Consideration may also be given to additional factors such as, but not limited to, indigenous communities, communities of color, communities with higher air pollution burden, household energy burden, population density, and proximity to healthcare facilities. Public EV charger deployment necessitates community engagement, creating a good customer experience for site hosts and EV drivers, while providing excellent customer service with a focus on continuing education, outreach, and timely repair and maintenance. Recognizing that transportation equity is multifaceted and may involve considerations beyond income designations, meaningful community engagement is critical to ensure that any project or policy is a good fit for the communities they are intended to benefit. Hawaiian Electric continues to engage in meaningful community discussions by gathering input from trusted community-based organizations, holding stakeholder meetings, and developing surveys and tools to identify underserved communities, their mobility preferences, and determine the most beneficial sites for EV charging.

As part of this ongoing effort, Hawaiian Electric has met with the LMI Advisory Council, which comprises over 50 nonprofit organizations and over 100 representatives from across our service territory. This meeting was to meet the Council members and provide information regarding Hawaiian Electric's electrification of transportation initiatives, including the proposed expansion of its public charging Project and the Charge Up Hawaii tool. Hawaiian Electric intends to continue discussions with the LMI Advisory Council, as well as the Energy Equity

Hui, Hawaii Energy, and other trusted community representatives to continue discussions and explore ways to gain a deeper understanding of varying priorities including cultural sensitivities, literacy levels, language barriers, work and childcare obligations, and mobility needs/preferences. In addition, Hawaiian Electric will continue to conduct briefings with State Legislators and County Representatives to gain an understanding of district specific needs that may not surface through other outreach efforts.

The Company will seek to leverage digital communications such as the Charge Up Hawaii webtool to open new pathways of communication for ongoing engagement on community charging needs. Feedback from a DEH member suggested the Company "link up with community associations to get feedback [on] EV charging needs", and have "public meetings tying into community planning efforts [and] get public to provide input into siting of EV charging infrastructure." The Company plans to undertake targeted outreach to the following groups in order to gather feedback on siting preferences and to encourage engagement:

- Community associations (e.g., Moloka'i Clean Energy Hui, Climate Action Advisory Committee, Maui Climate Action Advisory Committee);
- Hawaiian Electric LMI Advisory Council;
- County housing agencies;
- Rural communities that have limited access to charging infrastructure;
- State Agencies and commercial fleets;
- Non-Governmental Organizations and Community-Based Organizations;
- Transportation Network Companies e.g. taxis, Uber, Lyft, holoholo;
- EV Driver Associations;
- Rental and Tour Fleets;

- Energy Equity Hui; and
- Hawaii Energy

A number of these groups were suggested by DEH members during the June workshop. The Company will continue to seek additional stakeholders for engagement in an effort to achieve robust stakeholder representation and proposes to continue this engagement should this Application be approved. As discussed in Section II.C. in this exhibit above, the Company seeks to site stations with a number of goals in mind and ongoing stakeholder engagement will:

- Include efforts to engage potential site hosts and increase interest in hosting as finding willing, qualified site hosts at desired locations has been a challenge.
- Assist in developing partnerships that can support equity-focused station siting;
- Seek input from EV drivers, utility customers, and fleets to determine specific locations that are needed to meet current and near-term charging demand not being met by other providers; and
- Seek input from researchers, charging companies, and automakers to strive for the development of a more geographically dispersed backbone network that leverages any existing plans for installations.

D. IMPLEMENTATION PROCESS

1. Siting

The Company contends that it is important that the Project has flexibility when identifying potential sites in order to meet charging infrastructure gaps that will continue to change over time. Overly prescriptive siting requirements can limit the eligible types of sites and slow the deployment of charging infrastructure. Drawing upon the Company's experience in the

Pilot and industry best practices, the Company has developed the Site Host Journey below, that outlines the process by which a Company fast charging station gets installed.

Step 1: Intake Process

The Company will utilize communications and outreach strategies to create robust awareness of the Program to attract potential site hosts. The Company will focus on education of the Program in attempt to develop a queue of interested site hosts and is considering an online enrollment process for interested site hosts as part of Program deployment.

The Company will continue to focus relationship building with large multi-site landowners to increase deployment efficiencies and reduce license agreement negotiation time and administrative burden. In general, the Company has experienced increased interest from larger property managers, upon the enactment of Act 89, which requires a site to install at least one charging station if their parking lot has at least one hundred parking spaces available for use by the public. Investigation will be given to sites and high-interest census tracts identified through the Charge Up Hawaii initiative as they relate to and provide support to the Backbone Study. The Company will also continue to seek input from stakeholders such as community-based organizations and representatives, fleets, automakers, and EV drivers for potential site locations.

Step 2: Virtual Assessment

The Company aims to complete the Virtual Assessment before scheduling the first Site Host meeting. The Company will use online and system information to assess among other things, the following elements: the available space for a charging station, the potential distance

from the proposed stall to the electrical service connection, the locations of transformers and available capacity and the location relative to flood plains.[28]

Step 3: Site Host Meeting

Following the Virtual Assessment, the Site Host Meeting may or may not be on the phone or at the site. Here the Company would present some EV background information if the Company felt the Site Host could benefit from this, the Project background and scope, benefits to the Site Host, the Company's requirements for an ADA stall, the site hosts obligations, terms of revenue collection and schedule. The Company would also ask the Site Host for any existing civil plans. In response to Site Hosts' concern about loss of parking stalls, the Company has determined to only designate the first fast charger on a given site as ADA accessible, thereby making each additional charger on the site a smaller space commitment for site hosts.

Step 4: Site Walkthrough

During the walkthrough, the Company will discuss siting options and preferences with the Site Hosts**,** clarify the Company's requirements**,** access ground slope and parking surface conditions to assess work and ADA compliance**,** look for ADA accommodations (such as existing ADA facilities/stalls, curb cut-outs)**,** assess existing transformers**,** assess power poles for location and electrical service equipment (poles with existing transformers and risers usually cannot be used)**,** assess other existing utilities such as sewer/water, locate and access any manholes/handholes and note existing hardscape and landscape.

Step 5: Conceptual Design

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[28] During the Pilot, the Company would conduct flood zone checks to avoid installing chargers in flood zones. However, the Company will evaluate ways to safely deploy in flood zones as a way to expand potential siting locations.

A conceptual design will be developed and provided to the Site Host. During the Pilot phase, the Company would initially require the execution of a memorandum of understanding with the site host that would acknowledge the conceptual design. However, as part of the Project, the Company will eliminate this step to shorten the deployment timeline by moving directly to the negotiation of the License Agreement. To alleviate site host concerns earlier in the selection process and to help expedite agreements, the Company is exploring making the License Agreement and supporting Frequently Asked Questions guidance document (i.e., handbook) easily accessible on the Project webpage.

Step 6: Final Agreement

The Site Host must execute the final License Agreement before the Company will expend resources in the following Design and Construction phases.

Step 7: Design

Upon execution of the License Agreement, the Company will begin drafting detailed design plans and develop final infrastructure estimates. Due to the limited nature of the Pilot, this function was conducted on an ad hoc basis, however, as part of the Project, the Company will identify a prequalified pool of architectural and engineering firms through which the design will be completed. If resources and timing allow, the Company will perform in-house pre-engineering work to expedite the design process.

Step 8: Construction:

The Company will submit construction plans to the relevant authority having jurisdiction (e.g., The City and County of Honolulu, Department of Planning and Permitting) to secure all necessary reviews, approvals and permits. The Company will procure, construct, and maintain

reviews, approvals, and permits; as well as construct and maintain the necessary equipment. If practicable, the Company may identify a prequalified pool of contractors for this work.

Step 9: Charging Equipment Installation, Testing & Commissioning:

Following installation of the charging infrastructure, the Company will install, test, and commission the charging equipment. The Company will select the charging equipment through a pre-qualified pool of EVSE vendors. All charge station equipment will be procured through a request for proposal ("RFP"). The range of acceptable power levels for chargers will be between 50kw to 150kw.

a. Procurement Processes

The Company will employ an RFP process to establish a prequalified pool of architectural and engineering firms and construction contractors to ensure adequate design and construction resources are available to support the Project as it grows. The Company will evaluate multiple deployment methods including design-bid-build, design-build, design-build-operate-maintain, and where available, the Company will perform pre-engineering work internally to help expedite the design process.

Currently, Efacec is the sole equipment manufacturer used for the Pilot charging stations under two different network providers, namely, Greenlots and OpConnect. The Company currently envisions issuing an RFP for network provider services for the Project charging network with the option to include the charging stations along with the network services. The Company will continue to issue RFPs for EVSE throughout the deployment period and as technology and customer needs change.

b. Installation Cost Minimization & Sizing

One of the lessons learned from the Pilot, is to use the initial construction as an opportunity to "future proof" locations to accommodate higher capacity charging more easily. On a case-by-case basis, and where it is shown to be cost effective, the Company will seek to increase service capacity at an installation site to enable future higher capacity chargers. This site future proofing will be done by oversizing the transformer and upsizing or laying additional conduit to support site expansion, where the marginal cost of doing so is not prohibitive.

As discussed herein, the Company has learned that locating a single DCFC is a less optimal use of initial construction resources, given the significant preference from stakeholders to provide additional charging stations at each given site. Thus, the Company has identified its preferred configuration of 2 DCFC ports and 1 dual-port Level 2 charger per site. The intent of the Level 2 charging is to provide some redundancy should a DCFC station not be functioning or to provide options during high utilization periods to mitigate waiting times at the DCFC stations.[29]

2. Operation and Maintenance

Providing public fast charging with a high level of reliability is of upmost importance to Hawaiian Electric. The goal of the Company is to maximize availability of charging stations. In order to provide this level of reliability, the Company issued RFP No. 072720-03 on July 21, 2020 to transition the maintenance and repair services of all DCFC's as part of the existing EV-U, EV-MAUI and future programs to a third-party Contractor. A Contractor with experience in managing large networks of multiple EVSE types was recently selected and a 2-year service

[29] In addition, some vehicle types, namely most plug-in hybrid electric vehicles cannot fast charge and can only charge at Level 2 capacity.

level agreement has been executed between the Company and the selected Contractor. Having the Contractor onboard will help to resolve issues in a timely manner.

The Contractor will provide inspection and preventative maintenance services for each charger on an annual basis and at a per site fixed cost. During the site visit and inspection, routine preventative maintenance will be performed as recommended by the EVSE original equipment manufacturer. If this Project is approved and the number of sites is expanded, the Company will leverage its increased purchasing power to improve response times and increase stock of key replacement parts on the islands to serve the larger charging network, significantly reducing repair wait times and remedying concerns from site hosts and drivers, as described in the Company's review of lessons learned.

Similarly, it is the intention for the Level 2 charging O&M to also be completed by a third-party Contractor. The Company plans on issuing an additional RFP to solicit a Contractor.[30]

3. Education and Outreach

The Company plans to address key EV adoption barriers and customer needs through a comprehensive education and outreach effort intended to improve EV awareness, educate on the benefits of EVs and EV charging, better understand customer needs, and build greater awareness of Hawaiian Electric's public charging network. Education and outreach for the Project will target a broad range of customers and attempt to address concerns ranging from basic EV questions to highly nuanced and detail-specific needs. The Company has allocated an Education and Outreach budget of approximately $4M, which is approximately 5 percent of the overall

[30] In addition, the Company will explore bringing some of these services in-house over time, if such services are cost effective. In addition, the Project can spur additional market investment that can also create jobs as a secondary effect.

Project budget. As shown in Table 5 of Exhibit I (*Best Practices Review*), the percent of overall budget for education and outreach efforts in other utility projects range from 3% to 16%. If approved, the Company proposes to build upon its current customer engagement and stakeholder outreach through various strategies within an awareness campaign and data analysis tools discussed further herein.

a. Awareness Campaign

The Company will develop an Awareness Campaign to increase public awareness of electric transportation and the benefits and considerations of EV ownership. The Company will partner with organizations like DEH, Hawaii Energy, Hawaii Auto Dealers Association, and local EV Associations to enhance educational materials, customer resources, and promotional events such as hands-on ride-and-drive events with the goal to help customers learn about EVs and develop informed opinions to determine if EVs are a right fit for their budget and mobility needs. Implementation of the Awareness Campaign will be done through collaborative development of content on social media, radio, television, newspaper, magazine, and direct outreach to local community organizations.

Additionally, the Company will develop specific material to increase awareness of Hawaiian Electric's public charging network. This aspect of the Awareness Campaign will be geared specifically towards EV drivers and will consist of television, radio, web, and print content to promote the Project, the Company's public charger sites, and educate customers by providing instructions on how to locate and use Hawaiian Electric fast chargers. The Company will also explore creative marketing and install additional signage at the chargers to provide greater visibility of the public chargers and site locations.

b. Data Analysis Tools

Web-based tools such as the Backbone Tool and Charge Up Hawaii mapping tool will be used to support Project goals and deployment. The Company plans to update the 2019 Backbone Study and Tool to ensure that Project deployment decisions are rooted in updated and clarified empirical data. The updated Backbone Tool can be leveraged for future programs, rates, and policy development, and can potentially serve as a resource to external parties as well. The Company plans to utilize the Charge Up Hawaii tool for future outreach efforts and will be leveraged to open pathways of communication with specific focus to community groups who were not represented in the first set of data collection, The Project budget includes a one-year extension of service and maintenance as the Company transitions the tool to in-house management. Additionally, as charger deployment increases, the Company will evaluate the need for new software resources to support with data collection of charger utilization, network performance, and maintenance.

Exhibit B
Public Electric Vehicle Charger Expansion Application
Proposed Rate Design

A. Introduction

The Company proposes revisions to the EV-U rates and rate design to provide charging opportunities for customers at stations operated by the Company that are generally cost-competitive with gasoline to help incentivize EV adoption and that offer an incentive to utilize the charging stations during the solar day. The Company's proposed revised EV-U rates include 1) the removal of charging operations and maintenance ("O&M") costs and network fees from the EV-U rate design itself, 2) an update of the underlying basis of the rate to be the proposed Schedule EV-J, Electric Vehicle Charging Service – Demand ("EV-J"), as filed in Docket No. 2020-0152[1] rate for each Company, 3) an update of the design basis of the rate such that it is revenue neutral for a corresponding EV-J customer based on average historical EV-U usage by time period and by Company, and 4) an update of the baseline surcharges incorporated in the rate to June 2021 surcharges. These updates are intended to make the EV-U charging rates more attractive to the end-charging customer and more competitive with the cost of gasoline.

B. Background

The Commission approved the current Pilot EV-U rates in Order No. 34867 ("Order 34867") filed October 13, 2017 in Docket No. 2016-0168 that are in effect from December 12, 2017 to June 30, 2023.[2] The current Pilot EV-U rates were developed using "the underlying rate structure of Schedule EV-F with an added cost component for pilot expenses, but excluding the

[1] Docket No. 2020-0152, For Approval to Establish Electric Vehicle Tariffs for Schedule EV-J - Electric Vehicle Charging Service - Demand and Schedule EV-P – Electric Vehicle Charging Service - Large Demand, on a Pilot Basis, filed September 30, 2020.
[2] Ordering Paragraph 1 at 13: The Companies' revised tariff sheets, filed on September 5, 2017, are approved, effective from the date of this Order. As a result, the commission specifically approves the Companies' revised tariff sheets for their existing Schedules EV-F and EV-U. The Companies, in turn, will implement the commission-approved revised tariff sheets in sixty calendar days from the date of this Order.

Schedule J surcharges that apply to Schedule EV-F".[3] The EV-U Pilot expenses consist of: incremental O&M expenses (network service provider fees, non-labor O&M expenses (equipment and warranty costs)), and applicable revenue taxes.[4] In addition, in lieu of Schedule J surcharges that apply to underlying Schedule EV-F, a proxy surcharge value is embedded within EV-U rates that was a simple average of Schedule J monthly surcharges from September 2016 to August 2017.[5]

1. Current Pilot EV-U Rate Design is not Competitive with Gasoline Equivalent on a cents per kWh basis

The current Pilot EV-U TOU rates are not competitive with the cost of gasoline on an equivalent cents per kWh ("cents/kWh") – even in the current environment of relatively high gasoline costs.[6] Competitiveness and predictable pricing can help create a fair playing field to drive EV adoptions.

Table 1, below, illustrates that the current Pilot EV-U rates range from a low of 8.8 percent to a high of 41.4 percent above the cost of gasoline based on a survey of gasoline prices conducted July 26 – 29, 2021. Only during the Mid-Day TOU period[7] on the islands of Molokai and Lanai, with gasoline prices of $5.14 and $5.79 per gallon, respectively, is EV-U below the cents/kWh equivalent cost of gasoline.

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[3] Id. At 9. Internal quotation and footnotes omitted.
[4] Id at 9-10. Internal quotation and footnotes omitted.
[5] See, e.g., "Revised Rate Structures for Schedule EV-F and EV-U", filed September 5, 2017, Docket No. 2016-0168, Attachment 1 at 10.
[6] Gasoline price per gallon: Oahu ($3.85); Hilo Hawaii ($4.01); Kahului Maui ($3.99); Molokai ($5.14); Lanai ($5.79). Prices obtained July 26 -29, 2021.
[7] See e.g., Order No. 34867, Approving Revised Tariff Sheets, Docket No. 2016-0168, filed October 13, 2017 at 6. "three different TOU periods over a 24-hour period: On-Peak (i.e., between 5:00 p.m. to 10:00 p.m.), Off-Peak (10:00 p.m. to 9:00 a.m.), and Mid-Day (9:00 a.m. to 5:00 p.m.)." footnote omitted.

Table 1. Comparison of Current Pilot EV-U Rates to Gasoline Equivalent cents/kWh Rate

Gasoline Equivalent

30 Avg Vehicle MPG

0.3 EV Efficiency (kWh/mile)

Comparison of Current EV-U Rates to Gasoline Equivalent

	Time-of-use Period	Gasoline Equivalent Rate (¢/kWh)	Current EV-U Rate (¢/kWh)	Difference (¢)	Difference (%)
		[A]	[B]	[C]=[B]-[A]	[D]=[C]/[A]
Hawaiian Electric	On-Peak	42.7778	57.0000	14.2222	33.2%
	Mid-Day	42.7778	49.0000	6.2222	14.5%
	Off-Peak	42.7778	54.0000	11.2222	26.2%
Hawaii Electric Light	On-Peak	44.5556	63.0000	18.4444	41.4%
	Mid-Day	44.5556	51.0000	6.4444	14.5%
	Off-Peak	44.5556	61.0000	16.4444	36.9%
Maui Electric - Maui	On-Peak	44.3333	62.0000	17.6667	39.8%
	Mid-Day	44.3333	49.0000	4.6667	10.5%
	Off-Peak	44.3333	60.0000	15.6667	35.3%
Maui Electric - Molokai	On-Peak	57.1111	66.0000	8.8889	15.6%
	Mid-Day	57.1111	54.0000	-3.1111	-5.4%
	Off-Peak	57.1111	64.0000	6.8889	12.1%
Maui Electric - Lanai	On-Peak	64.3333	72.0000	7.6667	11.9%
	Mid-Day	64.3333	60.0000	-4.3333	-6.7%
	Off-Peak	64.3333	70.0000	5.6667	8.8%

Figures 1 through 5, below, illustrate the cents/kWh cost of gasoline equivalent compared to the current Pilot EV-U rates by TOU period, by island. The gasoline equivalent is shown as a horizontal band with a plus/minus spread of $0.20 per gallon to provide a measure of variability in the market price of gasoline.

Figure 1. Pilot EV-U TOU Rates vs. Gasoline Equivalent cents/kWh on O'ahu

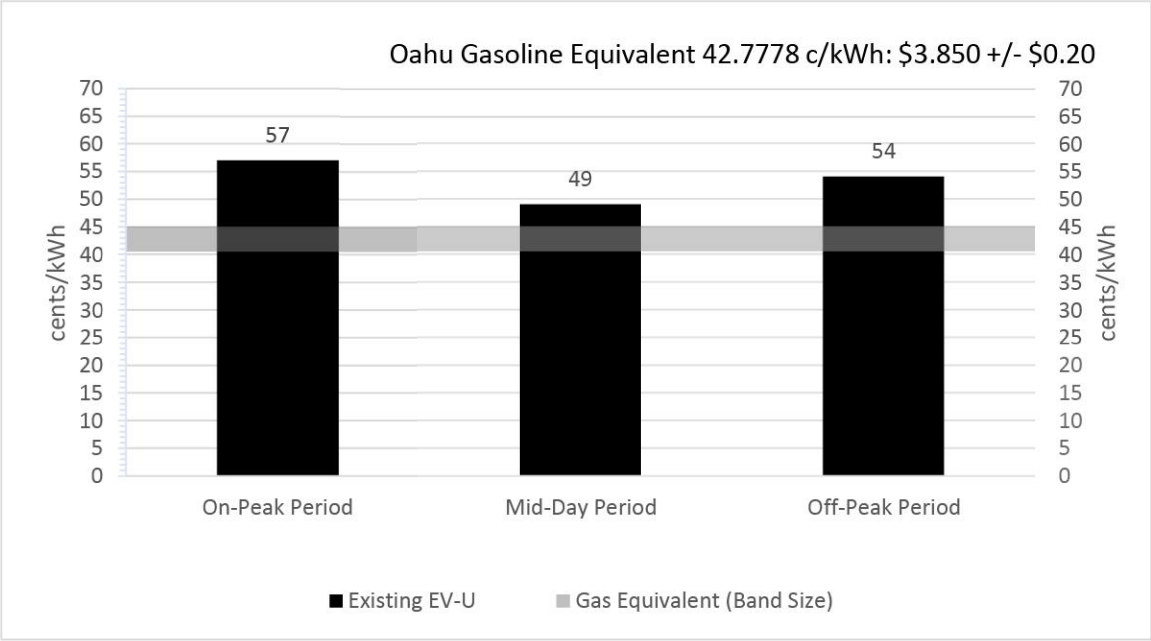


Figure 2. Pilot EV-U TOU Rates vs. Gasoline Equivalent cents/kWh on Hawai'i Island

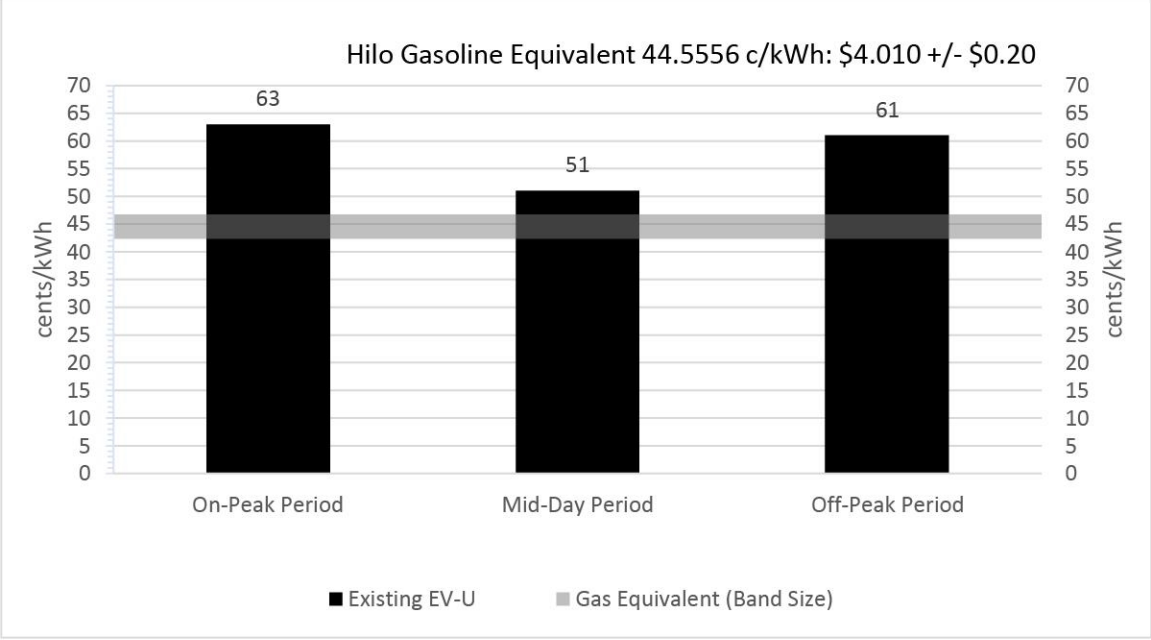


Figure 3. Pilot EV-U TOU Rates vs. Gasoline Equivalent cents/kWh on Maui Island

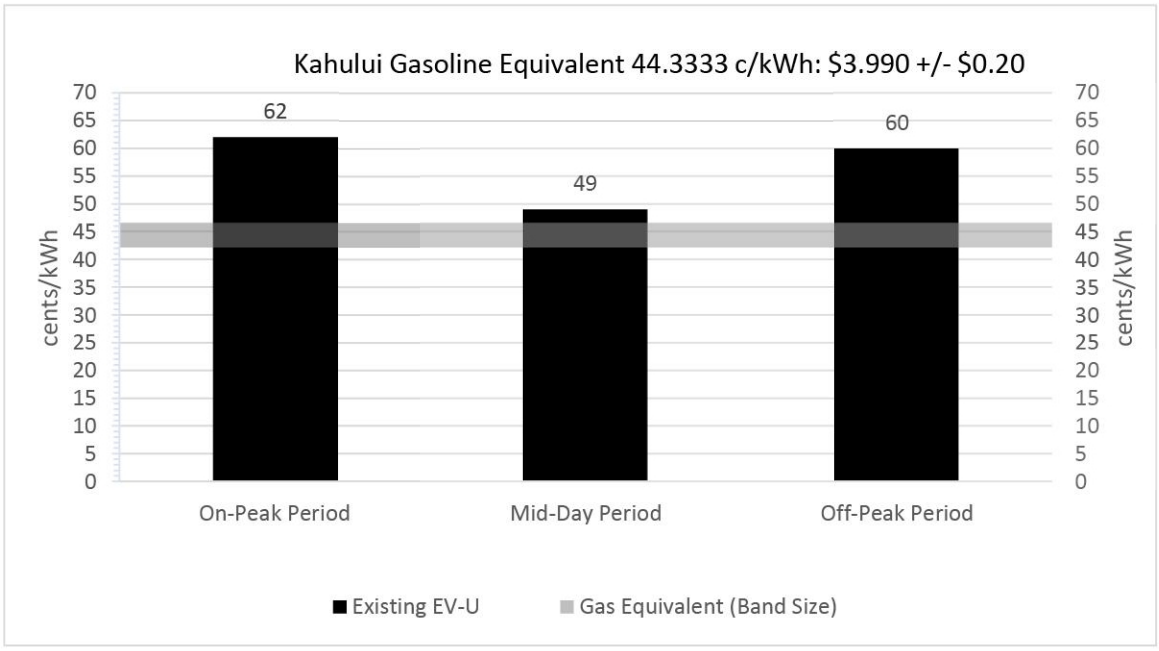


Figure 4. Pilot EV-U TOU Rates vs. Gasoline Equivalent cents/kWh on Moloka‘i Island

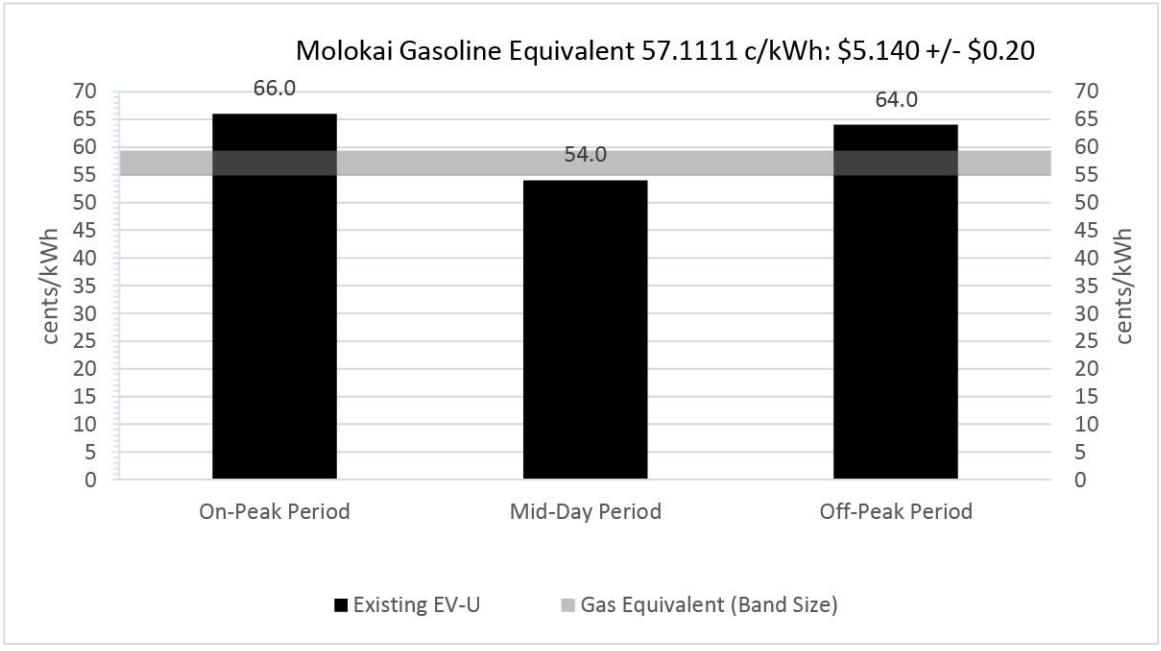
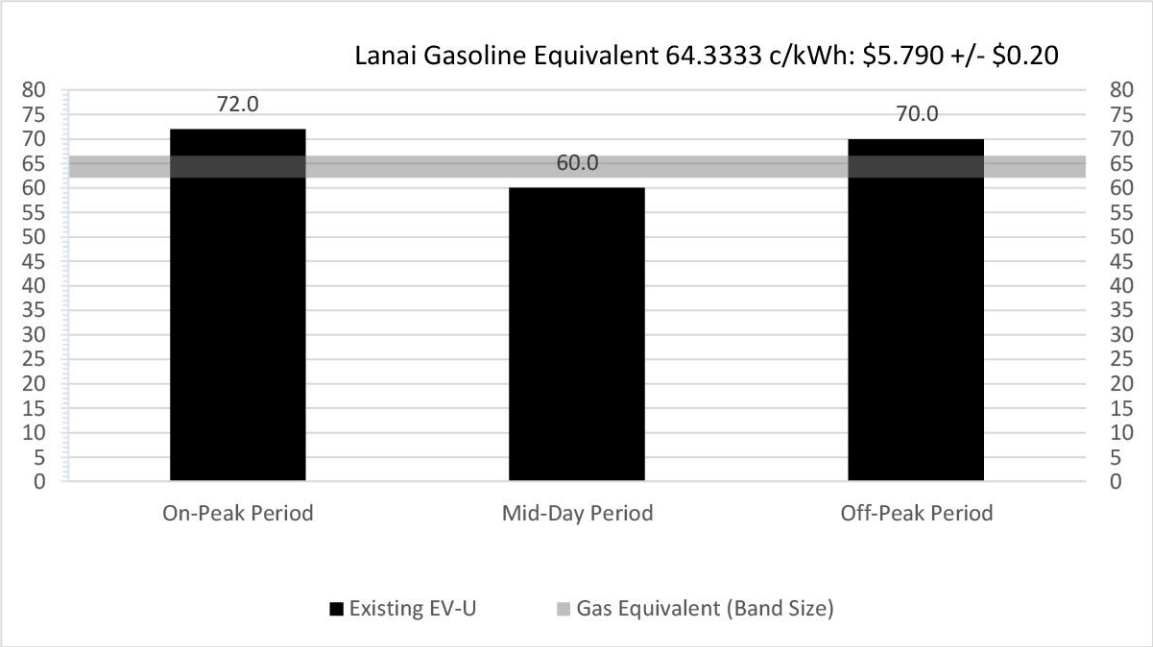


Figure 5. Pilot EV-U TOU Rates vs. Gasoline Equivalent cents/kWh on Lana'i Island



2. Current EV-U Rate Design

As indicated above, the current EV-U TOU pilot rate design is based on Schedule EV-F plus an adder to account for pilot O&M expenses (network fees, non-labor O&M expenses), a proxy customer surcharge, and applicable revenue taxes. The underlying Schedule EV-F is designed to be approximately equal to a Schedule J bill using about 5,000 kWh per month which approximates consumption of fourteen 15-minute fast charges per day in a 30-day month with each 15-minute charge using approximately 12.5 kWh.[8]

Network fees are a combination of fixed costs and variable charges based on revenue assessed to the Company by the network providers to facilitate charge session initialization, payment, and other network services such as data gathering and reporting.[9] Currently, these

[8] See, e.g., "Revised Rate Structures for Schedule EV-F and EV-U", filed September 5, 2017, Docket No. 2016-0168, Attachment 1 at 13.
[9] See e.g., Id., Attachment 1 at 9.

network fees are assumed to be approximately $0.44 per charge session plus 5.4% of total revenue; and are converted to a cents/kWh charge by the Company based on the underlying assumptions regarding forecasted number of charging sessions and energy consumption.

Non-Labor O&M expense are for outside services needed to maintain an adequate service level to the DCFC chargers and consist of equipment and warranty costs. These Non-labor O&M expenses are assessed to the Company on an annual basis and converted to a cents/kWh charge by the Company based on the underlying assumptions regarding forecasted energy consumption. Notably, outside labor costs are not included in the determination of EV-U rates, in consideration of the impact of such costs on the overall rate design. The Company maintains that setting EV-U rates "based on all EV charging facility-related O&M costs would likely lead to decreased utilization of the fast-charging resources, thereby jeopardizing the broader pilot goal to support growth in the EV market".[10]

Customer surcharges embedded in the current EV-U rates are: Green Infrastructure Fee ("GIF"), Energy Cost Recovery Clause ("ECRC"), Purchased Power Adjustment Clause ("PPAC"), Revenue Balancing Account Provision ("RBA"), Renewable Energy Infrastructure Provision ("REIP"), Integrated Resource Planning Cost Recovery Provision ("DSM" and "Solar Saver"), and Public Benefits Fee ("PBF") based on a simple average from September 2016 to August 2017. The GIF is converted to a cents/kWh charge by the Company based on the underlying assumptions regarding forecasted energy consumption; all other customer surcharges are already expressed as a cents/kWh charge.

[10] Id. Attachment 1 at 9.

Applicable revenue taxes are incorporated into the EV-U TOU rates for all the above components except for customer surcharges as these surcharges already incorporate revenue taxes.

C. Proposed Revision to EV-U Rate Design

The Company proposes to revise the EV-U TOU rates to be competitive with gasoline equivalent cents/kWh rates by modifying the rate design as follows: change the underlying rate schedule upon which EV-U rate are based on, from Schedule EV-F to the proposed EV-J rate; removing from EV-U TOU rates the expenses related to network fees and other Non-Labor O&M expenses; update the proxy customer surcharges to reflect more recent surcharge amounts; and use historical average DCFC energy usage by Company in the determination of the TOU rates. The Company proposes that these rates would take effect three months after an order approving the proposed rates.

1. Propose to Change Underlying Rate from Schedule EV-F to proposed Schedule EV-J

In the Company's application for approval to establish Schedule EV-J in Docket No. 2020-0152, the Company stated "to ensure customer adoption, the Company will endeavor to establish sufficiently clear and valuable price signals to motivate customers to make a behavioral change […, and] submits these rate designs aimed at supporting market segments, such as commercial, multiple-unit dwellings ("MUD"), workplace charging, and fleets.[11] [EV-J is] "designed based on each island's hourly electricity supply costs developed using the Company's current planning assumptions as discussed in the Integrated Grid Planning (IGP) process. The Pilot rates provide a lower cost mid-day period that encourages EV drivers to

[11] Id., at 4.

charge during the day when the grid experiences lower marginal costs and high supply of clean solar energy. This lower cost mid-day period will incentivize EV drivers to experience fuel savings compared to gasoline costs for internal combustion engines ("ICEs"), as well as compared to the Company's existing rate options. These fuel cost savings can help encourage greater EV adoption as they further improve the economics of owning an electric vehicle."[12] Schedule EV-J "is intended for workplace and public Level 2 charging stations, as well as small-scale [direct current ("DC")] fast charging sites."[13]

By using the proposed Schedule EV-J as a basis for the proposed revision to Schedule EV-U rates, the underlying rate schedule remains a rate that is available to other EV charging providers.

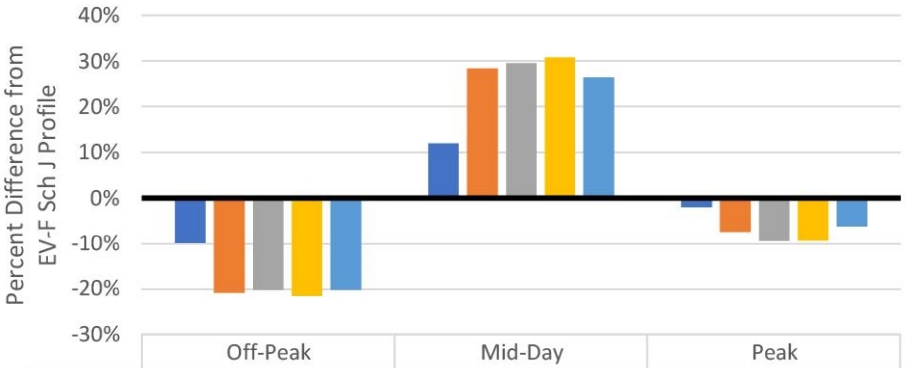
In developing the current Schedule EV-F rates that is the basis of current EV-U rates the underlying TOU period usage profiles are those of the class load profiles for the General Service Demand (Schedule J), for Hawaiian Electric (2012-2013 Class Load Study ("CLS")), Hawaii Electric Light (2008-2009 CLS), and Maui Electric (2009 CLS), respectively. In the absence of EV specific load profiles, these CLS load profiles were used to estimate EV energy consumption by TOU Period.

Since the initial development of the current EV-U rates the Company has recorded consumption data by TOU period.[14] In developing the revised EV-U TOU rates the Company proposes to use the five months of recorded data from January to May 2021 to determine the percentage of EV consumption by TOU Period. The rationale for using the first five months of

[12] Id., at 13.
[13] Id., at 14, footnote omitted.
[14] See e.g., Transmittal No. 13-07 (non-docketed) – Schedule EV-F and EV-U Hawaiian Electric's Annual Report, Filed March 31, 2021, Appendix A.

2021 is to reduce the impacts of COVID-19 on the recorded data used to establish the revised Schedule EV-U rates[15] and to incorporate usage data for one DCFC charger that became operational in August 2020 and two new DCFC chargers that became operational in 2021.[16] Figure 6, below, illustrates the percentage difference between recorded EV consumption by TOU period and the percentage of CLS usage by TOU period.

Figure 6. Difference between Recorded EV Consumption and Class Load Study usage by TOU Period



	Off-Peak	Mid-Day	Peak
HECO	-9.84%	11.94%	-2.11%
HELCO	-20.75%	28.26%	-7.51%
Maui	-20.12%	29.51%	-9.39%
Molokai	-21.44%	30.76%	-9.32%
Lanai	-20.13%	26.39%	-6.26%

As shown in Figure 6, the majority of EV consumption is during the Mid-Day with the Off-Peak hours showing an almost corresponding decline in usage with the balance of the decline attributable to the Peak TOU period. Intuitively this is reasonable as the EV operator[17]

[15] Id., at 7.
[16] Hawai‘i Island (Puna Kai Shopping Center) began operation in August 2020. In 2021 DCFC chargers on O‘ahu (Waipio Shopping Center, Salt Lake Shopping Center) became operational. Due to operational issues with the HELCO Kilauea Main Office DCFC charger the recorded data from August to December 2020 was utilized.
[17] The company uses the term “EV operator” to mean the person charging the EV.

faces a higher EV-U charging rate during the peak period; and is less likely to charge – away from home – during the evening to overnight hours.

2. Propose to Remove Expenses Related to Network Fees and Non-Labor O&M Expenses from EV-U Rates

The Company proposes to remove the network related fees and the non-labor O&M expenses from the cents per kWh adder to the underlying rate schedule (currently Schedule EV-F) in determining the revised EV-U TOU rates.

(a) Network Fees

The Company proposes that network related fees that are currently contained within the cents per kWh adder to the underlying rate schedule (currently Schedule EV-F) be removed from EV-U TOU rates and such fees, determined by the third-party operator of the Company owned EV charging equipment, be paid by the EV operator directly to the third-party operator. The third-party operator will determine the required amount of charge and post the amount prominently on the charging equipment, either as a fixed amount or percentage of the transaction. By removing the network fees from the EV-U TOU rates the Company does not have to forecast the number of sessions and forecast the amount of EV consumption to convert network fees to a cents per kWh value, nor reconcile over or under payments to the third-party operator during the term of the contract. Adding a third-party service charge to an EV charging session is comparable to paying a service charge for concert tickets.

(b) Non-Labor O&M Expenses

The Company proposes to remove the largely fixed costs (equipment and service warranties) from the cents/kWh adder to EV-U TOU rates and recover these expenses from all customers, including EV operators, utilizing the EPRM of the RBA. The Company has previously expressed concern that setting EV-U rates based on recovery of "all EV charging

facility-related O&M costs would likely lead to decreased utilization of the fast charging resources, thereby jeopardizing the broader pilot goal to support growth in the EV market".[18] Removing non-labor O&M expenses will help support growth of the EV market making EV-U rates price competitive relative to gasoline equivalent cents/kWh charging rates. Further, removing O&M expense from EV-U TOU rates will eliminate the need to forecast EV consumption and the translation of fixed costs into a variable adder.

3. Propose to Update Proxy Customer Surcharge contained in EV-U Rates

The current EV-U TOU rates contains a proxy value that is not directly related to actual surcharge recovery that is required by other Company tariffs. The current proxy value embedded in EV-U rates is the simple average of historical monthly surcharges (i.e., GIF, BCAC, PPAC, RBA, RBIP, DSM, Solar Saver, PBF) from September 2016 to August 2017.[19] The Company proposes to update the proxy value to include all surcharges applicable to Schedule J customers as of June 2021. The Company may update these charges on a quarterly basis as permitted by current EV-U tariff language.[20]

D. Proposed EV-U Rates

Table 2 below shows the comparison between the current EV-U rates and the proposed revised EV-U rates by island and by TOU period.

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[18] See, e.g., "Revised Rate Structures for Schedule EV-F and EV-U", filed September 5, 2017, Docket No. 2016-0168, Attachment 1 at 9.
[19] Id. At 10.
[20] See e.g., Hawaiian Electric Schedule EV-U Tariff, Sheet No. 96A, "The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated electric vehicle charging facility, (2) changes in other costs to operate the charging facility, and (3) efforts to assess the market price appropriate for this service. Available at: "https://www.hawaiianelectric.com/documents/billing_and_payment/rates/hawaiian_electric_rates/heco_rates_ev_u.pdf

Table 2. Comparison of Current and Proposed EV-U Rates

	Time-of-use Period	Current Rate (¢/kWh)	Proposed Rate (¢/kWh)	Change (¢)	Change (%)
Hawaiian Electric	On-Peak	57.0000	35.2807	-21.7193	-38.1%
	Mid-Day	49.0000	26.6137	-22.3863	-45.7%
	Off-Peak	54.0000	35.2807	-18.7193	-34.7%
Hawaii Electric Light	On-Peak	63.0000	48.5468	-14.4532	-22.9%
	Mid-Day	51.0000	38.3128	-12.6872	-24.9%
	Off-Peak	61.0000	48.5468	-12.4532	-20.4%
Maui Electric - Maui Division	On-Peak	62.0000	43.9352	-18.0648	-29.1%
	Mid-Day	49.0000	32.9462	-16.0538	-32.8%
	Off-Peak	60.0000	43.9352	-16.0648	-26.8%
Maui Electric - Molokai Division	On-Peak	66.0000	47.0488	-18.9512	-28.7%
	Mid-Day	54.0000	36.0598	-17.9402	-33.2%
	Off-Peak	64.0000	47.0488	-16.9512	-26.5%
Maui Electric - Lanai Division	On-Peak	72.0000	54.1164	-17.8836	-24.8%
	Mid-Day	60.0000	43.1274	-16.8726	-28.1%
	Off-Peak	70.0000	54.1164	-15.8836	-22.7%

The average reduction[21] in EV-U rates across TOU periods is: Hawaiian Electric (-39.5%), Hawaii Electric Light (-22.7%), Maui Electric – Maui Division (-29.6%), Maui Electric – Molokai Division (-29.5%), and Maui Electric – Lanai Division (-25.2%). By TOU period the largest percent reduction is during the Mid-Day with the next largest percent reduction in On-Peak period; and is a function of using the proposed schedule EV-J rate design.

1. Using Proposed Schedule EV-J TOU Rates as basis for EV-U TOU Rates

While the largest proportion of the reduced TOU rates are attributable to the removal of network fees and O&M expenses from the EV-U TOU rates, these expenses represent a fixed amount across all TOU periods. Using the proposed Schedule EV-J as an underlying rate to build the proposed revisions to EV-U modifies the rate difference between the Mid-Day rate and

[21] Average reduction is the simple average of the percentage change for each TOU period, by island.

both the On-Peak and the Off-Peak period, respectively.[22] The Current EV-U rate design has a difference between the On-Peak and Mid-Day that is higher than the difference between the Off-Peak and Mid-Day.[23] Using Hawaiian Electric Schedule EV-U as an example, the current On-Peak to Mid-Day difference is +8 cents/kWh and the current Off-Peak to Mid-Day difference is +5 cents/kWh. The proposed Schedule EV-J is designed with the Mid-Day energy rate as the lowest TOU period rate with the difference between the Mid-Day rate and both the On-Peak and the Off-Peak period, respectively, being the same at +8.6670 cents/kWh in Hawaiian Electric's case. Staying with Hawaiian Electric and the current EV-U rate design, the On-Peak to Mid-Day difference in rates is 16.3% and the Off-Peak to Mid-day difference in rates is 10.2%. With the proposed EV-U rate design the difference to Mid-Day is the same for both On-Peak and Off-Peak at 32.6%. This larger difference between Mid-Day and On-Peak or Off-Peak provides a greater incentive to charge during the solar day.

2. Using Island Specific DCFC Station Parameters for EV-U TOU Rates

The current EV-U rate design used the same forecast of DCFC key station parameters for all islands. i.e., level of demand ("kW", 47.5kW), number of charging sessions per unit (1,212 annual, 101 monthly), and EV consumption by EV operators (25,236 kWh annual, 2,103 kWh monthly).[24] The Company's proposed revised EV-U TOU rates use island specific historical values for these parameters resulting in differing impacts by island based on recorded data.[25]

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[22] The Company has not proposed an EV-J rate for the islands of Molokai or Lanai and propose to use the EV-U rate developed for the island of Maui and replace Maui related customer surcharges with customer surcharges for Molokai and Lanai, respectively.
[23] See "Revised Rate Structures for Schedule EV-F and EV-U", filed September 5, 2017, Docket No. 2016-0168, Attachment 4 at 1 - 5.
[24] Id.
[25] The Company continues to use 47.5kW as a proxy for level of demand per DCFC.

(a) Input Assumptions Key Station Parameters

As previously mentioned in Section B.1., above, the Company is using recorded data from the first five months of 2021 to incorporate usage data for new DCFC charger stations and to limit the impacts of COVID-19 on recorded data used for rate design. For the development of these key station parameters the Company calculated an average DCFC unit by island, and then calculated the EV-U TOU rates based on a site configuration of two single-port DCFCs.[26] See Table 3, below for a listing of the key station parameters by island. For Maui Electric there is one DCFC Station on Molokai Island and none on Lanai Island upon which to draw upon historical usage information, thus the Company proposes to use the Maui Island historical data as a proxy to establish revised EV-U TOU rates for Molokai and Lanai.

Table 3. Per DCFC Unit Key Station Parameters by Island

	Per DCFC Unit - Key Station Parameters							
	kWh Consumed (% of Total)							
Company	On-Peak Period	Mid-Day Period	Off-Peak Period	Total	Average kWh Consumed per Month	DCFC Unit kW	Per Unit Session Count	Load Factor (730 HR Mth)
Hawaiian Electric	26.80%	54.05%	19.14%	100.00%	3,516	47.5	200.0	10.14%
Hawaii Electric Light	16.73%	71.01%	12.26%	100.00%	1,223	47.5	77.0	3.53%
Maui Electric - Maui Division	17.78%	69.75%	12.47%	100.00%	2,234	47.5	170.0	6.44%
Maui Electric - Molokai Division	17.78%	69.75%	12.47%	100.00%	2,234	47.5	170.0	6.44%
Maui Electric - Lanai Division	17.78%	69.75%	12.47%	100.00%	2,234	47.5	170.0	6.44%

The preferred site configuration identified in the instant Application is two (2) single-port DCFCs and one (1) dual-port Level 2 charging station leaving flexibility in determining the configuration for locating the remaining Level 2 charging stations to meet specific needs of each site and community being served.[27] The Company's proposed EV-U TOU rates were developed using a two (2) single-port DCFCs station configuration. The Company does not have

[26] The current EV-U TOU rates are based on a site configuration of a single DCFC station per site.
[27] See e.g., Application Section VIII.B. Scope and Size and Exhibit A.

experience with two (2) single-port DCFCs and one (1) dual-port Level 2 charging station configuration but does have experience with running two co-located DCFC units at its Ward offices on Oahu (Ward 1 and Ward 2). The addition of a Level 2 charger to a two DCFC station configuration is expected to have minimal impact on overall station consumption or peak demand as the forecasted Level 2 charger load factor (utilization) is expected to be approximately 4% (416 kWh per month, 14 kW).[28] When the Company gains more experience in operating Level 2 chargers the EV-U TOU rates may be adjusted based on actual operating experience.

(b) Load Factor impacts the chosen EV-U TOU Rates

Table 3, above identifies the load factor associated with an average two (2) single-port DCFC station. Load factor expresses the relationship between energy consumption and demand over a given interval – in this case a 730-hour month. The higher the load factor for a given level of demand (i.e., 47.5 kW per single-port DCFC station, 95.0 kW for a two (2) single-port DCFC station) the more energy to spread fixed costs (e.g., Customer Charge, Demand Charge, GIF) and thus a lower EV-U TOU rate to achieve revenue neutrality to the underlying rate schedule (EV-J).

Figure 7, below, illustrates the difference between the proposed EV-U TOU rates (i.e., based on the average of all units) and other potential EV-U TOU Rate(s) if the rates were determined by historical key station parameter using individual station data on Oahu, plotted against each individual unit's calculated load factor.[29] "All Stations (13)" is the average of the

[28] While the potential maximum demand for the preferred station configuration is approximately 114 kW (two 50 kW DCFCs, two L2 ports at 7 kW per port), the rate design utilizes a lower "realized" value of 95 kW as it is unknown what impact a L2 charger will have on recorded maximum demand.
[29] e.g., developing rates based on the highest usage station Ward 2, or lowest usage station Dole Plantation.

thirteen DCFC units on Oahu (Load Factor 10.14%) and is the base comparison value. "Ward Station (2)" represents the two DCFC units at the Company's Ward avenue offices operated as two (2) single-port DCFC station configuration. The DCFC load factor ranges from a low of 2.27% (Dole Plantation) to a high of 27.50% (Ward 2). Figure 7 illustrates that, for low load factor installations, the EV-U TOU rate needs to be much higher than proposed in this Application; but a higher load factor (e.g., the Ward units), beyond the "All Stations (13)" load factor, the amount of "savings" in term of lower EV-U TOU rates is not much greater than the average of all stations.

Figures 8 through 10 illustrate the proposed EV-U TOU rates and other potential EV-U TOU Rates (based on the average of all units) for the islands of Hawai'i, Maui, and Moloka'i and Lana'i, respectively, in a similar manner as Figure 7 with similar results.

Figure 7. Impact of Load Factor on Proposed EV-U TOU Rates – O'ahu

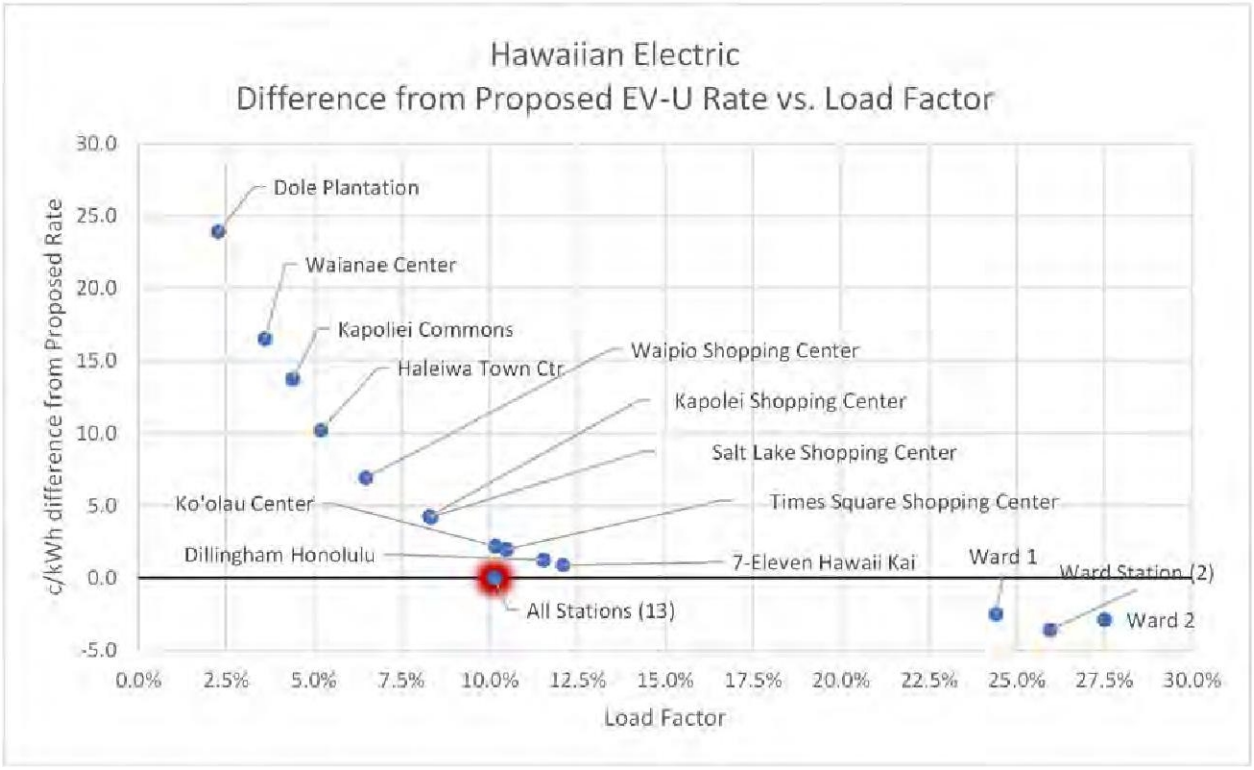


Figure 8. Impact of Load Factor on proposed EV-U TOU Rates – Hawai'i

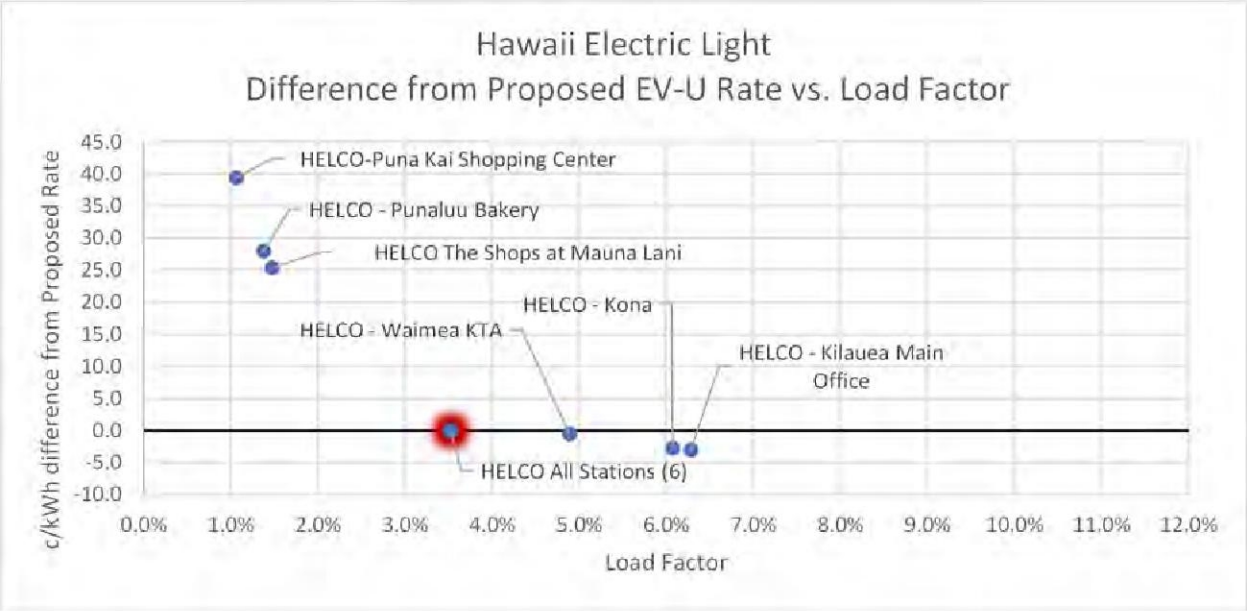


Figure 9. Impact of Load Factor on proposed EV-U TOU Rates – Maui

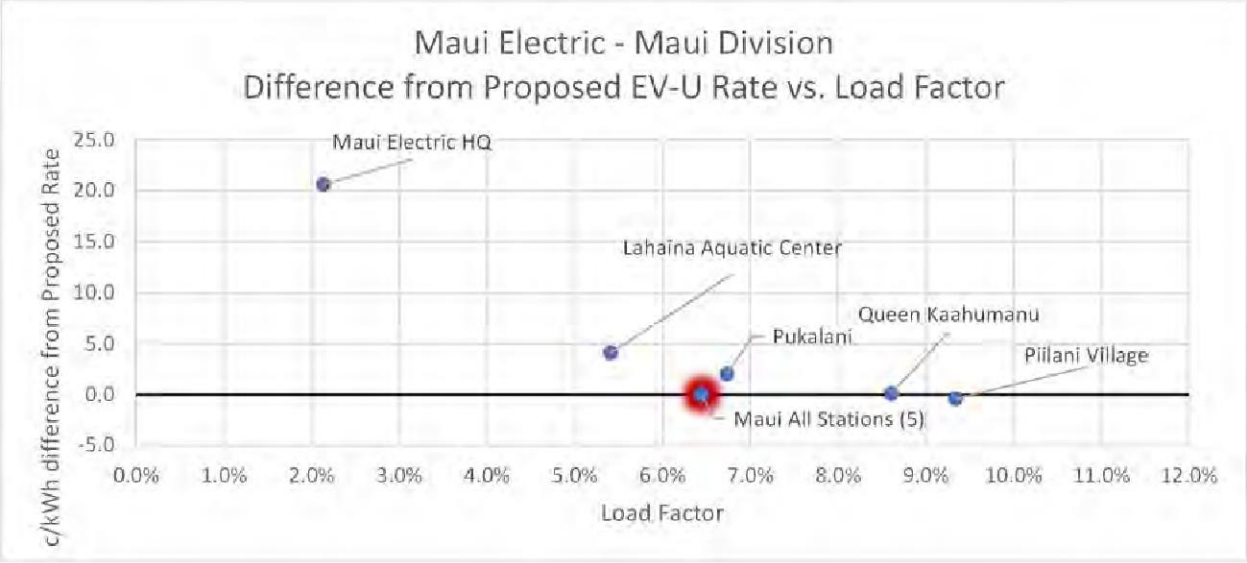
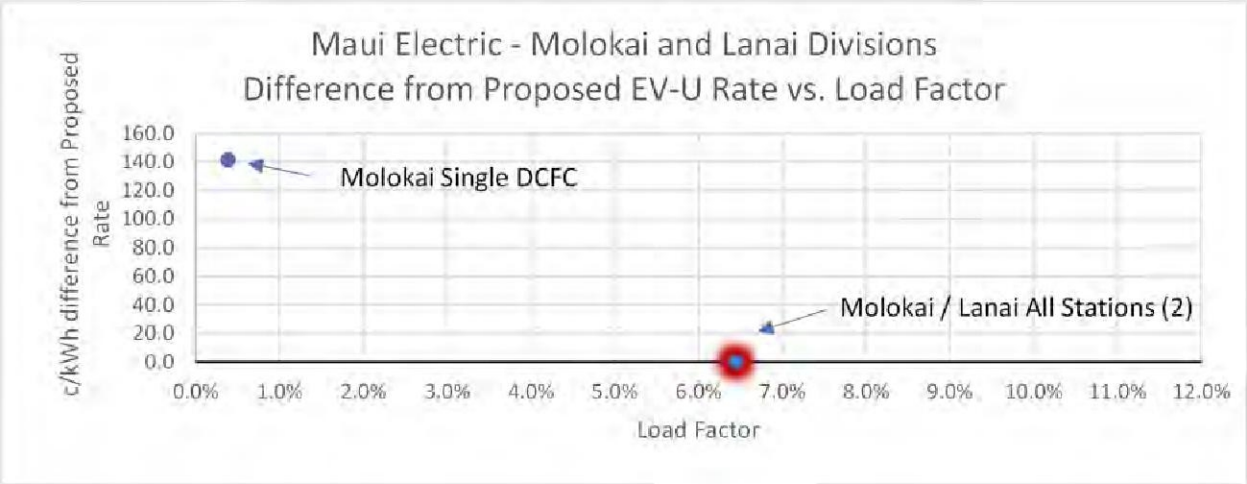


Figure 10. Impact of Load Factor on proposed EV-U TOU Rates – Moloka'i and Lana'i



3. Proposed EV-U TOU Rates Compared to Gasoline Equivalent Cents/kWh

Figures 11 through 15 below illustrate the Revised EV-U TOU rates compared to the gasoline equivalent cents per kWh rate for Oahu, Hawaii, Maui, Molokai, and Lanai, respectively.[30] The proposed EV-U TOU rates are competitive with gasoline for all islands except Hawaii during the On-Peak and Off-Peak periods where the EV-U TOU rates are comparable within the +/- 20 cents per gallon banding.

[30] Gasoline prices on each island were converted to $/kWh equivalent values based on an EV efficiency of 0.3 kWh per mile and a gasoline efficiency of 30 miles per gallon.

Figure 11. Proposed EV-U TOU Rates vs. Gasoline Equivalent Cents/kWh - Oahu

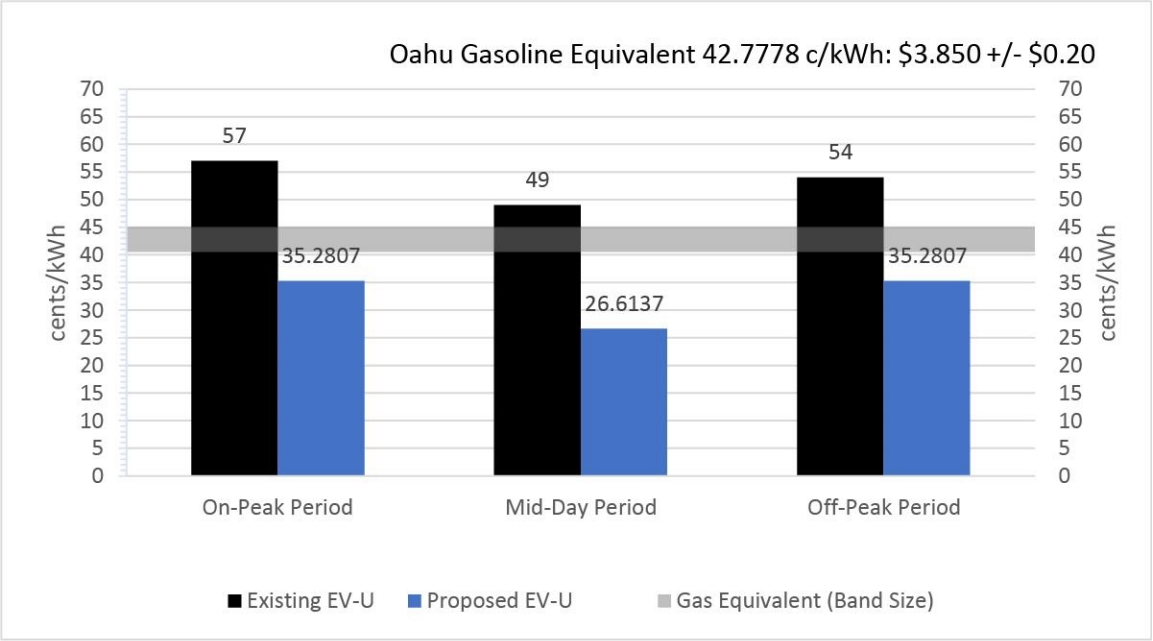


Figure 12. Proposed EV-U TOU Rates vs. Gasoline Equivalent Cents/kWh - Hawaii

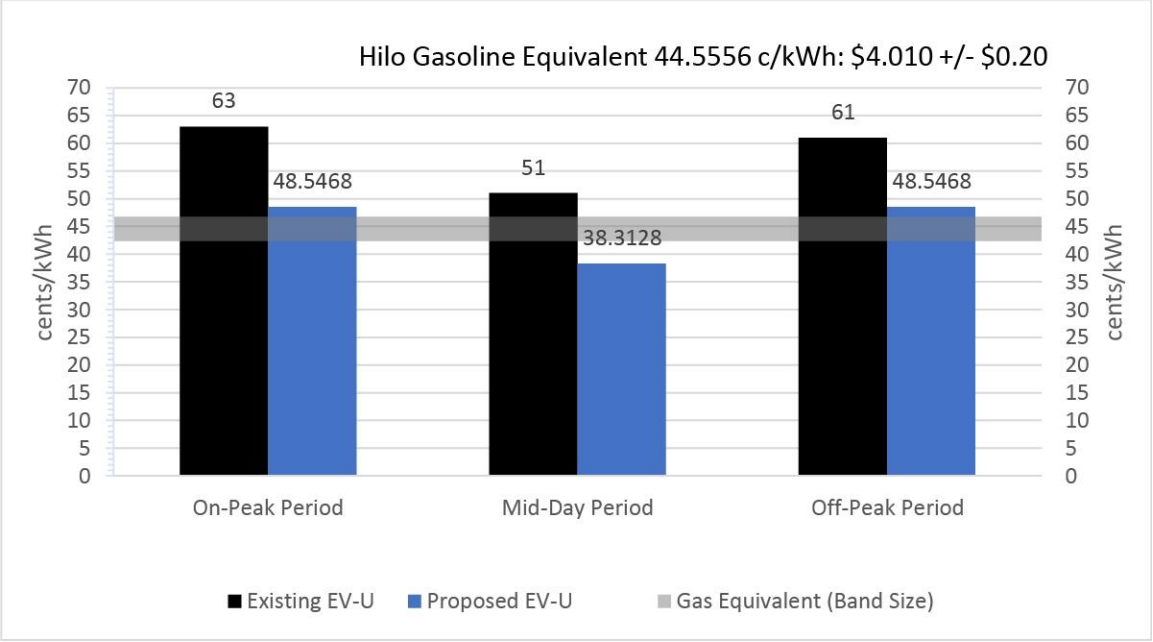


Figure 13. Proposed EV-U TOU Rates vs. Gasoline Equivalent Cents/kWh - Maui

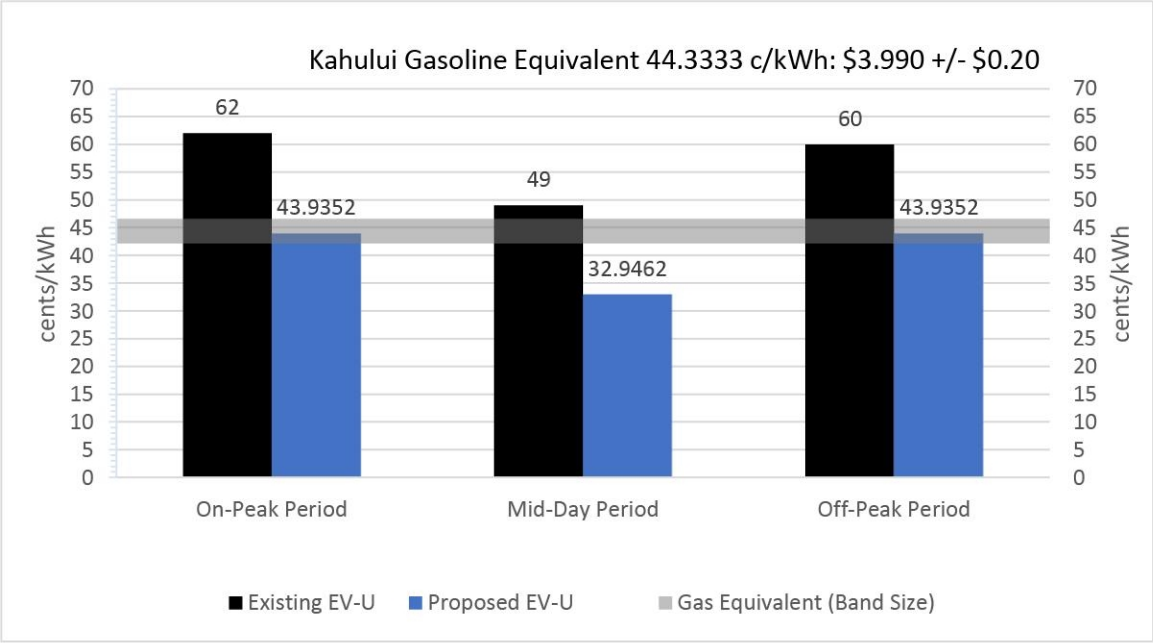


Figure 14. Proposed EV-U TOU Rates vs. Gasoline Equivalent Cents/kWh - Molokai

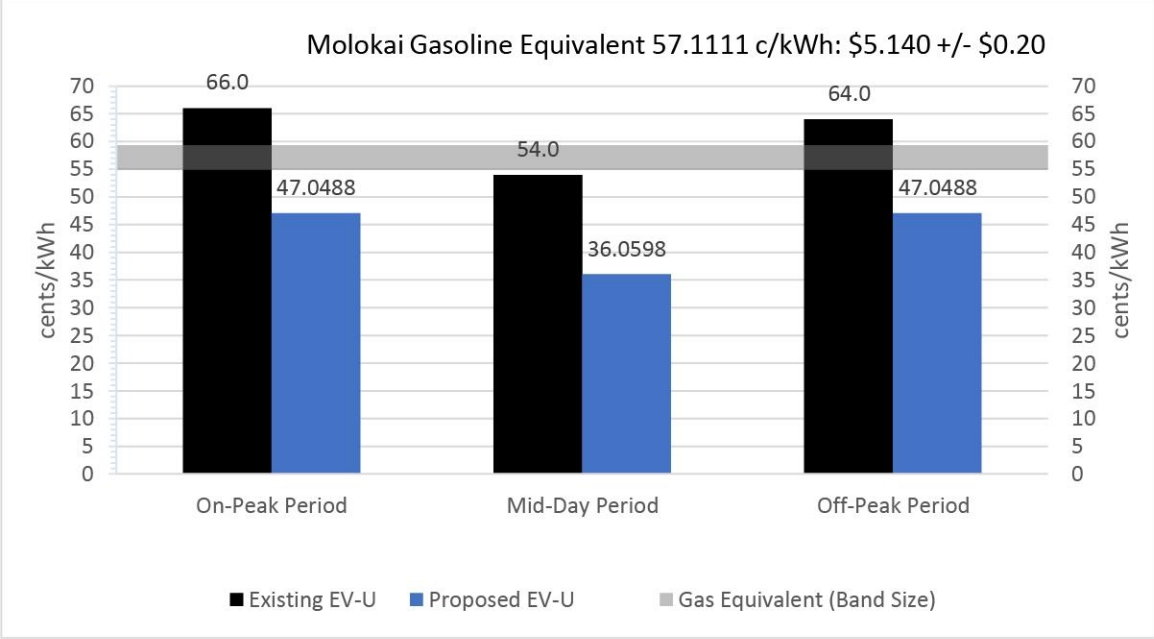
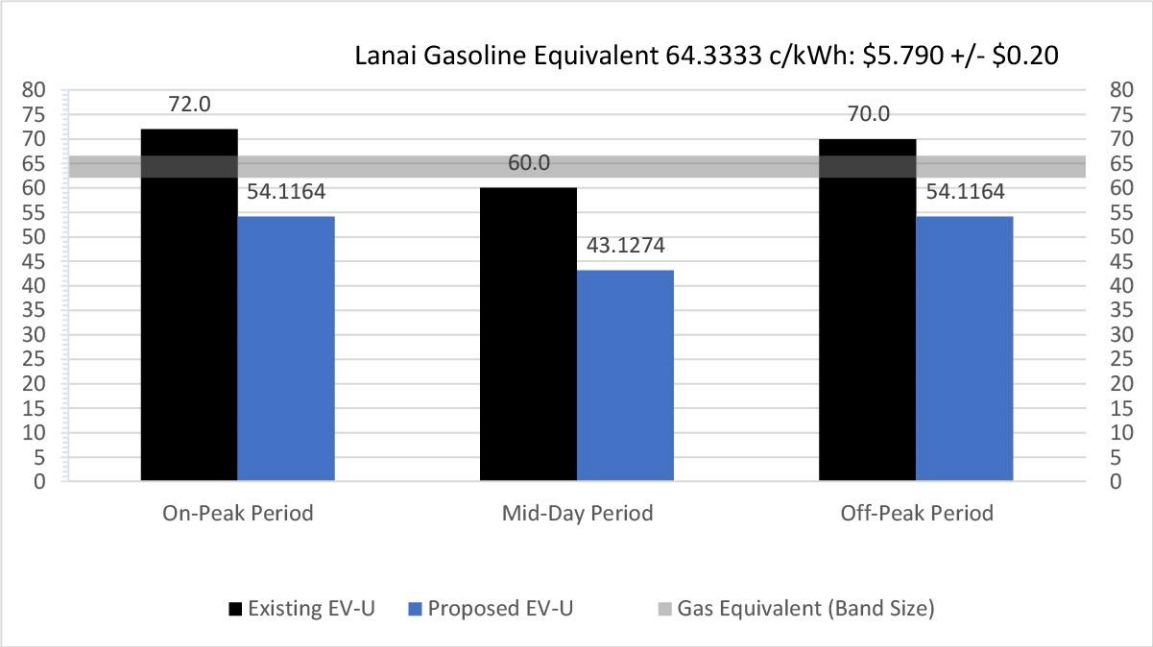


Figure 15. Proposed EV-U TOU Rates vs. Gasoline Equivalent Cents/kWh - Lanai



E. Termination of Schedule EV-MAUI Rates

The Company proposes to terminate Schedule EV-MAUI and to have charging stations currently served under Schedule EV-MAUI to be served under Schedule EV-U when the proposed EV-U rates become effective. To avoid customer confusion and to convey consistent price signals, the Company would like to have one set of EV charging rates available to Maui customers.

F. Future Changes to the Proposed EV-U Rates

The Company proposes that it be permitted to propose changes to the rates in Schedule EV-U. The existing Schedule EV-U allows the Company to offer changes to the EV-U TOU rates once a quarter.[31] The Company proposes to maintain a similar provision in its EV-U revisions. The Company proposes the following general update review framework to its EV-U TOU rates:

[31] See, e.g., Hawaiian Electric Schedule EV-U, Revised Sheet No. 96A: "The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule

1) if the update follows the proposed EV-U methodology and only consists of (a) an update to baseline surcharge values, or (b) a change in the underling Schedule EV-J rates, it would be filed on a not less than 30 days notice filing to the Commission and would take effect unless suspended by the Commission;
2) if the update generally follows the proposed EV-U methodology and incorporates updates to the historical usage or applicable load profiles, which may also include an update of baseline surcharge values, it would be filed on a not less than 60 days notice filing to the Commission and would take effect unless suspended by the Commission; and
3) if larger, more structural changes are needed, such as to adjust the rate methodology for competitive reasons, those changes could be filed on a longer timeline for the Commission's review and approval.

G. Non-Rate Changes to Proposed EV-U Tariff Language

In addition to the proposed changes in the determination of TOU period rates as described above, to transition the proposed EV-U tariff from a pilot to a permanent Tariff offering the Company proposes the following changes in tariff language. Clean and blacklined versions of the proposed EV-U tariffs are provided as Exhibit B1 and B2, respectively.

The Company proposes to modify the language referencing "DC fast charging" to "electric charging" to reflect the tariff more accurately is applicable to the operation of EV charging facilities, whether in the current configuration of standalone DCFC chargers, the preferred station configuration of two DCFC chargers and one L2 charger, or an L2 charger as a standalone station. The Company proposes to remove language referencing the maximum

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applicable to the Company-operated electric vehicle charging facility, (2) changes in other costs to operate the charging facility, and (3) efforts to assess the market price appropriate for this service."

number of chargers across the combined service territories. Finally, the Company proposes to remove language related to the termination date of the pilot.

2. Service

Non substantive changes in reference to electric vehicles as EV.

3. Rates

Language is inserted to clearly identify that the posted TOU period charges "may be administered and billed to the EV operator through the Company's network provider on behalf of the Company", that the network provider "may add network fees to the charging service amount as posted on the charging facilities", and that the "EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider". These changes in tariff will inform the EV operator that the billed amount for service includes both a charge for energy consumed and a charge to cover applicable third-party imposed fees to operate the network as posted on the EV charging facility. Finally, the Company proposes to modify the language related to resetting the TOU energy charges to include changes in the rates of surcharges applicable to Schedule J customers and for updated data used in the methodology to derive the TOU energy charges in this schedule.

Superseding Sheet No. 96
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 96
Effective xx xx, 202x

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	per on-peak kWh	35.2807 ¢
Mid-Day Energy Charge	per mid-day kWh	26.6137 ¢
Off-Peak Energy Charge	per off-peak kWh	35.2807 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

SHEET NO. 96B
Effective XXX XX, 202x

Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the EV charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

Superseding Sheet No. 94
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 94
Effective xx xx, 202x

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	48.5468 ¢
Mid-Day Energy Charge	- per mid-day kWh	38.3128 ¢
Off-Peak Energy Charge	- per off-peak kWh	48.5468 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

Superseding Sheet No. 94A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 94A
Effective xx xx, 202x

Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the EV charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

Superseding Sheet No. 99
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 99
Effective xx xx, 202x

MAUI DIVISION

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	43.9352 ¢
Mid-Day Energy Charge	- per mid-day kWh	32.9462 ¢
Off-Peak Energy Charge	- per off-peak kWh	43.9352 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

Superseding Sheet No. 99A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 99A
Effective xx xx, 202x

Maui Division

Schedule EV-U Continued

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

Superseding Sheet No. 99B
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 99B
Effective xx xx, 21xx

Maui Division

Schedule EV-U (Continued)

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

Superseding Sheet No. 154
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 154
Effective xx xx, 202x

MOLOKAI DIVISION

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	47.0488 ¢
Mid-Day Energy Charge	- per mid-day kWh	36.0598 ¢
Off-Peak Energy Charge	- per off-peak kWh	47.0488 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

Superseding Sheet No. 154A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 154A
Effective xx xx, 202x

Molokai Division
Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

Superseding Sheet No. 154B
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 154B
Effective xx xx, 202x

Molokai Division
Schedule EV-U (Continued)

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

Superseding Sheet No. 110
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 110
Effective xx xx, 202x

LANAI DIVISION

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	54.1164 ¢
Mid-Day Energy Charge	- per mid-day kWh	43.1274 ¢
Off-Peak Energy Charge	- per off-peak kWh	54.1164 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

Superseding Sheet No. 110A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 110A
Effective xx xx, 202x

Lanai Division
Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

Superseding Sheet No. 110B
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 110B
Effective xx xx, 202x

Lanai Division
Schedule EV-U (Continued)

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

Superseding Sheet No. 96
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 96
Effective xx xx, 202x

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	per on-peak kWh	35.2807 ¢
Mid-Day Energy Charge	per mid-day kWh	26.6137 ¢
Off-Peak Energy Charge	per off-peak kWh	35.2807 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

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Effective July 4, 2013 to Effective December 12, 2017 ¶
December 11, 2017 to June 30, 2023¶

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Deleted: , will be permitted under this Schedule. The Companies may submit a request to increase the permitted maximum for the review and approval of the Hawaii Public Utilities Commission.

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Service under this Schedule will be available through June 30, 2023.¶

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¶
COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE¶
PILOT¶
¶
APPLICABILITY:¶
¶
This Schedule is applicable only for DC fast charging service provided to on-road electric vehicles at Company-operated public electric vehicle charging facilities. A maximum total of twenty-five (25) DC fast charging customer accounts (i.e., 25 utility meters) across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc., will be permitted under this Schedule. The Companies may submit a request to increase the permitted maximum for the review and approval of the Hawaii Public Utilities Commission.¶
¶
Service under this Schedule will be available through June 30, 2023.¶
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SERVICE:¶
¶ ... [1]

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SHEET NO. 96B
Effective XXX XX, 202x

Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the EV charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

HAWAIIAN ELECTRIC COMPANY, INC.

Transmittal Letter Dated xx xx, 202x.

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Superseding Sheet No. 94
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 94
Effective xx xx, 202x

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	48.5468 ¢
Mid-Day Energy Charge	- per mid-day kWh	38.3128 ¢
Off-Peak Energy Charge	- per off-peak kWh	48.5468 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

HAWAII ELECTRIC LIGHT COMPANY, INC.

Transmittal Letter Dated xx xx, 202x.

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COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE¶
PILOT¶
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APPLICABILITY:¶
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This Schedule is applicable only for DC fast charging service provided to on-road electric vehicles at Company-operated public electric vehicle charging facilities. A maximum total of twenty-five (25) DC fast charging customer accounts (i.e., 25 utility meters) across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc., will be permitted under this Schedule. The Companies may submit a request to increase the permitted maximum for the review and approval of the Hawaii Public Utilities Commission.¶
¶
Service under this Schedule will be available through June 30, 2023.¶
¶
SERVICE:¶
¶
Public electric vehicle charging service to on-road electric vehicles at designated Company facilities. ¶
¶
Procedures for proper use of the Company's charging facilities are provided at the facilities. The vehicle operator is responsible for following procedures properly.¶
¶
RATES:¶
¶
TIME-OF-USE RATE PER CHARGING SERVICE KWH¶
¶
On-Peak Energy Charge - per on-peak kWh 63.0000 ¢¶
¶
Mid-Day Energy Charge - per mid-day kWh 51.0000 ¢¶
¶
Off-Peak Energy Charge - per off-peak kWh 61.0000 ¢¶
¶

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Superseding Sheet No. 94A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 94A
Effective xx xx, 202x

Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the EV charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

HAWAII ELECTRIC LIGHT COMPANY, INC.

Transmittal Letter Dated xx xx, 202x.

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Schedule EV-U (Continued)¶

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¶
The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter. ¶
¶
The Company-operated public electric vehicle charging facility is subject to the appropriate rate schedule for electric service.¶
¶
TIME-OF-USE RATING PERIODS:¶
¶
The Time-of-Use rating periods under this Schedule shall be as follows:¶
¶
On-Peak Period: 5:00 p.m. - 10:00 p.m., Daily¶
Mid-Day Period: 9:00 a.m. - 5:00 p.m., Daily¶
Off-Peak Period: 10:00 p.m. - 9:00 a.m., Daily¶
¶
The start time of the charging session shall determine the applicable time-of-use period.¶
¶
CONDITIONS OF SERVICE:¶
¶
The Company may, from time to time, curtail electric vehicle charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, (3) for economic purposes, or for pilot evaluation purposes.¶
¶
RULES AND REGULATIONS:¶
¶
Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

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Superseding Sheet No. 99
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 99
Effective xx xx, 202x

MAUI DIVISION

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	43.9352 ¢
Mid-Day Energy Charge	- per mid-day kWh	32.9462 ¢
Off-Peak Energy Charge	- per off-peak kWh	43.9352 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

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SCHEDULE EV-U¶
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COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE¶
PILOT¶
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APPLICABILITY:¶
¶
This Schedule is applicable only for DC fast charging service provided to on-road electric vehicles at Company-operated public electric vehicle charging facilities. A maximum total of twenty-five (25) DC fast charging customer accounts (i.e., 25 utility meters) across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc., will be permitted under this Schedule. The Companies may submit a request to increase the permitted maximum for the review and approval of the Hawaii Public Utilities Commission.¶
¶
Service under this Schedule will be available through June 30, 2023.¶
¶
SERVICE:¶
¶
Public electric vehicle charging service to on-road electric vehicles at designated Company facilities. ¶
¶
Procedures for proper use of the Company's charging facilities are provided at the facilities. The vehicle operator is responsible for following procedures properly.
¶
RATES:¶
¶
TIME-OF-USE RATE PER CHARGING SERVICE KWH¶
¶
On-Peak Energy Charge - per on-peak kWh 62.0000 ¢¶
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Mid-Day Energy Charge - per mid-day kWh 49.0000 ¢ ¶
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Superseding Sheet No. 99A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 99A
Effective xx xx, 202x

Maui Division

Schedule EV-U Continued

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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Superseding Sheet No. 99B
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 99B
Effective xx xx, 21xx

Maui Division

Schedule EV-U (Continued)

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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Superseding Sheet No. 154
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 154
Effective xx xx, 202x

MOLOKAI DIVISION

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	47.0488 ¢
Mid-Day Energy Charge	- per mid-day kWh	36.0598 ¢
Off-Peak Energy Charge	- per off-peak kWh	47.0488 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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December 11, 2017 to June 30, 2023¶

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SCHEDULE EV-U¶
¶
COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE¶
PILOT¶
¶
APPLICABILITY:¶
¶
This Schedule is applicable only for DC fast charging service provided to on-road electric vehicles at Company-operated public electric vehicle charging facilities. A maximum total of twenty-five (25) DC fast charging customer accounts (i.e., 25 utility meters) across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc., will be permitted under this Schedule. The Companies may submit a request to increase the permitted maximum for the review and approval of the Hawaii Public Utilities Commission.¶
¶
Service under this Schedule will be available through June 30, 2023.¶
¶
SERVICE:¶
¶
Public electric vehicle charging service to on-road electric vehicles at designated Company facilities. ¶
¶
Procedures for proper use of the Company's charging facilities are provided at the facilities. The vehicle operator is responsible for following procedures properly.
¶
RATES:¶
¶
TIME-OF-USE RATE PER CHARGING SERVICE KWH¶
¶
On-Peak Energy Charge - per on-peak kWh 66.0000 ¢¶
¶
Mid-Day Energy Charge - per mid-day kWh 54.0000 ¢¶
¶
Off-Peak Energy Charge - per off-peak kWh 64.0000 ¢¶

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Superseding Sheet No. 154A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 154A
Effective xx xx, 202x

Molokai Division
Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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Schedule EV-U (Continued)¶

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¶
The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter. ¶
¶
The Company-operated public electric vehicle charging facility is subject to the appropriate rate schedule for electric service.¶
¶
TIME-OF-USE RATING PERIODS:¶
¶
The Time-of-Use rating periods under this Schedule shall be as follows:¶
¶
On-Peak Period: 5:00 p.m. - 10:00 p.m., Daily¶
Mid-Day Period: 9:00 a.m. - 5:00 p.m., Daily¶
Off-Peak Period: 10:00 p.m. - 9:00 a.m., Daily¶
¶
The start time of the charging session shall determine the applicable time-of-use period.¶
¶
CONDITIONS OF SERVICE:¶
¶
The Company may, from time to time, curtail electric vehicle charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, (3) for economic purposes, or for pilot evaluation purposes.¶

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Superseding Sheet No. 154B
Effective December 12,
2017 to June 30, 2023

REVISED SHEET NO. 154B
Effective xx xx, 202x

Molokai Division
Schedule EV-U (Continued)

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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December 11, 2017 to June 30, 2023¶
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Schedule EV-U (Continued)¶

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Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.¶

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Superseding Sheet No. 110
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 110
Effective xx xx, 202x

LANAI DIVISION

SCHEDULE EV-U

COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE

APPLICABILITY:

This Schedule is applicable only for electric charging service provided to on-road electric vehicles at Company-operated public electric vehicle ("EV") charging facilities across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc.

SERVICE:

Public EV charging service to on-road electric vehicles at designated Company facilities.

Procedures for proper use of the Company's EV charging facilities are provided at the facilities. The EV operator[1] is responsible for following procedures properly.

RATES:

TIME-OF-USE RATE PER CHARGING SERVICE KWH

On-Peak Energy Charge	- per on-peak kWh	54.1164 ¢
Mid-Day Energy Charge	- per mid-day kWh	43.1274 ¢
Off-Peak Energy Charge	- per off-peak kWh	54.1164 ¢

The Time-of-Use Energy Charges charged under this schedule may be administered and billed to the EV operator through the Company's network provider on behalf of the Company. In addition to the Time-of-Use Energy Charges above, the network provider may add network fees to the charging service amount as posted on the charging facilities. The EV operator will be responsible for payment of Time-of-Use Energy Charges charged by the Company plus any network fees charged by the network provider.

[1] The Company uses the term "EV operator" to mean the person charging the EV.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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December 11, 2017 to June 30, 2023 ¶

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SCHEDULE EV-U¶
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COMMERCIAL PUBLIC ELECTRIC VEHICLE CHARGING SERVICE¶
PILOT¶
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APPLICABILITY:¶
¶
This Schedule is applicable only for DC fast charging service provided to on-road electric vehicles at Company-operated public electric vehicle charging facilities. A maximum total of twenty-five (25) DC fast charging customer accounts (i.e., 25 utility meters) across the combined service territories of Hawaiian Electric Company, Inc., Maui Electric Company, Limited, and Hawaii Electric Light Company, Inc., will be permitted under this Schedule. The Companies may submit a request to increase the permitted maximum for the review and approval of the Hawaii Public Utilities Commission.¶
¶
Service under this Schedule will be available through June 30, 2023.¶
¶
SERVICE:¶
¶
Public electric vehicle charging service to on-road electric vehicles at designated Company facilities. ¶
¶
Procedures for proper use of the Company's charging facilities are provided at the facilities. The vehicle operator is responsible for following procedures properly.
¶
RATES:¶
¶
TIME-OF-USE RATE PER CHARGING SERVICE KWH¶
¶
On-Peak Energy Charge - per on-peak kWh 72.0000 ¢¶
¶
Mid-Day Energy Charge - per mid-day kWh 60.0000 ¢¶
¶
Off-Peak Energy Charge - per off-peak kWh 70.0000 ¢¶

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Superseding Sheet No. 110A
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 110A
Effective xx xx, 202x

Lanai Division
Schedule EV-U (Continued)

RATES CONTINUED:

The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated EV charging facility, which includes changes in the rates of surcharges that are applicable to Schedule J customers, (2) changes in other costs to operate the charging facility, (3) updated data that is used in the methodology to derive the Time-of-Use Energy Charges in this schedule, and (4) efforts to assess the market price appropriate for this service.

The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter.

The Company-operated public EV charging facility is subject to the appropriate rate schedule for electric service.

TIME-OF-USE RATING PERIODS:

The Time-of-Use rating periods under this Schedule shall be as follows:

On-Peak Period:	5:00 p.m. - 10:00 p.m., Daily
Mid-Day Period:	9:00 a.m. - 5:00 p.m., Daily
Off-Peak Period:	10:00 p.m. - 9:00 a.m., Daily

The start time of the charging session shall determine the applicable time-of-use period.

CONDITIONS OF SERVICE:

The Company may, from time to time, curtail EV charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, or (3) for economic purposes.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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December 11, 2017 to June 30, 2023¶
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Schedule EV-U (Continued)¶

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Deleted: The Time-of-Use Energy Charges may be re-set each quarter, upon a notice filed with the Commission, to reflect (1) rate changes in the electric rate schedule applicable to the Company-operated electric vehicle charging facility, (2) changes in other costs to operate the charging facility, and (3) efforts to assess the market price appropriate for this service. ¶
¶
The quarterly Time-of-Use Energy Charges shall become effective within two (2) working days of the first day of the quarter. ¶
¶
The Company-operated public electric vehicle charging facility is subject to the appropriate rate schedule for electric service.¶
¶
TIME-OF-USE RATING PERIODS:¶
¶
The Time-of-Use rating periods under this Schedule shall be as follows:¶
¶
On-Peak Period: 5:00 p.m. - 10:00 p.m., Daily¶
Mid-Day Period: 9:00 a.m. - 5:00 p.m., Daily¶
Off-Peak Period: 10:00 p.m. - 9:00 a.m., Daily¶
¶
The start time of the charging session shall determine the applicable time-of-use period.¶
¶
CONDITIONS OF SERVICE:¶
¶
The Company may, from time to time, curtail electric vehicle charging (1) when there is insufficient generation to meet a projected peak demand period (at the discretion of the Company), (2) to support system reliability, (3) for economic purposes, or for pilot evaluation purposes.¶

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Superseding Sheet No. 110B
Effective December 12, 2017 to June 30, 2023

REVISED SHEET NO. 110B
Effective xx xx, 202x

Lanai Division
Schedule EV-U (Continued)

RULES AND REGULATIONS:

Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.

MAUI ELECTRIC COMPANY, LIMITED

Transmittal Letter Dated xx xx, 202x.

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Effective July 4, 2013 Effective December 12, 2017 ¶
To December 11, 2017 to June 30, 2023¶
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Schedule EV-U (Continued)¶

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Service supplied under this Schedule shall be subject to the Rules and Regulations of the Company.¶

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Exhibit C

Public Electric Vehicle Charger Expansion Project Application

Project Justification with Business Case Support

PROJECT JUSTIFICATION WITH BUSINESS CASE SUPPORT

I. OVERVIEW OF OUTCOMES

In this Exhibit, the Company provides a detailed business case analysis evaluating the key costs and benefits associated with the Project and the incremental electric load at the Project's charging stations for the lifetime of each charger. The Company worked with consultants at E3 to perform a cost-benefit assessment using the estimated Project implementation schedule and Project costs described below in Exhibit C, Section II.

The cost-benefit assessment included three main scenarios: (1) the Project's energy supply costs, implementation costs, and benefits through additional utility bill revenue, considered alongside public charging associated with broader EV adoption forecasted by the Company, (2) the Project's energy supply costs, implementation costs, and benefits through additional utility bill revenue, and (3) the Project's energy supply costs and benefits through additional utility bill revenue only. The first scenario shows the Project costs and benefits alongside the energy supply costs and utility revenue for all public charging associated with the Company's EV adoption forecast. This scenario should be the focus of this analysis because the Project is a necessary step to help accelerate deployment of third-party investment in additional public charging infrastructure and to accelerate broader EV adoption. A summary of the benefit-cost ratio results for the managed charging case on the proposed EV-U rate are shown below in Table 1. Additional scenario results will be discussed in detail in Section IV.B of this Exhibit.

Table 1. Cost-Benefit Assessment Results Summary

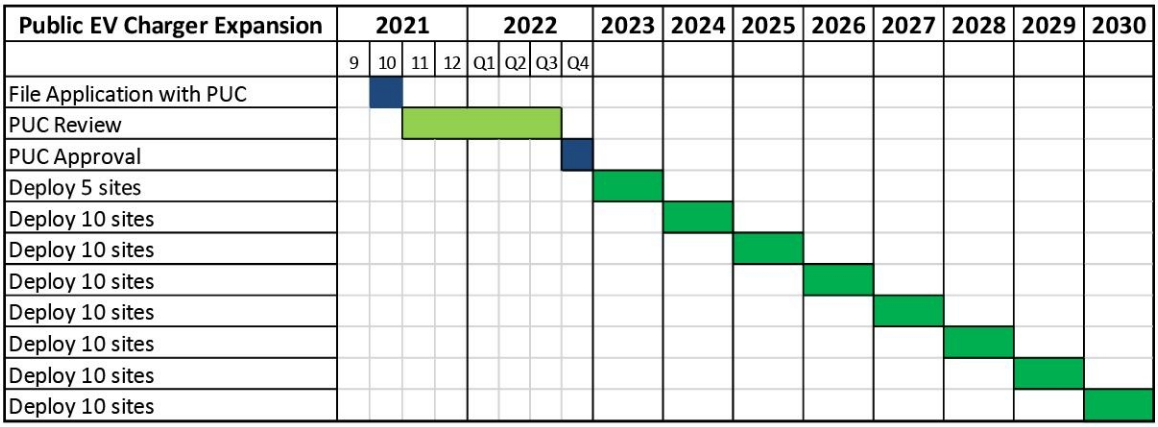
	Ratepayer Impact Measure (RIM) Cost-Benefit Ratio Results for the Managed Charging Case on Proposed EV-U Tariff		
	O'ahu	Maui County	Hawai'i Island
Scenario 1: Full EV Forecast	1.23	1.38	1.26
Scenario 2: Total Project Costs and Benefits	0.30	0.40	0.42
Scenario 3: Project Energy Costs and Revenue Only	2.76	4.05	5.22

II. SCHEDULE/OPERATIONAL IMPACTS

A. IMPLEMENTATION SCHEDULE

The proposed implementation schedule shown in Figure 1 below, begins in 2023 following Commission approval (assumed in 2022) through the end of 2030.

Figure 1. Estimated Project Implementation Schedule



The costs for the Project as discussed in Exhibit F (*Estimated Project Costs*) are based on the targeted number of sites to be deployed in each year as shown in Table 2, below. This target reflects the Company's best estimated deployment schedule at the time of filing, however, the Company requests flexibility in the actual number of sites per year and on which islands, in order to address actual implementation conditions and program uptake across service territories.

Table 2. Targeted Annual Number of Sites

Annual Number of Sites	2023	2024	2025	2026	2027	2028	2029	2030	Total
O'ahu	2	6	6	6	6	6	6	6	44
Hawai'i	1	2	2	2	2	2	2	2	15
Maui County	2	2	2	2	2	2	2	2	16
Total	**5**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**75**

The Company's current deployment approach utilized under the existing EV-U Pilot and EV-MAUI program have been largely successful in deploying charging infrastructure with minimal inconvenience to the site host. The Company proposes to use this existing approach for the Project and therefore no additional ramp up time will be required post Commission approval. The details are discussed in Exhibit A (*Project Development*).

B. OPERATIONAL IMPACTS OF EV CHARGING

The operational impacts of EV charging depend greatly on the type of charging behavior seen at the Project's charging stations. As described in more detail in the cost-benefit analysis section of this exhibit, two charging load shapes were evaluated: unmanaged charging and managed charging, which is consistent with the evaluation parameters established in the Roadmap. In the unmanaged charging case, drivers charge without regard to specific price signals; in the managed charging case, drivers take into account time-of-use rates at their location and adjust their charging behavior accordingly.

In both charging behavior cases, the majority of charging at the Project's stations take place during the middle of the day, consistent with current behavior seen at DCFC stations. This

outcome is likely due to the fact that the Pilot charging stations mostly serve public locations commonly frequented during the daytime. In the managed charging cases, an increased portion of evening peak charging is moved to the nighttime and daytime to reflect sensitivity to the lower-priced time-of-use rates periods in the proposed EV-U tariff. Detailed results are provided below in Section IV.B of this Exhibit.

III. EXPECTED INVESTMENT

A. PROJECT COST ESTIMATE

The combined Capital and Expense Costs for the Project over the anticipated implementation period of 2023 through 2030, are estimated at nearly $79 million in cumulative nominal dollars, and approximately $61 million on a Net Present Value (NPV) basis, using 6.885 percent discount rate (consistent with the Company's financial assumptions). The costs for the Project are discussed in Exhibit F (*Estimated Project Costs*) and also summarized Table 3 and Table 4 below.

Table 3 – Project Cost Estimate

Estimated Budget (nominal $)	Total ($ nominal)	NPV at 6.885% discount rate
HECO - Capital	$33,849,728	$26,280,165
HECO - O&M	$11,233,336	$8,647,502
HECO - Total	**$45,083,064**	**$ 34,927,667**
HELCO - Capital	$11,514,349	$8,990,354
HELCO - O&M	$4,789,336	$3,706,664
HELCO - Total	**$45,083,064**	**$12,697,019**
MECO - Capital	$12,205,292	$9,681,211
MECO - O&M	$5,041,336	$3,921,300
MECO - Total	**$45,083,064**	**$13,602,512**
Total - Capital	$57,569,369	$44,951,730
Total - O&M	$21,064,008	$16,275,467
Total	**$78,633,377**	**$61,227,197**

Table 4. Annual Project Costs

Estimated Budget (nominal $)	2023	2024	2025	2026	2027
HECO - Capital	$1,372,371	$4,237,380	$4,363,312	$4,496,017	$4,634,387
HECO - O&M	$742,667	$1,090,667	$1,210,667	$1,342,667	$1,486,667
HECO - Total	**$2,115,038**	**$5,328,047**	**$5,573,979**	**$5,838,684**	**$6,121,054**
HELCO - Capital	$679,822	$1,411,836	$1,460,530	$1,504,512	$1,548,139
HELCO - O&M	$322,667	$502,667	$538,667	$586,667	$634,667
HELCO - Total	**$1,002,489**	**$1,914,503**	**$1,999,197**	**$2,091,179**	**$2,182,806**
MECO - Capital	$1,371,995	$1,409,965	$1,460,368	$1,504,664	$1,548,295
MECO - O&M	$418,667	$514,667	$562,667	$610,667	$658,667
MECO - Total	**$1,790,662**	**$1,924,632**	**$2,023,035**	**$2,115,331**	**$2,206,962**
Total - Capital	$3,424,188	$7,059,181	$7,284,210	$7,505,192	$7,730,821
Total - O&M	$1,484,001	$2,108,001	$2,312,001	$2,540,001	$2,780,001
Total	**$4,908,189**	**$9,167,182**	**$9,596,211**	**$10,045,193**	**$10,510,822**

Estimated Budget (nominal $)	2028	2029	2030	Total	NPV at 6.885% discount rate
HECO - Capital	$4,772,535	$4,911,349	$5,062,378	$33,849,728	$26,280,165
HECO - O&M	$1,630,667	$1,786,667	$1,942,667	$11,233,336	$8,647,502
HECO - Total	**$6,403,202**	**$6,698,016**	**$7,005,045**	**$45,083,064**	**$ 34,927,667**
HELCO - Capital	$1,586,106	$1,636,503	$1,686,901	$11,514,349	$8,990,354
HELCO - O&M	$682,667	$730,667	$790,667	$4,789,336	$3,706,664
HELCO - Total	**$2,268,773**	**$2,367,170**	**$2,477,568**	**$45,083,064**	**$12,697,019**
MECO - Capital	$1,586,266	$1,636,668	$1,687,071	$12,205,292	$9,681,211
MECO - O&M	$706,667	$754,667	$814,667	$5,041,336	$3,921,300
MECO - Total	**$2,292,933**	**$2,391,335**	**$2,501,738**	**$45,083,064**	**$13,602,512**
Total - Capital	$7,944,907	$8,184,520	$8,436,350	$57,569,369	$44,951,730
Total - O&M	$3,020,001	$3,272,001	$3,548,001	$21,064,008	$16,275,467
Total	**$10,964,908**	**$11,456,521**	**$11,984,351**	**$78,633,377**	**$61,227,197**

IV. COST-BENEFIT ANALYSIS

The Company worked with consultants from E3 to perform a cost-benefit assessment for the proposed Project. This cost-benefit analysis evaluated the key costs and benefits associated with the Project and its incremental load at the Project's charging stations.

A. METHODOLOGY

1. Cost Test Perspectives

The cost-benefit assessment used the Ratepayer Impact Measure ("RIM") to consider the effect of the proposed Project on the Company's ratepayers. The RIM test compares the utility's marginal costs to serve the additional EV charging load to the additional utility revenue brought in from the EV charging sites' bills. In this case, the Company also included the costs of the Project to evaluate the effect of the Project on ratepayers. The RIM test indicates the overall impact on ratepayers: net benefits in the RIM test indicate that the Project has greater revenue than its costs and thus will exert downward pressure on rates, whereas net costs indicate that the Project will increase rates.

In previous filings, the Company also considered the Participant Cost Test ("PCT"), which shows the costs and benefits from the perspective of an EV driver participating in the Project. This perspective is appropriate for programs like the Company's eBus Make-ready Infrastructure Pilot, where the participant (i.e., bus owner or operator) who installs the charging stations through the program is the same party responsible for procuring the electric vehicles (i.e., electric buses), as well as realizing any lifetime benefits of the vehicles. However, in this Project, the "participant" that avoids the cost of installing and operating charging infrastructure does not necessarily have vehicles that also charge at that site. Therefore, the Company contends that the participant perspective was not as suitable for this filing.

2. Input Data

The cost-benefit assessment was performed individually for O'ahu, Maui County (to include the Project's charging stations on both Maui island and Moloka'i), and Hawai'i Island. Hourly energy and capacity costs for each island were based on the Company's recent Integrated Grid Planning modeling using the RESOLVE model. Customer bills were calculated and compared under the current EV-U and proposed EV-U tariffs for each island. For the scenarios showing the impact of the Project's charging stations on the full forecast for EV adoption in the Company's territory, the proposed EV-J and EV-P rates were used to calculate utility bills at other public charging stations.

The analysis assumes the first proposed set of Project charging stations will be operational in 2023, consistent with the Company's proposed deployment schedule, and the final charging stations in the Project will be installed in 2030. The analysis assumes that the charging stations and infrastructure will be operational for 15-years, so the complete timeframe for the analysis is 2023 through 2044 (to account for the full 15-year lifetime of chargers installed in 2030). The Company used a discount rate of 6.885 percent, consistent with its general finance assumptions, for calculating the net present value ("NPV") of the annual costs and benefits.

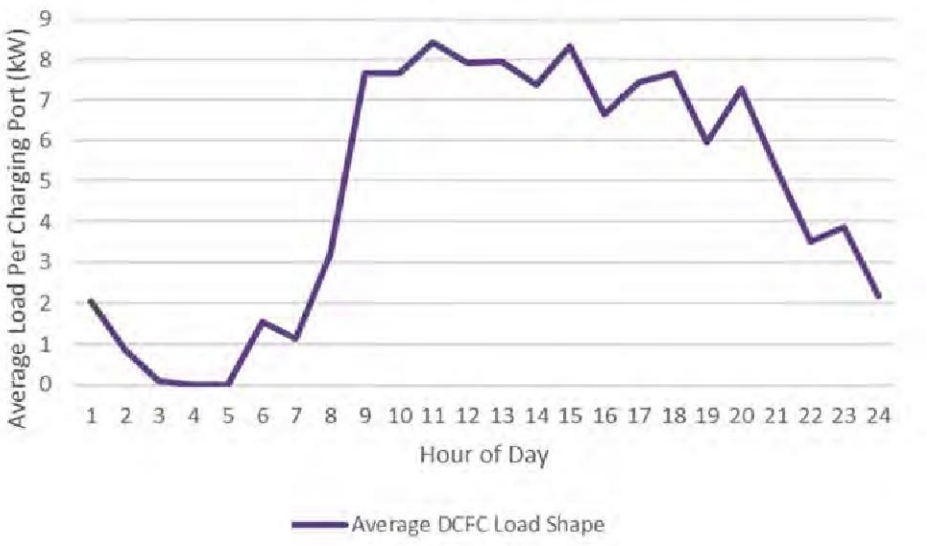
3. EV Charging Load Shapes

The Company leveraged EV charging load shapes produced by its consultant E3's EV Load Shape Tool. The EV charging shapes were developed based on actual travel data from the National Household Travel Survey ("NHTS"), and assumptions regarding EV charging access for different driver types. The EV Load Shape Tool produced hourly charging load shapes for Level 2 and DCFC ports based on when drivers arrive to different charging location types and the potential EV charging available. The base, or "unmanaged", charging shapes represent

driving behavior when each driver charges their EV as soon as they get to a location with EV charging access. The tool also produced "managed" charging shapes, in which drivers are assumed to optimize their charging behavior according to price signals (i.e., time-of-use rate periods) at their charging locations, while still being able to meet their travel needs.

The DCFC load shape is based on the EV Load Shape Tool's output for charging at public, fast charging locations. This shape was benchmarked against recent utilization data from the Company's current pilot sites to ensure the shape and overall energy consumption is consistent with actual data seen at the Company's DCFC locations. The same DCFC shape is used for both the unmanaged and managed charging scenarios – because drivers typically use DCFC sites as on-demand charging, there is less ability to shift charging behavior during the day. However, it is important to note that the DCFC load shape (both that produced by E3's EV Load Shape Tool and the actual data from the Company's current charging stations) has most charging occurring during the daytime, which is when the proposed EV-U rate has its lowest price period. In this sense, the DCFC shape is already consistent with the expected managed charging behavior. An average hourly load shape for a DCFC charger is shown in Figure 2.

Figure 2. Average DCFC Load Shape (Unmanaged = Managed)



The cost-benefit analysis also considers unmanaged and managed load shapes for Level 2 charging ports that will be installed alongside the DCFC ports. Because the actual sites for the Project's charging stations are not yet identified, the Company considered charging behavior from both public charging stations, as well as those serving multi-unit dwellings. The Company anticipates that some of the Project's sites may be located near multi-unit dwellings and therefore able to serve drivers located at those residences. Therefore, the Level 2 load shape used in the analysis combines the public and multi-unit dwelling charging shapes from E3's EV Load Shape Tool. The unmanaged shape represents standard charging behavior at public and multi-unit dwellings, and the managed shape considers potential shifting based on drivers' response to the proposed EV-U rate. The average Level 2 load shapes are shown below in Figure 3.

Figure 3. Average Level 2 Load Shapes for Unmanaged and Managed Charging

In order to estimate the actual magnitude of the load shapes, the Company benchmarked the shapes against actual data. The DCFC shape was benchmarked against actual historic data from the Company's current DCFC sites and scaled to represent the average utilization at these sites. The Level 2 load shape was benchmarked against utilization data from Southern California Edison's ("SCE") Charge Ready program.[1] The SCE program data provides a useful proxy for estimating the expected utilization for the charging stations installed in this Project. The Level 2 shape was scaled to represent the same amount of average charging as seen by SCE.

The cost-benefit analysis scenarios consider charging only at public stations. For the full forecast scenario, approximately 15 percent of charging is assumed to be at public charging locations, consistent with the Company's assumptions in the Backbone Study. This analysis assumes no change in residential charging load, which is not modeled here.

[1] Southern California Edison ("SCE"), Charge Ready Quarterly Report, Q2 2020. The load shape for a Level 2 public charging port was scaled so that the average monthly energy consumption matched that of the public charging ports in SCE's program. Data was used from SCE's program in January 2020 to reflect pre-COVID charging behavior.

4. Calculation

The hourly EV charging load shapes for each site location type were multiplied by the hourly electricity supply costs to calculate annual costs in the RIM test. The proposed EV-U tariff was applied to the hourly load shapes to calculate the annual Project revenue in the RIM test. These calculations were performed in consultant E3's cost-benefit assessment model from 2023 through 2044 (to represent the full lifetime of charging stations installed from 2023 through 2030) for O'ahu, Maui County, and Hawai'i Island.

The NPV for the annual costs and benefits were calculated, then compared alongside the NPV of Project costs for each island. The cost-benefit assessment considered cases under the current EV-U tariff and proposed EV-U tariff for both unmanaged and managed charging load shapes by island. Additional high and low energy supply cost sensitivities (based on a 25% increase and decrease in energy supply costs from RESOLVE) were conducted for the managed load shape under the proposed EV-U tariff in the final scenario for Project energy supply costs and utility revenue.

B. RESULTS

The Company sees this Project as an essential building block to accelerate the transition to clean transportation and mitigate the impacts of climate change. Similar to the Company's Charge Ready Hawai'i Pilot application, the Company evaluated a scenario where Project costs are considered against the broader backdrop of EV adoption and charging at other public charging stations. In this scenario, the Project is a necessary step to help accelerate deployment of third-party investment in additional public charging infrastructure and to accelerate broader EV adoption in the intervening years. The Company considered its full forecast for EV adoption on O'ahu, Maui County, and Hawai'i Island, and modeled charging at public level 2 and DCFC

sites. The total amount of public charging for the full forecast scenario is based on approximately 15 percent of total forecasted EV load for the Company's EV forecast. The charging at Project stations on the EV-U rate is included as part of this total amount of public charging. The remaining 85% of total EV load is still assumed to occur at residences and is not considered in this analysis, which addresses public charging only. The Project sites were evaluated on the proposed EV-U rate, whereas other public charging was analyzed using the proposed EV-J and EV-P tariffs. Assuming a 15-year life for each charging station, the analysis calculated the lifetime RIM costs and benefits for all public charging for charging stations and vehicles adopted from 2023 through 2030 (resulting a complete analysis timeframe of 2023-2044, to account for the full 15-year equipment life).

The results for these full EV forecast scenarios are shown in Figure 4, Figure 5, and Figure 6 below. Within this scenario, three cases for each island or county were considered: (1) unmanaged charging behavior, with Project load on the current EV-U tariff and all other public charging load on the proposed EV-J and EV-P tariffs, (2) unmanaged charging behavior, with Project load on the proposed EV-U tariff and all other public charging load on the proposed EV-J and EV-P tariffs, and (3) managed charging behavior, with Project load on the proposed EV-U tariff and all other public charging load on the proposed EV-J and EV-P tariffs. The first case has the highest utility bills and energy supply costs since charging is unmanaged and the current EV-U tariff, which has higher volumetric rates than the proposed EV-U tariff, is used. In the second case, utility bills decrease because of the proposed EV-U tariff. In the third case, both utility bills and energy supply costs decrease because of managed charging that better aligns with the tariff's time-of-use periods and lower supply costs. All three cases are fairly similar, however, since the DCFC load shape is the same for both unmanaged and managed, as described above in Section

IV.A.3. Most DCFC charging already takes place during the daytime, which aligns well with the expectations of managed charging and lower-cost periods.

In this full EV forecast scenario, where the Project costs are considered in this context of broader EV adoption and public charging, the RIM test shows benefit-cost ratios of 1.23 for O‘ahu, 1.38 for Maui County, and 1.26 for Hawai‘i, in the managed charging scenarios – demonstrating that wide-spread EV adoption, aided by this Project, will generate significant net benefits beyond these Project costs over the lifetime of the charging stations.

Figure 4 Full EV Forecast RIM Results for O‘ahu with Project Costs

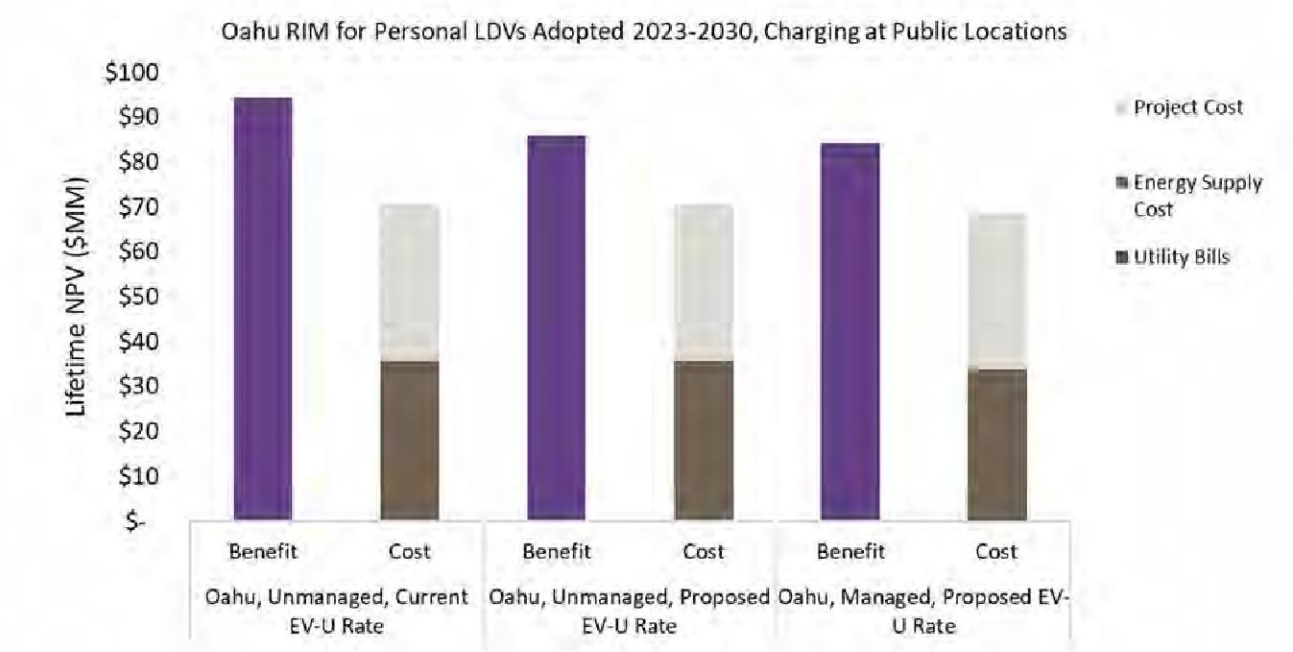


Figure 5 Full EV Forecast RIM Results for Maui County with Project Costs

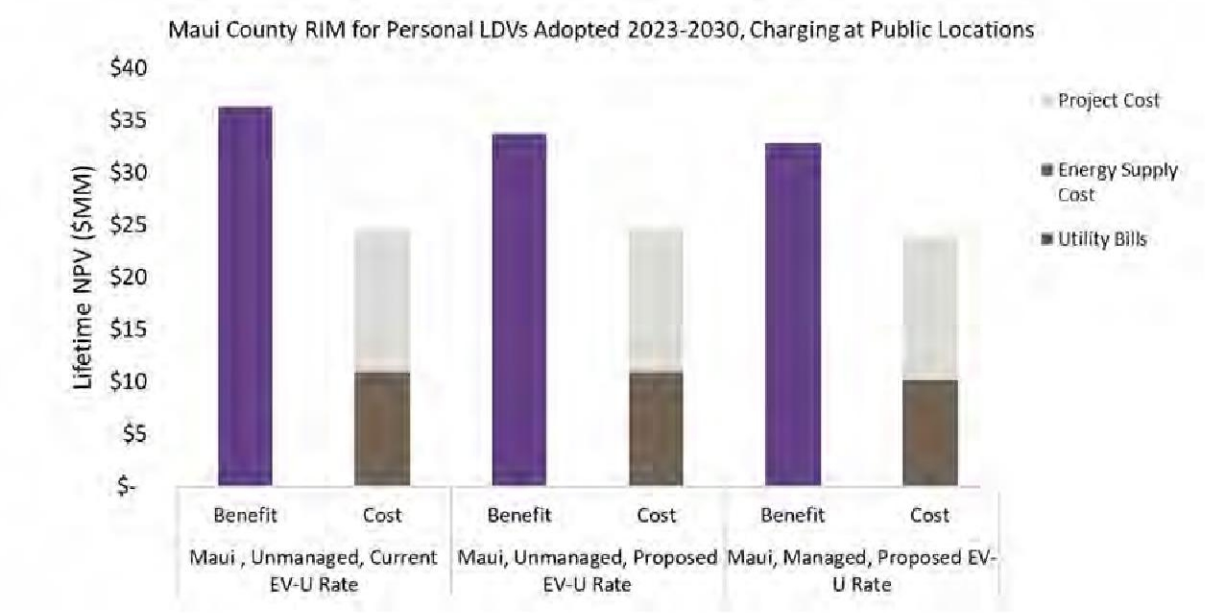
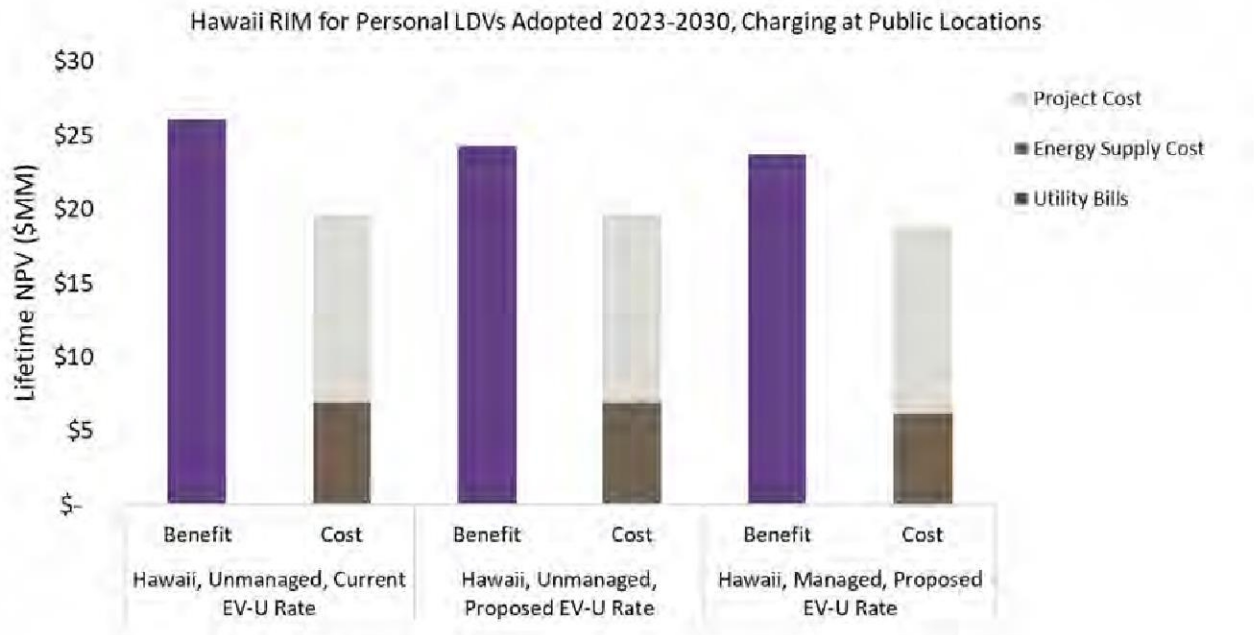


Figure 6 Full EV Forecast RIM Results for Hawai‘i Island with Project Costs



The next set of scenarios shows only the Project costs and benefits, without the backdrop of widespread EV adoption and additional public charging beyond the Project chargers on the EV-U tariff. In these scenarios, the benefit-cost ratios for the managed charging case on the proposed EV-U tariff are 0.30, 0.40, and 0.42 for O‘ahu, Maui County, and Hawai‘i Island, respectively, demonstrating that the net benefits from additional revenue from the charging stations are presently not enough to cover the total Project costs. The RIM results for the main three scenarios (unmanaged charging on current EV-U rate, unmanaged charging on proposed EV-U rate, and managed charging on proposed EV-U rate) are shown alongside Project costs in Figure 7, Figure 8, and Figure 9 below.

Figure 7 Ratepayer Impact Measure Results for O‘ahu with Project Costs

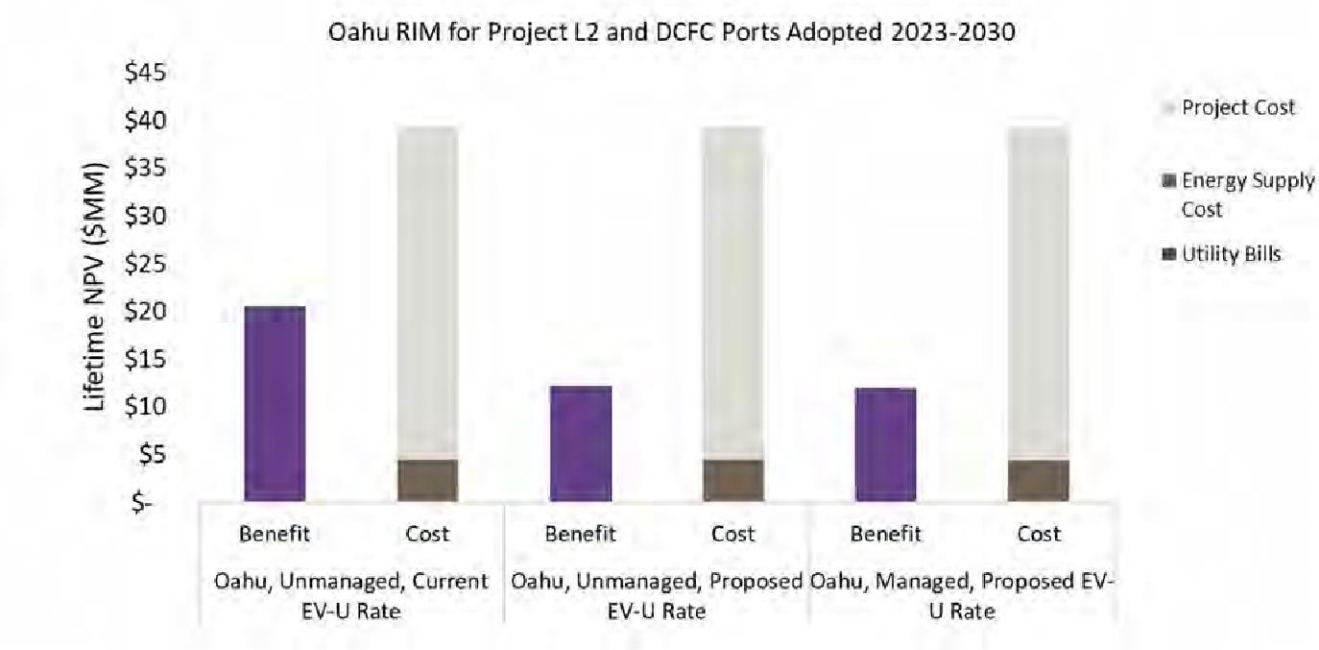


Figure 8 Ratepayer Impact Measure Results for Maui County with Project Costs

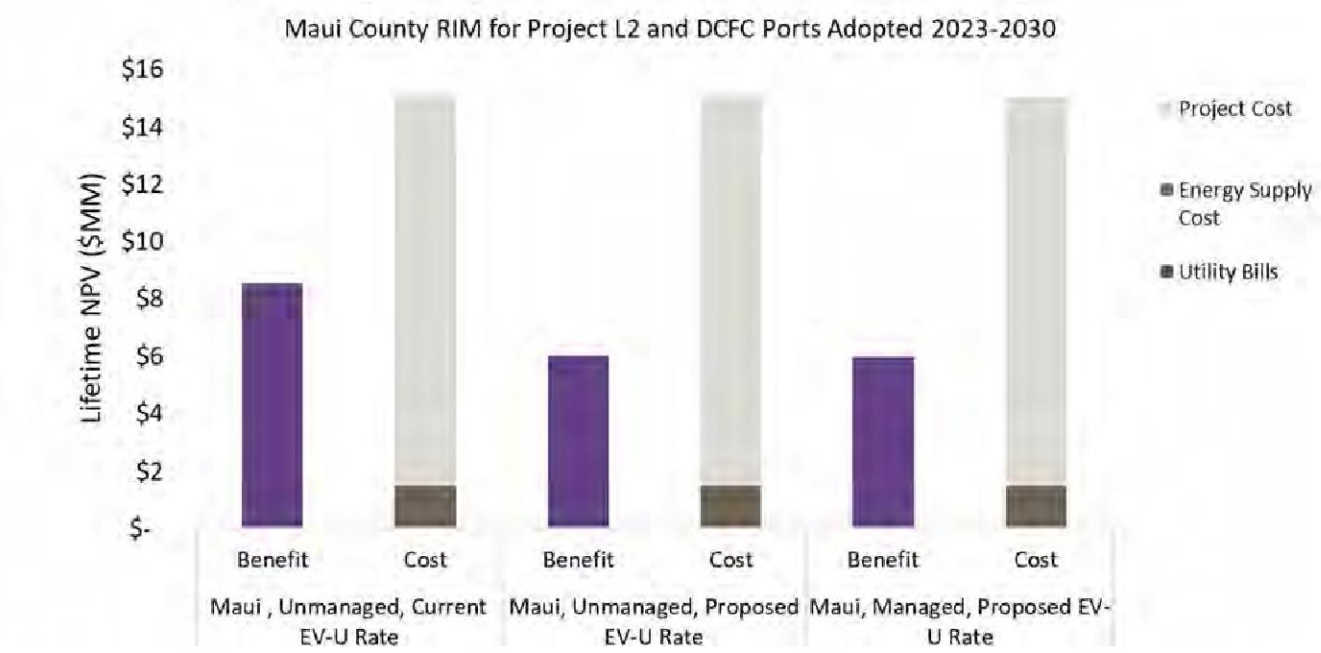
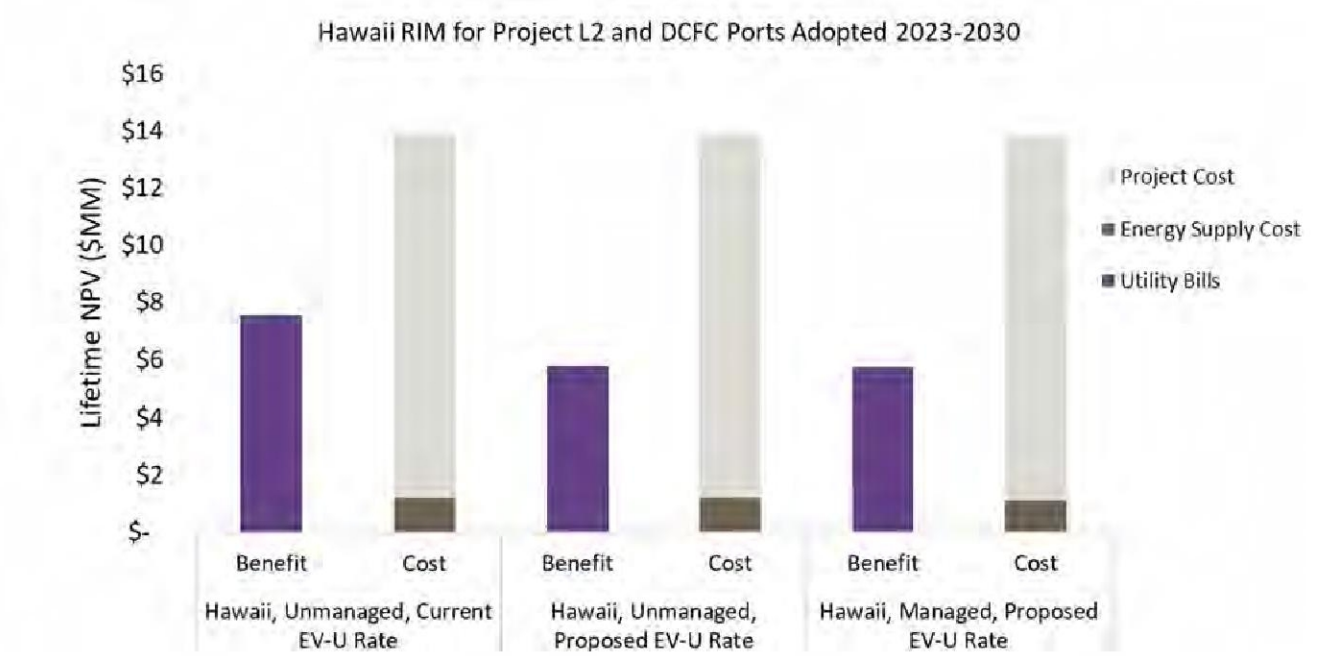


Figure 9 Ratepayer Impact Measure Results for Hawai‘i Island with Project Costs



In the final scenario, only the Project's energy supply costs and additional utility revenue are considered. Since the first scenario with the full EV forecast shows Project costs against the backdrop of widespread EV adoption, this scenario removes the Project costs to isolate the effects of just the ongoing energy supply costs and utility revenue associated with the Project charging stations. Figure 10, Figure 11, and Figure 12 show the RIM results for the Project on O'ahu, Maui County, and Hawai'i Island. For this scenario, two additional sensitivities were included: one with a 25% increase in hourly energy supply costs, and one with a 25% decrease in hourly energy supply costs.

For all cases modeled on O'ahu, Maui County, and Hawai'i Island, the RIM test shows positive net benefits when only including the revenue from utility bills at the Project charging stations (benefit) and the energy supply costs (cost). Figure 10, Figure 11, and Figure 12 show the following effects when moving through the scenarios: the first scenario, with unmanaged charging and the current EV-U rate, has the highest utility bills due to the high volumetric charges on the current rate. When the proposed EV-U rate is considered, utility bills decrease due to the lower volumetric rates in the proposed tariff. When managed charging is considered, both utility bills and energy supply costs decline due to drivers responding to the TOU rates and thereby charging during less expensive times of day. The high and low energy supply cost sensitivities show the expected changes in the energy supply costs. In all cases, additional revenue from utility bills for the Project chargers exceeds the energy supply costs to serve those charging stations. The analysis assumes there is no reduction in residential EV charging load with the incremental Project stations on the EV-U tariff.

As described earlier in this Exhibit, the load shape for DCFC is the same in both the unmanaged and managed cases. Most DCFC charging already takes place during the daytime,

and because this is an on-demand charger type, there is not much additional room to shift charging. Therefore, the DCFC load shape is already consistent with managed charging behavior, and the main difference in the managed charging cases is some additional load shifting with the Level 2 ports. This means that the results are fairly similar in each case, with the variations described above when changing from unmanaged to managed or from the current EV-U tariff to the proposed tariff.

As seen in the below figures for the Project only scenario, the benefit-ratios for the managed charging case on the proposed EV rate are 2.76 for O‘ahu, 4.05 for Maui County, and 5.22 for Hawai‘i Island – meaning that in these cases, the benefits exceed the energy supply costs, before total costs of the Project are included.

Figure 10. Ratepayer Impact Measure Results for O‘ahu

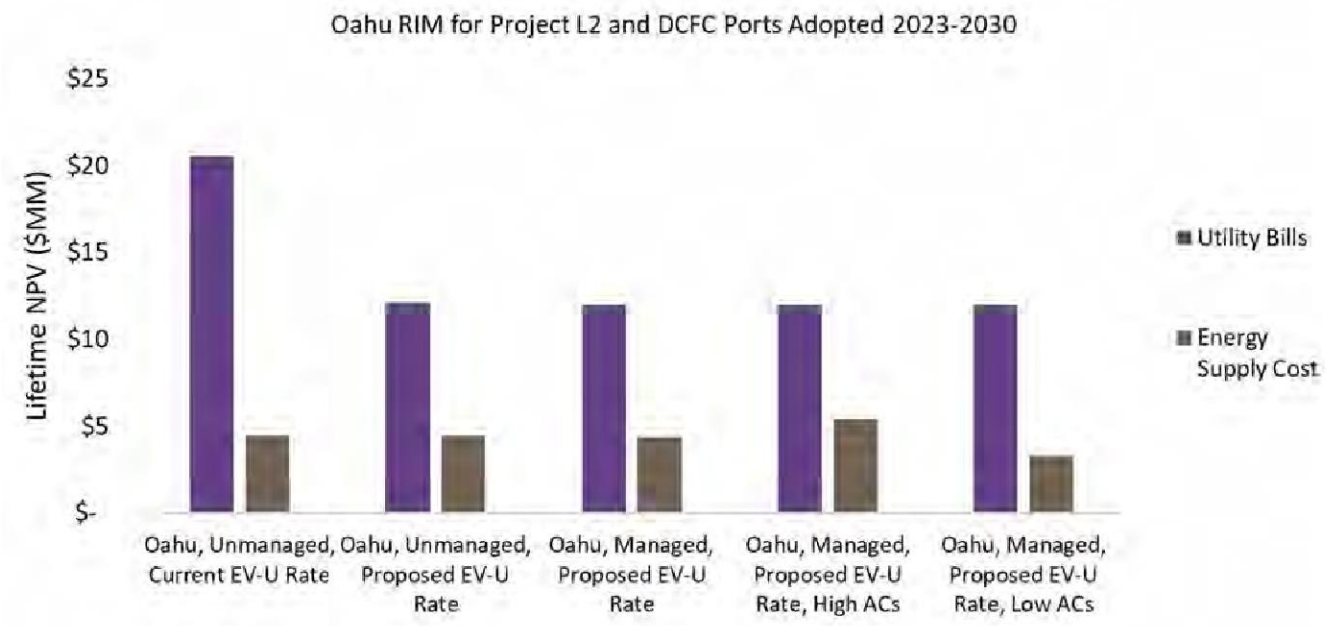


Figure 11. Ratepayer Impact Measure Results for Maui County

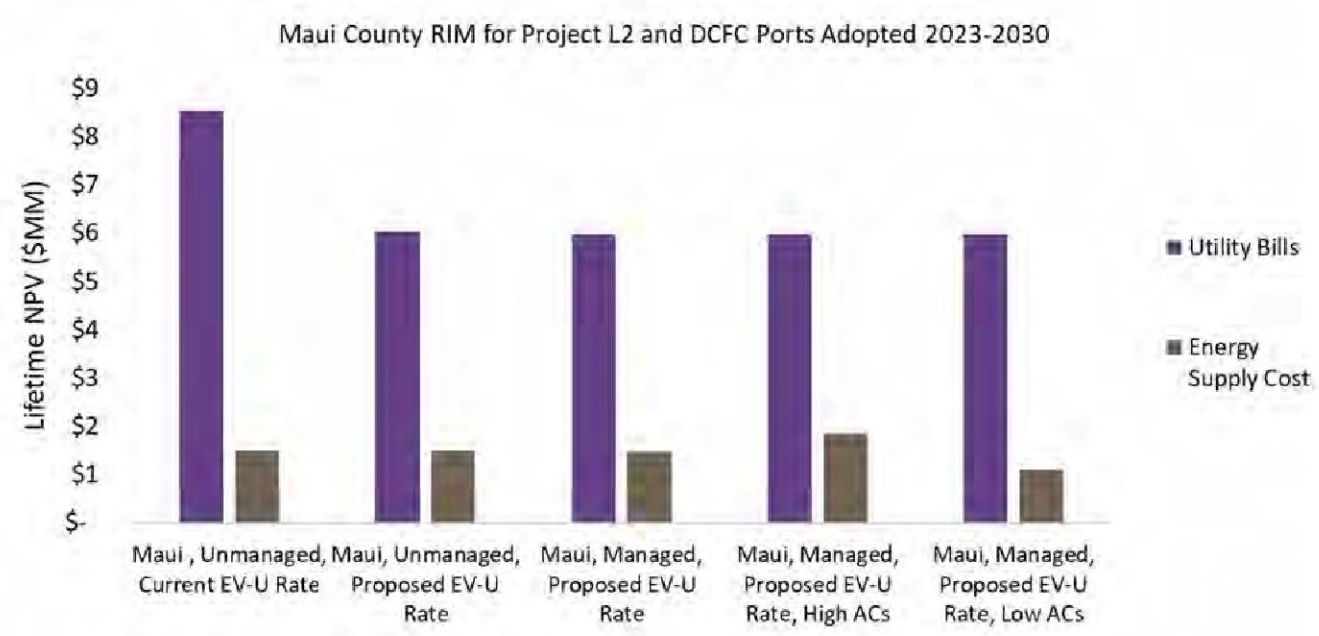


Figure 12 Ratepayer Impact Measure Results for Hawai‘i

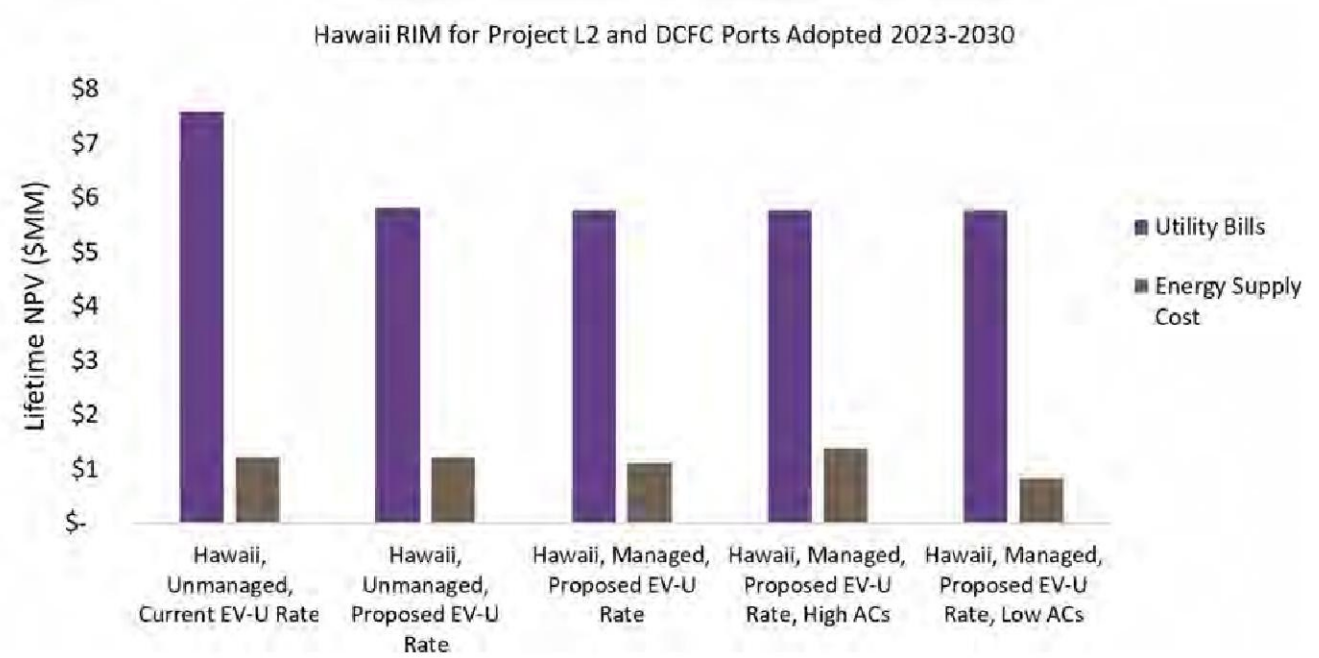


Exhibit D

Public Electric Vehicle Charger Expansion Application

Accounting and Ratemaking Treatment

ACCOUNTING & RATEMAKING TREATMENT[1]

The Company proposes the following accounting and ratemaking treatment specific to the accompanying application for the Public Electric Vehicle Charger Expansion project, herein referred to as the Project ("Project").

The proposed accounting for the foundational components of the Project generally follows the accounting for capital expenditures approved by the Public Utilities Commission ("Commission") in the past. In general, the cost of the EV charging station will be capitalized. Such treatment is in accordance with Generally Accepted Accounting Principles ("GAAP") and consistent with the Company's current accounting for such costs.

I. ELECTRIC VEHICLE (EV) CHARGING STATION AND INFRASTRUCTURE

The Company is requesting approval to recover the estimated Capital and O&M costs of the Project totaling $79 million plus the on-going incremental O&M expenses of approximately $1.57 million per year after 2030, through the EPRM until new rates become effective that provide cost recovery for the Project or as otherwise provided by the Commission.

The Company will follow its existing general policies and procedures with respect to accounting for the Project costs.

A. CAPITAL COSTS

Project costs will be capitalized following the Company's existing practices for capital costs. Costs will be included in construction work in progress and transferred to plant in service upon completion. Depreciation/amortization will be included in plant accounts following the Federal Energy Regulatory Commission ("FERC") Uniform System of Accounts, consistent with

[1] Note: References to exhibits in this document refer to exhibits included in the accompanying application unless otherwise noted.

the Company's Property Unit Catalog, and will commence starting the beginning of the calendar year following the date the capital is placed in service. Specific treatment will be as follows:

The capital costs for the Project include the EV charging station, infrastructure, and any related installation expenses. The Company will capitalize all infrastructure and EV charging stations at each site included in plant-in-service when operational and the cost amortized over fifteen years, beginning January 1 of the year following the in-service date. This is consistent with the Company's latest Commission approved amortization period for FERC plant account 398, "General Plant – Miscellaneous Equipment" which was used for the EV-U Pilot.

The capital costs are proposed to be recovered through the EPRM guidelines approved at that time, until such costs are reflected in new rates that provide cost recovery for the Project or as otherwise provided by the Commission, as discussed in Exhibit E (*Exceptional Project Recovery*).

B. EXPENSES

The Company will incur incremental O&M expenses with each EV charging station related to installation (e.g., customer outreach, site evaluations, data collection, vendor support) and on-going maintenance and repair of EV charging stations. These costs may be incurred as soon as the EV charging station is placed in-service and are not included in existing rates. There are currently no quantifiable offsetting benefits, however as noted in Section III below, the Company will offset costs eligible for EPRM recovery with EV-U revenues, net of revenue taxes, so that all customers will benefit from this Project.

Over the course of the project installation and post-installation, to the extent that incremental O&M costs are not recovered in current rates, the Company request to recover the O&M costs through the EPRM, until such costs are reflected in new rates that provide cost

recovery for the Project or as otherwise provided by the Commission, as discussed in Exhibit E (*Exceptional Project Recovery*).

The Company will defer current year incurred O&M in a regulatory asset account. In the annual EPRM filing, the Company will include the prior year actual incurred O&M expenses that were recorded in the regulatory asset account. The costs will be incorporated in target revenues via the annual MPIR/EPRM revenue adjustment filing as of January 1 (i.e. the year subsequent to when the costs were incurred) and will be subject to Commission review as part of the Spring Revenue Report filed at the end of March. Costs included in the regulatory asset account will be amortized to expense over 12 months starting January 1st of the subsequent year as amounts are accrued to target revenues.

II. USED AND USEFUL CRITERIA

The Company will deem the EV charging stations and associated installation costs as used and useful upon installation and successful completion of commissioning showing the EV charging station is able to operate as intended, thereby providing value to the Company and customers.

III. EV-U REVENUES

Consistent with the EPRM guidelines, the Company intends to include all Schedule EV-U revenues less revenues for revenue taxes from the Project's charging stations (excluding the EV-Maui charging stations) in the calculation of net costs eligible for EPRM recovery. In doing so, all customers will benefit from any kWh sales under these rates.

Schedule EV-U revenues will be considered Other Operating Revenue since they are generated by the provision of EV charging services rather than through the sale of electricity.

Other Operating Revenues are included in annual determination of the Earnings Sharing Mechanism provided for in the ARA Provision.

Exhibit E

Public Electric Vehicle Charger Expansion Application

Exceptional Project Recovery

INTERIM RECOVERY

The Company is requesting recovery of the total Project costs as noted in Exhibit F (*Estimated Project Costs*) through the Exceptional Project Recovery Mechanism ("EPRM") until new rates become effective that provide cost recovery for the Project or as otherwise provided by the Commission.

I. BACKGROUND

The EPRM Guidelines established by the Commission in Decision and Order No. 37507 ("D&O 37507") in the Performance-Based Regulation ("PBR") proceeding in Docket No. 2018-0088 ("EPRM Guidelines") provide a mechanism for recovery of revenues for net costs of approved eligible projects placed in service during a Multi-Year Rate Period, that is not provided for by other effective tariffs, the Annual Revenue Adjustment, Performance Incentive Mechanisms, or Shared Savings Mechanisms.[1]

As discussed herein, the Company's proposed recovery of this Project complies with the EPRM Guidelines. Therefore, the Companies respectively request approval to recover the total Project Costs through the EPRM.

A. THE PROJECT QUALIFIES FOR EPRM RECOVERY

1. EPRM Recovery of the Project Costs Will Not be Duplicative

Section II.B.3 of the EPRM Guidelines prohibits duplicative cost recovery and states as follows:

> Notwithstanding any other specific provisions in these Guidelines, the EPRM adjustment mechanism shall not collect or recover revenues for costs or expenses recovered through other effective tariffs or revenue recovery mechanisms, including but not limited to revenues collected through the ARA, PIMs, or SSMs. The utility shall have the burden of proof in an application for recovery of

[1] See Appendix A, Section II.A.1 of the EPRM Guidelines issued in Decision & Order No. 37507 on December 23, 2020 in Docket No. 2018-0088.

> revenues through the EPRM adjustment mechanism that recovered revenues should not be duplicative.[2]

The Company's Application does not seek duplicative cost recovery. The Project's total costs are incremental costs that were not embedded in the rates approved for the Maui Electric 2018, Hawai'i Electric Light 2019, or Hawaiian Electric 2017 or 2020 test year rate cases, nor recovered through any recovery mechanism that is currently in effect.

2. The Project is an Eligible EPRM Project

Pursuant to Section III.B.1 of the EPRM Guidelines, projects and costs that may be eligible for recovery through the EPRM Mechanism are Eligible Projects, including but not restricted to the following illustrative examples, subject to the Commission's approval in accordance with the EPRM Guidelines:

(a) Infrastructure that is necessary to connect renewable energy projects. Infrastructure projects such as transmission lines, interconnection equipment and substations, which are necessary to bring renewable energy to the system. For example, renewable energy projects, such as wind farms, solar farms, biomass plants and hydroelectric plants, not located in proximity to the electric grid must overcome the additional economic barrier of constructing transmission lines, a switching station and other interconnection equipment. Building infrastructure to these projects will encourage additional renewable generation on the grid;

(b) Projects that make it possible to accept more renewable energy. Projects that can assist in the integration of more renewable energy onto the electrical grid. For example, new firm generation or modifications to firm generation to accept more variable renewable generation or energy storage and pumped hydroelectric storage facilities that allow a utility to accept and accommodate more as-available renewable energy;

(c) Projects that encourage clean energy choices and/or customer control to shift or conserve their energy use. Projects that can encourage renewable choices, facilitate

[2] Id., Section II at 2.

conservation' and efficient energy use, and/or otherwise allow customers to control their own energy use. For example, smart meters would allow customers to monitor their own consumption and use of electricity and allow for future time-based pricing programs. Systems such as automated appliance switching would provide an incentive to customers to allow a utility to mitigate sudden declines in power production inherent in as-available energy;

(d) Approved or Accepted Plans, Initiatives, and Programs. Capital investment projects and programs, including those transformational projects identified within the Companies' ongoing planning and investigative dockets, as such plans may be approved, modified, or accepted by the Commission, and projects consistent with objectives established in investigative dockets;

(e) Utility Scale Generation and Energy Storage. Electric utilities may seek recovery through the EPRM adjustment mechanism for the costs of a utility scale renewable generation or energy storage project, or a generation or energy storage project, that can assist in the integration of more renewable energy onto the electrical grid;

(f) Grid Modernization projects. Projects such as smart meters, inverters, energy storage, and distribution automation to enable demand response.

(g) Service Contracts. Company contracts with third-parties that (1) provide facilities or functionality that could otherwise be provided by a utility capital project and (2) provide services that directly and predominantly support another express EPRM Eligible Projects category.

The Project will make it possible to accept more renewable energy onto the electrical grid to support the incremental energy needed to provide charging services to the expanded network of public charging facilities, especially during the mid-day period of high solar availability when public charging is incentivized through the lowest time-of-use rate on the proposed revised Schedule EV-U, encourages clean energy choices through EV adoption, and is consistent with the Company's Electrification of Transportation Strategic Roadmap in Docket No. 2018-0315.

Therefore, the Project qualifies under Sections III.B.1(b), III.B.1(c), and III.B.1(d) of the EPRM Guidelines.

3. EPRM Recovery Will Follow Established EPRM Guidelines

The following is a summary of the proposed ratemaking treatment of the various costs impact by this Project, which are described in Table 1 below:

Table 1. Proposed Ratemaking Treatment of Various Impacted Costs

Cost Component or Savings	Proposed Ratemaking Treatment
EV-U Expansion Project Capital	EPRM
EV-U Expansion Project O&M	EPRM
EV-U Expansion Project On-going O&M	EPRM
EV-U Expansion Project, EV-U Revenues	EPRM

The Company is seeking to recover Eligible Project costs through the EPRM adjustment mechanism pursuant to the process set forth in Section III.C.2.b and Section III.C.2.c of the EPRM Guidelines, which states the following:

(a) Costs eligible for the EPRM adjustment mechanism include:

i. Return on the net of tax average annual undepreciated investment or unamortized balance of the deferred cost in allowed Major Projects or Deferred Cost Projects during EPRM recovery for each project at rate of return to be determined in the review of each Eligible Project application, as approved by the Commission, except that in the initial year in service, the average of the balance at the in-service date and the balance at the end of the initial year;

ii. Recorded depreciation accruals (at a rate and methodology to be determined in review of each project's application, and as approved by the Commission) in allowed Major Projects to begin on the following January 1st after the month of the in-service date of the Project;

iii. Amortization accruals (at a rate and methodology to be determined in review of each project's application, and as approved by the Commission) in allowed Deferred Cost Projects to begin on the

date of the onset of EPRM recovery of the deferred cost for the project;

iv. Operations and maintenance expenses associated with the Eligible Project, not otherwise included in base rates, the ARA, or other cost recovery mechanisms;

v. Other relevant costs, applicable taxes, and/or offsetting cost savings, approved by the Commission.

(b) All costs that are allowed to be recovered through the EPRM adjustment mechanism, shall be offset by any related net benefits of implementation of the approved Eligible Project (e.g., cost savings, revenue enhancements offset by O&M expenses, avoided depreciation on retired utility plant, etc.), as those net benefits are quantifiable and can be realized by the electric utility.

As installation of the Public EV charging stations will be commissioned throughout the year, the Company plans to file for EPRM recovery of the Project costs through the annual MPIR/EPRM true-up filing accruing January 1st of the year following. EPRM recovery will be based on actual recorded costs and the depreciation, tax and authorized return rates in place at that time, net of Schedule EV-U revenues (excluding revenue taxes) related to such Public EV charging stations. Recovery of on-going incremental O&M costs will be based on actual recorded costs for the previous year.

4. <u>The Project Application Complies with Section III.C.3. of the EPRM Guidelines</u>

Section III.C.3.(a) through (j) of the EPRM Guidelines establish certain requirements for applications seeking recovery through the EPRM Mechanism. As discussed below, the Project satisfies each of these requirements.

(a) Burden of Proof

Section III.C.3.a of the EPRM Guidelines provides:

> With respect to applications seeking approval to utilize the EPRM adjustment mechanism for cost recovery, the electric utility bears the burden of proof that all project costs proposed for EPRM treatment meet the criteria specified herein and are not routine replacements of existing equipment or systems with like kind assets, relocations of existing facilities, restorations of existing facilities, or other kinds of business-as-usual investments.

The purpose of the Project is to build upon the current EV charging infrastructure by supporting the critical backbone needed to support EV adoption. The EV-U pilot provided a small subset of the need and this Project will add public EV charging to support the growth of EVs. The Project is therefore not a business as usual investment.

(b) G.O. 7 Application

Section III.3.b. of the EPRM Guidelines provides:

> Application for recovery of revenues through the EPRM adjustment mechanism shall be made in conjunction with and as part of an application (1) pursuant to General Order No. 7, (2) for deferred accounting treatment, or (3) for other specific project or program authorization or approval. Absent a requirement to file an application for such project or program authorization or approval, the utility may file a separate independent application for recovery of costs through the EPRM adjustment mechanism.

The Company's application for recovery of revenues through the EPRM adjustment mechanism is submitted in conjunction with and as part of the accompanying Application, which seeks General Order No. 7 ("G.O.7") approval and Project authorization and approval.

(c) Costs Net of Benefits

Section III.C.3.c. of the EPRM Guidelines provides:

> Costs recovered through the EPRM adjustment mechanism shall be offset by all known and measurable operational net savings and benefits resulting from the Eligible Projects (including accumulated depreciation and accumulated Deferred income tax reserves, reductions in operating and maintenance expenses, related additional revenues, etc.), to the extent such savings or benefits are not passed on to ratepayers through energy cost or other adjustment clause mechanisms, and to the extent that such savings or benefits can reasonably be quantified. Net savings and benefits shall be offset as they are realized to the extent feasible. A business case study shall be submitted with each application identifying and quantifying all operational and financial impacts of the Eligible Project and illustrating the cost/benefit tradeoffs that justify proceeding with the project to the extent that such impacts can reasonably be determined.

The Benefits of implementing the Project are discussed in Exhibit C (*Project Justification and Business Case Support*). At this time, there are no quantifiable offsetting benefits, however as noted in Exhibit D (*Accounting and Ratemaking Treatment*), the Company will include all EV-U revenues, net of revenue taxes, from kWh sales resulting from the EV chargers installed under this project, in the determination of net costs to be recovered under EPRM.

(d) EPRM Eligibility

Section III.C.3.d. of the EPRM Guidelines provides:

> Application for Eligible Projects hereunder shall be made, pursuant to General Order No. 7 procedures, or other applicable authority or procedure. Applications shall explain each basis for claimed EPRM eligibility, indicating the linkage of the project to any previously submitted planning studies, previously submitted construction budgets and any relevant active Commission dockets. Applications shall also include the information set forth in the following paragraphs (e) through (i).

As discussed above, the Application has been filed pursuant to G.O. 7 procedures; in addition, also as discussed above, and in the Application, the Project supports recent

Commission decisions and planning initiatives, including the Company's Electrification of Transportation Strategic Roadmap in Docket No. 2018-0315, approved DER and DR programs, as well as the Company's on-going Integrated Grid Planning process. The Project is thus eligible for EPRM recovery for the reasons stated herein and, in the Application, and other Exhibits thereto.

(e) Project Business Case

Section III.C.3.e. of the EPRM Guidelines provides:

> A detailed business case study shall be included, covering all aspects of the planned investments and activities, indicating all expected costs, benefits, scheduling and all reasonably anticipated operational impacts. The business case shall reasonably document and quantify the cost/benefit characteristics of the investments and activities, indicating each criterion used to evaluate and justify the project, including consideration of expected risks and ratepayer impacts.
>
> The business case should also clearly outline how it will advance transformational efforts with appropriate quantifications, to the extent such quantifications can reasonably be determined.

The Company has provided the detailed business case in Exhibit C (*Project Justification with Business Case Support*). Additional discussion of the planned execution of investments for the Project is discussed in Exhibit A (Project Development).

(f) Project Schedule and Budget

Section III.C.3.f. of the EPRM Guidelines provides:

> A detailed schedule and budget for each element of the planned investment and activities shall be submitted, quantifying any contingencies, risks, and uncertainties, and indicating planned

> accounting and ratemaking procedures and expected net customer impacts.

Please refer to Exhibit C (*Project Justification with Business Case Support*), Exhibit D (*Accounting and Ratemaking Treatment*), and Exhibit G (*Revenue Requirements and Bill Impacts*) sections.

(g) Criteria for Used and Useful Status

Section III.C.3.g. of the EPRM Guidelines provides:

> Applications must state the specific criteria that are proposed for determination of used and useful status of the project, to ensure that no costs are Deferred or recovered for new assets that are merely commercially available but are not being used to provide service to ratepayers.

The Project will be deemed used and useful once EV charging stations are installed and commissioned as further discussed in Exhibit D (*Accounting and Ratemaking Treatment*).

(h) Costs Net of Savings

Section III.C.3.h. of the EPRM Guidelines provides:

> Recoverable costs shall be limited to the lesser of actual net incurred project/program costs or Commission-approved amounts, net of savings.

The Company acknowledges that costs recoverable through the EPRM Mechanism shall be limited to the lesser of the actual net incurred project/program costs or Commission-approved amounts, net of savings. Please see subsection A.4.c (Costs Net of Benefits) above, for a discussion of the anticipated costs, net of benefits.

B. EPRM RECOVERY

The Company is requesting recovery of the total costs of the Project, including Capital and O&M totaling $79 million during the Project's implementation phase through the EPRM. The EV chargers are planned to be placed into service at various points during the Project's

2023-2030 implementation period along with the associated O&M. The Companies request that all prudently incurred Project costs, which include on-going incremental O&M costs related to the repair and maintenance of the EV chargers past the 2030 implementation period (estimated at $1.57 million per year, not included in the $79 million Project estimate), be recovered through the EPRM to the extent that Project costs are not recovered in current rates.

According to the EPRM Guidelines, "Accrual of revenues recovered through the EPRM adjustment mechanism for an Eligible Project shall commence upon certification of the project's completion and/or in-service date in accordance with terms approved by the Commission at the time cost recovery through the EPRM adjustment mechanism is approved in the underlying proceeding for EPRM relief."[3]

The Company proposes that the capital and incremental O&M revenue requirements be recovered through the EPRM until new rates become effective that provide cost recovery for the Project or as otherwise provided by the Commission. In the actual EPRM filing, the revenue requirements will follow the EPRM guidelines approved at that time based on actual costs incurred and detailed classification of the costs in the depreciation and tax calculation.

The EV charging stations will be installed and commissioned throughout the year. Associated incremental O&M costs, net of all known quantifiable benefits, will also be incurred pre- and post-installation.

To the extent that the Project costs are not recovered in current rates, to reduce the administrative burden, the Companies plan to simplify the EPRM filing to once a year and will request recovery of actual capital and incremental O&M incurred during the prior year, net of EV-U revenues (less revenue taxes) during the prior year from the Project chargers, to be

[3] D&O 37507, Appendix A at 12.

included in and align with the annual MPIR/EPRM revenue adjustment filing in February which will be subject to Commission review as a part of the Spring Revenue Report filed in March of the subsequent year.

Recovery through the EPRM would cease when new rates become effective that provide recovery for the Project costs of depreciation, return on investment, and operations and maintenance, or as otherwise provided by the Commission. At such time, the Company proposes that EV-U revenues (net of revenue taxes) for the Project chargers commence to be included in the calculation of recorded adjusted revenues that are compared with target revenues in the calculation of the Decoupling Mechanism Revenue Balancing Account ("RBA") Adjustment. In doing so, all customers will benefit from any kWh sales under the EV-U rates for the Project chargers.

Exhibit F

Public Electric Vehicle Charger Expansion Project Application

Estimated Project Costs

The total estimated cost of the Project is approximately $79 million to install and operate 150 single-port Direct Current fast charging ("DCFC") and 150 dual-port Level 2 charging stations across the Company service territories from 2023 through 2030. The Project cost includes maintenance of the charging stations and public education and outreach. Although the preferred configuration for each site is two (2) DCFC ports and one (1) dual-port Level 2 charging station, for simplicity, and to account for the uncertainty in the actual costs per site, the Project cost estimate assumed that each site consisted of two DCFC ports and two dual-port Level 2 charging stations. As explained in the Application and Exhibit A (*Project Development*), the 75 Level 2 chargers represent a potential contingency in the budget, allowing for either a) deployment of additional charging infrastructure, b) increased O&M expenses, or c) any unforeseen costs that may arise as a result of scaling and/or needed expenditures to improve customer satisfaction or ease of use.

The costs for the Project, as the EV charging stations are placed into service, are broken down by utility and accounting treatment, as shown in Table 1, based on targeted annual number of sites[1] for a total of 75 sites. The Company respectfully notes that the Project will require flexibility to address actual implementation conditions and program uptake across service territories. Such flexibility may require reallocation of budgeted amounts between the three service territories, between the years, and between capital and O&M, while remaining within the $79 million total cost. For example, during a given year there may be more interested parties on an island than initially budgeted in Table 1, or particular sites may be better suited to a smaller or larger configuration. This flexibility will further allow the Company to execute in accordance with the Project schedule.

[1] Application Table 3.

Table 1 – Project Cost Estimate

Estimated Budget (Millions)	Hawaiian Electric	Hawai'i Electric Light	Maui Electric	Total
Outside Services – Engineering (site assessment, design, permits, project management)	$8.06	$2.75	$2.92	$13.73
Outside Services – Construction Services	$16.13	$5.48	$5.81	$27.42
Materials	$8.94	$3.04	$3.22	$15.20
AFUDC	$0.72	$0.24	$0.26	$1.22
Total Capital	**$33.85**	**$11.51**	**$12.21**	**$57.57**
O&M (non-capital labor, maintenance/repair)	$9.90	$3.46	$3.71	$17.07
O&M - Education and Outreach	$1.33	$1.33	$1.33	$3.99
Total O&M	**$11.23**	**$4.79**	**$5.04**	**$21.06**
TOTAL	**$45.08**	**$16.30**	**$17.25**	**$78.63**

As the Project is deployed, the Company will incur new, incremental, ongoing O&M expenses broadly covering two categories: (1) maintenance and repair of the charging stations, and (2) education and outreach. Lessons learned from the Pilot illustrates the need for more resources dedicated to these efforts as discussed in Exhibit A (*Project Development*). The major O&M expense items include customer outreach, site evaluations, materials and equipment, vendor support, outside services, data collection, and web-based tools.

The annual Project costs for 2023-2030 are shown by utility in Tables 2-4 below.

Table 2 – Annual Estimated Budget for Hawaiian Electric

Hawaiian Electric Estimated Costs (Millions)	Total Capital	O&M Non-Capital Labor	O&M Education and Outreach	O&M Maintenance & Repair	Total O&M
2023	$1.37	$0.54	$0.17	$0.03	$0.74
2024	$4.24	$0.78	$0.17	$0.14	$1.09
2025	$4.36	$0.79	$0.17	$0.25	$1.21
2026	$4.50	$0.80	$0.17	$0.37	$1.34
2027	$4.63	$0.82	$0.17	$0.50	$1.49
2028	$4.77	$0.83	$0.17	$0.63	$1.63
2029	$4.91	$0.85	$0.17	$0.77	$1.79
2030	$5.06	$0.86	$0.17	$0.92	$1.94
Total	**$33.85**	**$6.28**	**$1.33**	**$3.62**	**$11.23**

Table 3 - Annual Estimated Budget for Hawai'i Electric Light

Hawai'i Electric Light Estimated Costs (Millions)	Total Capital	O&M Non-Capital Labor	O&M Education and Outreach	O&M Maintenance & Repair	Total O&M
2023	$0.68	$0.14	$0.17	$0.02	$0.32
2024	$1.41	$0.28	$0.17	$0.05	$0.50
2025	$1.46	$0.28	$0.17	$0.09	$0.54
2026	$1.50	$0.29	$0.17	$0.13	$0.59
2027	$1.55	$0.30	$0.17	$0.17	$0.63
2028	$1.59	$0.30	$0.17	$0.22	$0.68
2029	$1.64	$0.30	$0.17	$0.26	$0.73
2030	$1.69	$0.31	$0.17	$0.31	$0.79
Total	**$11.51**	**$2.20**	**$1.33**	**$1.26**	**$4.79**

Table 4 - Annual Estimated Budget for Maui Electric

Maui Electric Estimated Costs (Millions)	Total Capital	O&M Non-Capital Labor	O&M Education and Outreach	O&M Maintenance & Repair	Total O&M
2023	$1.37	$0.22	$0.17	$0.03	$0.42
2024	$1.41	$0.28	$0.17	$0.07	$0.51
2025	$1.46	$0.29	$0.17	$0.11	$0.56
2026	$1.50	$0.30	$0.17	$0.15	$0.61
2027	$1.55	$0.30	$0.17	$0.19	$0.66
2028	$1.59	$0.30	$0.17	$0.24	$0.71
2029	$1.64	$0.30	$0.17	$0.28	$0.75
2030	$1.69	$0.31	$0.17	$0.34	$0.81
Total	**$12.21**	**$2.30**	**$1.33**	**$1.41**	**$5.04**

The estimated annual maintenance and repair costs is shown in

Table **5** below. The Company is requesting to recover these expenses (estimated to be approximately $1.57 million annually after 2030) through the EPRM Mechanism until such costs are reflected in base rates established in the Companies' respective rate cases, as described in Exhibit D (*Accounting and Ratemaking Treatment*).

Table 5 – Annual Estimated Maintenance & Repair Costs

Estimated Maintenance & Repair Costs (Millions)	**Hawaiian Electric**	**Hawai'i Electric Light**	**Maui Electric**	**Total**
2023	$0.03	$0.02	$0.03	$0.09
2024	$0.14	$0.05	$0.07	$0.26
2025	$0.25	$0.09	$0.11	$0.45
2026	$0.37	$0.13	$0.15	$0.65
2027	$0.50	$0.17	$0.19	$0.86
2028	$0.63	$0.22	$0.24	$1.09
2029	$0.77	$0.26	$0.28	$1.32
2030	$0.92	$0.31	$0.34	$1.57
Total	**$3.62**	**$1.26**	**$1.41**	**$6.29**

Exhibit G

Public Electric Vehicle Charger Expansion Application

Revenue Requirements and Bill Impacts

REVENUE REQUIREMENTS AND BILL IMPACTS

The Hawaiian Electric Companies[1] performed a high level, economic analysis to forecast revenue requirements and bill impacts for the Public Electric Vehicle Charger Expansion Project ("Project"). This high-level forecast uses broad or simplified assumptions for the purpose of estimating revenue requirements over the life of the investment and a typical monthly residential bill impact. Actual results may differ based on the application of specific rules and on the actual costs incurred.[2]

The Project forecast analysis assumed a typical residential customer uses 500kWh per month. Bill impacts reflect a 22 year period (2024-2045) to capture the 15 year life of the EV charging stations that are installed in 2030 and the recurring maintenance and repairs expenses of the charging stations. The forecasted bill impact excludes costs for the complete replacement of the EV charging station if it should fail before the assumed 15 year life. Beyond the Project implementation timeframe (2030), the Companies will need to continue to invest in supporting EV adoption. At this time the scope and scale of this future effort are not known. Technology is evolving at a rapid pace. As a result, the Companies will need to assess the needs of the customers and the appropriate technology that is available. Replacements will be included in future filings or rate cases.

[1] Hawaiian Electric, Hawai'i Electric Light and Maui Electric are collectively referred to as the "Hawaiian Electric Companies" or the "Companies."
[2] The Excel file providing the supporting calculations for this exhibit will be emailed to the Commission's puc.supportingdocketfiles@hawaii.gov and the Consumer Advocate.

Table 1 – Consolidated EV Charging Stations without Incremental Revenues Revenue

	Year	Hawaiian Electric	Hawaii Electric Light	Maui Electric	Consolidated
1	2023	-	-	-	**-**
2	2024	1.03	0.46	0.68	**2.17**
3	2025	2.09	0.89	1.00	**3.98**
4	2026	2.89	1.15	1.27	**5.31**
5	2027	3.67	1.42	1.53	**6.62**
6	2028	4.46	1.68	1.79	**7.93**
7	2029	5.24	1.94	2.04	**9.22**
8	2030	6.03	2.20	2.30	**10.53**
9	2031	6.82	2.47	2.56	**11.85**
10	2032	5.45	1.86	1.95	**9.26**
11	2033	5.24	1.79	1.88	**8.91**
12	2034	5.05	1.72	1.82	**8.59**
13	2035	4.88	1.67	1.75	**8.30**
14	2036	4.72	1.61	1.69	**8.02**
15	2037	4.58	1.56	1.64	**7.78**
16	2038	4.34	1.46	1.49	**7.29**
17	2039	3.85	1.28	1.29	**6.42**
18	2040	3.25	1.09	1.09	**5.43**
19	2041	2.66	0.89	0.90	**4.45**
20	2042	2.05	0.69	0.69	**3.43**
21	2043	1.44	0.48	0.48	**2.40**
22	2044	0.83	0.28	0.28	**1.39**
23	2045	0.22	0.07	0.07	**0.36**
	Total	80.79	28.66	30.19	**139.64**
	NPV	39.82	14.25	15.28	**69.35**

Table 2 – Hawaiian Electric EV Charging Stations without Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Capital Revenue Requirement	O&M - Labor Revenue Requirement	Maintenance Revenue Requirement	Edu. & Revenue Requirement	**Total Revenue Requirement**	Sales Forecast (MWh)[1]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[2]**
1	2023	-	-	-	-	**-**	6,366,292	0.0000	$ **-**
2	2024	0.22	0.59	0.04	0.18	**1.03**	6,441,818	0.0160	$ **0.08**
3	2025	0.90	0.86	0.15	0.18	**2.09**	6,520,703	0.0321	$ **0.16**
4	2026	1.56	0.87	0.28	0.18	**2.89**	6,599,300	0.0438	$ **0.22**
5	2027	2.19	0.88	0.42	0.18	**3.67**	6,611,700	0.0555	$ **0.28**
6	2028	2.82	0.90	0.56	0.18	**4.46**	6,645,400	0.0671	$ **0.34**
7	2029	3.43	0.91	0.72	0.18	**5.24**	6,681,300	0.0784	$ **0.39**
8	2030	4.03	0.93	0.89	0.18	**6.03**	6,753,400	0.0893	$ **0.45**
9	2031	4.63	0.94	1.07	0.18	**6.82**	6,787,600	0.1005	$ **0.50**
10	2032	4.36	-	1.09	-	**5.45**	6,823,700	0.0799	$ **0.40**
11	2033	4.12	-	1.12	-	**5.24**	6,878,700	0.0762	$ **0.38**
12	2034	3.91	-	1.14	-	**5.05**	6,922,700	0.0729	$ **0.36**
13	2035	3.72	-	1.16	-	**4.88**	6,977,200	0.0699	$ **0.35**
14	2036	3.54	-	1.18	-	**4.72**	7,058,300	0.0669	$ **0.33**
15	2037	3.37	-	1.21	-	**4.58**	7,111,800	0.0644	$ **0.32**
16	2038	3.11	-	1.23	-	**4.34**	7,185,800	0.0604	$ **0.30**
17	2039	2.64	-	1.21	-	**3.85**	7,285,800	0.0528	$ **0.26**
18	2040	2.18	-	1.07	-	**3.25**	7,431,700	0.0437	$ **0.22**
19	2041	1.73	-	0.93	-	**2.66**	7,512,000	0.0354	$ **0.18**
20	2042	1.28	-	0.77	-	**2.05**	7,637,300	0.0268	$ **0.13**
21	2043	0.84	-	0.60	-	**1.44**	7,776,400	0.0185	$ **0.09**
22	2044	0.41	-	0.42	-	**0.83**	7,945,400	0.0104	$ **0.05**
23	2045	-	-	0.22	-	**0.22**	8,079,300	0.0027	$ **0.01**
Total		54.99	6.88	17.48	1.44	**80.79**		*Average*	$ **0.26**
NPV @	6.88%	26.54	4.76	7.52	1.01	**39.82**			

Notes:
1. Estimated Hawaiian Electric Sales in MWH.
2. Hawaiian Electric typical residential energy consumption, per month.

Table 3 – Hawai'i Electric Light EV Charging Stations without Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Capital Revenue Requirement	O&M - Labor Revenue Requirement	Maintenance Revenue Requirement	Edu. & Revenue Requirement	**Total Revenue Requirement**	Sales Forecast (MWh)[1]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[2]**
1	2023	-	-	-	-	**-**	989,103	0.0000	**$ -**
2	2024	0.11	0.15	0.02	0.18	**0.46**	992,000	0.0464	**$ 0.23**
3	2025	0.34	0.31	0.06	0.18	**0.89**	990,370	0.0899	**$ 0.45**
4	2026	0.56	0.31	0.10	0.18	**1.15**	984,705	0.1168	**$ 0.58**
5	2027	0.77	0.32	0.15	0.18	**1.42**	979,927	0.1449	**$ 0.72**
6	2028	0.98	0.32	0.20	0.18	**1.68**	982,973	0.1709	**$ 0.85**
7	2029	1.18	0.33	0.25	0.18	**1.94**	978,219	0.1983	**$ 0.99**
8	2030	1.38	0.33	0.31	0.18	**2.20**	977,491	0.2251	**$ 1.13**
9	2031	1.58	0.34	0.37	0.18	**2.47**	977,693	0.2526	**$ 1.26**
10	2032	1.49	-	0.37	-	**1.86**	980,258	0.1897	**$ 0.95**
11	2033	1.41	-	0.38	-	**1.79**	978,330	0.1830	**$ 0.91**
12	2034	1.33	-	0.39	-	**1.72**	981,199	0.1753	**$ 0.88**
13	2035	1.27	-	0.40	-	**1.67**	988,996	0.1689	**$ 0.84**
14	2036	1.21	-	0.40	-	**1.61**	999,038	0.1612	**$ 0.81**
15	2037	1.15	-	0.41	-	**1.56**	1,005,152	0.1552	**$ 0.78**
16	2038	1.04	-	0.42	-	**1.46**	1,013,498	0.1441	**$ 0.72**
17	2039	0.88	-	0.40	-	**1.28**	1,023,641	0.1250	**$ 0.63**
18	2040	0.73	-	0.36	-	**1.09**	1,038,353	0.1050	**$ 0.52**
19	2041	0.58	-	0.31	-	**0.89**	1,047,686	0.0849	**$ 0.42**
20	2042	0.43	-	0.26	-	**0.69**	1,063,080	0.0649	**$ 0.32**
21	2043	0.28	-	0.20	-	**0.48**	1,081,157	0.0444	**$ 0.22**
22	2044	0.14	-	0.14	-	**0.28**	1,101,904	0.0254	**$ 0.13**
23	2045	-	-	0.07	-	**0.07**	1,120,098	0.0062	**$ 0.03**
Total		18.84	2.41	5.97	1.44	**28.66**		*Average*	**$ 0.65**
NPV @	7.00%	9.05	1.64	2.55	1.00	**14.25**			

Notes:
1. Estimated Hawaii Electric Light Sales in MWH.
2. Hawaii Electric Light typical residential energy consumption, per month.

Table 4 – Maui Electric EV Charging Stations without Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Capital Revenue Requirement	O&M - Labor Revenue Requirement	Maintenance Revenue Requirement	Edu. & Revenue Requirement	**Total Revenue Requirement**	Sales Forecast (MWh)[1]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[2]**
1	2023	-	-	-	-	**-**	991,318	0.0000	$ **-**
2	2024	0.22	0.24	0.04	0.18	**0.68**	998,297	0.0681	$ **0.34**
3	2025	0.44	0.30	0.08	0.18	**1.00**	1,002,118	0.0998	$ **0.50**
4	2026	0.65	0.32	0.12	0.18	**1.27**	1,010,939	0.1256	$ **0.63**
5	2027	0.86	0.32	0.17	0.18	**1.53**	1,020,115	0.1500	$ **0.75**
6	2028	1.06	0.33	0.22	0.18	**1.79**	1,028,293	0.1741	$ **0.87**
7	2029	1.26	0.33	0.27	0.18	**2.04**	1,031,130	0.1978	$ **0.99**
8	2030	1.46	0.33	0.33	0.18	**2.30**	1,038,344	0.2215	$ **1.11**
9	2031	1.65	0.34	0.39	0.18	**2.56**	1,047,022	0.2445	$ **1.22**
10	2032	1.55	-	0.40	-	**1.95**	1,062,522	0.1835	$ **0.92**
11	2033	1.47	-	0.41	-	**1.88**	1,079,158	0.1742	$ **0.87**
12	2034	1.40	-	0.42	-	**1.82**	1,097,114	0.1659	$ **0.83**
13	2035	1.33	-	0.42	-	**1.75**	1,116,863	0.1567	$ **0.78**
14	2036	1.26	-	0.43	-	**1.69**	1,141,138	0.1481	$ **0.74**
15	2037	1.20	-	0.44	-	**1.64**	1,159,595	0.1414	$ **0.71**
16	2038	1.04	-	0.45	-	**1.49**	1,183,049	0.1259	$ **0.63**
17	2039	0.88	-	0.41	-	**1.29**	1,206,540	0.1069	$ **0.53**
18	2040	0.73	-	0.36	-	**1.09**	1,233,460	0.0884	$ **0.44**
19	2041	0.58	-	0.32	-	**0.90**	1,252,621	0.0718	$ **0.36**
20	2042	0.43	-	0.26	-	**0.69**	1,276,873	0.0540	$ **0.27**
21	2043	0.28	-	0.20	-	**0.48**	1,301,261	0.0369	$ **0.18**
22	2044	0.14	-	0.14	-	**0.28**	1,326,542	0.0211	$ **0.11**
23	2045	-	-	0.07	-	**0.07**	1,346,119	0.0052	$ **0.03**
Total		19.89	2.51	6.35	1.44	**30.19**		*Average*	$ **0.63**
NPV @	6.94%	9.76	1.73	2.78	1.01	**15.28**			

Notes:
1. Estimated Maui Electric Sales in MWH.
2. Maui Electric typical residential energy consumption, per month.

Table 5 – Consolidated EV Charging Stations with "Base Unmanaged" Incremental Revenues Revenue Requirement ($ in millions)

	Year	Hawaiian Electric	Hawaii Electric Light	Maui Electric	Consolidated
1	2023	-	-	-	**-**
2	2024	0.98	0.43	0.60	**2.01**
3	2025	1.85	0.76	0.85	**3.46**
4	2026	2.45	0.93	1.03	**4.41**
5	2027	3.04	1.10	1.22	**5.36**
6	2028	3.62	1.27	1.38	**6.27**
7	2029	4.19	1.43	1.55	**7.17**
8	2030	4.76	1.58	1.70	**8.04**
9	2031	5.31	1.75	1.88	**8.94**
10	2032	3.92	1.12	1.25	**6.29**
11	2033	3.68	1.04	1.17	**5.89**
12	2034	3.46	0.96	1.08	**5.50**
13	2035	3.27	0.89	1.01	**5.17**
14	2036	3.08	0.83	0.95	**4.86**
15	2037	2.92	0.76	0.88	**4.56**
16	2038	2.65	0.65	0.72	**4.02**
17	2039	2.20	0.52	0.60	**3.32**
18	2040	1.82	0.42	0.49	**2.73**
19	2041	1.45	0.32	(0.06)	**1.71**
20	2042	1.07	0.22	(0.08)	**1.21**
21	2043	0.69	0.13	(0.11)	**0.71**
22	2044	0.32	0.04	(0.12)	**0.24**
23	2045	(0.04)	(0.05)	(0.13)	**(0.22)**
	Total	56.69	17.10	17.86	**91.65**
	NPV	29.30	9.24	10.06	**48.60**

Table 6 – Hawaiian Electric EV Charging Stations with "Base Unmanaged" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	6,366,292	0.0000	**$ -**
2	2024	1.04	(0.06)	**0.98**	6,441,818	0.0152	**$ 0.08**
3	2025	2.10	(0.25)	**1.85**	6,520,703	0.0284	**$ 0.14**
4	2026	2.89	(0.44)	**2.45**	6,599,300	0.0371	**$ 0.19**
5	2027	3.68	(0.64)	**3.04**	6,611,700	0.0460	**$ 0.23**
6	2028	4.47	(0.85)	**3.62**	6,645,400	0.0545	**$ 0.27**
7	2029	5.25	(1.06)	**4.19**	6,681,300	0.0627	**$ 0.31**
8	2030	6.04	(1.28)	**4.76**	6,753,400	0.0705	**$ 0.35**
9	2031	6.82	(1.51)	**5.31**	6,787,600	0.0782	**$ 0.39**
10	2032	5.46	(1.54)	**3.92**	6,823,700	0.0574	**$ 0.29**
11	2033	5.24	(1.56)	**3.68**	6,878,700	0.0535	**$ 0.27**
12	2034	5.05	(1.59)	**3.46**	6,922,700	0.0500	**$ 0.25**
13	2035	4.88	(1.61)	**3.27**	6,977,200	0.0469	**$ 0.23**
14	2036	4.72	(1.64)	**3.08**	7,058,300	0.0436	**$ 0.22**
15	2037	4.58	(1.66)	**2.92**	7,111,800	0.0411	**$ 0.21**
16	2038	4.34	(1.69)	**2.65**	7,185,800	0.0369	**$ 0.18**
17	2039	3.84	(1.64)	**2.20**	7,285,800	0.0302	**$ 0.15**
18	2040	3.25	(1.43)	**1.82**	7,431,700	0.0245	**$ 0.12**
19	2041	2.66	(1.21)	**1.45**	7,512,000	0.0193	**$ 0.10**
20	2042	2.05	(0.98)	**1.07**	7,637,300	0.0140	**$ 0.07**
21	2043	1.44	(0.75)	**0.69**	7,776,400	0.0089	**$ 0.04**
22	2044	0.83	(0.51)	**0.32**	7,945,400	0.0040	**$ 0.02**
23	2045	0.22	(0.26)	**(0.04)**	8,079,300	-0.0005	**$ (0.00)**
Total		80.85	(24.16)	**56.69**		*Average*	**$ 0.19**
NPV @	6.88%	39.86	(10.56)	**29.30**			

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaiian Electric Sales in MWH.
3. Hawaiian Electric typical residential energy consumption, per month

Table 7 – Hawai'i Electric Light EV Charging Stations with "Base Unmanaged" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	989,103	0.0000	**$**	**-**
2	2024	0.47	(0.04)	**0.43**	992,000	0.0433	**$**	**0.22**
3	2025	0.89	(0.13)	**0.76**	990,370	0.0767	**$**	**0.38**
4	2026	1.15	(0.22)	**0.93**	984,705	0.0944	**$**	**0.47**
5	2027	1.42	(0.32)	**1.10**	979,927	0.1123	**$**	**0.56**
6	2028	1.68	(0.41)	**1.27**	982,973	0.1292	**$**	**0.65**
7	2029	1.94	(0.51)	**1.43**	978,219	0.1462	**$**	**0.73**
8	2030	2.20	(0.62)	**1.58**	977,491	0.1616	**$**	**0.81**
9	2031	2.47	(0.72)	**1.75**	977,693	0.1790	**$**	**0.89**
10	2032	1.86	(0.74)	**1.12**	980,258	0.1143	**$**	**0.57**
11	2033	1.79	(0.75)	**1.04**	978,330	0.1063	**$**	**0.53**
12	2034	1.72	(0.76)	**0.96**	981,199	0.0978	**$**	**0.49**
13	2035	1.66	(0.77)	**0.89**	988,996	0.0900	**$**	**0.45**
14	2036	1.61	(0.78)	**0.83**	999,038	0.0831	**$**	**0.42**
15	2037	1.56	(0.80)	**0.76**	1,005,152	0.0756	**$**	**0.38**
16	2038	1.46	(0.81)	**0.65**	1,013,498	0.0641	**$**	**0.32**
17	2039	1.29	(0.77)	**0.52**	1,023,641	0.0508	**$**	**0.25**
18	2040	1.09	(0.67)	**0.42**	1,038,353	0.0404	**$**	**0.20**
19	2041	0.89	(0.57)	**0.32**	1,047,686	0.0305	**$**	**0.15**
20	2042	0.68	(0.46)	**0.22**	1,063,080	0.0207	**$**	**0.10**
21	2043	0.48	(0.35)	**0.13**	1,081,157	0.0120	**$**	**0.06**
22	2044	0.28	(0.24)	**0.04**	1,101,904	0.0036	**$**	**0.02**
23	2045	0.07	(0.12)	**(0.05)**	1,120,098	-0.0045	**$**	**(0.02)**
Total		28.66	(11.56)	**17.10**		*Average*	**$**	**0.39**
NPV @	7.00%	14.26	(5.02)	**9.24**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaii Electric Light Sales in MWH.
3. Hawaii Electric Light typical residential energy consumption, per month

Table 8 – Maui Electric EV Charging Stations with "Base Unmanaged" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	991,318	0.0000	**$ -**
2	2024	0.68	(0.08)	**0.60**	998,297	0.0601	**$ 0.30**
3	2025	1.01	(0.16)	**0.85**	1,002,118	0.0848	**$ 0.42**
4	2026	1.27	(0.24)	**1.03**	1,010,939	0.1019	**$ 0.51**
5	2027	1.54	(0.32)	**1.22**	1,020,115	0.1196	**$ 0.60**
6	2028	1.79	(0.41)	**1.38**	1,028,293	0.1342	**$ 0.67**
7	2029	2.05	(0.50)	**1.55**	1,031,130	0.1503	**$ 0.75**
8	2030	2.30	(0.60)	**1.70**	1,038,344	0.1637	**$ 0.82**
9	2031	2.57	(0.69)	**1.88**	1,047,022	0.1796	**$ 0.90**
10	2032	1.95	(0.70)	**1.25**	1,062,522	0.1176	**$ 0.59**
11	2033	1.88	(0.71)	**1.17**	1,079,158	0.1084	**$ 0.54**
12	2034	1.81	(0.73)	**1.08**	1,097,114	0.0984	**$ 0.49**
13	2035	1.75	(0.74)	**1.01**	1,116,863	0.0904	**$ 0.45**
14	2036	1.70	(0.75)	**0.95**	1,141,138	0.0833	**$ 0.42**
15	2037	1.64	(0.76)	**0.88**	1,159,595	0.0759	**$ 0.38**
16	2038	1.49	(0.77)	**0.72**	1,183,049	0.0609	**$ 0.30**
17	2039	1.29	(0.69)	**0.60**	1,206,540	0.0497	**$ 0.25**
18	2040	1.09	(0.60)	**0.49**	1,233,460	0.0397	**$ 0.20**
19	2041	0.89	(0.95)	**(0.06)**	1,252,621	-0.0048	**$ (0.02)**
20	2042	0.69	(0.77)	**(0.08)**	1,276,873	-0.0063	**$ (0.03)**
21	2043	0.48	(0.59)	**(0.11)**	1,301,261	-0.0085	**$ (0.04)**
22	2044	0.28	(0.40)	**(0.12)**	1,326,542	-0.0090	**$ (0.05)**
23	2045	0.07	(0.20)	**(0.13)**	1,346,119	-0.0097	**$ (0.05)**
Total		30.22	(12.36)	**17.86**		*Average*	**$ 0.38**
NPV @	6.94%	15.30	(5.24)	**10.06**			

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Maui Electric Sales in MWH.
3. MauiElectric typical residential energy consumption, per month

Table 9 – Consolidated EV Charging Stations with "Base Managed" Incremental Revenues Revenue Requirement ($ in millions)

	Year	Hawaiian Electric	Hawaii Electric Light	Maui Electric	Consolidated
1	2023	-	-	-	**-**
2	2024	0.98	0.43	0.60	**2.01**
3	2025	1.85	0.76	0.85	**3.46**
4	2026	2.45	0.93	1.03	**4.41**
5	2027	3.04	1.11	1.22	**5.37**
6	2028	3.63	1.27	1.38	**6.28**
7	2029	4.19	1.43	1.55	**7.17**
8	2030	4.77	1.59	1.71	**8.07**
9	2031	5.32	1.75	1.88	**8.95**
10	2032	3.94	1.13	1.25	**6.32**
11	2033	3.69	1.05	1.17	**5.91**
12	2034	3.48	0.97	1.09	**5.54**
13	2035	3.28	0.89	1.02	**5.19**
14	2036	3.10	0.83	0.96	**4.89**
15	2037	2.93	0.77	0.88	**4.58**
16	2038	2.66	0.66	0.72	**4.04**
17	2039	2.21	0.53	0.61	**3.35**
18	2040	1.83	0.43	0.50	**2.76**
19	2041	1.46	0.33	(0.06)	**1.73**
20	2042	1.07	0.22	(0.08)	**1.21**
21	2043	0.70	0.13	(0.11)	**0.72**
22	2044	0.33	0.04	(0.12)	**0.25**
23	2045	(0.04)	(0.05)	(0.13)	**(0.22)**
	Total	56.87	17.20	17.92	**91.99**
	NPV	29.38	9.28	10.08	**48.74**

Table 10 – Hawaiian Electric EV Charging Stations with "Base Managed" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	6,366,292	0.0000	**$ -**
2	2024	1.04	(0.06)	**0.98**	6,441,818	0.0152	**$ 0.08**
3	2025	2.10	(0.25)	**1.85**	6,520,703	0.0284	**$ 0.14**
4	2026	2.89	(0.44)	**2.45**	6,599,300	0.0371	**$ 0.19**
5	2027	3.68	(0.64)	**3.04**	6,611,700	0.0460	**$ 0.23**
6	2028	4.47	(0.84)	**3.63**	6,645,400	0.0546	**$ 0.27**
7	2029	5.25	(1.06)	**4.19**	6,681,300	0.0627	**$ 0.31**
8	2030	6.04	(1.27)	**4.77**	6,753,400	0.0706	**$ 0.35**
9	2031	6.82	(1.50)	**5.32**	6,787,600	0.0784	**$ 0.39**
10	2032	5.46	(1.52)	**3.94**	6,823,700	0.0577	**$ 0.29**
11	2033	5.24	(1.55)	**3.69**	6,878,700	0.0536	**$ 0.27**
12	2034	5.05	(1.57)	**3.48**	6,922,700	0.0503	**$ 0.25**
13	2035	4.88	(1.60)	**3.28**	6,977,200	0.0470	**$ 0.24**
14	2036	4.72	(1.62)	**3.10**	7,058,300	0.0439	**$ 0.22**
15	2037	4.58	(1.65)	**2.93**	7,111,800	0.0412	**$ 0.21**
16	2038	4.34	(1.68)	**2.66**	7,185,800	0.0370	**$ 0.19**
17	2039	3.84	(1.63)	**2.21**	7,285,800	0.0303	**$ 0.15**
18	2040	3.25	(1.42)	**1.83**	7,431,700	0.0246	**$ 0.12**
19	2041	2.66	(1.20)	**1.46**	7,512,000	0.0194	**$ 0.10**
20	2042	2.05	(0.98)	**1.07**	7,637,300	0.0140	**$ 0.07**
21	2043	1.44	(0.74)	**0.70**	7,776,400	0.0090	**$ 0.05**
22	2044	0.83	(0.50)	**0.33**	7,945,400	0.0042	**$ 0.02**
23	2045	0.22	(0.26)	**(0.04)**	8,079,300	-0.0005	**$ (0.00)**
Total		80.85	(23.98)	**56.87**		*Average*	**$ 0.19**
NPV @	6.88%	39.86	(10.49)	**29.38**			

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaiian Electric Sales in MWH.
3. Hawaiian Electric typical residential energy consumption, per month

Table 11 – Hawai'i Electric EV Charging Stations with "Base Managed" Incremental Revenues Light Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	989,103	0.0000	**$**	**-**
2	2024	0.47	(0.04)	**0.43**	992,000	0.0433	**$**	**0.22**
3	2025	0.89	(0.13)	**0.76**	990,370	0.0767	**$**	**0.38**
4	2026	1.15	(0.22)	**0.93**	984,705	0.0944	**$**	**0.47**
5	2027	1.42	(0.31)	**1.11**	979,927	0.1133	**$**	**0.57**
6	2028	1.68	(0.41)	**1.27**	982,973	0.1292	**$**	**0.65**
7	2029	1.94	(0.51)	**1.43**	978,219	0.1462	**$**	**0.73**
8	2030	2.20	(0.61)	**1.59**	977,491	0.1627	**$**	**0.81**
9	2031	2.47	(0.72)	**1.75**	977,693	0.1790	**$**	**0.89**
10	2032	1.86	(0.73)	**1.13**	980,258	0.1153	**$**	**0.58**
11	2033	1.79	(0.74)	**1.05**	978,330	0.1073	**$**	**0.54**
12	2034	1.72	(0.75)	**0.97**	981,199	0.0989	**$**	**0.49**
13	2035	1.66	(0.77)	**0.89**	988,996	0.0900	**$**	**0.45**
14	2036	1.61	(0.78)	**0.83**	999,038	0.0831	**$**	**0.42**
15	2037	1.56	(0.79)	**0.77**	1,005,152	0.0766	**$**	**0.38**
16	2038	1.46	(0.80)	**0.66**	1,013,498	0.0651	**$**	**0.33**
17	2039	1.29	(0.76)	**0.53**	1,023,641	0.0518	**$**	**0.26**
18	2040	1.09	(0.66)	**0.43**	1,038,353	0.0414	**$**	**0.21**
19	2041	0.89	(0.56)	**0.33**	1,047,686	0.0315	**$**	**0.16**
20	2042	0.68	(0.46)	**0.22**	1,063,080	0.0207	**$**	**0.10**
21	2043	0.48	(0.35)	**0.13**	1,081,157	0.0120	**$**	**0.06**
22	2044	0.28	(0.24)	**0.04**	1,101,904	0.0036	**$**	**0.02**
23	2045	0.07	(0.12)	**(0.05)**	1,120,098	-0.0045	**$**	**(0.02)**
Total		28.66	(11.46)	**17.20**		*Average*	**$**	**0.39**
NPV @	7.00%	14.26	(4.98)	**9.28**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaii Electric Light Sales in MWH.
3. Hawaii Electric Light typical residential energy consumption, per month

Table 12 – Maui Electric EV Charging Stations with "Base Managed" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	991,318	0.0000	**$ -**
2	2024	0.68	(0.08)	**0.60**	998,297	0.0601	**$ 0.30**
3	2025	1.01	(0.16)	**0.85**	1,002,118	0.0848	**$ 0.42**
4	2026	1.27	(0.24)	**1.03**	1,010,939	0.1019	**$ 0.51**
5	2027	1.54	(0.32)	**1.22**	1,020,115	0.1196	**$ 0.60**
6	2028	1.79	(0.41)	**1.38**	1,028,293	0.1342	**$ 0.67**
7	2029	2.05	(0.50)	**1.55**	1,031,130	0.1503	**$ 0.75**
8	2030	2.30	(0.59)	**1.71**	1,038,344	0.1647	**$ 0.82**
9	2031	2.57	(0.69)	**1.88**	1,047,022	0.1796	**$ 0.90**
10	2032	1.95	(0.70)	**1.25**	1,062,522	0.1176	**$ 0.59**
11	2033	1.88	(0.71)	**1.17**	1,079,158	0.1084	**$ 0.54**
12	2034	1.81	(0.72)	**1.09**	1,097,114	0.0994	**$ 0.50**
13	2035	1.75	(0.73)	**1.02**	1,116,863	0.0913	**$ 0.46**
14	2036	1.70	(0.74)	**0.96**	1,141,138	0.0841	**$ 0.42**
15	2037	1.64	(0.76)	**0.88**	1,159,595	0.0759	**$ 0.38**
16	2038	1.49	(0.77)	**0.72**	1,183,049	0.0609	**$ 0.30**
17	2039	1.29	(0.68)	**0.61**	1,206,540	0.0506	**$ 0.25**
18	2040	1.09	(0.59)	**0.50**	1,233,460	0.0405	**$ 0.20**
19	2041	0.89	(0.95)	**(0.06)**	1,252,621	-0.0048	**$ (0.02)**
20	2042	0.69	(0.77)	**(0.08)**	1,276,873	-0.0063	**$ (0.03)**
21	2043	0.48	(0.59)	**(0.11)**	1,301,261	-0.0085	**$ (0.04)**
22	2044	0.28	(0.40)	**(0.12)**	1,326,542	-0.0090	**$ (0.05)**
23	2045	0.07	(0.20)	**(0.13)**	1,346,119	-0.0097	**$ (0.05)**
Total		30.22	(12.30)	**17.92**		*Average*	**$ 0.38**
NPV @	6.94%	15.30	(5.22)	**10.08**			

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Maui Electric Sales in MWH.
3. MauiElectric typical residential energy consumption, per month

Table 13 – Consolidated EV Charging Stations with "Full EV Forecast Unmanaged" Incremental Revenues Revenue Requirement ($ in millions)

	Year	Hawaiian Electric	Hawaii Electric Light	Maui Electric	Consolidated
1	2023	-	-	-	**-**
2	2024	(6.00)	(0.33)	(0.73)	**(7.06)**
3	2025	(6.76)	(0.13)	(0.86)	**(7.75)**
4	2026	(8.09)	(0.28)	(1.21)	**(9.58)**
5	2027	(9.81)	(0.63)	(1.83)	**(12.27)**
6	2028	(12.03)	(1.20)	(2.87)	**(16.10)**
7	2029	(14.78)	(1.97)	(4.11)	**(20.86)**
8	2030	(18.10)	(2.87)	(5.37)	**(26.34)**
9	2031	(21.91)	(3.83)	(6.90)	**(32.64)**
10	2032	(25.18)	(5.03)	(8.46)	**(38.67)**
11	2033	(25.49)	(5.17)	(8.64)	**(39.30)**
12	2034	(25.69)	(5.30)	(8.82)	**(39.81)**
13	2035	(25.79)	(5.42)	(9.00)	**(40.21)**
14	2036	(25.90)	(5.51)	(9.18)	**(40.59)**
15	2037	(25.84)	(5.57)	(9.27)	**(40.68)**
16	2038	(25.50)	(5.64)	(9.32)	**(40.46)**
17	2039	(22.91)	(5.49)	(8.91)	**(37.31)**
18	2040	(21.76)	(5.54)	(8.73)	**(36.03)**
19	2041	(20.25)	(5.35)	(8.78)	**(34.38)**
20	2042	(18.26)	(4.90)	(7.97)	**(31.13)**
21	2043	(15.65)	(4.17)	(6.66)	**(26.48)**
22	2044	(12.38)	(3.19)	(5.06)	**(20.63)**
23	2045	(8.24)	(2.06)	(3.41)	**(13.71)**
	Total	(396.32)	(79.58)	(136.09)	**(611.99)**
	NPV	(173.13)	(30.80)	(54.83)	**(258.76)**

Table 14 – Hawaiian Electric EV Charging Stations with "Full EV Forecast Unmanaged" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	6,366,292	0.0000	**$**	**-**
2	2024	1.04	(7.04)	**(6.00)**	6,441,818	-0.0931	**$**	**(0.47)**
3	2025	2.10	(8.86)	**(6.76)**	6,520,703	-0.1037	**$**	**(0.52)**
4	2026	2.89	(10.98)	**(8.09)**	6,599,300	-0.1226	**$**	**(0.61)**
5	2027	3.68	(13.49)	**(9.81)**	6,611,700	-0.1484	**$**	**(0.74)**
6	2028	4.47	(16.50)	**(12.03)**	6,645,400	-0.1810	**$**	**(0.91)**
7	2029	5.25	(20.03)	**(14.78)**	6,681,300	-0.2212	**$**	**(1.11)**
8	2030	6.04	(24.14)	**(18.10)**	6,753,400	-0.2680	**$**	**(1.34)**
9	2031	6.82	(28.73)	**(21.91)**	6,787,600	-0.3228	**$**	**(1.61)**
10	2032	5.46	(30.64)	**(25.18)**	6,823,700	-0.3690	**$**	**(1.85)**
11	2033	5.24	(30.73)	**(25.49)**	6,878,700	-0.3706	**$**	**(1.85)**
12	2034	5.05	(30.74)	**(25.69)**	6,922,700	-0.3711	**$**	**(1.86)**
13	2035	4.88	(30.67)	**(25.79)**	6,977,200	-0.3696	**$**	**(1.85)**
14	2036	4.72	(30.62)	**(25.90)**	7,058,300	-0.3669	**$**	**(1.83)**
15	2037	4.58	(30.42)	**(25.84)**	7,111,800	-0.3633	**$**	**(1.82)**
16	2038	4.34	(29.84)	**(25.50)**	7,185,800	-0.3549	**$**	**(1.77)**
17	2039	3.84	(26.75)	**(22.91)**	7,285,800	-0.3144	**$**	**(1.57)**
18	2040	3.25	(25.01)	**(21.76)**	7,431,700	-0.2928	**$**	**(1.46)**
19	2041	2.66	(22.91)	**(20.25)**	7,512,000	-0.2696	**$**	**(1.35)**
20	2042	2.05	(20.31)	**(18.26)**	7,637,300	-0.2391	**$**	**(1.20)**
21	2043	1.44	(17.09)	**(15.65)**	7,776,400	-0.2012	**$**	**(1.01)**
22	2044	0.83	(13.21)	**(12.38)**	7,945,400	-0.1558	**$**	**(0.78)**
23	2045	0.22	(8.46)	**(8.24)**	8,079,300	-0.1020	**$**	**(0.51)**
Total		80.85	(477.17)	**(396.32)**		*Average*	**$**	**(1.27)**
NPV @	6.88%	39.86	(212.99)	**(173.13)**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaiian Electric Sales in MWH.
3. Hawaiian Electric typical residential energy consumption, per month

Table 15 – Hawai'i Electric Light EV Charging Stations with "Full EV Forecast Unmanaged" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh	**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	989,103	0.0000	**$ -**
2	2024	0.47	(0.80)	**(0.33)**	992,000	-0.0333	**$ (0.17)**
3	2025	0.89	(1.02)	**(0.13)**	990,370	-0.0131	**$ (0.07)**
4	2026	1.15	(1.43)	**(0.28)**	984,705	-0.0284	**$ (0.14)**
5	2027	1.42	(2.05)	**(0.63)**	979,927	-0.0643	**$ (0.32)**
6	2028	1.68	(2.88)	**(1.20)**	982,973	-0.1221	**$ (0.61)**
7	2029	1.94	(3.91)	**(1.97)**	978,219	-0.2014	**$ (1.01)**
8	2030	2.20	(5.07)	**(2.87)**	977,491	-0.2936	**$ (1.47)**
9	2031	2.47	(6.30)	**(3.83)**	977,693	-0.3917	**$ (1.96)**
10	2032	1.86	(6.89)	**(5.03)**	980,258	-0.5131	**$ (2.57)**
11	2033	1.79	(6.96)	**(5.17)**	978,330	-0.5285	**$ (2.64)**
12	2034	1.72	(7.02)	**(5.30)**	981,199	-0.5402	**$ (2.70)**
13	2035	1.66	(7.08)	**(5.42)**	988,996	-0.5480	**$ (2.74)**
14	2036	1.61	(7.12)	**(5.51)**	999,038	-0.5515	**$ (2.76)**
15	2037	1.56	(7.13)	**(5.57)**	1,005,152	-0.5541	**$ (2.77)**
16	2038	1.46	(7.10)	**(5.64)**	1,013,498	-0.5565	**$ (2.78)**
17	2039	1.29	(6.78)	**(5.49)**	1,023,641	-0.5363	**$ (2.68)**
18	2040	1.09	(6.63)	**(5.54)**	1,038,353	-0.5335	**$ (2.67)**
19	2041	0.89	(6.24)	**(5.35)**	1,047,686	-0.5106	**$ (2.55)**
20	2042	0.68	(5.58)	**(4.90)**	1,063,080	-0.4609	**$ (2.30)**
21	2043	0.48	(4.65)	**(4.17)**	1,081,157	-0.3857	**$ (1.93)**
22	2044	0.28	(3.47)	**(3.19)**	1,101,904	-0.2895	**$ (1.45)**
23	2045	0.07	(2.13)	**(2.06)**	1,120,098	-0.1839	**$ (0.92)**
Total		28.66	(108.24)	**(79.58)**		*Average*	**$ (1.78)**
NPV @	7.00%	14.26	(45.06)	**(30.80)**			

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaii Electric Light Sales in MWH.
3. Hawaii Electric Light typical residential energy consumption, per month

Table 16 – Maui Electric EV Charging Stations with "Full EV Forecast Unmanaged" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	991,318	0.0000	**$**	**-**
2	2024	0.68	(1.41)	**(0.73)**	998,297	-0.0731	**$**	**(0.37)**
3	2025	1.01	(1.87)	**(0.86)**	1,002,118	-0.0858	**$**	**(0.43)**
4	2026	1.27	(2.48)	**(1.21)**	1,010,939	-0.1197	**$**	**(0.60)**
5	2027	1.54	(3.37)	**(1.83)**	1,020,115	-0.1794	**$**	**(0.90)**
6	2028	1.79	(4.66)	**(2.87)**	1,028,293	-0.2791	**$**	**(1.40)**
7	2029	2.05	(6.16)	**(4.11)**	1,031,130	-0.3986	**$**	**(1.99)**
8	2030	2.30	(7.67)	**(5.37)**	1,038,344	-0.5172	**$**	**(2.59)**
9	2031	2.57	(9.47)	**(6.90)**	1,047,022	-0.6590	**$**	**(3.30)**
10	2032	1.95	(10.41)	**(8.46)**	1,062,522	-0.7962	**$**	**(3.98)**
11	2033	1.88	(10.52)	**(8.64)**	1,079,158	-0.8006	**$**	**(4.00)**
12	2034	1.81	(10.63)	**(8.82)**	1,097,114	-0.8039	**$**	**(4.02)**
13	2035	1.75	(10.75)	**(9.00)**	1,116,863	-0.8058	**$**	**(4.03)**
14	2036	1.70	(10.88)	**(9.18)**	1,141,138	-0.8045	**$**	**(4.02)**
15	2037	1.64	(10.91)	**(9.27)**	1,159,595	-0.7994	**$**	**(4.00)**
16	2038	1.49	(10.81)	**(9.32)**	1,183,049	-0.7878	**$**	**(3.94)**
17	2039	1.29	(10.20)	**(8.91)**	1,206,540	-0.7385	**$**	**(3.69)**
18	2040	1.09	(9.82)	**(8.73)**	1,233,460	-0.7078	**$**	**(3.54)**
19	2041	0.89	(9.67)	**(8.78)**	1,252,621	-0.7009	**$**	**(3.50)**
20	2042	0.69	(8.66)	**(7.97)**	1,276,873	-0.6242	**$**	**(3.12)**
21	2043	0.48	(7.14)	**(6.66)**	1,301,261	-0.5118	**$**	**(2.56)**
22	2044	0.28	(5.34)	**(5.06)**	1,326,542	-0.3814	**$**	**(1.91)**
23	2045	0.07	(3.48)	**(3.41)**	1,346,119	-0.2533	**$**	**(1.27)**
Total		30.22	(166.31)	**(136.09)**		*Average*	**$**	**(2.69)**
NPV @	6.94%	15.30	(70.13)	**(54.83)**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Maui Electric Sales in MWH.
3. MauiElectric typical residential energy consumption, per month

Table 17 – Consolidated EV Charging Stations with "Full EV Forecast Managed" Incremental Revenues Revenue Requirement ($ in millions)

	Year	Hawaiian Electric	Hawaii Electric Light	Maui Electric	Consolidated
1	2023	-	-	-	**-**
2	2024	(5.89)	(0.31)	(0.70)	**(6.90)**
3	2025	(6.62)	(0.11)	(0.81)	**(7.54)**
4	2026	(7.92)	(0.25)	(1.15)	**(9.32)**
5	2027	(9.60)	(0.58)	(1.75)	**(11.93)**
6	2028	(11.77)	(1.13)	(2.75)	**(15.65)**
7	2029	(14.46)	(1.88)	(3.96)	**(20.30)**
8	2030	(17.72)	(2.75)	(5.18)	**(25.65)**
9	2031	(21.46)	(3.68)	(6.66)	**(31.80)**
10	2032	(24.69)	(4.86)	(8.20)	**(37.75)**
11	2033	(25.01)	(5.00)	(8.38)	**(38.39)**
12	2034	(25.21)	(5.13)	(8.56)	**(38.90)**
13	2035	(25.31)	(5.25)	(8.73)	**(39.29)**
14	2036	(25.43)	(5.34)	(8.91)	**(39.68)**
15	2037	(25.37)	(5.40)	(9.00)	**(39.77)**
16	2038	(25.04)	(5.47)	(9.05)	**(39.56)**
17	2039	(22.48)	(5.33)	(8.65)	**(36.46)**
18	2040	(21.35)	(5.37)	(8.48)	**(35.20)**
19	2041	(19.87)	(5.20)	(8.55)	**(33.62)**
20	2042	(17.93)	(4.76)	(7.76)	**(30.45)**
21	2043	(15.37)	(4.06)	(6.49)	**(25.92)**
22	2044	(12.16)	(3.11)	(4.93)	**(20.20)**
23	2045	(8.09)	(2.01)	(3.32)	**(13.42)**
	Total	(388.75)	(76.98)	(131.97)	**(597.70)**
	NPV	(169.76)	(29.72)	(53.10)	**(252.58)**

Table 18 – Hawaiian Electric EV Charging Stations with "Full EV Forecast Managed" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	6,366,292	0.0000	**$**	**-**
2	2024	1.04	(6.93)	**(5.89)**	6,441,818	-0.0914	**$**	**(0.46)**
3	2025	2.10	(8.72)	**(6.62)**	6,520,703	-0.1015	**$**	**(0.51)**
4	2026	2.89	(10.81)	**(7.92)**	6,599,300	-0.1200	**$**	**(0.60)**
5	2027	3.68	(13.28)	**(9.60)**	6,611,700	-0.1452	**$**	**(0.73)**
6	2028	4.47	(16.24)	**(11.77)**	6,645,400	-0.1771	**$**	**(0.89)**
7	2029	5.25	(19.71)	**(14.46)**	6,681,300	-0.2164	**$**	**(1.08)**
8	2030	6.04	(23.76)	**(17.72)**	6,753,400	-0.2624	**$**	**(1.31)**
9	2031	6.82	(28.28)	**(21.46)**	6,787,600	-0.3162	**$**	**(1.58)**
10	2032	5.46	(30.15)	**(24.69)**	6,823,700	-0.3618	**$**	**(1.81)**
11	2033	5.24	(30.25)	**(25.01)**	6,878,700	-0.3636	**$**	**(1.82)**
12	2034	5.05	(30.26)	**(25.21)**	6,922,700	-0.3642	**$**	**(1.82)**
13	2035	4.88	(30.19)	**(25.31)**	6,977,200	-0.3628	**$**	**(1.81)**
14	2036	4.72	(30.15)	**(25.43)**	7,058,300	-0.3603	**$**	**(1.80)**
15	2037	4.58	(29.95)	**(25.37)**	7,111,800	-0.3567	**$**	**(1.78)**
16	2038	4.34	(29.38)	**(25.04)**	7,185,800	-0.3485	**$**	**(1.74)**
17	2039	3.84	(26.32)	**(22.48)**	7,285,800	-0.3085	**$**	**(1.54)**
18	2040	3.25	(24.60)	**(21.35)**	7,431,700	-0.2873	**$**	**(1.44)**
19	2041	2.66	(22.53)	**(19.87)**	7,512,000	-0.2645	**$**	**(1.32)**
20	2042	2.05	(19.98)	**(17.93)**	7,637,300	-0.2348	**$**	**(1.17)**
21	2043	1.44	(16.81)	**(15.37)**	7,776,400	-0.1976	**$**	**(0.99)**
22	2044	0.83	(12.99)	**(12.16)**	7,945,400	-0.1530	**$**	**(0.77)**
23	2045	0.22	(8.31)	**(8.09)**	8,079,300	-0.1001	**$**	**(0.50)**
Total		80.85	(469.60)	**(388.75)**		*Average*	**$**	**(1.25)**
NPV @	6.88%	39.86	(209.62)	**(169.76)**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaiian Electric Sales in MWH.
3. Hawaiian Electric typical residential energy consumption, per month

Table 19 – Hawai'i Electric Light EV Charging Stations with "Full EV Forecast Managed" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	989,103	0.0000	**$**	**-**
2	2024	0.47	(0.78)	**(0.31)**	992,000	-0.0312	**$**	**(0.16)**
3	2025	0.89	(1.00)	**(0.11)**	990,370	-0.0111	**$**	**(0.06)**
4	2026	1.15	(1.40)	**(0.25)**	984,705	-0.0254	**$**	**(0.13)**
5	2027	1.42	(2.00)	**(0.58)**	979,927	-0.0592	**$**	**(0.30)**
6	2028	1.68	(2.81)	**(1.13)**	982,973	-0.1150	**$**	**(0.57)**
7	2029	1.94	(3.82)	**(1.88)**	978,219	-0.1922	**$**	**(0.96)**
8	2030	2.20	(4.95)	**(2.75)**	977,491	-0.2813	**$**	**(1.41)**
9	2031	2.47	(6.15)	**(3.68)**	977,693	-0.3764	**$**	**(1.88)**
10	2032	1.86	(6.72)	**(4.86)**	980,258	-0.4958	**$**	**(2.48)**
11	2033	1.79	(6.79)	**(5.00)**	978,330	-0.5111	**$**	**(2.56)**
12	2034	1.72	(6.85)	**(5.13)**	981,199	-0.5228	**$**	**(2.61)**
13	2035	1.66	(6.91)	**(5.25)**	988,996	-0.5308	**$**	**(2.65)**
14	2036	1.61	(6.95)	**(5.34)**	999,038	-0.5345	**$**	**(2.67)**
15	2037	1.56	(6.96)	**(5.40)**	1,005,152	-0.5372	**$**	**(2.69)**
16	2038	1.46	(6.93)	**(5.47)**	1,013,498	-0.5397	**$**	**(2.70)**
17	2039	1.29	(6.62)	**(5.33)**	1,023,641	-0.5207	**$**	**(2.60)**
18	2040	1.09	(6.46)	**(5.37)**	1,038,353	-0.5172	**$**	**(2.59)**
19	2041	0.89	(6.09)	**(5.20)**	1,047,686	-0.4963	**$**	**(2.48)**
20	2042	0.68	(5.44)	**(4.76)**	1,063,080	-0.4478	**$**	**(2.24)**
21	2043	0.48	(4.54)	**(4.06)**	1,081,157	-0.3755	**$**	**(1.88)**
22	2044	0.28	(3.39)	**(3.11)**	1,101,904	-0.2822	**$**	**(1.41)**
23	2045	0.07	(2.08)	**(2.01)**	1,120,098	-0.1794	**$**	**(0.90)**
Total		28.66	(105.64)	**(76.98)**		*Average*	**$**	**(1.72)**
NPV @	7.00%	14.26	(43.98)	**(29.72)**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Hawaii Electric Light Sales in MWH.
3. Hawaii Electric Light typical residential energy consumption, per month

Table 20 – Maui Electric EV Charging Stations with "Full EV Forecast Managed" Incremental Revenues Revenue Requirement ($ in millions) and Bill Impact

	Year	Project Cost Revenue Requirement	Pilot Incremental Revenues[1]	**Net Revenue Requirement**	Sales Forecast (MWh)[2]	Rate Impact ¢/kWh		**Bill Impact 500 kWh[3]**
1	2023	-	-	**-**	991,318	0.0000	**$**	**-**
2	2024	0.68	(1.38)	**(0.70)**	998,297	-0.0701	**$**	**(0.35)**
3	2025	1.01	(1.82)	**(0.81)**	1,002,118	-0.0808	**$**	**(0.40)**
4	2026	1.27	(2.42)	**(1.15)**	1,010,939	-0.1138	**$**	**(0.57)**
5	2027	1.54	(3.29)	**(1.75)**	1,020,115	-0.1715	**$**	**(0.86)**
6	2028	1.79	(4.54)	**(2.75)**	1,028,293	-0.2674	**$**	**(1.34)**
7	2029	2.05	(6.01)	**(3.96)**	1,031,130	-0.3840	**$**	**(1.92)**
8	2030	2.30	(7.48)	**(5.18)**	1,038,344	-0.4989	**$**	**(2.49)**
9	2031	2.57	(9.23)	**(6.66)**	1,047,022	-0.6361	**$**	**(3.18)**
10	2032	1.95	(10.15)	**(8.20)**	1,062,522	-0.7717	**$**	**(3.86)**
11	2033	1.88	(10.26)	**(8.38)**	1,079,158	-0.7765	**$**	**(3.88)**
12	2034	1.81	(10.37)	**(8.56)**	1,097,114	-0.7802	**$**	**(3.90)**
13	2035	1.75	(10.48)	**(8.73)**	1,116,863	-0.7817	**$**	**(3.91)**
14	2036	1.70	(10.61)	**(8.91)**	1,141,138	-0.7808	**$**	**(3.90)**
15	2037	1.64	(10.64)	**(9.00)**	1,159,595	-0.7761	**$**	**(3.88)**
16	2038	1.49	(10.54)	**(9.05)**	1,183,049	-0.7650	**$**	**(3.82)**
17	2039	1.29	(9.94)	**(8.65)**	1,206,540	-0.7169	**$**	**(3.58)**
18	2040	1.09	(9.57)	**(8.48)**	1,233,460	-0.6875	**$**	**(3.44)**
19	2041	0.89	(9.44)	**(8.55)**	1,252,621	-0.6826	**$**	**(3.41)**
20	2042	0.69	(8.45)	**(7.76)**	1,276,873	-0.6077	**$**	**(3.04)**
21	2043	0.48	(6.97)	**(6.49)**	1,301,261	-0.4987	**$**	**(2.49)**
22	2044	0.28	(5.21)	**(4.93)**	1,326,542	-0.3716	**$**	**(1.86)**
23	2045	0.07	(3.39)	**(3.32)**	1,346,119	-0.2466	**$**	**(1.23)**
Total		30.22	(162.19)	**(131.97)**		*Average*	**$**	**(2.61)**
NPV @	6.94%	15.30	(68.40)	**(53.10)**				

Notes:
1. Pilot Incremental Revenue from Exhibit C, Project Justification with Business Case Support
2. Estimated Maui Electric Sales in MWH.
3. MauiElectric typical residential energy consumption, per month

KEY ASSUMPTIONS USED IN FINANCIAL ANALYSIS

The Companies utilized various assumptions in the high level, economic analysis to forecast revenue requirements and bill impacts. This high-level forecast uses broad or simplified assumptions for the purpose of estimating revenue requirements over the life of the investment and a typical monthly residential bill impact. Actual results may differ based on the application of specific rules and on the actual costs incurred. The key assumptions are highlighted in the following sections.

I. COST OF CAPITAL ASSUMPTIONS

Cost of capital assumptions are based on the current approved rate case for each Company. Please refer to figures 1 through 3 below for current assumptions used in the forecast.

Figure 1 – Hawaiian Electric

HECO TY2020 Rate Case Dkt 2019-0085 Final D&O 37387 Cost of Capital Assumptions	Weight	Rate	Weighted Average	After-Tax Weighted Average	Weighted Average Revenue Requirement	Weighted Average Gross-up for Income Taxes
Short Term Debt	0.58%	2.50%	0.01%	0.01%	0.016%	0.01%
Long Term Debt (Taxable Debt)	41.42%	4.55%	1.88%	1.40%	2.068%	1.88%
Hybrids	0.00%	0.00%	0.00%	0.00%	0.000%	0.00%
Preferred Stock	0.85%	5.33%	0.05%	0.05%	0.067%	0.06%
Common Stock	57.15%	9.50%	5.43%	5.43%	8.026%	7.31%
	100.00%		7.37%	6.885%	10.177%	9.272%

Figure 2 – Hawai‘i Electric Light

HELCO TY2019 Rate Case Dkt 2018-0368 PUC Final D&O 37237 Cost of Capital Assumptions	Weight	Rate	Weighted Average	After-Tax Weighted Average	Weighted Average Revenue Requirement	Weighted Average Gross-up for Income Taxes
Short Term Debt	0.61%	3.75%	0.02%	0.02%	0.025%	0.02%
Long Term Debt (Taxable Debt)	40.59%	4.79%	1.94%	1.44%	2.134%	1.94%
Hybrids	0.80%	7.83%	0.06%	0.05%	0.069%	0.06%
Preferred Stock	1.17%	8.12%	0.09%	0.09%	0.140%	0.13%
Common Stock	56.83%	9.50%	5.40%	5.40%	7.980%	7.27%
	100.00%		7.52%	7.001%	10.349%	9.429%

Figure 3 – Maui Electric

MECO TY2018 Rate Case Dkt 2017-0150 Final D&O No. 36219 Cost of Capital Assumptions	Weight	Rate	Weighted Average	After-Tax Weighted Average	Weighted Average Revenue Requirement	Weighted Average Gross-up for Income Taxes
Short Term Debt	1.37%	3.00%	0.04%	0.03%	0.045%	0.04%
Long Term Debt (Taxable Debt)	38.68%	4.54%	1.76%	1.30%	1.928%	1.76%
Hybrids	1.96%	7.16%	0.14%	0.10%	0.154%	0.14%
Preferred Stock	0.98%	8.15%	0.08%	0.08%	0.118%	0.11%
Common Stock	57.02%	9.50%	5.42%	5.42%	8.007%	7.30%
	100.00%		7.43%	6.935%	10.251%	9.341%

II. TAX ASSUMPTIONS

Tax and tax credit assumptions are based on current Federal and State laws. Please refer to figure 4 below for current assumptions used in the forecast.

Figure 4 – Consolidated

		Effective
Federal Income Tax Rate	21.00%	19.74%
State Income Tax Rate	6.40%	6.02%
		25.75%
State Investment Tax Credit (ITC)		4.00%
Accelerated State ITC Amortization Period		10
Public Service Company Tax		5.885%
PUC Fee		0.500%
Franchise Tax		2.500%
Composite Revenue Tax Rate		8.885%

For forecasting purposes, state investment tax credit was applied to the total capital investment. In reality, certain costs may not be eligible for state investment tax credits. In addition, the amortization period for the state investment tax credit is assumed to be 10 years for all Companies, which is consistent with Hawaiian Electric's 2020 test year rate case, Maui Electric's 2018 test year rate case, and Hawai'i Electric Light's 2019 test year rate case.

III. DEPRECIATION AND AMORTIZATION ASSUMPTIONS

Depreciation and amortization assumptions are based on the expected useful life of the investment. Depreciation is forecasted to begin the year after the asset is placed into service. In reality, depreciation will be based on current Commission-approved depreciation rates. Please refer to figure 5 below for current assumptions used in the forecast.

Figure 5 – Project Consolidated

	EV Charging Stations
Expected Useful Life	15
MACRS Tax Life ("Tax Life")	7
Tax Class Life ("Class Life")	-

IV. INVESTMENT ASSUMPTIONS

Investment assumptions are based on the forecasts of costs based on the scope of the Public Electric Vehicle Charger Expansion Project. Please refer to figures 6 through 8 below for current assumptions used in the forecast.

Figure 6 – Hawaiian Electric

Project	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Useful Life
EV Charging Stations	$1,372,371	$4,237,379	$4,363,311	$4,496,017	$4,634,387	$4,772,535	$4,911,349	$5,062,378	15
O&M	$742,667	$1,090,667	$1,210,667	$1,342,667	$1,486,667	$1,630,667	$1,786,667	$1,942,667	
TOTAL	**$2,115,038**	**$5,328,046**	**$5,573,978**	**$5,838,684**	**$6,121,054**	**$6,403,202**	**$6,698,016**	**$7,005,045**	

Figure 7 – Hawai‘i Electric Light

Project	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Useful Life
EV Charging Stations	$679,822	$1,411,836	$1,460,530	$1,504,512	$1,548,139	$1,586,106	$1,636,503	$1,686,901	15
O&M	$322,667	$502,667	$538,667	$586,667	$634,667	$682,667	$730,667	$790,667	
TOTAL	**$1,002,489**	**$1,914,503**	**$1,999,197**	**$2,091,179**	**$2,182,806**	**$2,268,773**	**$2,367,170**	**$2,477,568**	

Figure 8 – Maui Electric

Project	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Useful Life
EV Charging Stations	$1,371,995	$1,409,965	$1,460,368	$1,504,664	$1,548,295	$1,586,265	$1,636,668	$1,687,071	15
O&M	$418,667	$514,667	$562,667	$610,667	$658,667	$706,667	$754,667	$814,667	
TOTAL	**$1,790,662**	**$1,924,632**	**$2,023,035**	**$2,115,331**	**$2,206,962**	**$2,292,932**	**$2,391,335**	**$2,501,738**	

Hawaiian Electric Company, Inc.
Oʻahu, HI

Date
October 2021

PUBLIC ELECTRIC VEHICLE CHARGER EXPANSION GHG ANALYSIS

HAWAIIAN ELECTRIC COMPANY, INC.

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1. INTRODUCTION

This report provides an estimate of the lifecycle emissions of greenhouse gases ("GHG" or "emissions") associated with the proposed Hawaiian Electric (or "Company") Public Electric Vehicle Charger Expansion Project ("Project"). This GHG emissions analysis ("analysis") is being provided pursuant to Hawai'i Revised Statute ("HRS") § 269-6(b).

Electric transportation is an increasingly important element in the transition to a sustainable and clean energy future supporting the reduction of the State's reliance on fossil fuels.

Installation of infrastructure and chargers for electric vehicle charging stations is needed to support the conversion of fossil-fueled vehicles to electric vehicles and lead to reduction of GHG emissions from the direct fuel use of vehicles, as discussed in this analysis.

This analysis covers installation of the infrastructure and charging stations, operations of the chargers, and the fuel impact of electric vehicles as the end goal of the Project.

The Project as proposed includes installation of up to seventy-five (75) charging site facilities. Because the actual design of the individual installations in this Project has not been completed at this time, this analysis evaluates a prototype facility that provides a conservative estimate of emissions. Each facility is assumed to facilitate two (2) Direct Current Fast Chargers ("DCFC") and two (2) Level 2 Electric Vehicle Charging Stations ("Level 2 EVCS"). Similarly, due to these uncertainties, to estimate the usage of the charging stations, Hawaiian Electric presents a facility base utilization scenario based on conservative assumptions for estimated utilization per facility.

The Prototyple Facility is assumed for a Site on O'ahu which provides a conservative result because the O'ahu electric grid has a higher GHG intensity (GHG emissions in metric tons ("MT") carbon dioxide equivalent ("CO_2e") per kilowatt-hour ("kWh") of generation) compared to the GHG intensities for the islands of Maui and Hawai'i. The overall Project GHG analysis impact is evaluated by scaling the Prototype Facility and net GHG emissions reduction by a factor of seventy-five (75) to account for the potential number of facilities in this Project

2. APPROACH OVERVIEW

Hawaiian Electric and Ramboll have conducted an analysis to estimate the projected GHG emissions that would result from the proposed installation of the Project using a Prototype Facility. The Prototype Facility assumes a Site on O'ahu, with two (2) DCFC's and two (2) Level 2 EVCS's per Site. Infrastructure of the Prototype Facility includes the installation of bollards with a concrete foundation, underground conductors, circuit breakers, handholes, switches, a switchgear, a mini power center, communication equipment, cellular meter, and temporary circuit testing terminals.

This analysis evaluates the potential GHG emissions directly attributable to the installation of the proposed Infrastructure and the charger's equipment, as well as GHG emissions that may be produced at earlier stages in the production process, such as component and raw material production and transportation. This analysis also evaluates GHG emissions during operations by including indirect emissions during electric vehicle charging from the grid and the avoided emissions based on the amount of gasoline fuel that would be displaced by

electric vehicles. In addition, this analysis evaluates the potential GHG emissions related to the downstream processes, such as decommissioning and disposal. Thus, this analysis evaluates Upstream, Downstream, and Operational GHG emissions that would result from the Prototype Facility for the duration of its lifetime. The Prototype Facility lifetime is assumed to be the combined expected service life of the Infrastructure and EVCS, which at the time of this analysis is estimated to be fifteen (15) years.

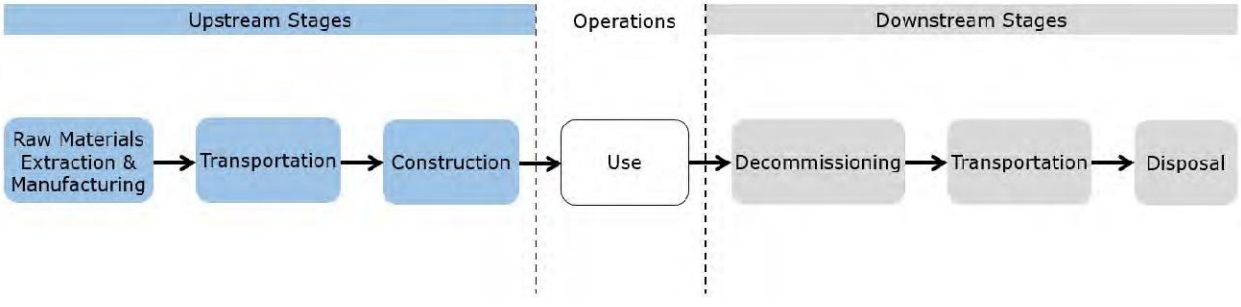
This analysis is intended to capture both the direct emissions and reasonably foreseeable indirect emissions. The projected lifecycle GHG emissions are based on the best reasonably available public data that has undergone scientific peer-review and the most current information, including emissions factors, available at the time of this analysis. This analysis incorporates the use of actual project-specific data as well as emissions values from peer-reviewed literature, and, in many cases, adjusts the literature-based emissions values to reasonably account for site-specific factors. Where practicable and reasonably estimable, this information was then localized to account for unique location-specific factors applicable to a project in Hawai‘i, such as significant transportation distances, and supplemented with direct emissions calculated to account for the upstream, operations, and downstream emissions. The use of a combination of localized peer-reviewed published studies and direct emissions calculations for the Prototype Facility represents the "GHG Analysis" approach in this evaluation.

The project emissions and net emissions reduction of the Prototype Facility are then multiplied by a factor of seventy-five (75) to account for the potential number of charging facilities that will be developed in the Project. As mentioned above, the Prototype Facility location on O‘ahu represents the most conservative estimate for potential locations on the other islands because the grid GHG intensity of O‘ahu is higher compared to GHG intensities for the islands of Maui and Hawai‘i.

3. PROTOTYPE FACILITY GHG EMISSIONS

This GHG Analysis evaluates the potential GHG emissions of the proposed Prototype Facility and the Project. The analysis approach addresses the direct emissions and reasonably foreseeable indirect emissions across the Upstream, Operations, and Downstream Stages, as shown in **Figure 1**.

Figure 1. Stages for Consideration in Prototype Facility GHG Emissions Calculations



Potentially significant and reasonably foreseeable equipment, materials, and activities are accounted for throughout the lifecycle. The following sections provide an overview of the methodology and key assumptions for the Raw Material Extraction and Manufacturing,

Additional Transportation to and from Oʻahu, Prototype Facility Construction, Operations & Maintenance and Decommissioning & Disposal Stages.

3.1 Raw Material Extraction and Manufacturing

The GHG emissions associated with raw material extraction and manufacturing ("RMEM") are for equipment and materials installed or used for the Prototype Facility. The GHG emissions are estimated based on this total number of pieces of equipment consistent with the facility lifetime. For each piece of equipment or material, the RMEM stage emissions are based on a peer-reviewed GHG emissions factor that represents the GHG emissions associated with raw material extraction and manufacturing of the material or equipment, scaled to the Prototype Facility based on the quantity or amount of the material or equipment required for the Prototype Facility. Detailed calculation of the RMEM stage is presented in the enclosed Attachment A, Appendix Table A1.

3.2 Additional Transportation To and From Oʻahu

To supplement the lifecycle results, the additional transportation GHG emissions were calculated using an "inventory approach" where direct GHG emissions from transportation are calculated based on project-specific and Oʻahu-specific data.

This includes upstream and downstream transportation for all components from manufacturer locations to the Site. The net weight is determined based on the weight of each system component and the quantity of each component, if available, or publicly available information for similar components. The transportation GHG emissions are calculated by determining the distance, mode of travel (e.g., truck or ship) with corresponding emission factor, and weight of material transported for each transportation leg. For a given transportation segment, if the mode of travel is not known and if multiple travel modes are available, the most emissions-intensive mode is selected.[1] Transportation GHG emissions are estimated based on one-way travel from an origin to a destination with the exception of estimated emissions to or from the Site. GHG emissions to and from the site are estimated based on the roundtrip distance.

Road transportation GHG emission factors were obtained from the United States Environmental Protection Agency ("US EPA", or in brief "EPA") Scope 3 Inventory Guidance,[2] and the emission factor for shipping was obtained from Global Maritime Trade Lane Emissions Factors.[3] Shipping distances were estimated using the Sea Distance tool,[4] based

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[1] Because GHG emissions per ton-mile of transportation from maritime shipping are lower than for rail and trucks, this analysis conservatively assumes the most emissions-intensive transportation mode if the travel mode is not known.

[2] EPA Scope 3 Inventory Guidance is available at: https://www.epa.gov/climateleadership/scope-3-inventory-guidance, and recommends emission factors from Table 8 of Emission Factors for Greenhouse Gas Inventories, available at: https://www.epa.gov/sites/production/files/2021-04/documents/emission-factors_apr2021.pdf.

[3] The emission factor for shipping is based on the Global Maritime Emission Factor for dry (i.e., non-refrigerated) cargo shipping over all trade lanes for 2019 with a 70% utilization factor, assuming an average load weight of 10 tons in each container, as implemented in CN's Carbon Calculator, available at: https://www.cn.ca/en/delivering-responsibly/environment/emissions/carbon-calculator/. Global Maritime Emission Factors are available at: https://static1.squarespace.com/static/5b3f37f489c17230345b5f15/t/5f46109c14efc67813f2bca8/1598427336870/BSR-Clean-Cargo-Emissions-Report-2020.pdf.

[4] Available at: https://sea-distances.org.

on shipping distances from the nearest port to the manufacturer location to Los Angeles, from Los Angeles to Honolulu. Truck distances were estimated using Google Maps[5] to determine driving distances.

Detailed calculation of the Transporation stage is presented in the enclosed Attachment A, Appendix Table A2.

3.3 Construction

Construction GHG emissions were based on construction activity information, such as schedule, equipment mix, and on-road trip information, for specific construction activities. Emission factors for off-road equipment were obtained from OFFROAD,[6] which is a model that estimates emissions from heavy duty equipment created by the California Air Resources Board ("CARB"). Emission factors for on-road trips for workers and vendors were obtained from CARB's EMFAC website, which provides emissions inventories and associated documentation for on-road mobile sources in California.[7]

Detailed calculation of the Construction stage is presented in the enclosed Attachment A, Appendix Table A3.

3.4 Operations & Maintenance

Operations (Use) GHG emissions include direct GHG emissions associated with the operation and maintenance ("O&M") of the Prototype Facility for the duration of its lifetime. The Operations stage includes GHG emissions produced by mobile sources that are associated with ongoing operation and maintenance of the facility. The mobile sources emissions are estimated based on the total number of truck trips per year and the vehicle mileage travelled, as estimated by Hawaiian Electric. California's EMFAC2017 database is used to estimate emission factors that were developed by averaging statewide emission factors for the California region in 2023 for Light Heavy-Duty Truck ("LHDT1") vehicles.

Indirect GHG emissions associated with energy consumption due to operation of the charging stations are also included in this analysis. Due to the high degree of uncertainties of the specifics of this project, energy consumption is based on the managed charging cases for the Project as shown in the Business Case Analysis (Exhibit C of the Application) assuming a conservative estimate for the utilization of the four charging stations (two DCFC and two Level 2 EVCS) at the facility. Indirect GHG emissions associated with energy consumption of the charging stations are calculated based on annual grid energy consumption during time of use ("TOU") and grid carbon intensity for the TOU. The TOU are divided into three different categories: mid-day, peak, and off-peak. Mid-day is specified between 9AM to 5PM, peak is between 5PM to 10PM, and off-peak is between 10PM to 9AM. The grid intensity for each TOU is based on the actual 2020 Oʻahu grid intensity. As more renewables are added to the grid, the grid intensities are likely to decrease, resulting in lower indirect emissions associated with energy consumption. Therefore, the 2020 grid intensities used for this analysis represent the most conservative estimates.

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[5] Google Maps. (n.d.). Available at: google.com/maps.

[6] California Air Resources Board (CARB) 2017. OFFROAD 2017. Available at: https://www.arb.ca.gov/orion/.

[7] California Air Resources Board (CARB) 2017. EMFAC2017. Available at: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools.

Detailed calculation of the O&M stage is presented in the enclosed Attachment A, Appendix Table A4.

3.5 Decommissioning and Disposal

GHG emissions associated with the decommissioning and disposal of the Infrastructure to be installed for the Prototype Facility and the DCFC/Level 2 EVCS were calculated.

The decommissioning GHG emissions are assumed to be 3% of construction GHG emissions.[8] The disposal estimates account for potential end of life treatment including landfill, incineration, and recycling, and conservatively do not take credit for recycling. Disposal GHG emissions are based on the ecoinvent database,[9] which provided GHG emission factors for disposal of the equipment installed for the Prototype facility. The ecoinvent emission factors are multiplied by the mass of system components or material to estimate GHG emissions from decommissioning and disposal. The emission factors use ecoinvent's "market for" processes which consider all disposal treatment options, such as landfill, municipal incineration, and recycling, for the specific component and creates a weighted emission factor based on real-world production data. The Downstream transportation GHG emissions include transportation of material from the Prototype Facility Site to a disposal site in Los Angeles, California. The scrap yard in Los Angeles was selected as the disposal site as a reasonable, conservative assumption.[10]

Detailed calculation of the Decommisioning and Disposal stage is presented in the enclosed Attachment A, Appendix Table A5.

4. AVOIDED EMISSIONS FROM ELECTRIC VEHICLE FUEL USE IMPACT

Avoided emissions ("Avoided GHG Emissions") in this instance are defined as GHG emissions from the combustion of fossil fuel that would be avoided by vehicles powered by electricity.

For the purposes of comparison, this section discusses the GHG emissions that would result if the Infrastructure were not built and vehicles continue to consume fossil fuel. The Avoided GHG Emissions are calculated based on the combustion emissions of the fuel consumed based on the assumed fuel economy and fuel type of the vehicles that would be displaced by electric vehicles. The Avoided GHG emissions are assumed to equal the Avoided direct generation (i.e., combustion) emissions, and do not account for Upstream or Downstream emissions of fossil fuel supply or associated fueling infrastructure. This approach is conservative, because including upstream and downstream emissions of fossil fuel would

[8] Based on GHG emissions estimated for construction and deconstruction phases for the Southern California Edison's Lakeview Substation Project. Available at: https://www.cpuc.ca.gov/Environment/info/esa/lakeview/DEIR/Lakeview_SS_Apps.pdf.

[9] Ecoinvent v3.6. (2019, September 12). Sixth update of ecoinvent version 3 (ecoinvent V3.6) Database, available at: https://www.ecoinvent.org/database/ecoinvent-36/ecoinvent-36.html.

[10] At this stage in the Project lifecycle, the end-of-life fate of the Project equipment is not known. There are several potential options for equipment end-of-life, including reuse of equipment in Hawai'i, disposal in Hawai'i, or transportation back to Los Angeles for disposal. Of the potential end-of-life activities, the latter of sending all equipment to a Los Angeles scrap yard is the most conservative assumption.

increase the avoided emissions and overall net emissions reduction. Even without the avoided upstream and downstream of fossil fuel, the Project GHG emissions are lower than the Avoided GHG emissions, resulting in a net emissions reduction. As more renewables are incorporated onto the grid, the avoided GHG emissions and overall net GHG emissions reduction will be even higher.

The U.S. Environmental Protection Agency ("EPA") reported that fuel economy for a gasoline-powered vehicle is 24.9 miles per gallon ("mpg").[11] According to the National Renewable Energy Laboratory ("NREL"), an electric vehicle efficiency is 0.25 kilowatt hour ("kWh") per mile.[12] Based on the estimated electicity dispensed by the Prototype Facility for the facility base utilization scenario, during mid-day, peak, and off-peak for the 15 years duration of this Prototype Facility operation, the total emissions from the diesel fuel that would be avoided is 2,035 MT CO2e per facility. Detailed calculation of the avoided emissions is presented in the enclosed Attachment A, Appendix Table A6.

5. NET GHG EMISSION REDUCTION

Estimated Net GHG Emissions are defined as the estimated Avoided GHG Emissions from fossil-fueled vehicle minus estimated GHG emissions from the Prototype Facility. The lower the Prototype Facility's GHG Emissions relative to the Avoided GHG Emissions, the higher the Net GHG Emissions reduction. The sections below describe the Net Operations GHG Emissions Reductions (**Section 5.1**) and the Net Lifecycle GHG Emissions Reduction (**Section 5.2**) from a Prototype Facility. To account for seventy-five (75) potential facilities that are expected to be developed in the Program, the overall Project's net GHG emissions reduction is estimated by multiplying the net GHG emission reduction from the Protoype Facility by a factor of seventy-five (75). The results for both the Prototype Facility and the Project are presented in Section 6 and Attachment A Table 1.

[11] U.S. Environmental Protection Agency (EPA). 2020. EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology since 1975. Page 5. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010U68.pdf

[12] National Renewable Energy Laboratory (NREL). 2018. California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025 (Table C.1). Available at: https://www.nrel.gov/docs/fy18osti/70893.pdf.

5.1 Net Operations GHG Emissions Reduction

The Net Operations GHG Emissions Reduction associated with the operation and maintenance of each Prototype Facility is estimated to be **1,032 MT CO_2e** or **0.72 kg CO_2e/kWh**. The estimated Net Operations Emissions Reductions (in units of MT CO_2e) are calculated as follows:

Net Operations Emissions Reduction	=	Avoided Operations Emissions	-	Facility Operations Emissions
1,032 MT CO_2e	=	2,035 MT CO_2e	-	1,003 MT CO_2e

To obtain the Net Operations GHG Intensity Reduction (in units of kg CO_2e/kWh), the above Net Operations Emissions Reduction is divided by the Prototype Facility's lifetime capacity:

$$\text{Net Operations Intensity Reduction} = \frac{\text{Net Operations Emissions Reduction}}{\text{Total Electricity Consumption}}$$

$$0.72 \text{ kg } CO_2e/\text{kWh} = \frac{1{,}032 \text{ MT } CO_2e * 1{,}000 \text{ kg}}{95{,}485 \text{ kWh/year} * 15 \text{ year} * 1 \text{ MT}}$$

5.2 Net Lifecycle GHG Emissions Reduction

The Net Lifecycle GHG Emissions Reduction associated with a Prototype Facility is estimated to be **823 MT CO_2e** or **0.57 kg CO_2e/kWh**. The estimates are calculated as follows:

Net Lifecycle Emissions Reduction	=	Avoided Lifecycle Emissions	-	Facility Lifecycle Emissions
823 MT CO_2e	=	2,035 MT CO_2e	-	1,212 MT CO_2e

To obtain the Net Lifecycle GHG Intensity Reduction (in units of kg CO_2e/kWh), the above Net Lifecycle Emissions Reduction is divided by a Prototype Facility's lifetime capacity:

$$\text{Net Lifecycle Intensity Reduction} = \frac{\text{Net Lifecycle Emissions Reduction}}{\text{Total Electricity Consumption}}$$

$$0.57 \text{ kg } CO_2e/\text{kWh} = \frac{823 \text{ MT } CO_2e * 1{,}000 \text{ kg}}{95{,}485 \text{ kWh/year} * 15 \text{ year} * 1 \text{ MT}}$$

6. CONCLUSION / GHG ANALYSIS RESULTS

It is estimated that the Public Electric Vehicle Charging Station Expansion Project will result in a GHG emissions reduction of **61,704 MT CO_2e**, compared to the baseline if the Infrastructure and DCFC/Level 2 EVCS were not built and the vehicles continue to consume fossil fuel. The GHG emissions reduction accounts for the seventy-five (75) facilities expected to participate in the Pilot Project, for the anticipated duration of fifteen (15) years of the facilities' operations. These estimates are conservative based on assumptions for a Prototype Facility located on Oʻahu.

The GHG Analysis for a Prototype Facility includes projected GHG emissions directly attributable to the Prototype Facility as well as indirect GHG emissions from upstream and downstream activities, modified to the Prototype Facility and its location, all as described above in this report. The Prototype Facility will lead to a net lifecycle emissions reduction of **823 MT CO_2e**, through avoided use of fossil fuel that would be displaced by the electric vehicles, enabled by the installation of the Prototype Facility and Infrastructure. Total Project net lifecycle emissions reduction is estimated as **61,704 MT CO_2e** for the seventy-five (75) facilities included in the Project. The total Prototype Facility and Project GHG emissions are summarized in **Table 1**.

Table 1. GHG Emissions by Stage

Project Stage	GHG Intensity (kg CO_2e/kWh)	GHG Emissions[1,2] (MT CO_2e)
	Prototype Facility: Information for Each Site	
Project Operations	0.70	1,003
Project Lifecycle	0.85	1,212
Avoided Operations	1.4	2,035
Avoided Lifecycle	1.4	2,035
Net GHG Emissions Reduction - Operations[3]	**0.72**	**1,032**
Net GHG Emissions Reduction - Lifecycle [3]	**0.57**	**823**
	Overall Project Base Utilization[4]	
Net GHG Emissions Reduction - Operations[3]	**0.72**	**77,414**
Net GHG Emissions Reduction - Lifecycle [3]	**0.57**	**61,704**

Notes:

1. The GHG emissions that would result if the Infrastructure were not built and vehicles continue to consume fossil-fuel (referred to as "Avoided GHG Emissions"), are calculated based on the combustion emissions of the fuel that would be consumed, based on the assumed fuel economy and fuel type of the vehicles that would be displaced by electric vehicles. The Avoided GHG Emissions are assumed to equal the Avoided direct generation (i.e., combustion) emissions, and do not account for upstream or downstream emissions of fossil fuel supply or associated fueling infrastructure. This approach is conservative, because including upstream and downstream emissions of fossil fuel would only increase the avoided emissions and overall net emissions reduction. Even without the avoided upstream and downstream of fossil fuel, the Project GHG Emissions are lower than the Avoided GHG Emissions, resulting in net emissions reduction.
2. The Avoided GHG Emissions estimates are based on the most current information including emissions factors available to Ramboll at the time the analysis was completed.
3. Net Emissions are defined as the Avoided GHG Emissions less the Project GHG Emissions.
4. Overall project accounts for seventy-five (75) prototype facilities that are expected to participate in the Pilot project. The emissions reduction for operations and lifecycle are assumed to equal 75 times the estimated emissions reductions for the Prototype facility.

As presented in Attachment A Table 1, the majority of the lifecycle GHG emissions are contributed by the indirect emissions from electricity used for charging. As more renewables are added to the grid, the grid intensities are likely to decrease, resulting in lower indirect emissions associated with energy consumption and higher net lifecycle emissions reduction.

ATTACHMENT A
TABLES AND CALCULATIONS

RAMBOLL

Public Electric Vehicle Charger Expansion Project
Oʻahu
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2	Table 2	Net Emissions	Net GHG Emissions Reduction
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A2	Appendix Table A2	Transportation (project)	Material Transportation GHG Emissions Calculations
A3	Appendix Table A3	Construction	Construction GHG Emissions Calculations
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A5	Appendix Table A5	Decom. & Disposal	Decommissioning & Disposal GHG Emissions Calculations
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RAMBOLL

Table 1
Project GHG Emissions by Stage
Public Electric Vehicle Charger Expansion Project
Oʻahu

Project Stage		GHG Intensity ($kg\ CO_2e/kWh$)[1,2]	GHG Emissions ($MT\ CO_2e$)[1,2]
		Prototype Facility: Information for Each Site	
Upstream[3]	Raw Materials Extraction & Manufacturing	0.10	149
	Transportation	0.010	14
	Construction	0.026	37
Prototype Facility Operations	Operations & Maintenance	0.70	1,003
Downstream[4]	Transportation	0.0016	2.3
	Decommissioning & Disposal	0.0045	6.5
Total Prototype Facility Operations[5]		**0.70**	**1,003**
Total Prototype Facility Lifecycle		**0.85**	**1,212**
Total Project Operations[6]		**0.70**	**75,219**
Total Project Lifecycle[6]		**0.85**	**90,929**

Notes:

1. This table summarizes results from the GHG Analysis undertaken to determine the GHG emissions from the Project (referred to as "Project GHG Emissions"). The facility utilization asumption is based on the Business Case Analysis provided in Exhibit C of the Application. The facility utilization is based on the managed charging cases for the Project assuming a conservative estimate for the utilization of the four charging stations (two DCFC and two Level 2) at the facility. The supporting calculations are provided in the Calculation tabs for each Project Stage; each tab provides live cell logic, references, calculations and formulas unhidden and unprotected. The GHG Intensity is calculated by dividing the Project GHG Emissions by the Project lifetime charging capacity to present the GHG emission rate relative to the electricity dispensed by the project. Note that numbers may not add to totals due to rounding.
2. The Project GHG Emissions estimates are based on the most current information including emissions factors available to Ramboll at the time the analysis was completed. Notably, the operations & maintenance emissions are based on the electric grid intensity from 2020 and would be expected to decrease substantially in future years.
3. Upstream Transportation & Distribution and Construction Stages include all construction and transportation activity related to the installation of the proposed project activities, as described in more detail in the Transportation and Construction calculation tables.
4. Downstream decommissioning and disposal emissions include emissions associated with the removal and disposal of Project equipment.
5. Total Prototype Facility Operations includes GHG emissions from the Operations & Maintenance (Use) stage of the Prototype Facility.
6. Total project accounts for seventy-five (75) prototype facilities that are expected to participate in the Pilot project. The emissions for operations and lifecycle are assumed to equal 75 times the estimated emissions for the Prototype facility.

Abbreviations:

CO_2e - carbon dioxide equivalent
GHG - greenhouse gas
kg - kilogram
MWh - Megawatt hour
MT - metric ton

RAMBOLL

Table 2
Net GHG Emissions Reduction
Public Electric Vehicle Charger Expansion Project
Oʻahu

Project Stage	GHG Intensity (kg CO_2e/kWh)	GHG Emissions[1,2] (MT CO_2e)
	Prototype Facility: Information for Each Site	
Project Operations	0.70	1,003
Project Lifecycle	0.85	1,212
Avoided Operations	1.4	2,035
Avoided Lifecycle	1.4	2,035
Net GHG Emissions Reduction - Operations[3]	**0.72**	**1,032**
Net GHG Emissions Reduction - Lifecycle [3]	**0.57**	**823**
	Overall Project Base Utilization[4]	
Net GHG Emissions Reduction - Operations[3]	**0.72**	**77,414**
Net GHG Emissions Reduction - Lifecycle [3]	**0.57**	**61,704**

Notes:

1. The GHG emissions that would result if the Infrastructure were not built and vehicles continue to consume fossil-fuel (referred to as "Avoided GHG Emissions"), are calculated based on the combustion emissions of the fuel that would be consumed, based on the assumed fuel economy and fuel type of the vehicles that would be displaced by electric vehicles. The Avoided GHG Emissions are assumed to equal the Avoided direct generation (i.e., combustion) emissions, and do not account for upstream or downstream emissions of fossil fuel supply or associated fueling infrastructure. This approach is conservative, because including upstream and downstream emissions of fossil fuel would only increase the avoided emissions and overall net emissions reduction. Even without the avoided upstream and downstream of fossil fuel, the Project GHG Emissions are lower than the Avoided GHG Emissions, resulting in net emissions reduction.

2. The Avoided GHG Emissions estimates are based on the most current information including emissions factors available to Ramboll at the time the analysis was completed.
3. Net Emissions are defined as the Avoided GHG Emissions less the Project GHG Emissions.
4. Overall project accounts for seventy-five (75) prototype facilities that are expected to participate in the Pilot project. The emissions reduction for operations and lifecycle are assumed to equal 75 times the estimated emissions reductions for the Prototype facility.

Abbreviations:

CO_2e - carbon dioxide equivalent
GHG - greenhouse gas
kg - kilogram
MT - metric ton
MWh - megawatt hour

RAMBOLL

Table 3
Project Specific Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
General Project			
Project Name	Public Electric Vehicle Charger Expansion Project	--	Provided by Hawaiian Electric.
Project Location (Island)	Oʻahu	--	Assumed a Site in Oʻahu to be conservative because Oʻahu has higher grid intensity compared to Maui or Hawaiʻi island.
Project Lifetime	15	yr	Provided by Hawaiian Electric.
Project Site Area	0.23	acres	Provided by Hawaiian Electric.
Number of Sites	75	--	Provided by Hawaiian Electric.
Electricity Dispensed by Project Chargers, Mid-Day (per Site)	53,980	total kWh/year for all EVCS in the facility	Provided by Hawaiian Electric from Cost-Benefit Analysis, assuming each facility serves 4 EVCS (6 ports). This includes 2 single-port DCFC and 2 dual-port level 2 chargers.
Electricity Dispensed by Project Chargers, Peak (per Site)	20,500	total kWh/year for all EVCS in the facility	Provided by Hawaiian Electric from Cost-Benefit Analysis, assuming each facility serves 4 EVCS (6 ports). This includes 2 single-port DCFC and 2 dual-port level 2 chargers.
Electricity Dispensed by Project Chargers, Off-Peak (per Site)	21,005	total kWh/year for all EVCS in the facility	Provided by Hawaiian Electric from Cost-Benefit Analysis, assuming each facility serves 4 EVCS (6 ports). This includes 2 single-port DCFC and 2 dual-port level 2 chargers.
Island Location of Site (Final Port Location)	Honolulu Harbor	--	Determined based on Project Location (Island).
Distance from Final Hawaiʻi Port to Site Location	20	mi	Provided by Hawaiian Electric.
Make-Ready Infrastructure Prototype Facility Inputs (per Site)			
Electric Vehicle Charging Stations (EVCS) - Level 2 Chargers	Yes		
Number of EVCS per Site	2	--	Provided by Hawaiian Electric. Total: 75 Sites.
Type of EVCS	Level 2	--	Assumed for the prototype facility.
EVCS Amperage	600	A	Provided by Hawaiian Electric.
EVCS Voltage	480	V	Provided by Hawaiian Electric.
EVCS Manufacturer	unknown	--	Provided by Hawaiian Electric.
Location of EVCS Manufacturer	City of Industry, California	--	Confirmed by Hawaiian Electric.
Predominant Type of Vehicles Using Chargers	Car	--	Confirmed by Hawaiian Electric.
Predominant Fuel Being Replaced by Chargers	Gasoline		Confirmed by Hawaiian Electric.
Weight per Charger	37	kg	A typical Level 2 charger may weight 37 kg based on Schneider (2017).
Equipment Lifetime (Expected Useful Life of the Equipment)	15	yr	Provided by Hawaiian Electric.
Number of Equipment over Project Lifetime	2	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Electric Vehicle Charging Stations (EVCS) - DCFC Chargers	Yes		
Number of EVCS per Site	2	--	Provided by Hawaiian Electric. Total: 75 Sites.
Type of EVCS	DCFC	--	Assumed for the prototype facility.
EVCS Amperage	600	A	Provided by Hawaiian Electric.
EVCS Voltage	480	V	Provided by Hawaiian Electric.
EVCS Manufacturer	unknown	--	Provided by Hawaiian Electric.
Location of EVCS Manufacturer	City of Industry, California	--	Confirmed by Hawaiian Electric.
Predominant Type of Vehicles Using Chargers	Car	--	Confirmed by Hawaiian Electric.
Predominant Fuel Being Replaced by Chargers	Gasoline		Confirmed by Hawaiian Electric.
Weight per Charger	295	kg	DCFC weight of 295 kg is estimated based on ChargePoint Express 250 DC Fast Charger.
Equipment Lifetime (Expected Useful Life of the Equipment)	15	yr	Provided by Hawaiian Electric.
Number of Equipment over Project Lifetime	2	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.

Table 3
Project Specific Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
Mini Power Center	Yes		
Number of Mini Power Centers	1	item	Provided by Hawaiian Electric.
Mini Power Centers Rating	23	kVA	Provided by Hawaiian Electric based on Eaton (2021).
Mini Power Center Manufacturer	Eaton	--	Provided by Hawaiian Electric.
Location of Mini Power Center Manufacturer	Cleveland, Ohio	--	Provided by Hawaiian Electric.
Weight of Each Mini Power Center	625	lb	Provided by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	15	yr	Confirmed by Hawaiian Electric.
Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Provided by Hawaiian Electric.
Bollards with Concrete Foundation	Yes		
Number of Bollards (w/ concrete foundation)	12	item	Provided by Hawaiian Electric.
Weight of Each Bollard	438	kg	Confirmed by Hawaiian Electric.
Height of Bollard (above ground)	4	ft	Provided by Hawaiian Electric.
Height of Bollard (below ground)	2	ft	Provided by Hawaiian Electric.
Diameter of Bollard	4	in	Provided by Hawaiian Electric.
Concrete encasing thickness	2	in	Provided by Hawaiian Electric.
Volume of concrete foundation (length x width x height)	905	in x in x in	Calculated based on information provided by the Hawaiian Electric.
Weight of Each Concrete Foundation	35	kg	Provided by Hawaiian Electric.
Additional Components Included for Bollards (w/ Concrete Foundation)	NA	--	Provided by Hawaiian Electric.
Location of Bollard Manufacturer - Steel Poles (w/ Concrete Foundation)	Valley, Nebraska	--	Confirmed by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	58	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for poles and fixtures.
Number of Equipment over Project Lifetime	12	item	Estimated based on lifetime of equipment and Project lifetime.
Final Concrete Disposal Location	Local (Island Location of Site)	--	Provided by Hawaiian Electric.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Conductor (Copper)	Yes		
Conductor Material	Copper	--	Provided by Hawaiian Electric.
Location of Conductor Manufacturer	Wadsworth, Ohio	--	Estimated based on locations provided by the Hawaiian Electric.
Wire 1 Diameter	0.081	in	Diameter of 12 AWG wire provided by Hawaiian Electric.
Wire 1 Length	50	ft	Provided by Hawaiian Electric.
Wire 2 Diameter	0.13	in	Diameter of #8 copper wire provided by the Hawaiian Electric.
Wire 2 Length	2,880	ft	Provided by Hawaiian Electric.
Wire 3 Diameter	0.36	in	Diameter of 2/0 copper wire provided by Hawaiian Electric.
Wire 3 Length	60	ft	Provided by Hawaiian Electric.
Wire 4 Diameter	0.46	in	Provided by Hawaiian Electric.
Wire 4 Length	70	ft	Provided by Hawaiian Electric.
Wire 5 Diameter	0.70	in	Diameter of 250 MCM conductor from main switchboard to DCFC provided by Hawaiian Electric.
Wire 5 Length	100	ft	Provided by Hawaiian Electric.
Wire 6 Diameter	0.35	in	Diameter of 3 AWG conductor from main switchboard to Mini Power Center provided by Hawaiian Electric.
Wire 6 Length	100	ft	Provided by Hawaiian Electric.
Total Conductor Volume	1,243	in^3	Calculated based on dimensions provided
Total Conductor Weight	403	lb	Calculated based on total weight and a copper density of 0.324 lb/in^3.
Equipment Lifetime (Expected Useful Life of the Equipment)	20	yr	Provided by Hawaiian Electric.
Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Provided by Hawaiian Electric.

Table 3
Project Specific Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
Duct Bank Casing	Yes		
Duct Bank Casing (Containing Transmission Line + Conduit Duct) Material	Thermal Concrete	--	Confirmed by Hawaiian Electric.
Duct Bank Casing Width (Transformer to Meter)	4	in	Provided by Hawaiian Electric.
Duct Bank Casing Depth (Transformer to Meter)	4	in	Provided by Hawaiian Electric.
Length Of Duct Bank Casing (Transformer to Meter)	50	ft	Provided by Hawaiian Electric.
Duct Bank Casing Width (Overhead to Transformer)	4	in	Provided by Hawaiian Electric.
Duct Bank Casing Depth (Overhead to Transformer)	4	in	Provided by Hawaiian Electric.
Length Of Duct Bank Casing (Overhead to Transformer)	480	ft	Provided by Hawaiian Electric.
Volume of Duct Bank	59	ft^3	Calculated based on duct bank casing dimensions and length.
Weight of Duct Bank	8,833	lb	Calculated based on Thermal Concrete density of 150 lb/ft3 and confirmed by the Hawaiian Electric.
Material to Surround Duct Bank	Fluidized Thermal Backfill	--	Confirmed by Hawaiian Electric.
Volume of Material to Surround Duct Bank	4,579	ft^3	Calculated based on excavation dimensions confirmed by Hawaiian Electric.
Weight of Material to Surround Duct Bank	654,741	lb	Calculated based on concrete density of 143 lb/ft3 that the Hawaiian Electric confirmed for Fluidized Thermal Backfill.
Percent of Thermal Concrete Materials Manufactured in British Columbia	21%	%	Based on information Hawaiian Electric confirmed for Thermal Concrete, the remaining Thermal Concrete Materials are manufactured locally in Hawaiʻi.
Percent of Fluidized Thermal Backfill Concrete Materials Manufactured in British Columbia	25%	%	Based on information the developer confirmed for Fluidized Thermal Backfill, the remaining Fluidized Thermal Backfill Materials are manufactured locally in Hawaiʻi.
Location of Duct Bank Casing Manufacturer - British Columbia	British Columbia, Canada	--	Confirmed by Hawaiian Electric.
Location of Duct Bank Casing Manufacturer - Local Manufacturer	Kapolei, Hawaiʻi	--	Confirmed by Hawaiian Electric.
Distance from Location of Duct Bank Casing Manufacturer - 2 to Site Location	20	mi	Calculated based on information provided by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	60	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for underground conduit.
Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
Final Concrete Disposal Location	Local (Island Location of Site)	--	Concrete disposal location provided by Hawaiian Electric.
End of Life Treatment	Decommissioning and disposal	--	Provided by Hawaiian Electric.
Circuit Breaker	Yes		
Number of Circuit Breakers - Type 1	2	item	Provided by Hawaiian Electric.
Number of Circuit Breakers - Type 2	1	item	Provided by Hawaiian Electric.
Circuit Breaker Rating - Type 1	100	A	DCFC circuit breaker provided by Hawaiian Electric based on Eaton (2021).
Circuit Breaker Rating - Type 2	70	A	Mini power center circuit breaker provided by Hawaiian Electric based on Eaton (2021).
Specification of Circuit Breaker - Type 1	Eaton	--	DCFC circuit breaker provided by Hawaiian Electric based on Eaton (2021).
Specification of Circuit Breaker - Type 2	Eaton	--	Mini power center circuit breaker provided by Hawaiian Electric based on Eaton (2021).
Weight of Each Circuit Breaker - Type 1	12	lb	Provided by Hawaiian Electric.
Weight of Each Circuit Breaker - Type 2	4.5	lb	Provided by Hawaiian Electric.
Location of Circuit Breaker Manufacturer	Arecibo, Puerto Rico	--	Confirmed by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	55	yr	Confirmed by Hawaiian Electric.
Number of Equipment over Project Lifetime - Type 1	2	item	Estimated based on lifetime of equipment and Project lifetime.
Number of Equipment over Project Lifetime - Type 2	1	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.

Table 3
Project Specific Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
Below Grade Handholes	Yes		
Total Number of Handholes	1	item	Provided by Hawaiian Electric.
Dimensions of Handholes	3 x 5	ft x ft	Provided by Hawaiian Electric; up to 3 x 5'
Handhole Material	Steel Frame with Concrete	--	Confirmed by Hawaiian Electric.
Volume of Each Handhole	200	ft^3	Default based on one-third the volume provided by Hawaiian Electric for previous GHG analysis project for 6x11 manholes. Confirmed by the Hawaiian Electric.
Weight of Each Handhole	13,621	lb	Default based on one-third the weight provided by Hawaiian Electric for previous GHG analysis project for 6x11 manholes. Confirmed by the Hawaiian Electric.
Location of Handhole Manufacturer	Kapolei, Hawai'i	--	Confirmed by Hawaiian Electric.
Distance from Handhole Manufacturer to Site	20	mi	Calculated based on information provided by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	51	yr	Confirmed by Hawaiian Electric.
Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
Final Concrete Disposal Location	Local (Island Location of Site)	--	Concrete disposal location provided by Hawaiian Electric.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Disconnect Switches	Yes		
Number of Disconnect Switches	2	item	Provided by Hawaiian Electric.
Amperage of Disconnect Switches	100	Amps	Provided by Hawaiian Electric.
Specification of Disconnect Switches	TU-1D (Hubbell, Turner) SBF_6912 (Royal)	--	Confirmed by Hawaiian Electric.
Weight of Each Disconnect Switches	1,100	lb	Confirmed by Hawaiian Electric.
Weight of Switch Enclosure	150	lb	Provided by Hawaiian Electric.
Insulation Gas in Disconnect Switches	N/A	--	Confirmed by Hawaiian Electric.
Location of Disconnect Switch Manufacturer	Centralia, Missouri	--	Confirmed by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	55	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for Station Equipment - Substations.
Number of Equipment over Project Lifetime	2	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Switchgears	Yes		
Total Number of Switchgears	1	item	Provided by Hawaiian Electric.
Amperage of Switchgears	400	Amps	Confirmed by Hawaiian Electric.
Weight of Switchgears	499	kg	Confirmed by Hawaiian Electric.
Specification of Switchgears	Eaton Switchgear	--	Confirmed by Hawaiian Electric.
Switchgear Insulation Material	Glass-polyester	--	Confirmed by Hawaiian Electric.
Location of Switches Manufacturer	Omaha, Nebraska	--	Confirmed by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	55	yr	Equipment lifetime based on Hawaiian Electric's Depreciation Study for Station Equipment - Substations.
Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Access Card Reader - EVSE Communications Box	Yes		
Number of Access Card Readers	3	item	Provided by Hawaiian Electric.
Weight of Each Access Card Reader	0.34	kg	Tier 1 Equipment information confirmed by the Hawaiian Electric.
Manufacturer/Model of Access Card Readers	HID Proximity ProxPro 5355	--	Tier 1 Equipment information confirmed by the Hawaiian Electric.
Location of Access Card Reader Manufacturer	Austin, Texas	--	Tier 1 Equipment information confirmed by the Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	30	yr	Tier 1 Equipment information confirmed by the Hawaiian Electric.
Number of Equipment over Project Lifetime	3	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.

Table 3
Project Specific Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
Cellular Meter	Yes		
Total Number of Cellular Meters	1	item	Provided by Hawaiian Electric.
Manufacturer and Model of Cellular Meters	L+G LTE 9S	--	Provided by Hawaiian Electric.
Weight of Cellular Meters	6.0	lb	Based on data sheet for Landis + Gyr E650 S4e Cellular Meter.
Location of Cellular Meters Manufacturer	Reynosa, Mexico	--	Based on Landis+Gyr website for electric meter manufacturing plant.
Equipment Lifetime (Expected Useful Life of the Equipment)	30	yr	Based on communication equipment lifetime provided by Hawaiian Electric for previous GHG Analysis project.
Number of Equipment over Project Lifetime	1	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Temporary Circuit-Testing Terminal	Yes		
Total Number of Circuit-Testing Terminals	6	item	Provided by Hawaiian Electric.
Voltage of Circuit-Testing Terminals	120VAC/125VDC	--	Confirmed by Hawaiian Electric.
Weight of Circuit-Testing Terminals	318	kg	Note that this may be an overestimate, both in weight per terminal and because temporary terminals should not have full RMEM emissions attributed to a single project.
Location of Circuit-Testing Terminals Manufacturer	Des Moines, Iowa	--	Confirmed by Hawaiian Electric.
Equipment Lifetime (Expected Useful Life of the Equipment)	30	yr	Confirmed by Hawaiian Electric.
Number of Equipment over Project Lifetime	6	item	Estimated based on lifetime of equipment and Project lifetime.
End of Life Treatment	Decommissioning and disposal	--	Confirmed by Hawaiian Electric.
Use (General)			
Electricity Emission Factor - Mid-Day	1,378	lb CO_2e/MWh	Provided by Hawaiian Electric based on 2020 actual Oʻahu grid intensity. Note, this will likely decrease in future years due to more renewables added into the grid. This is a conservative estimate.
Electricity Emission Factor - Peak	1,773	lb CO_2e/MWh	Provided by Hawaiian Electric based on 2020 actual Oʻahu grid intensity. Note, this will likely decrease in future years due to more renewables added into the grid. This is a conservative estimate.
Electricity Emission Factor - Off-Peak	1,737	lb CO_2e/MWh	Provided by Hawaiian Electric based on 2020 actual Oʻahu grid intensity. Note, this will likely decrease in future years due to more renewables added into the grid. This is a conservative estimate.
Truck Trips for O&M	4	trips/year	Confirmed by Hawaiian Electric.
Truck Trip Distance for O&M	30	miles/round-trip	Confirmed by Hawaiian Electric.
Decommissioning and Disposal of Proposed Project			
Decommissioning Intensity Relative to Construction	3%	%	Based on GHG emissions estimated for construction and deconstruction phases for the Southern California Edison's Lakeview Substation Project, which includes substation and transmission line scope, and is therefore of similar scope to this Project.
Global Warming Potentials			
Carbon Dioxide	1.0	g CO_2e/g CO_2	Intergovernmental Panel on Climate Change (IPCC), Fifth Assessment Report (AR5), 2014.
Methane	28	g CO_2e/g CH_4	
Nitrous Oxide	265	g CO_2e/g N_2O	
Sulfur Hexafluoride	23,500	g CO_2e/g SF_6	

Abbreviations:

CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
DCFC - D.C. Fast Charger
ft - feet
ft^3 - cubic feet
GHG - greenhouse gas
GWP - global warming potentials
g - gram
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
kV - kilovolt
kVA - kilovolt-ampere
lb - pounds
mi - miles
MVA - megavolt-ampere
N_2O - nitrous oxide
SF_6 - sulfur hexafluoride
yr - year

Table 3
Project Specific Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
O'ahu

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Table 4
Project Specific Construction Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
General Project Construction (Per Site)			
Construction Start Date (mm/dd/yyyy)	7/1/2023	--	Provided by Hawaiian Electric.
Construction End Date (mm/dd/yyyy)	12/31/2023	--	Provided by Hawaiian Electric.
Construction Site Area	0.23	acres	Provided by Hawaiian Electric.
Number of Sites	75	--	Provided by Hawaiian Electric.
Site Clearing	Yes		
Backhoe	1	#	Confirmed by Hawaiian Electric.
Vans	1	#	
Pick-Up Truck	2	#	
Generator	1	#	
Number of Potholes	4	#	Provided by Hawaiian Electric.
Number of Days	2	days	Provided by Hawaiian Electric.
Number of Workers	6	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	1,800	ft^3	Assumes 1,200 sqft of hardened surface and 600 sqft of cleared/grubbed land will be removed with approximately 1 ft of thickness.
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Roadways	Yes		
Vans	1	#	Confirmed by Hawaiian Electric.
Pick-Up Truck	2	#	
Generator	1	#	
Number of Days	2	days	Provided by Hawaiian Electric.
Number of Workers	5	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	60	ft^3	Assumes 120 sqft of hardened surface to be removed with approximately 6" of thickness.
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Concrete Foundation Installation	Yes	#	
Pick-Up Truck	2	#	Confirmed by Hawaiian Electric.
Hyliner	1	#	
Number of Days	5	days	Provided by Hawaiian Electric.
Number of Workers	4	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Trenching	Yes		
Backhoe	1	#	Confirmed by Hawaiian Electric.
Number of Days	5	days	Provided by Hawaiian Electric.
Number of Workers	1	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	4,800	ft^3	Based on trench dimensions provided; 600 ft * 24 inches x 4 ft for trenching
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Underground Cable Installation	Yes		
Backhoe	1	#	Confirmed by Hawaiian Electric.
Crane	1	#	
Forklift	1	#	
Number of Days	5	days	Provided by Hawaiian Electric.
Number of Workers	4	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Handhole Installation	Yes		
Crane	1	#	Confirmed by Hawaiian Electric.
Forklift	1	#	
Number of Days	7	days	Provided by Hawaiian Electric.
Number of Workers	3	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Default assumption that no excavated material will be hauled offsite.
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.

Table 4
Project Specific Construction Inputs and Assumptions
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Prototype Facility: Information for Each Site	Unit	Reference
Trench Backfill	Yes		
Backhoe	2	#	Confirmed by Hawaiian Electric.
Number of Days	5	days	Provided by Hawaiian Electric.
Number of Workers	3	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Provided by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Paving	Yes		
Paving Equipment	1	#	Confirmed by Hawaiian Electric.
Skidsteer	1	#	
Aggregate Truck	1	#	
Generator	1	#	
Number of Days	2	days	Provided by Hawaiian Electric.
Number of Workers	1	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Confirmed by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Switchgear Installation	Yes		
Vans	1	#	Confirmed by Hawaiian Electric.
Boom Truck	1	#	
Flat Bed	1	#	
Pick-Up Truck	1	#	
Generator	1	#	
Number of Days	2	days	Provided by Hawaiian Electric.
Number of Workers	6	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Confirmed by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Grounding Installation	Yes		
Vans	1	#	Confirmed by Hawaiian Electric.
Pick-Up Truck	1	#	
Generator	1	#	
Number of Days	2	days	Provided by Hawaiian Electric.
Number of Workers	8	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Confirmed by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Interconnection Wiring	Yes		
Vans	2	#	Confirmed by Hawaiian Electric.
Pick-Up Truck	1	#	
Generator	1	#	
Number of Days	4	days	Provided by Hawaiian Electric.
Number of Workers	5	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Confirmed by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.
Final Testing	Yes		
Vans	1	#	Confirmed by Hawaiian Electric.
Pick-Up Truck	1	#	
Generator	0	#	
Number of Days	0.5	days	Provided by Hawaiian Electric.
Number of Workers	3	workers	Default value estimated assuming 1.25 workers per piece of equipment, per CalEEMod Appendix A.[1]
Excavated Material to be Removed	0	ft^3	Confirmed by Hawaiian Electric.
Worker Trip Length to/from the Site	35	miles/one-way trip	Confirmed by Hawaiian Electric.
Offsite Hauling Trip Length	20	miles/one-way trip	Confirmed by Hawaiian Electric.

Abbreviations:

- number
CalEEMod - CALifornia Emissions Estimator MODel
ft^3 - cubic feet

References:

1. CAPCOA. 2017. CALifornia Emissions Estimator MODel. Available online at: http://www.caleemod.com/

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Appendix Table A1
Raw Materials Extraction & Manufacturing GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
Oʻahu

Description	Total Items[1]	Weight per Item (kg)[1]	Rating (MVA)[1]	Lifecycle GHG Emission Factor	Units	Note	GHG Emissions (MT CO_2e)
	Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site		Pilot Project			Prototype Facility: Information for Each Site
Electric Vehicle Charging Stations (EVCS) - Level 2 Chargers	2	--	--	403	kg CO2e/charger	2	0.81
Electric Vehicle Charging Stations (EVCS) - DCFC Chargers	2	--	--	4,560	kg CO2e/charger	3	9.1
Bollards with Concrete Foundation - Steel Bollards	12	438	--	4.7	kg CO_2e/kg	4	25
Bollards with Concrete Foundation - Concrete Foundation	12	35	--	0.11	kg CO_2e/kg	5	0.045
Conductor (Copper) Weight of Conductor	1	183	--	4.7	kg CO2e/kg	6	0.86
Duct Bank Casing (Thermal Concrete)	1	4,007	--	0.11	kg CO_2e/kg	7	0.42
Material to Surround Duct Bank (Fluidized Thermal Backfill)	1	296,986	--	0.11	kg CO_2e/kg	8	31
Mini Power Center	1	283	0.023	6,237	kg CO_2e/item	9	6.2
Circuit Breaker - Type 1	2	5.2	--	4.2	kg CO_2e/kg	10	0.044
Circuit Breaker - Type 2	1	2.0	--	4.2	kg CO_2e/kg	10	0.0086
Below Grade Handholes	1	6,178	--	0.11	kg CO_2e/kg	12	0.65
Disconnect Switches	2	499	--	2.7	kg CO_2e/kg	12	2.7
Switchgears	1	499	--	4.2	kg CO_2e/kg	13	2.1
Access Card Reader - EVSE Communications Box	3	0.34	--	37	kg CO_2e/kg	16	0.037
Cellular Meter	1	2.7	--	37	kg CO_2e/kg	15	0.10
Temporary Circuit-Testing Terminal	6	318	--	37	kg CO_2e/kg	16	70
							149

Appendix Table A1
Raw Materials Extraction & Manufacturing GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

Notes:

1. Project specifications, assumptions and references are provided in Table 3. Where weight is not shown, it is not used in the calculation.
2. The GHG emission factor for the electric vehicle charging stations (EVCS) - Level 2 Chargers is obtained from Schneider Electric (2017). Electric Vehicle Charging Station Product Environmental Profile. Available at: https://download.schneider-electric.com/files?p_Doc_Ref=ENVPEP1608002EN.
3. The GHG emission factor for the electric vehicle charging stations (EVCS) - DCFC Chargers is obtained from Bi et al (2015). Plug-in vs. wireless charging: Life cycle energy and greenhouse gas emissions for an electric bus system. Available at: https://chrismi.sdsu.edu/publications/2015_Bi_Zicheng.Applied.Energy.pdf.
4. The GHG emission factor for the Bollards with Concrete Foundation - Steel Bollards is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Classen, M., market for steel, chromium steel 18/8, hot rolled, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
5. The GHG emission factor for the Bollards with Concrete Foundation - Concrete Foundation is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Martineau, G., market for concrete, 20MPa, North America geography ("RNA", e.g. value represents activities which are considered to be an average valid for all countries in North America, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6. The emission factor is normalized based on the density of concrete, approximately 2,335 kg/m^3, provided in documentation of the dataset.
6. The GHG emissions factor for the Secondary Conductor (Copper) is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Althaus, H.J., copper production, primary, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
7. The GHG emission factor for the Duct Bank Casing (Thermal Concrete) is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Martineau, G., market for concrete, 20MPa, North America geography ("RNA", e.g. value represents activities which are considered to be an average valid for all countries in North America, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6. The emission factor is normalized based on the density of concrete, approximately 2,335 kg/m^3, provided in documentation of the dataset.
8. The GHG emission factor for Material to Surround Duct Bank (Fluidized Thermal Backfill) is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Martineau, G., market for concrete, 20MPa, North America geography ("RNA", e.g. value represents activities which are considered to be an average valid for all countries in North America, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6. The emission factor is normalized based on the density of concrete, approximately 2,335 kg/m^3, provided in documentation of the dataset.
9. The GHG emission factor for the Mini Power Center is estimated from Jorge, et al. (2011b, Figure 1). These factors represent the CO_2e emissions per item associated with raw material extraction and production for the transformer. Jorge et al., 2011b estimated emissions from transformers of ratings between 0.35 to 500 MVA; the emission factor for the Mini Power Center Transformer was calculated based on the emissions per transformer rating for the Jorge transformer with the closest rating (using geometric mean) to the Project's transformer, scaled to the Project's rating.
10. The GHG emission factor for the Circuit Breakers is estimated from Jorge, et al., 2011b (Figure 2). This factor represent the CO2e emissions per item associated with raw material extraction and production for the Circuit Breaker. The emission factor for the Circuit Breakers is based on the emission factor for the Medium Voltage Switchgear from Jorge et al., 2011b.

Appendix Table A1
Raw Materials Extraction & Manufacturing GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

[11] The GHG emission factor for the Below Grade Handholes is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Martineau, G., market for concrete, 20MPa, North America geography ("RNA", e.g. value represents activities which are considered to be an average valid for all countries in North America, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6. The emission factor is normalized based on the density of concrete, approximately 2,335 kg/m^3, provided in documentation of the dataset.

[12] The GHG emission factor for the Disconnect Switches is estimated from Jorge, et al., 2011b (Figure 2b). This factor represents the CO_2e emissions per item associated with raw material extraction and production for the Disconnect Switches. The emission factor for the Disconnect Switches is based on the emission factor for the Center Breaker Disconnector from Jorge et al., 2011b, normalized based on weight provided in Table S14 of Jorge, et al. 2011b.

[13] The GHG emission factor for the Switchgears is estimated from Jorge, et al., 2011b (Figure 2). This factor represent the CO_2e emissions per item associated with raw material extraction and production for the Switchgears. The emission factor for the Switchgears is based on the emission factor for the Medium Voltage Switchgear from Jorge et al., 2011b, normalized based on weight, provided in Table S18 of Jorge, et al., 2011b.

[14] The GHG emission factor for the Access Card Reader is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for electronics, for control units, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.

[15] The GHG emission factor for the Cellular Meter is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for electronics, for control units, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.

[16] The GHG emission factor for the Temporary Circuit-Testing Terminal is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for electronics, for control units, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), System Model Allocation, cut-off by classification ("Allocation, cut-off by classification", e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.

Abbreviations:

CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
DCFC - D.C. Fast Charger
GHG - greenhouse gas
GWP - global warming potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
kV - kilovolts
m^2 - square meter
MT - metric ton
MVA - megavolt-ampere
SF_6 - sulfur hexafluoride
T&D - transmission and distribution

Appendix Table A1
Raw Materials Extraction & Manufacturing GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

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Appendix Table A2
Material Transportation GHG Emissions Calculations - Prototype Facility: Information for Each Site
Public Electric Vehicle Charger Expansion Project
O'ahu

Mode of Travel	Emission Factors[1,2]							
	CO_2	units	CH_4	units	N_2O	units	CO_2e	units
Truck	0.21	kg/ton-mi	2.0E-06	kg/ton-mi	4.9E-06	kg/ton-mi	0.15	kg/MT-km
	1.407	kg/vehicle-mi	0.000013	kg/vehicle-mi	3.30E-05	kg/vehicle-mi	1.42	kg/vehicle-mi
Ship	--	kg/ton-mi	--	kg/ton-mi	--	kg/ton-mi	0.0066	kg/MT-km

Transportation Emissions:

Shipment Item	Weight per Item (kg)	Total Items	Net Weight[3] (MT)	Phase	Origin	Destination	Mode[4]	Trip length (mi or nmi)[5]	Trip Type[6]	GHG Emissions (MT CO_2e)	
										Per Segment	Per Shipment Item Type
Electric Vehicle Charging Stations (EVCS) - Level 2 Chargers	37	2	0.074	Upstream	City of Industry, California (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	36	One-Way	6.2E-04	0.031
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.0020	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.029	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.029	0.031
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.0020	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	4.3E-04	
Electric Vehicle Charging Stations (EVCS) - DCFC Chargers	295	2	0.59	Upstream	City of Industry, California (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	36	One-Way	0.0050	0.052
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.016	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.031	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.031	0.051
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.016	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.0035	
Mini Power Center	283	1	0.28	Upstream	Cleveland, Ohio (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	2,361	One-Way	0.16	0.19
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.0078	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.030	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.030	0.039
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.0078	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.0017	
Bollards with Concrete Foundation - Steel Bollard	438	12	5.3	Upstream	Valley, Nebraska (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	1,562	One-Way	1.9	2.1
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.14	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.053	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.053	0.23
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.14	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.031	
Bollards with Concrete Foundation - Concrete Foundation	35	12	0.42	Upstream	Valley, Nebraska (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	1,562	One-Way	0.15	0.20
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.012	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.030	
				Downstream	Site	Grace Pacific Landfill, O'ahu	Truck	20	Roundtrip	0.030	0.030
Conductor (Copper)	183	1	0.18	Upstream	Wadsworth, Ohio (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	2,376	One-Way	0.10	0.14
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.0050	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.029	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.029	0.035
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.0050	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.0011	

Appendix Table A2
Material Transportation GHG Emissions Calculations - Prototype Facility: Information for Each Site
Public Electric Vehicle Charger Expansion Project
Oʻahu

Shipment Item	Weight per Item (kg)	Total Items	Net Weight[3] (MT)	Phase	Origin	Destination	Mode[4]	Trip length (mi or nmi)[5]	Trip Type[6]	GHG Emissions (MT CO_2e)	
										Per Segment	Per Shipment Item Type
Duct Bank Casing (Thermal Concrete)	828	1	0.83	Upstream	British Columbia, Canada (Manufacturer/Warehouse)	Victoria (Port)	Truck	288	One-Way	0.056	0.12
					Victoria (Port)	Los Angeles (Port)	Ship	1,081	One-Way	0.011	
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.023	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.032	
				Downstream	Site	Grace Pacific Landfill, Oʻahu	Truck	20	Roundtrip	0.032	0.032
	3,179	1	3.2	Upstream	Kapolei, Hawaiʻi (Manufacturer/Warehouse)	Site	Truck	20	Roundtrip	0.043	0.043
				Downstream	Site	Grace Pacific Landfill, Oʻahu	Truck	20	Roundtrip	0.043	0.043
Material to Surround Duct Bank (Fluidized Thermal Backfill)	73,417	1	73	Upstream	British Columbia, Canada (Manufacturer/Warehouse)	Victoria (Port)	Truck	288	One-Way	5.0	8.3
					Victoria (Port)	Los Angeles (Port)	Ship	1,081	One-Way	1.0	
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	2.0	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.37	
				Downstream	Site	Grace Pacific Landfill, Oʻahu	Truck	20	Roundtrip	0.37	0.37
	223,569	1	224	Upstream	Kapolei, Hawaiʻi (Manufacturer/Warehouse)	Site	Truck	20	Roundtrip	1.1	1.1
				Downstream	Site	Grace Pacific Landfill, Oʻahu	Truck	20	Roundtrip	1.1	1.1
Circuit Breaker - Type 1	5.2	2	0.010	Upstream	Arecibo, Puerto Rico (Manufacturer/Warehouse)	Puerto Rico (Port)	Truck	44	One-Way	1.1E-04	0.029
					Puerto Rico (Port)	Los Angeles (Port)	Ship	3,943	One-Way	5.0E-04	
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	2.9E-04	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.028	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.028	0.029
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	2.9E-04	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	6.1E-05	
Circuit Breaker - Type 2	2.0	1	0.0020	Upstream	Arecibo, Puerto Rico (Manufacturer/Warehouse)	Puerto Rico (Port)	Truck	44	One-Way	2.1E-05	0.029
					Puerto Rico (Port)	Los Angeles (Port)	Ship	3,943	One-Way	9.9E-05	
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	5.6E-05	
					--	--	Truck	--	One-Way	--	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.028	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.028	0.028
					--	--	Truck	--	One-Way	--	
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	5.6E-05	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	1.2E-05	
Below Grade Handholes	6,178	1	6.2	Upstream	Kapolei, Hawaiʻi (Manufacturer/Warehouse)	Site	Truck	20	Roundtrip	0.057	0.057
				Downstream	Site	Grace Pacific Landfill, Oʻahu	Truck	20	Roundtrip	0.057	0.057
Disconnect Switches	499	2	1.0	Upstream	Centralia, Missouri (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	1,780	One-Way	0.42	0.48
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.027	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.033	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.033	0.066
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.027	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.0058	
Switchgears	499	1	0.50	Upstream	Omaha, Nebraska (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	1,686	One-Way	0.20	0.24
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.014	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.031	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.031	0.047
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.014	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.0029	

Appendix Table A2
Material Transportation GHG Emissions Calculations - Prototype Facility: Information for Each Site
Public Electric Vehicle Charger Expansion Project
Oʻahu

Shipment Item	Weight per Item (kg)	Total Items	Net Weight[3] (MT)	Phase	Origin	Destination	Mode[4]	Trip length (mi or nmi)[5]	Trip Type[6]	GHG Emissions (MT CO_2e)	
										Per Segment	Per Shipment Item Type
Access Card Reader - EVSE Communications Box	0.34	3	0.0010	Upstream	Austin, Texas (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	1,498	One-Way	3.5E-04	0.029
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	2.8E-05	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.028	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.028	0.028
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	2.8E-05	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	5.9E-06	
Cellular Meter	2.7	1	0.0027	Upstream	Reynosa, Mexico (Manufacturer/Warehouse)	Mexico (Port)	Truck	865	One-Way	5.5E-04	0.029
					Mexico (Port)	Los Angeles (Port)	Ship	1,006	One-Way	3.4E-05	
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	7.4E-05	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.028	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.028	0.028
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	7.4E-05	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	1.6E-05	
Temporary Circuit-Testing Terminal	318	6	1.9	Upstream	Des Moines, Iowa (Manufacturer/Warehouse)	Los Angeles (Port)	Truck	1,748	One-Way	0.78	0.87
					Los Angeles (Port)	Honolulu Harbor (Port)	Ship	2,231	One-Way	0.052	
					Honolulu Harbor (Port)	Site	Truck	20	Roundtrip	0.037	
				Downstream	Site	Honolulu Harbor (Port)	Truck	20	Roundtrip	0.037	0.10
					Honolulu Harbor (Port)	Los Angeles (Port)	Ship	2,231	One-Way	0.052	
					Los Angeles (Port)	Los Angeles (Scrap Yard)	Truck	25	One-Way	0.011	
										Total Upstream GHG Emissions (MT CO_2e)[7]	**14**
										Total Downstream GHG Emissions (MT CO_2e)[8]	**2.3**
										Total GHG Emissions (MT CO_2e)	**16**

Notes:

1. The emission factors for road transportation are taken from US Environmental Protection Agency (EPA) Scope 3 Inventory Guidance, which recommends emission factors from Table 8 of Emission Factors for Greenhouse Gas Inventories.
2. The emission factor for shipping is based on the Global Maritime Emission Factor for dry (i.e., non-refrigerated) cargo shipping over all trade lanes for 2019 with a 70% utilization factor, assuming an average load weight of 10 tons in each container, as implemented in CN's Carbon Calculator.
3. The net weight is determined based on the weight of each item and the quantity of each item.
4. For a given transportation segment, if the mode of travel is not known and if multiple travel modes are available, the most emissions-intensive mode is selected.
5. The trip lengths for each leg of travel were estimated based on the following assumptions:
   (a) Shipping distances were estimated using the Sea Distance tool, available at https://sea-distances.org.
   (b) Truck distances were estimated by using Google Maps to determine driving distances between the locations.
6. GHG emissions are per segment (i.e. one-way travel) with the exception of estimated emissions to or from the site. These segments consider round-trip travel and use the USEPA Scope 3 Guidance EF for Heavy-Medium Duty Trucks to estimate emissions for the vehicle-miles traveled to or from the site.
7. Upstream transportation emissions include emissions from transporting the project materials from manufacturing to the project site.
8. Downstream transportation emissions include emissions from transporting the project materials from the project site to disposal at the scrap yard.

Abbreviations:

CH_4 - methane
CN - Canadian National
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
DCFC - D.C. Fast Charger
GHG - greenhouse gas
GWP - global warming potential
kg - kilogram
MVA - megavolt-ampere

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Appendix Table A3
Construction GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
Oʻahu

Construction Activity	Number of Workers	Days
	Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site
Site Clearing	6	2
Roadways	5	2
Concrete Foundation Installation	4	5
Trenching	1	5
Underground Cable Installation	4	5
Handhole Installation	3	7
Trench Backfill	3	5
Paving	1	2
Switchgear Installation	6	2
Grounding Installation	8	2
Interconnection Wiring	5	4
Final Testing	3	1

Construction Subphase	Equipment Type[1]	Total Items[1]	Avg. Usage Hours per Day	Utilization Rate	Hours of Operation (hr/ project)	Horsepower[2]	Load[2]	EF (g/bhp-hr)[3]			GHG Emissions[4] (MT CO_2e)
		Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site			CO_2	CH_4	CO_2e	Prototype Facility: Information for Each Site
Site Clearing	Backhoe	1.0	8.0	0.80	13	97	0.37	476	0.15	481	0.22
	Vans	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Pick-Up Truck	2.0	8.0	0.80	26	402	0.38	475	0.15	479	1.9
	Generator	1.0	8.0	0.80	13	84	0.74	568	0.025	569	0.45
Roadways	Vans	1.0	8.0	0.80	15	402	0.38	475	0.15	479	1.1
	Pick-Up Truck	2.0	8.0	0.80	30	402	0.38	475	0.15	479	2.2
	Generator	1.0	8.0	0.80	15	84	0.74	568	0.025	569	0.54
Concrete Foundation Installation	Pick-Up Truck	2.0	8.0	0.80	64	402	0.38	475	0.15	479	4.7
	Hyliner	1.0	8.0	0.80	32	231	0.29	473	0.15	477	1.0
Trenching	Backhoe	1.0	8.0	0.80	32	97	0.37	476	0.15	481	0.55
Underground Cable Installation	Backhoe	1.0	8.0	0.80	32	97	0.37	476	0.15	481	0.55
	Crane	1.0	8.0	0.80	32	231	0.29	473	0.15	477	1.0
	Forklift	1.0	8.0	0.80	32	89	0.20	472	0.15	476	0.27

Appendix Table A3
Construction GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

Construction Subphase	Equipment Type[1]	Total Items[1]	Avg. Usage Hours per Day	Utilization Rate	Hours of Operation (hr/ project)	Horsepower[2]	Load[2]	EF (g/bhp-hr)[3]			GHG Emissions[4] (MT CO_2e)
		Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site			CO_2	CH_4	CO_2e	Prototype Facility: Information for Each Site
Handhole Installation	Crane	1.0	8.0	0.80	45	231	0.29	473	0.15	477	1.4
	Forklift	1.0	8.0	0.80	45	89	0.20	472	0.15	476	0.38
Trench Backfill	Backhoe	2.0	8.0	0.80	64	97	0.37	476	0.15	481	1.1
Paving	Paving Equipment	1.0	8.0	0.80	13	132	0.36	471	0.15	475	0.29
	Skidsteer	1.0	8.0	0.80	13	97	0.37	476	0.15	481	0.22
	Aggregate Truck	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Generator	1.0	8.0	0.80	13	84	0.74	568	0.025	569	0.45
Switchgear Installation	Vans	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Boom Truck	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Flat Bed	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Pick-Up Truck	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Generator	1.0	8.0	0.80	13	84	0.74	568	0.025	569	0.45
Grounding Installation	Vans	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Pick-Up Truck	1.0	8.0	0.80	13	402	0.38	475	0.15	479	0.94
	Generator	1.0	8.0	0.80	13	84	0.74	568	0.025	569	0.45
Interconnection Wiring	Vans	2.0	8.0	0.80	51	402	0.38	475	0.15	479	3.7
	Pick-Up Truck	1.0	8.0	0.80	26	402	0.38	475	0.15	479	1.9
	Generator	1.0	8.0	0.80	26	84	0.74	568	0.025	569	0.91
Final Testing	Vans	1.0	8.0	0.80	3.2	402	0.38	475	0.15	479	0.23
	Pick-Up Truck	1.0	8.0	0.80	3.2	402	0.38	475	0.15	479	0.23
										Total Offroad Emissions from Construction Activity	**34**

Appendix Table A3
Construction GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

Construction Subphase	Average Worker Trip Rates[5] (trips/day)	Average Hauling Trip Rate (trips/day)	Worker Trip Length (mi/trip)	Hauling Trip Length (mi/trip)	CO_2e Hauling EF[6]		CO_2e Worker EF[6]		GHG Emissions[7] (MT CO_2e)
	Pilot Project	Pilot Project	Pilot Project	Pilot Project	(g/trip)	(g/mi)	(g/trip)	(g/mi)	Pilot Project
Site Clearing	13	5	35	20	304	696	65	276	0.4
Roadways	10	1	35	20	304	696	65	276	0.26
Concrete Foundation Installation	8	0	35	20	304	696	65	276	0.36
Trenching	3	5	35	20	304	696	65	276	0.5
Underground Cable Installation	8	0	35	20	304	696	65	276	0.36
Handhole Installation	5	0	35	20	304	696	65	276	0.34
Trench Backfill	5	0	35	20	304	696	65	276	0.24
Paving	3	0	35	20	304	696	65	276	0.049
Switchgear Installation	13	0	35	20	304	696	65	276	0.2
Grounding Installation	16	0	35	20	304	696	65	276	0.31
Interconnection Wiring	10	0	35	20	304	696	65	276	0.39
Final Testing	5	0	35	20	304	696	65	276	0.024
Total Onroad Emissions from Construction Activity									**3**
Total Construction Emissions									**37**

Notes:

1. Project specifications, assumptions and references are provided in Table 4. Each piece of construction equipment was modeled using a comparable piece of equipment from CalEEMod's off-road equipment list.
2. Unless specifically provided by the developer, horsepower and load factor were assumed to be consistent with CalEEMod® 2020.4.0., default assumptions.
3. Emission factors associated with offroad equipment are from ARB OFFROAD2017 for calendar years 2021 and 2022. This ARB database provides GHG emission factors for various equipment types and sizes. While more stringent criteria air pollutant requirements may result in lower criteria pollutant emission factors in California than Hawai'i, the fuel economy and therefore the GHG emission factors from offroad equipment are not expected to vary regionally. The OFFROAD database does not contain emission factors for N_2O emissions, which are expected to be minimal compared to overall offroad GHG emissions.
4. Offroad GHG emissions are calculated using a g/bhp-hr emission factor. This emission factor is multiplied by the hours of operation, horsepower, and load for each piece of equipment, then converted from grams to metric tons.
5. The number of home-to-work trips per day associated with each construction subphase activity was determined by multiplying the number of workers by two.
6. Emission factors associated with worker and hauling trips were estimated from California statewide emission factors generated using EMFAC2017 for calendar years 2021 and 2022. The worker fleet assumes only light duty vehicles (EMFAC classes LDA, LDT1, and LDT2) and the hauling fleet assumes heavy duty trucks (EMFAC classes HHDT, LHDT1, LHDT2, MDV, and MHDT). Mobile emission factors from California's EMFAC database represent a reasonable estimate of mobile emission factors for the Project. Hawai'i does not maintain a publicly-accessible database like EMFAC that could be used to assess location-specific vehicle fleet data in future years. However, 2015 data on average fuel economy for the existing light-duty fleets show relatively minor differences between Hawai'i, California, and US-average vehicles. Given that onroad vehicles represent a small portion of lifecycle emissions for the Project, any adjustments to these emission factors would not result in significant changes to the resulting emissions.
7. Onroad GHG emissions are calculated using g/trip and g/mi emission factors. The g/trip emission factors are multiplied by the trips per day, and the g/mi emission factors are multiplied by the miles per trip and trips per day. These emission rates are then multiplied by the number of days in each subphase, and converted from grams to metric tons.

Appendix Table A3
Construction GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
Oʻahu

Abbreviations:

ARB - California Air Resources Board
BESS - Battery Energy Storage System
bhp - brake horsepower
CalEEMod - California Emissions Estimator MODel
CH_4 - methane
CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
EF - emissions factor
EMFAC - EMission FACtor model
g - gram
GHG - greenhouse gas
HHDT - heavy-heavy-duty truck
hr - hour
kg - kilogram
LDA - light-duty automobile
LDT - light-duty truck
LHDT - light-heavy-duty truck
MDV - medium-duty vehicle
MHDT - medium-heavy-duty truck
mi - mile
MT - metric ton
N_2O - nitrous oxide
OHL - overhead line
PV - Photovoltaic
T&D - transmission and distribution

References:

California Emissions Estimator Model (CalEEMod®) v2020.4.0 Appendix D. Available at: http://www.aqmd.gov/docs/default-source/caleemod/05_appendix-d2016-3-2.pdf?sfvrsn=4.
California Air Resources Board (ARB) 2017. OFFROAD 2017. Available at: https://www.arb.ca.gov/orion/
California Air Resources Board (ARB) 2017. EMFAC2017. Available at: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools

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Appendix Table A4
Project Operations GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
Oʻahu

Inputs:

Source[1]	Input	Prototype Facility: Information for Each Site
		Base Utilization
First Year of Operation		2023
General - Mobile (Trucks)[2]	Annual Truck Trips (trips/yr)	4.0
	Truck Trip VMT (mi/round trip)	30
Charger Use	Electricity Dispensed - Mid-Day (kWh/yr)	53,980
	Electricity Dispensed - Peak (kWh/yr)	20,500
	Electricity Dispensed - Off-Peak (kWh/yr)	21,005

Emission Factors and Assumptions:

Source	Details	Prototype Facility: Information for Each Site
		Base Utilization
Truck Maintenance Trips[3]	Running Emissions (g/mi)	696
	Trip Emissions (g/trip)	304
Electricity Intensity Factor (kg CO_2e/MWh)	Electricity Dispensed - Mid-Day	625
	Electricity Dispensed - Peak	804
	Electricity Dispensed - Off-Peak	788

Greenhouse Gas Emissions:

Emission Source	Subcategory	Prototype Facility: Information for Each Site
		Base Utilization
Truck Maintenance Trips	Running Emissions (MT)	0.083
	Trip Emissions (MT)	0.0012
Emissions Increase from Electricity Used for Charging (MT)		67
	Years of Operation	15
	Total Emissions per Year (MT)	67
	Total Emissions Over Lifetime (MT)	**1,003**

Notes:

1. Project specifications, assumptions and references are provided in Table 3.
2. Mobile truck trips represent small trucks that drive to the Project site to perform routine operations and management procedures. Annual Truck Trips and Truck Trip VMT are provided in Table 3.
3. Mobile emission factors are from California's EMFAC2017 database. Emission factors were estimated by averaging statewide emission factors in the year of first operation for LHDT1 vehicles. Mobile emission factors from California's EMFAC database represent a reasonable estimate of mobile emission factors for the Project. Hawaii does not maintain a publicly-accessible database like EMFAC that could be used to assess location-specific vehicle fleet data in future years. However, 2015 data on average fuel economy for the existing light-duty fleets show relatively minor differences between Hawaii, California, and US-average vehicles. Given that onroad vehicles represent a small portion of lifecycle emissions for the Project, any adjustments to these emission factors would not result in significant changes to the resulting emissions.

Abbreviations:

CO_2 - carbon dioxide
CO_2e - carbon dioxide equivalent
EMFAC - Emissions FACtor model
g - grams
GWP - global warming potential
LHDT1 - light-heavy-duty truck
mi - miles
MT - metric ton
VMT - vehicle miles traveled
yr - year

References

California Air Resources Board (ARB) 2017. EMFAC2017. Available at: https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools

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Appendix Table A5
Decommissioning & Disposal GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
Oʻahu

Decommissioning and Disposal:

Stages	Components	Total Items[1]	Weight per Item (kg)[1]	Lifecycle GHG Emission Factor	Units	Note	GHG Emissions (MT CO_2e)
		Prototype Facility: Information for Each Site	Prototype Facility: Information for Each Site				Prototype Facility: Information for Each Site
Disposal	Electric Vehicle Charging Stations (EVCS) - Level 2 Chargers	2	37	0.15	kg CO_2e/kg disposed	2	0.0114
	Electric Vehicle Charging Stations (EVCS) - DCFC Chargers	2	295	0.15	kg CO_2e/kg disposed	2	0.091
	Mini Power Center	1	283	0.32	kg CO_2e/kg disposed	3	0.090
	Bollards with Concrete Foundation - Steel Bollard	12	438	0.0083	kg CO_2e/kg disposed	4	0.044
	Bollards with Concrete Foundation - Concrete Foundation	12	35	0.0083	kg CO_2e/kg disposed	5	0.0035
	Conductor (Copper)	1	183	0.015	kg CO_2e/kg disposed	6	0.0027
	Duct Bank Casing (Thermal Concrete)	1	4,007	0.0083	kg CO_2e/kg disposed	7	0.033
	Material to Surround Duct Bank (Fluidized Thermal Backfill)	1	296,986	0.0083	kg CO_2e/kg disposed	8	2.5
	Circuit Breaker - Type 1	2	5.2	0.32	kg CO_2e/kg disposed	9	0.0033
	Circuit Breaker - Type 2	1	2.0	0.32	kg CO_2e/kg disposed	9	6.5E-04
	Below Grade Handholes	1	6,178	0.0083	kg CO_2e/kg disposed	10	0.051
	Disconnect Switches	2	499	0.32	kg CO_2e/kg disposed	11	0.32
	Switchgears	1	499	0.32	kg CO_2e/kg disposed	12	0.16
	Access Card Reader - EVSE Communications Box	3	0.34	1.1	kg CO_2e/kg disposed	13	0.0011
	Cellular Meter	1	2.7	1.1	kg CO_2e/kg disposed	14	0.0030
	Temporary Circuit-Testing Terminal	6	318	1.1	kg CO_2e/kg disposed	15	2.1
Proposed Project	System Decommissioning					16	1.1
					Total Decommissioning and Disposal Emissions		**6.5**

Notes:

1. Project specifications, assumptions and references are provided in Table 3.
2. The GHG emission factor for disposal and decommissioning of the EVCS - Level 2 and EVCS - DCFC is estimated from the Schneider Electric (2017) EVCS environmental profile, scaled based on the input charger weight.
3. The GHG emission factor for the Mini Power Center is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for used industrial electronic device, WEEE collection, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
4. The GHG emission factor for the Bollard with Concrete Foundation - Steel Bollard is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for scrap steel, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
5. The GHG emission factor for the Bollard with Concrete Foundation - Concrete Foundation is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., market for waste concrete, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
6. The GHG emission factor for the Secondary Conductor (Copper) is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., treatment of scrap copper, municipal incineration, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
7. The GHG emission factor for the Duct Bank Casing (Thermal Concrete) is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., market for waste concrete, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
8. The GHG emission factor for the Material to Surround Duct Bank (Fluidized Thermal Backfill) is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., market for waste concrete, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
9. The GHG emission factor for the Circuit Breakers is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for used industrial electronic device, WEEE collection, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
10. The GHG emission factor for the below Grade Handholes is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Doka, G., market for waste concrete, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
11. The GHG emission factor for the Disconnect Switches is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for used industrial electronic device, WEEE collection, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.
12. The GHG emission factor for the Switchgears is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for used industrial electronic device, WEEE collection, Rest of world geography ("RoW", e.g. datasets (activities) with this geography contain data for the rest of the world datasets which are not represented in the ecoinvent database for specific regions), System Model Allocation, cut-off by classification (“Allocation, cut-off by classification”, e.g. a producer is fully responsible for the disposal of its wastes and does not receive any credit for the provision of any recyclable materials), ecoinvent database version 3.6.

Appendix Table A5
Decommissioning & Disposal GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

[13] The GHG emission factor for the Access Card Reader is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for electronics scrap from control units, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), Allocation, cut-off by classification, ecoinvent database version 3.6.

[14] The GHG emission factor for the Cellular Meter is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for electronics scrap from control units, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), Allocation, cut-off by classification, ecoinvent database version 3.6.

[15] The GHG emission factor for the Temporary Circuit-Testing Terminal is obtained from ecoinvent using the IPCC Fifth Assessment Report GWP from Hischier, R., market for electronics scrap from control units, global geography ("GLO", e.g. value represents activities which are considered to be an average valid for all countries in the world, and are calculated as the average of the regional datasets that contain information for the activity), Allocation, cut-off by classification, ecoinvent database version 3.6.

[16] Decommissioning emissions are assumed to be a percentage of construction emissions, as detailed in the Decommissioning and Disposal of Proposed Project, Decommissioning Intensity Relative to Construction input in Table 3 and in the Lakeview DEIR reference tab.

Abbreviations:

CO_2e - carbon dioxide equivalent
DCFC - D.C. Fast Charger
GHG - greenhouse gas
GLO - global
GWP - global warming potential
IPCC - Intergovernmental Panel on Climate Change
kg - kilogram
MVA - megavolt-ampere
RoW - rest of world
SF_6 - sulfur hexafluoride
T&D - transmission and distribution
WEEE - Waste Electrical and Electronic Equipment

References

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Hischier, R., market for electronics scrap from control units, GLO, Allocation, cut-off by classification, ecoinvent database version 3.6.
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Schneider Electric (2017). Electric Vehicle Charging Station Product Environmental Profile. Available at: https://download.schneider-electric.com/files?p_Doc_Ref=ENVPEP1608002EN

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Appendix Table A6
Avoided GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
Oʻahu

Inputs:

Source[1]	Input	Prototype Facility: Information for Each Site	Units
		Base Utilization	
Charger Use	Electricity Dispensed - Mid-Day	53,980	kWh/yr
	Electricity Dispensed - Peak	20,500	kWh/yr
	Electricity Dispensed - Off-Peak	21,005	kWh/yr
Predominant Type of Vehicles Using the Chargers		Car	--
Predominant Fuel Being Replaced by Chargers		Gasoline	--

EVCS Assumptions and Calculations:

Description	Prototype Facility: Information for Each Site	Units
	Base Utilization	
EV Fuel Economy[3]	0.25	kWh/mi
Fuel Economy of Fossil Fuel-Powered Vehicle[4]	24.9	mi/fuel gallon equivalent
Estimated Miles Replaced by Project Chargers	381,940	mi/yr
Gallons of Fuel Displaced by EVs	15,339	fuel gallon equivalents/yr
Emissions from Burning Fuel[2]	8.8	kg CO_2e/fuel gallon equivalent
Emissions Reduction for EV Replacing Fossil Fuel-Powered Vehicle	136	MT CO_2e/yr
Years of Operation	15	yr
Total Avoided Emissions	2,035	MT CO_2e

Notes:

1. Project specifications, assumptions and references are provided in Table 3.
2. Emission Factors for fuels are based on the U.S. Energy Information Administration (EIA). Carbon Dioxide Emissions Coefficients. 2021. Retrieved from: https://www.eia.gov/environment/emissions/co2_vol_mass.php
3. The EV fuel economy for electric cars is based on the National Renewable Energy Laboratory (NREL). 2018. California Plug-In Electric Vehicle Infrastructure Projections: 2017-2025 (Table C.1). Available at: https://www.nrel.gov/docs/fy18osti/70893.pdf.
4. Fuel economy for diesel fueled cars is from U.S. Environmental Protection Agency (EPA). 2020. EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology since 1975. Page 5. Available at: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1010U68.pdf

Abbreviations:

CO_2e - carbon dioxide equivalent
EPA - environmental protection agency
IPCC - Intergovernmental Panel on Climate Change
GHG - greenhouse gas
kg - kilgrams
kWh - kilowatt-hour
MT - metric ton

Appendix Table A6
Avoided GHG Emissions Calculations
Public Electric Vehicle Charger Expansion Project
O'ahu

References:

Code of Federal Regulations, Title 40, Part 98, Subpart C, Tables C-1 and C-2. https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=be77ce6e756f0befaa0dd95743e3342e&tpl=/ecfrbrowse/Title40/40cfr98_main_02.tpl

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Intergovernmental Panel on Climate Change (IPCC), Fifth Assessment Report (AR5), 2014.

Exhibit I

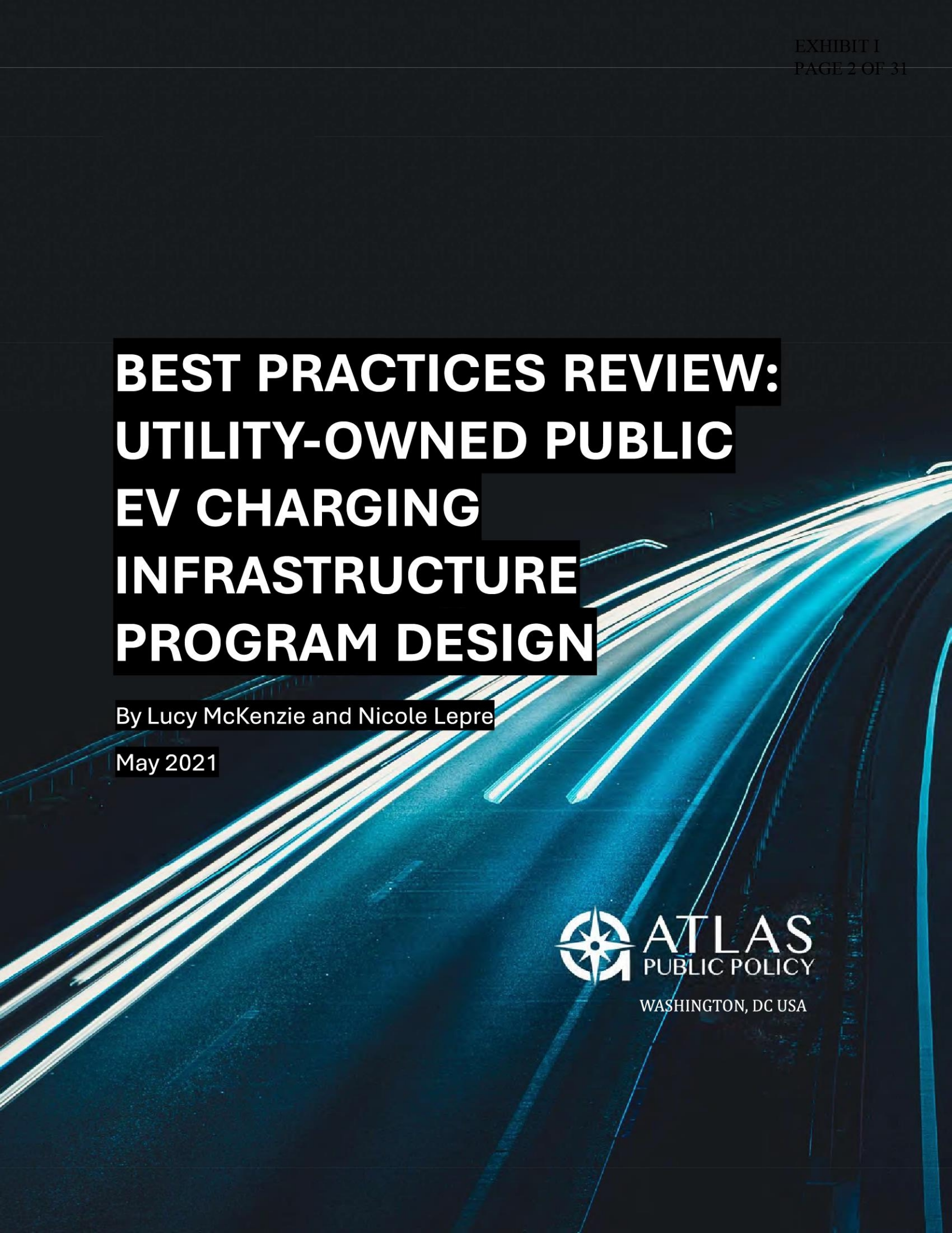
Public Electric Vehicle Charger Expansion Application

Best Practices Review

BEST PRACTICES REVIEW: UTILITY-OWNED PUBLIC EV CHARGING INFRASTRUCTURE PROGRAM DESIGN

By Lucy McKenzie and Nicole Lepre

May 2021



ATLAS PUBLIC POLICY
WASHINGTON, DC USA

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Introduction & Approach

This report seeks to collect best practices in the design of utility-owned public electric vehicle (EV) charging infrastructure programs. These best practices are organized under 14 public charging infrastructure program design elements developed by Atlas Public Policy (Atlas) and shown in Table 1.

Table 1. Public EV Charging Program Design Elements Reviewed

1. Utility ownership use cases and siting
2. Program size
3. Inclusion of underserved communities
4. Program outreach and education
5. Operations, maintenance & repair
6. Reporting and evaluation
7. Procurement of design and build work
8. Equipment vendor selection
9. Installation cost minimization
10. Installation sizing
11. Pricing, rate structures and metering
12. Cost recovery
13. Communications and payments
14. Power level

Best practices for each program design element are defined as those approved by state regulatory commissions.

Atlas Public Policy's EV Hub Utility Filings Dashboard identified 37 approved, utility-owned EV charging infrastructure programs in the U.S. across 25 investor-owned utilities in 20 states [1]. Atlas' Utility Filings Dashboard was used to derive summary-level statistics and information for all these programs. Twenty-seven of these programs included public charging stations. Of these, 13 programs were selected for more detailed review of filing and decision documents. These 13 programs were selected because they represent the largest approved investments, largest number of planned ports, and most recent approvals.

Table 2 below lists the programs that were reviewed in this more detailed fashion. Notably, all but two of these programs are pilot programs: only Duke Energy Florida's and Xcel Energy Colorado's programs are non-pilot programs.

Table 2: Approved Utility-Owned EV Infrastructure Programs Sample for More Detailed Review (sorted by most recent date approved)

Utility	Docket No.	Program Title	Pilot?	Program Term (years)	Date Approved	Use Targets for Utility-Owned Chargers
Duke Energy (FL)	20210016-EI	New EV Program in 2021 Settlement Agreement including General Base Rate Increases	No	4	5/4/2021	Public
Tampa Electric	20200220-EI	Electric Vehicle Charging Pilot Program	Yes	4	4/1/2021	Public, MUD, Fleets, Workplaces
Xcel Energy (CO)	20A-0204E	2021-2023 Transportation Electrification Plan	No	2	1/11/2021	Public
Duke Energy Progress & Duke Energy Carolinas (NC)	E-2, Sub 1197	Electric Transportation Pilot	Yes	3	11/24/2020	Public, MUD
Duke Energy (SC)	2018-321-E	Electric Transportation Pilot	Yes	3	9/1/2020	Public
Dominion Energy Virginia	PUR-2019-00154	Plan for Electric Distribution Grid Transportation Projects Pursuant to Section 56-585.1 A 6 of the Code of Virginia	Yes	3	3/26/2020	Public, Taxi/ Rideshare/ Shuttle
Portland General Electric (PGE)	UM-1811	Transportation Electrification Programs	Yes	10	11/17/2019	Public
Southern California Edison (SCE)	A1807022	Electrification Pilots for Parks Pursuant to Assembly Bill 1082	Yes	2	11/7/2019	Public (parks & beaches)

Utility	Docket No.	Program Title	Pilot?	Program Term (years)	Date Approved	Use Targets for Utility-Owned Chargers
Pacific Gas & Electric	A1807020	Electrification Pilots for Parks Pursuant to Assembly Bill 1082	Yes	2	11/7/2019	Public (parks & beaches)
San Diego Gas & Electric	A1807023	Electrification Pilots for Parks Pursuant to Assembly Bill 1082	Yes	2	11/7/2019	Public (parks & beaches)
Baltimore Gas & Electric, Delmarva Power, Potomac Edison, Pepco	9478	Statewide Electric Vehicle Portfolio	Yes	5	1/14/2019	Public
Puget Sound Energy	UE-180877	EVSE Portfolio	Yes	5	12/13/2018	Public, MUDs
Pacific Power	UM-1810	Transportation Electrification Programs	Yes	2	2/27/2018	Public

Source: Duke Energy (FL) (docket No. 20210016-EI): [2], Tampa Electric (docket No. 20200220-EI: [3], Xcel Energy (CO) (docket No. 20A-0204E): [4], Duke Energy Progress and Duke Energy Carolinas (docket No. E-2, Sub 1197): [5], Duke Energy (SC) (docket No. 2018-321-E): [6], Dominion Energy Virginia (docket No. PUR-2019-00154): [7], Portland General Electric (docket No. UM-1811): [8], San Diego Gas & Electric (docket No. A1807022): [9], Southern California Edison (docket No. A1807023): [9], Pacific Gas & Electric (docket No. A1807020): [9], Baltimore Gas & Electric Company (BGE), Delmarva Power, Potomac Edison, Pepco (docket No. 9478): [10], Puget Sound Electric (docket No. UE-180877): [11], Pacific Power (docket No. UM-1810): [12]

Utility Ownership Use Cases & Siting

Utilities have sought and been given approval to install chargers for specific use cases. Of the 37 U.S. approved utility-owned charging infrastructure programs at investor-owned utilities, 27 include public charging. Some of these also include multi-unit dwellings and other applications (see, for example, Table 2). The 10 programs that did not include public charging target multi-unit dwellings or workplaces or are specifically testing vehicle-grid integration. Some programs targeting public charging are specific about which public locations the program will target, such as the California programs targeting parks and beaches and the Xcel CO and Dominion programs targeting public locations that will support taxi/rideshare/shuttle drivers.

Common arguments cited in commission decisions approving the reviewed utility-owned programs are described below, with examples of each:

1. Utility-ownership is necessary to fill in charging gaps because the competitive market is currently insufficient to meet charging/ utility-ownership will help stimulate the market in its early stages. Examples are provided below:
    a. Duke Energy Carolinas and Duke Energy Progress (docket E-2, Sub 1197)
        i. *As Greenlots states, the private EV charging marketplace alone cannot adequately meet North Carolina's transportation electrification and emissions goals, let alone achieve market transformation or maximize future growth and associated benefits.*
    b. BGE, Delmarva Power, Potomac Edison, Pepco (docket 9478)
        i. *Although the Commission has adopted a policy in favor of competitive markets as an integral part of the State's electricity landscape, several industry participants observe that while EV markets continue to grow, public charging deployment has yet to attract sufficient levels of private investment to align with the State's EV adoption and GHG reduction goals. Several participants acknowledged during these proceedings that there are not enough EVs in Maryland to provide a return on investment for private market participants. And where private companies have been unable or unwilling to make initial capital investments in difficult and underserved areas, utility ownership can help reach these market segments faster.*
    c. Xcel Energy CO (docket 20A-0204E)
        i. Xcel will own charging stations if charging gaps remain after applications from interested site hosts and developers are reviewed. The approved Transportation Electrification Plan describes:
            1. *In order to maximize the impact of this program, the Company will solicit applications from site hosts and developers on a recurring basis and will determine which projects to*

select based on their alignment with the goals in SB 19-077. After taking applications and providing EV Supply Infrastructure to site hosts and developers, the Company will evaluate whether the needs of communities are being met and whether the overall public charging network is being adequately served by third parties and, if necessary, the Company is proposing to own and operate a limited number of public fast charging stations to address gaps in the network.

ii. "Public Service proposes that utility owned DCFCs would target underserved areas where the market does not attract private investment... Public Service states, as a regulated company, itis particularly well-suited to invest in underserved communities with less concern for immediate profitability."

iii. "...we expect to re-visit this issue and, at this time, we do expect to see a reduced role for utility ownership in a more mature market and will expect to address how utility ownership changes as competition develops."

d. Duke Energy SC (2018-32-E)

i. Utility-owned chargers can "...provide a foundational level of infrastructure and facilitate EV market growth,"

e. Pacific Power (UM-1810)

i. The programs also have broad support from various stakeholders representing divergent interests, including from companies active in the EV charging market who believe the programs will lead to EV market growth and greater opportunity for all market participants.

ii. We are not persuaded by the objections raised by ChargePoint to the Public Charging Pilot. As we stated in the docket UM 1811, we acknowledge that the provision of public EV charging is not a traditional utility service, but agree with the stipulating parties that additional investment in EV infrastructure is necessary in order to achieve widespread transportation electrification.

f. Tampa Electric (docket 2020220-EI)

i. "TECO claims the Pilot will increase customer confidence in the availability of public charging locations, thereby supporting EV adoption."

2. Utility ownership ensures proper maintenance of charging stations, which is important in public spaces to foster the public perception of reliability and certainty in public infrastructure. Examples from commission decision documents are provided below:

a. BGE (docket 9478)

i. The Commission finds that the Utilities have resources, electrical connectivity, and the technical bandwidth within their service

territories to address emerging challenges impacting the grid as a result of EV charging on a mass scale. The Utilities can also leverage their customer relationships to educate and advertise EV ownership to potential buyers. Furthermore, the Utilities will also be responsible for ensuring that public charging stations are working and maintained in good working order.

b. Duke Energy Carolinas and Duke Energy Progress (docket E-2, Sub 1197):

   i. *At the hearing, witness Reynolds stated that Duke is proposing to own and operate the DCFC stations to ensure that the stations are well maintained and operable for the full life of the asset.*

c. SDG&E (docket A18070223)

   i. *SDG&E asserts that its proposed ownership model will proactively mitigate stranded asset risk because utility ownership of the charging infrastructure ensures that the equipment is reliably operated and maintained. SDG&E believes its proposed ownership ensures that charging facilities will be reliable for drivers, mitigating the risk of insufficient maintenance, supplier bankruptcy, or insufficient funding.*

Some utilities provide guidance on the process by which they will select specific sites. Examples of excerpts from commission decisions are provided below:

a. Tampa Electric (docket 2020220-EI)

   DCFC Port locations will be carefully selected to help ensure 24/7 accessibility, proximity to local travel corridors frequently used by EV drivers, and the opportunity to serve multiple market segments. Site hosts will be selected in a way that helps to:

   a) Provide equitable distribution throughout the Tampa Electric's service area
   b) Ensure PEV driver accessibility
   c) Fill potential charging infrastructure gaps realized during implementation
   d) Achieve fairness using site host selection criteria detailed in program filing, which allows potential site hosts to self-nominate. TECO will review and score each application by market segment to determine if participation requirements and Pilot objectives can be achieved at the proposed site. Final determination will require on-site evaluations and site host agreements.

   Tampa Electric will work with the selected vendor, leveraging their prior experience and expertise, to maximize an equitable deployment across the targeted market segments.

b. Southern California Edison (docket A1807022)

SCE plans on prioritizing sites that are (a) in a high vehicle population area and would therefore have a higher need for chargers; (b) are within DACs; and (c) have access to appropriate electrical infrastructure in order to meet port targets within the approved budget of the Pilot

c. Pacific Power (docket UM-1810)

Pacific Power will schedule a workshop with the Stipulating Parties within 30 days of program approval focused on further refinement of site evaluation criteria and monitoring criteria. The utility will share a list of potential high-value sites for charging pods with Washington Utilities and Transportation Commission (UTC) Staff before selecting the first site.

Program Sizing

Among the programs sampled for detailed review, there is little detail provided on the utilities' approach to program sizing.

Notably, all but Duke Florida's (docket 20210016-EI) and Xcel's (docket 20A-0204E) programs are framed as pilot programs.

A few of the programs cite external studies on needed infrastructure:

a. PSE (docket UE-180877) cites a study from the Center for Climate and Energy Solutions supporting the conclusion that Washington needs more charging infrastructure to meet the growing need for public charging, but does not provide a direct link from this data to their program size.

b. In testimony for the initial filing, Dominion (docket PUR-2019-00154) explains that the program is not meant to be sufficient to meet the U.S. Department of Energy's EVI-Pro Lite1 tool's projected charging infrastructure needed to reach 2030 EV adoption levels forecasted by Navigant. Dominion also cites an Edison Electric Institute report on EV sales and infrastructure need projections.[2]

c. Baltimore Gas & Electric (docket 9478) is most specific on its sizing process: the utilities considered the findings of a Maryland-specific EV infrastructure gaps analysis conducted by the National Renewable Energy Laboratory (NREL) and sizes their proposed programs to meet one-third of the charging infrastructure need identified to meet the state's EV adoption

[1] https://afdc.energy.gov/evi-pro-lite

[2] Edison Electric institute, 2018, "Electric Vehicle Sales Forecast and the Charging Infrastructure Required Through 2030," http://www.ehcar.net/library/rapport/rapport233.pdf

goals. In their decision, the Public Service Commission of Maryland opted to limit the utility-owned port counts to half of those sought (i.e. one-sixth of the charging infrastructure needed to meet the state's adoption goals) in order to balance the benefits of utility ownership with concerns regarding competitive markets.

Inclusion of Underserved Communities

Underserved communities have increasingly been a focus in utilities' EV infrastructure filings. Atlas Public Policy's EV Hub has tracked 16 (43%) out of the 37 approved utility-owned EV charging infrastructure programs that include some kind of discussion of serving underserved communities. Of these, 12 programs (32%) include a specific carve-out (e.g., a percentage of installed charging ports or dollars spent) in these communities (see Table 3).

The 12 programs with a specific carve-out for disadvantaged communities have committed to investing $59 million in EV program investments in these communities, with the vast majority of these funds -- $47 million or 80% -- being committed by California's utilities.

Table 3. Investment in Disadvantaged Communities, U.S. Utility-Owned EV Charging Infrastructure Programs

	No. of Programs	**Approved Program Investments**
Approved U.S. Utility-Owned EV Infrastructure programs	37 (25 utilities)	$280 million
Dedicated investments for underserved communities	12 (7 utilities)	$59 million (21% of total approved investment; $47 million is by CA utilities)

Source: Atlas EV Hub

The sample of programs reviewed in detail illustrates what these kinds of commitments look like. Of the 13 programs reviewed in more detail, six include a target for a minimum percentage of installed ports or dollars spent to be deployed in underserved communities. These programs and targets are summarized in Table 4.

Table 4: Underserved Community commitments, Utility-Owned EV Charging Programs Sample

Utility	Docket No.	State	Inclusion of Underserved Communities Associated with Utility-Owned Charging Infrastructure Program
San Diego Gas & Electric	A1807023	California	50% of ports to be installed in underserved communities
Pacific Gas & Electric	A1807020	California	40 % of ports to be installed in underserved communities
Southern California Edison	A1807022	California	25% of ports to be installed in underserved communities
Xcel Energy (CO)	20A-0204E	Colorado	15% of spending to be made in underserved communities, plus Equity Performance Incentive Mechanism
Tampa Electric	20200220-EI	Florida	10% Level 2 ports to be installed in underserved communities
Duke Energy (FL)	20210016-EI	Florida	10% of Level 2 ports to be installed in underserved communities

For SDG&E, PG&E and SCE, disadvantaged communities (DACs) are defined as communities that are in the top 25 percent of the most impacted communities statewide as defined by CalEnviroScreen,[3] a health screening tool that ranks California's census tracts using data on 20 indicators of pollution, environmental quality, and socioeconomic and public health conditions.[4] The California Public Utilities Commission (CPUC) allowed that at the beginning of the second year of program implementation, these California utilities may request to focus charging infrastructure associated with the pilots outside of DACs if not

[3] Since SDG&E has only one state park in its service territory located in a DAC, the California Public Utilities Commission allowed the utility to apply a separate service territory definition rather than the statewide DAC definition to identify which top quartile of communities in its service territory qualify as disadvantaged for its Parks Pilot. (see pg. 59 of decision)

[4] "CalEPA and OEHHA Finalize Major Update to Environmental Health Screening Tool: CalEnviroScreen 3.0 to help guide investment in disadvantaged communities across the state," https://oehha.ca.gov/calenviroscreen/press-release/press-release-calenviroscreen/calepa-and-oehha-finalize-major-update

enough DAC sites are able to participate in the pilots to meet the DAC goal. Xcel and Tampa Electric apply their underserved community goals by applying income tests to census tracts in their service territory.[5] The approved Xcel Energy Colorado program also includes an Equity Performance Incentive Mechanism (PIM), tying Xcel's ability to recovery its costs to its success in achieving its equity targets:[6]

> *The Equity PIM would be based on the number of charging ports supported across Public Service's TEP programs that provide enhanced incentives for income-qualified customers and targeted communities. For example, the installation of 1,000 equity program charging ports would warrant an incentive of $400,000. The Equity PIM would have a ceiling of approximately $650,000.*

The remaining reviewed programs do not include any commission-determined requirements on utility-owned charging infrastructure programs related to underserved communities. PGE (docket UM-1811) includes proximity to underserved communities as a siting criteria preference in their initial filing but there is no specific requirement outlined in the order approving their program.

Dominion Energy's filing for its utility-owned charging program aimed at supporting rideshare drivers (docket PUR- 2019-00154) notes that rideshare rides often start and end in underserved communities, but does not carve out specific installation goals for these communities. The State Corporation Commission of Virginia notes this argument in its decision [13]. Dominion describes:

> *[T]he Company is committed to supporting electric rideshare vehicles; many such rides start or end in low income areas, with a Richmond Times Dispatch article reporting that 58% of local Lyft rides start or end in low-income areas.*

Dominion also notes that underserved communities are often less likely to be served by the competitive EV charging market in order to help justify its request to own the chargers. The Commission also notes this argument in its decision.

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[5] Tampa Electric defines 'Low-income community' according to Section 288.9913(3), F.S.:
"Any population census tract within the state where:

a. The poverty rate of such tract is at least 20 percent; or
b. In the case of a tract that is:
    1. Not located within a metropolitan area, the median family income for such tract does not exceed 80 percent of the statewide median family income; or
    2. Located within a metropolitan area, the median family income for such tract does not exceed 80 percent of the greater of the statewide median family income or the metropolitan area median income."

[6] The Colorado Public Service Commission states in the decision that Xcel Energy will collaborate with stakeholders to set up program parameters to establish income verification processes that do not rely on Xcel to verify income information. Eligibility criteria will be developed for the following types of sites: residential, multi-family housing, commercial workplaces, fleets, and charging hubs.

> *ChargePoint, among other things, objected to 'inject[ing] the utility into the competitive EV space.' Dominion, however, maintains that 'it is important to consider various utility investment models as part of the Pilot Program with the understanding that one model... may be better suited for some segments and geographic areas. . .' and that 'many rideshare rides start or end in low income areas, which are often less likely to have [fast charging] located nearby.'"*

Program Education & outreach

Atlas has tracked 19 out of 37 approved utility-owned EV charging infrastructures programs as including an outreach and/or education program [1]. Table 5 below provides details on the approved education and outreach (E&O) programs for the programs that were reviewed in detail.

As Table 5 shows, seven of the ten reviewed programs that included an E&O budget allocate between five and ten percent of the overall approved program budget (including all program elements, not just utility-owned infrastructure) to E&O. For the four programs in Maryland from BGE, Delmarva, PE, and Pepco (docket 9478), the Maryland Public Service Commission stated the importance of education and outreach and explicitly approved an education and outreach budget of up to five percent of the total program budget:

> *Because customer education and outreach is a vital component of a viable strategy to increase EV penetration in Maryland, the Commission approves the Utilities' proposal to commit a maximum of five percent of their planned programmatic costs as part of a Customer Education and Outreach strategy.*

Table 5: Education & Outreach Budgets in Utility-Owned EV Charging Programs Sample

Utility	Docket	State	Approved Education & Outreach Budget as Percent of Overall Budget
Dominion Energy Virginia	PUR-2019-00154	Virginia	16%
Pacific Gas & Electric	A1807020	California	13%
Xcel Energy (CO)	20A-0204E	Colorado	12%
Pacific Power	UM-1810	Oregon	10%
Puget Sound Energy	UE-180877	Washington	9%
Portland General Electric	UM-1811	Oregon	8%
Duke Energy (SC)	2018-321-E	South Carolina	7%
Duke Energy Progress and Duke Energy Carolinas (NC)	E-2, Sub 1197	North Carolina	7%
Southern California Edison	A1807022	California	6%
Baltimore Gas and Electric Company, Delmarva Power, Potomac Edison, Pepco	9478	Maryland	5%
San Diego Gas & Electric	A1807023	California	3%
Tampa Electric	20200220-EI	Florida	
Duke Energy (FL)	20210016-EI	Florida	

Operations, Maintenance & Repair

Most of the programs reviewed in detail include a budget for operations & maintenance (O&M). However, the elements that are included in O&M budgets vary significantly between reviewed utility programs. For example, some utilities consider items like education and

outreach (E&O), program administration, and program evaluation and reporting to be O&M costs while other programs include an O&M budget limited to maintenance and repair costs. In some cases, the O&M budget seemed to capture all costs sought in the program beyond capital costs. Figure 1, for example, shows the proposed O&M budget for SDG&E's Parks and Beaches program (docket A1807023).

Figure 1. proposed budget, SDG&E state Parks and beaches charging infrastructure pilot program (total program costs Over Two Years)

Table A-2
AB1083 State Parks & Beaches Charging Infrastructure Program
After Sales Tax, Unloaded, Unescalated, Direct Cost Estimate

	Capital	O&M
Engineering and Design	$ 456,000	
Trench, Conduit, Wire & Installation	$1,119,282	
Switchgear / Meters	$ 230,670	
Program and Project Management	$ 550,000	
Chargers / EVSE	$ 628,000	
ADA / Parking	$ 303,300	
Transformer	$ 273,780	
IT Costs	$ 280,000	
Network Communications		$ 39,960
Customer Engagement		$ 200,000
Measurement and Evaluation		$ 150,000
Charger / EVSE Maintenance & Warranty		$ 94,200
Tax and Contingency	$ 694,037	$ 10,397
Subtotal	$4,535,069	$ 494,557
Program Total (Capital and O&M)	$	5,029,627

Source: Company filing, Chapter 1, Docket A1807023

Table 6 summarizes the approved O&M budgets in the reviewed programs. To the extent possible, based on information in filings, education and outreach costs were excluded from the O&M costs shown below. Due to the fact that programs varied significantly in terms of what costs were included, these O&M budgets should not be considered an "apples to apples" comparison, and are provided here only to give a sense of the wide range that results from these inconsistencies in definition.

Table 6: Operations and Maintenance Budgets in Utility-Owned EV Charging Programs Sample

Utility	Docket No.	State	O&M as Percent of Approved Budget
Portland General Electric	UM-1811	Oregon	49%
Xcel Energy (CO)	20A-0204E	Colorado	20%
Tampa Electric	20200220-EI	Florida	13%
Southern California Edison	A1807022	California	11%
Duke Energy (FL)	20210016-EI	Florida	10%
Duke Energy (SC)	2018-321-E	South Carolina	7%
Pacific Gas & Electric	A1807020	California	6%
Pacific Power	UM-1810	Oregon	6%
Duke Energy Progress and Duke Energy Carolinas (NC)	E-2, Sub 1197	North Carolina	4%
San Diego Gas & Electric	A1807023	California	4%
Baltimore Gas and Electric Company, Delmarva Power, Potomac Edison, Pepco	9478	Maryland	0%
Puget Sound Energy	UE-180877	Washington	0%
Dominion Energy Virginia	PUR-2019-00154	Virginia	0%

It is also worth noting here again that many of the approved programs justified utility ownership in part due to the benefits of ensured maintenance of stations. Commissions cited arguments in favor of utility-ownership based on ensuring maintenance in the following reviewed programs:

- Duke Energy Carolinas (North Carolina) (docket E-2, Sub 1197)
- Duke Energy Progress (North Carolina) (docket E-2, Sub 1197)
- Baltimore Gas & Electric (docket 9478)

- Delmarva Power (docket 9478)
- Potomac Edison (docket 9478)
- Pepco (docket 9478)
- San Diego Gas & Electric (docket A1807023)

For example, with regard to SDG&E's program (docket A1807023), the CPUC cites SDG&E's argument in favor of utility ownership:

> *SDG&E asserts that its proposed ownership model will proactively mitigate stranded asset risk because utility ownership of the charging infrastructure ensures that the equipment is reliably operated and maintained. SDG&E believes its proposed ownership ensures that charging facilities will be reliable for drivers, mitigating the risk of insufficient maintenance, supplier bankruptcy, or insufficient funding.*

Several programs that have been active for at least a year included details on O&M challenges in their annual or semi-annual reporting. For example, Portland General Electric (docket No. UM-1811) noted in their 10/1/2020 Annual Report that they encountered frequent hardware-related issues and had to add resources for PGE's O&M team. They also describe customer challenges with the mobile app and payment process for the chargers. They describe:

> *Although Electric Avenue chargers received low customer ratings and encountered frequent hardware-related issues during initial deployment, problems and customer complaints over time have decreased due to added customer service resources by PGE's hardware and software partners, as well as improved coordination between all entities. Added resources for PGE's operations and maintenance team may result in further improvement in Electric Avenue success, including fewer issues and charger downtime....*
>
> *In an effort to address the frustrations reported by drivers, a new version of the mobile app was released in March 2020, and initial reports are positive. Some drivers have also expressed concern about temporary credit card authorization holds issued by the network providers payment processor.*

In addition, Baltimore Gas & Electric (docket No. 9478) noted in their February 1, 2021 semi-annual report that they plan to increase their Utility Admin budget in order to "take steps to ensure quick response time to EV charger outages – particularly as the size of the BGE network is rapidly expanding – by hiring a dedicated employee to respond and troubleshoot EV charger issues."

Reporting and Evaluation

Every program reviewed in detail includes reporting requirements. Annual reports are most commonly required, with some programs having semi-annual or final reporting requirements, and one program having two specified reporting dates. At least four of the programs reviewed include a requirement for a third party to perform the program evaluation. See Table 7.

Most programs reviewed are required to report costs incurred by the utility (e.g. installation costs, equipment costs, education and outreach costs, etc.), revenue from charger use, number of charging ports installed, charging use (e.g. kWh delivered, on- and off-peak kWh delivered), lessons learned on load management, and progress toward meeting underserved communities targets for programs that include such targets.

In addition, Duke Energy was directed in approval of its North Carolina and South Carolina programs to convene a collaborative stakeholder process to assess the pilot and provide feedback for future pilot programs. PSE (docket UE-180877) also committed to conducting stakeholder engagement during the pilot program development and execution.

Reporting requirements are most significant for the SDG&E (docket 18-07-023) and SCE (A1701021) programs. California's Public Utility Code §740.12(c) requires the California Public Utilities Commission (CPUC) to review data concerning the current and future electric transportation adoption and charging infrastructure utilization prior to authorizing an electrical corporation to collect new program costs related to transportation in customer rates. The CPUC directs the utilities to contribute an additional four percent of their total approved pilot budgets for a third-party evaluation that at minimum investigates:

- "Whether the pilots meet the stated purpose of accelerating widespread transportation electrification, reducing dependence on petroleum, meeting air quality standard, achieving disadvantaged communities targets, and reducing greenhouse gas emissions
- Maximization of benefits and minimization of costs
- Learning from analysis of data collected during program implementation including:
    - Infrastructure utilization data;
    - Number of incremental electric vehicles adopted;
    - Actual costs
    - Actual emissions reductions associated with pilots
    - Quantifiable impact assessment on grid impacts"

Table 7: Reporting Requirements in Utility-Owned charging infrastructure Programs Sample

State	Utility	Docket No.	Reporting requirements
California	Southern California Edison	A1807022	Annual
California	Pacific Gas & Electric	A1807020	Annual
California	San Diego Gas & Electric	A1807023	Annual
Colorado	Xcel Energy (CO)	20A-0204E	Annual
Florida	Tampa Electric	20200220-EI	Annual
Florida	Duke Energy (FL)	20210016-EI	Not specified
Maryland	Baltimore Gas and Electric Company, Delmarva Power, Potomac Edison, Pepco	9478	Semi-annual
North Carolina	Duke Energy Progress and Duke Energy Carolinas (NC)	E-2, Sub 1197	Annual
Oregon	Portland General Electric	UM-1811	Annual
Oregon	Pacific Power	UM-1810	Two report dates specified
South Carolina	Duke Energy (SC)	2018-321-E	Final Report
Virginia	Dominion Energy Virginia	PUR-2019-00154	Annual
Washington	Puget Sound Energy	UE-180877	Semi-Annual

Procurement of Design & Build Work

Procurement of any electric vehicle supply equipment (EVSE) design and build services beyond the utility's own capabilities is generally not mentioned in the reviewed program filings. PGE (docket UM-1811) specifies in their filing that they will issue a request for

proposal for 'engineering/design, EVSE hardware, EVSE back-end payment network, and system maintenance as needed' for its six Electric Avenues. SDG&E (docket 18-07-023) and SCE (docket 18-07-022) do state that the utilities will use IBEW-affiliated contractors for any work not undertaken by the utility.

Equipment Vendor Selection

Many of the approved programs reviewed require equipment vendors to be selected via a request for proposal (RFP) or request for qualifications (RFQ) process. Overall, Atlas has tracked 11 (30%) out of 37 approved utility-owned EV charging infrastructure programs where commission decisions specified that vendor selection must occur via an RFP or RFQ process [1]. This is the case for seven of the programs reviewed in detail:

- Pacific Power (docket UM-18110)
- Dominion Power (docket PUR-2019-00154)
- Tampa Electric (docket 20200220-EI)
- San Diego Gas & Electric (docket 18-07-023)
- Southern California Edison (docket 18-07-022)
- Pacific Gas & Electric (docket 18-07-020)
- Liberty Utilities (docket 18-07-025)

In some cases, requiring vendors to be selected via an RFP or RFQ process was intended to protect the competitive market. For example, in the Pacific Power program decision (docket UM-1810), the OPUC describes competitive procurement as a "safeguard" for the competitive market:

> *[W]e note that the stipulation contains safeguards to help protect the EV charging marketplace…PacifiCorp will use a competitive bidding process to procure the EV charging equipment, allowing vendors to compete on criteria to promote affordability, reliability, and quality."*

Similarly, the CPUC decision states of SCE's program (docket 18-07-022) that site hosts should be given the choice of a number of equipment suppliers:

> *"To promote competition and customer choice, SCE proposes to offer a broad range of qualified charging station models and network service providers from multiple suppliers as part of the AB 1083 Pilot. SCE proposes to issue a RFI to identify technically capable and financially viable third-party suppliers, including qualified WMDVBE suppliers, to cover the provision, installation, operation, networking and maintenance of the charging stations."*

In the South Carolina Duke Energy program (2018-321-E), Duke Energy and ChargePoint agreed on, and the Public Service Commission of South Carolina adopted, a stipulation that included the following requirements related to vendor selection:

- Participating site hosts shall have the choice of at least two (2) vendors of EV charging hardware and software which shall be prequalified by the Company to meet functional requirements.
- No single vendor of EV charging hardware shall be awarded 100% of total installations.

In the case of the SCE and SDG&E programs, the CPUC allowed the utilities to use an RFQ rather than RFP process due to time constraints.

Installation Cost Minimization

The programs reviewed use a variety of methods to help ensure installation costs are minimized. Pacific Power (docket UM-110), PGE (docket UM-1811), and Dominion Power (PUR-2019-00154) each include program cost caps. Tampa Electric (202002200-EI) includes a $5,000 per-port cost contribution cap for its utility-owned and operated Level 2 charging ports (though no cap for its income-qualified or government sites, nor its for DC fast chargers), with the site host able to contribute additional funds beyond the cap.

For PGE (docket UM-1811), the OPUC decision also specifies that any available tax credits will be deducted from the amount the utility would contribute to the installation.

The CPUC requires SDG&E (docket A1807023), SCE (A1807022), and PG&E (docket 18-07-020) to check in with them on site selection and planned costs:

> *We agree with Cal Advocates position that the AB 1082/1083 pilots should have a mechanism to ensure the pilots' benefits are maximized. At this time, we direct the utilities to file a Tier 2 advice letter within 6 months of the date of adoption of today's decision that at a minimum: (1) identifies the number of sites the utility performed a site-assessment; (2) identifies the costs to install the charging infrastructure at the sites where the utility performed a site-assessment; (3) includes the number of outstanding site-assessments the utility needs to perform; and (4) a revised pilot-wide port forecast based on the utility's performed site-assessments. Each utility is requested to update their Tier 2 advice letter filing by the end of the first year of pilot implementation.*

Many of the other programs that were reviewed require the utilities to include costs in their reporting requirements (see section Reporting and Evaluation).

The Equity Performance Incentive Mechanism found in Xcel Energy's Colorado program (docket 20A-0204E) caps spending based on how much investment has been made in equity (see section 'Inclusion of Underserved Communities').

It is also worth noting that several of the reviewed programs emphasize that they are pilot programs and are therefore small in scope and aimed at learning for larger, future projects. As such, their costs are limited by their size. As the OPUC decision for the PGE program (docket UM-1811) describes, "As pilots, the programs must be time-limited, cost-limited, and be designed to produce specific learnings."

Installation Sizing

Policymakers and advocates have sometimes called for larger installations or hubs of public EV chargers in order to allow for redundancy and/or to avoid congestion. The programs in the detailed review sample were reviewed for minimum per-site port requirements or any other requirements on installation sizing. In the case of SCE (docket A1807022) and PG&E (docket 18-07-020), the CPUC describes the benefits of a port minimum and states that they encouraged the utilities to install at least two ports per site. The CPUC explains, "In the interest of minimizing costs and maximizing overall benefits, we encourage the utilities to install at least 2 ports per site to ensure more than one person can utilize charging at a particular location." The Florida PSC decision on the Tampa Electric program (docket 20200220-EI) notes that the utility intends to install two Level 2 Ports at each of the four DCFC locations to provide redundancy, and that their program will require a minimum of 2 and a maximum of 6 ports to be installed at each public site. The Portland General Electric program (docket UM-1811) requires four dual-connector DC fast chargers and one dual-port Level 2 charger at each site. For the Puget Sound Energy program (docket Number UE-180877), there is no explicit port minimum, but the program specifies that there will be 32 DCFC ports at only eight locations.

Pricing, Rates and Metering

The reviewed programs reveal a number of pricing structures charged to customers for EV charging.

a. SCE (A1807022) will allow third parties to set the price of charging on utility-owned stations:
    - SCE (A1807022) will contract with a third-party EV charging station service provider to serve as the customer of record for the EV charging

stations. The third party will then be responsible for paying for the electricity associated with the charging stations and could collect revenue from the users of the charging stations. SCE will coordinate with each park and set reasonable charging rates for park visitors. The third party would have flexibility to set pricing and parking restrictions for drivers charging at the particular state park or beach. While SCE will encourage participating customers to pass SCE's TOU rate through directly to drivers, third parties may implement their own pricing plans. However, all participating customers would be required to participate in a demand response program. In an effort to ensure that end-use pricing is easy for drivers to understand, and provide an opportunity for drivers to access electricity at a price less costly than gasoline, SCE proposes requiring all participating customers to report prices being passed to drivers. SCE plans to aggregate this information to its TE Advisory Board on a quarterly basis.

b. Dominion Energy Virginia (PUR-2019-00154) and Tampa Electric (20200220-EI) will allow site hosts to have some input on the price that drivers see:

   - Dominion Energy Virginia (PUR-2019-00154) opted to allow the site hosts of company-owned charging infrastructure to manage and collect any fees associated with EV charging. These site hosts are billed on the standard non-residential rates for electricity service. The company will not retain any fees collected from drivers for the use of the charging stations.

   - Tampa Electric (20200220-EI) will charge the Site Host for electricity consumed by the charging equipment at standard tariff rates. The Site Host may choose to charge PEV drivers for charging or may provide charging at no cost. If the Site Host chooses to charge PEV drivers, the charge will be limited to Tampa Electric's then-current GS tariff rate, plus any telecom or administrative fees assessed by the billing vendor. The billing vendor will collect the billing and charging data associated with the charging events and make it available to Tampa Electric for assessment.

c. Pacific Power (UM-1820), PGE (UM-1811), Duke Energy South Carolina (docket 2018-321-E), and Duke energy North Carolina (docket E2, Sub 1197) were approved to charge users of the utility-owned charging stations a rate based on rates of other charging companies in their service territories.

   - The OPUC describes this as a "safeguard" for the competitive market, and the Washington UTC explains:

     PSE proposes to charge the average rate of other charging companies in its service area, rather than a rate based on the cost of service. Staff supports this approach for the near future, as it aligns with and reasonably balances the dual priorities of the statute: increasing access to EVSE and promoting fair competition in the provision of EVSE. Also, a more

traditional cost-of-service ratemaking model is unreachable without the information gained through this pilot.

- The Public Service Commission of South Carolina decision approved Duke Energy South Carolina's request to sample the market price ($/kWh) for fast EV charging, on a quarterly basis, and then charge customers a Fast Charge Fee equal to the approximate average price per kWh. Site hosts will further have the option of creating alternative pricing mechanisms for drivers, which, "for purposes of this Pilot only due to its unique design, may not exceed the Fast Charge Fee by more than twenty percent (20%)," with electricity still being sold directly by the utility to the driver.
- Duke Energy North Carolina was approved to use the same mechanism for their fast charging stations. According to the utility, "net revenue from charging would offset total program costs, ensuring that EV drivers pay a greater proportion of program costs than average customers."

d. In the remainder of the programs, drivers will pay utility rates directly, and these rates will not be based on market charging costs. The basis for these utility rates varies widely among programs:

- BGE (docket 9478) will charge users of public stations (level 2 and DCFC) a flat "wake-up" fee and a flat per kWh fee
- For Duke Energy North Carolina's (docket E2, Sub 1197) public Level 2 stations, the utility will charge users based on the established Small General Service schedule, plus $0.02/kWh to cover network platform and transaction fees (recall that their fast charging stations used the average market rate pricing described above)
- SDG&E (docket A1807023) plans to offer a time-of-use rate (the "EV-TOU" rate)
- PGE (UM-1811) selected a cost of service-based pricing model. The utility agreed to assess and update rates on an annual basis to ensure their rates are competitive with other providers.
- Xcel Energy (20A-0204E) was approved to offer a new rate system whereby public stations would charge customers a standard rate per minute during most hours and a much higher Critical Peak Pricing rate during the limited number of hours a year of high system-wide demand.

Most of the programs reviewed did not explicitly discuss metering in the commission decisions. The SDG&E approved program (docket A1807023) did however state that the utility will install new meters for its charging stations. In addition, with regard to the Baltimore Gas & Electric, Delmarva, Potomac Electric, and Pepco programs (docket 9478), the Maryland Public Service Commission stated that it would allow submeters to be used instead of requiring separate metering. The Commission explains that this will avoid socializing the costs of separate meters to all customers.

Cost Recovery

In 12 of the 13 of the programs reviewed in detail, the utilities plan to seek cost recovery from ratepayers either in the initial or subsequent filings. This is planned to be through distribution rates (SDG&E, SCE, PG&E, BGE), a customer surcharge (BGE), a demand side management cost adjustment rider (Xcel), or through an as-yet undefined base rate account (Duke Energy Carolinas and Duke Energy Progress). The only instance in which this was not the case was for PSE, whose cost recovery treatment was not fully established in the filing or decision document.

A few other notable cost recovery elements stood out in the decisions:

a. Pacific Power's program (docket UM-1810) provides that Clean Fuels Program credit from program chargers will go toward reducing the program's cost to ratepayers
b. In their decision on PGE's program, the Public Utility Commission of Oregon (OPUC) determined that they utility may use program revenue to add to the maximum allowable cost that is otherwise recoverable from customers.
c. For Duke Energy's program (docket 2018-321-E) any payments made by customers for charging are planned to first be used to offset the cost of electric service, including all riders, with any remaining amounts to be used to offset program costs
d. Duke Energy North Carolina (docket E2, sub 1197) plans to use net fast charging revenue billed at the average market cost of fast charging (set on a quarterly basis) to offset total program costs, "ensuring that EV drivers pay a greater proportion of program costs than average customers."

Communications and Payments

Several of the programs reviewed include requirements or a preference for chargers to accept multiple payment methods. For PSE's program (docket UE-180877), the Washington UTC requires the utility to prioritize EVSE vendors in its RFP process who commit to providing "universal payment options." Specifically, PSE should prioritize RFP response from vendors who will accept any major debit or credit card and not require customers to be members of a club or program:

> *Staff therefore recommends that the commission obtain an affirmative commitment from the company that any RFPs issued for EVSE investments intended for public use prioritize the capability of accepting any major debit or credit card at the charging location, and without requiring the customer to become a member of a club or program.*

For SDG&E's Parks Pilot program (A1807023), the CPUC decision explains that the utility will offer multiple payment methods in order to ensure a variety of EV drivers can use the stations:

> *...SDG&E plans to offer a variety of payment options for drivers utilizing charging stations in the Parks Pilot. SDG&E explains that providing customers the option to pay by credit card ensures charging stations are available to infrequent visitors, along with more regular users...*

In SCE's Parks Pilot program (A1807022) the CPUC states its agreement with a variety of stakeholders, including ChargePoint, Cal Advocates, and a group of Joint Parties, to require credit, debit, and electronic payment options:

> *The availability of credit and debit payment at more remote charging locations, such as state parks and beaches, should encourage customers to drive EVs to such destinations. Moreover, the availability of electronic payment should reduce the risk that these charging stations become inoperable as technology and payment standards change in the years to come.*

The Public Service Commission of South Carolina does not reference payment methods in approving Duke Energy's program (docket (2018-321-E), but the utility states in its filing that payment shall be made by smart phone app, radio-frequency identification (RFID) card or by credit card swipe at the site.

Several of the programs reviewed include Open Charge Point Protocol (OCPP) to ensure the chargers could be used by as many EV drivers as possible. For example, The Washington UTC describes in its decision on PSE's program (docket UE-180877):

> *The ability of EV drivers to move seamlessly between charger networks and stations, regardless of who owns or operates the equipment, is critical in addressing the market barrier of charging availability and access. Accordingly, staff recommends that EVSE acquired or deployed through these programs – especially those EVSE investments intended for public use – must meet common interoperability and open standards requirements, such as the Open Charge Point Protocol (OCPP) standards. This recommendation applies to standards and protocols for both hardware and software.*

Other programs that require charging equipment to meet OCPP standards are:

- San Diego Gas & Electric (docket A1807023)
- Southern California Edison (docket A1807022)
- Pacific Gas & Electric (docket 1807020)
- Tampa Electric (docket 20200220-EI)

The California utilities are also governed by EVSE Open Access requirements, which dictate that EVSE service providers in the state a) may not charge a subscription fee or require membership for public charging stations, b) must disclose the charges for using public EVSE at the point of sale, c) allow at least two options for payment, d) install the Open Charge Point interoperability billing standard on each EVSE; and e) disclose charger locations, fee schedules, accepted payment methods, and network roaming charges to NREL.[7]

Power Level

Only three of the programs reviewed include a minimum power level requirement. These programs were all from Duke Energy (Duke Energy Carolinas- E-2, Sub 1197, Duke Energy Progress - E-2, Sub 1197, and Duke Energy South Carolina - 2018-321-E), and all specified a 100 kW power level minimum for DC fast chargers.

[7] See U.S. Department of Energy summary here: https://afdc.energy.gov/laws/11067 .

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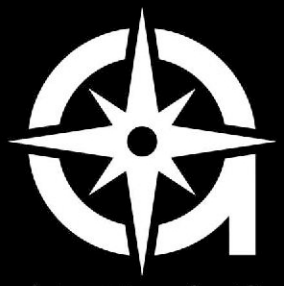
[11] Washington Utilities and Transportation Commission, "Puget Sound Energy Docket No. UE-180877," 13 December 2018. [Online]. Available: https://www.utc.wa.gov/docs/Pages/DocketLookup.aspx?FilingID=180877.

[12] Public Utility Commission of Oregon, "Pacific Power Docket No. UM-1810," 27 February 2018. [Online]. Available: http://apps.puc.state.or.us/edockets/docket.asp?DocketID=20576.

[13] Nathan J. Frost, "Case No. PUR-2019-00154 Direct Testimony of Nathan J. Frost on Behalf of Virginia ELectric and Power Company Before the State Corporation Commission of Virginia," 30 September 2019. [Online].



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Hawaiian Electric

Fast Charger Site Hosts Survey

Prepared by **Market Research**

July 2021

Overview of Survey

- The objective of the research was to determine initial interest, business benefits, challenges, and expansion of public fast chargers within Hawaiian Electric's program.
- **Online Survey**
  - Online survey conducted with site hosts in contact with our Key Account Managers.
    - Survey Fielding: **June 3 – July 2, 2021**
    - **11 site responses** from 20 sites *(excludes four Hawaiian Electric locations)*

Participating Sites

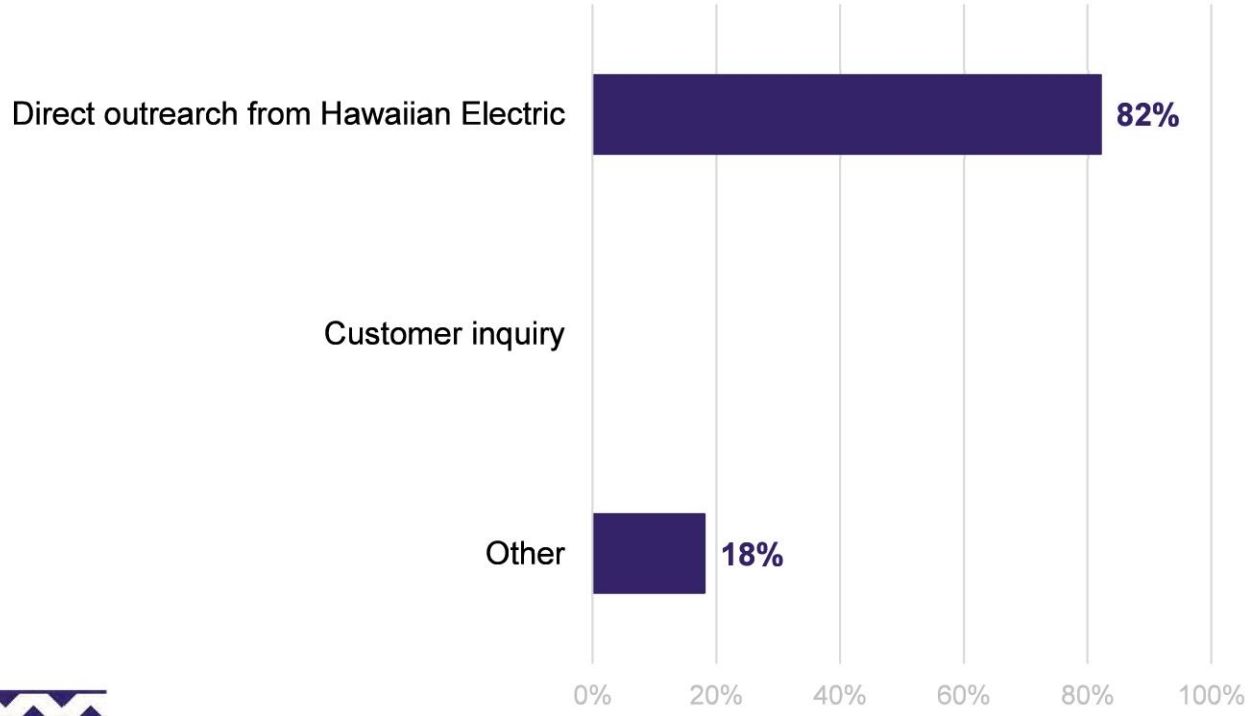
- Dole Plantation
- Hawai'i Kai 7-Eleven
- Iwilei Costco Parking Lot
- Salt Lake Shopping Center
- Times Square Shopping Center
- Waipio Shopping Center
- Queen Kaahumanu Shopping Center
- Puna Kai Shopping Center
- Punaluu Bake Shop
- The Shops at Mauna Lani
- Waimea KTA *x 2*

No Response

- Haleiwa Town Center
- Kapolei Commons
- Kapolei Shopping Center
- Koolau Center
- Waianae Shopping Mall
- Kaunakakai
- Lahaina Aquatic Center
- Piilani Village Shopping Center
- Pukalani Terrace Shopping Center

Hearing About Hawaiian Electric's Fast Charger Program

"How did you hear about Hawaiian Electric's Fast Charger program?"

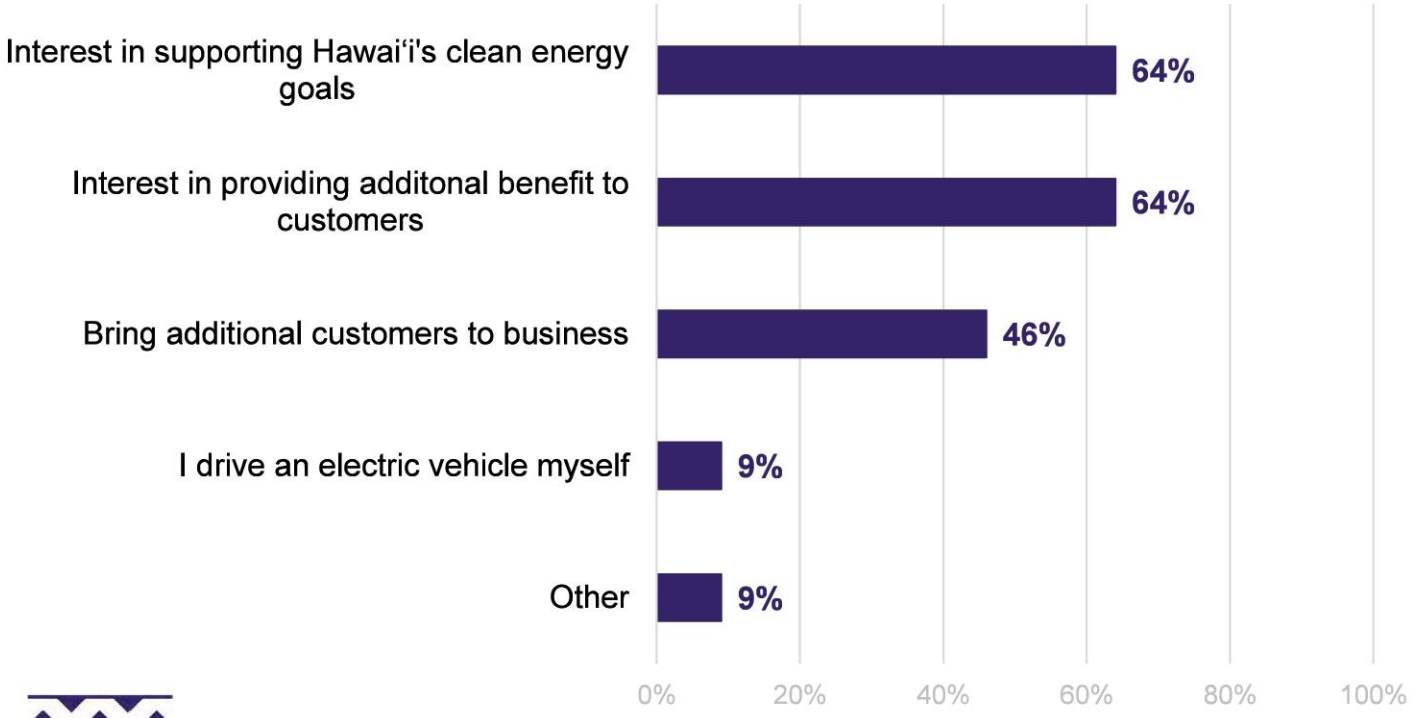


Other

- We built it first. First on the B.I.
- Corporate office

Initial Interest to Host a Fast Charger

"What drove your initial interest in signing up to host a fast charger?"



Other

- We also want to be prepared for any EV mandates (with enforcement) that is rolled out.

Percentages exceed 100% due to multiple response

Benefits From Participating in Fast Charger Program

"What business or customer benefits have you seen from participation in the fast charger program (i.e. ability to meet the state EV parking stall requirement, more patrons or customers visiting your site, additional income from EV charging / parking fees)?"

- Ability to meet the state EV parking stall requirement.
- Customers express their happiness with being able to charge and shop and use the fast charger. They like the fact that they can pay with a credit card or use the app.
- It helps to meet our EV parking requirement and it's an enhanced benefit to our customers and tenants.
- More customers come to site to charge their vehicles.
- More electric vehicles, so it's nice to offer them a charging option.
- More patrons visiting our site.
- Positive customer feedback, additional customers visiting our location, seems like more customers are getting EV
- Positive customer relations with the EV segment.

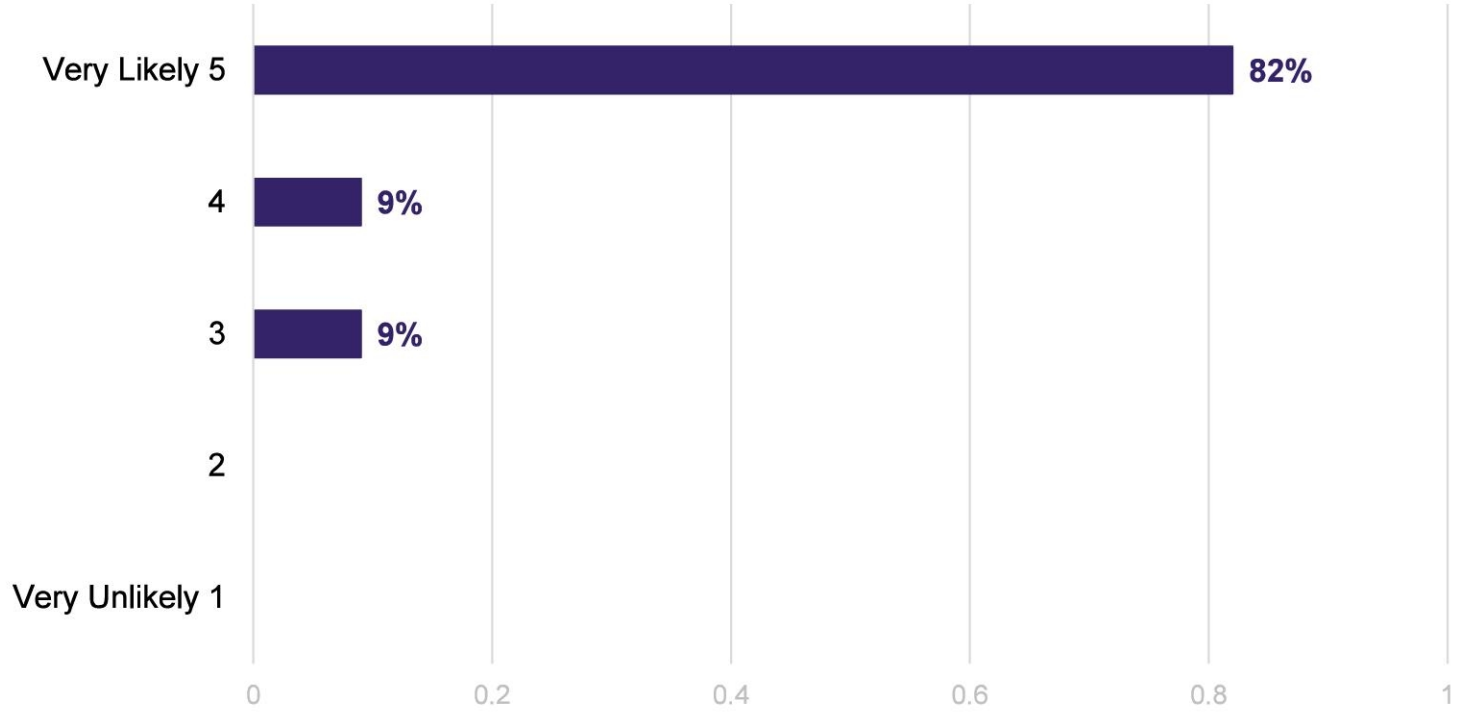
Challenges from Participating in Fast Charger Program

"Have you encountered any challenges or difficulties while being involved in the Hawaiian Electric Fast Charger program?"

- System is occasionally down. Part replacement for charging unit may have longer lead time. *[Waimea KTA]*
- Slow repair times, which results in a lot of customer complaints to me. *[The Shops at Mauna Lani]*
- No, the contractors and Hawaiian Electric teams were very accommodating, always kept us up to date and were very easy to work with. *[Salt Lake Shopping Center]*
- No, MEO was fast and efficient with the install. *[Queen Kaahumanu Shopping Center]*

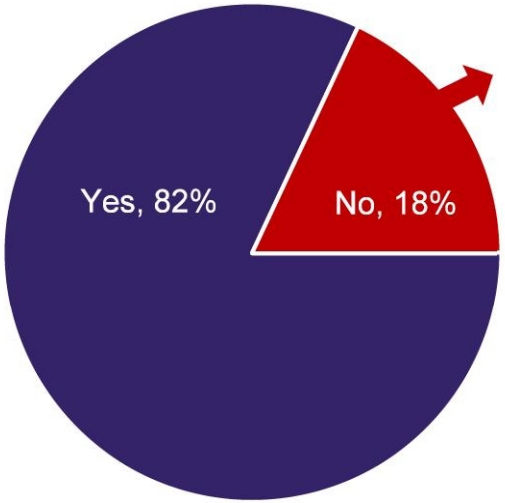
Likelihood to Recommend Fast Charger Program

"How likely are you to recommend the program to other potential EV charger hosts?"



Sufficient Charging Ports to Meet Needs

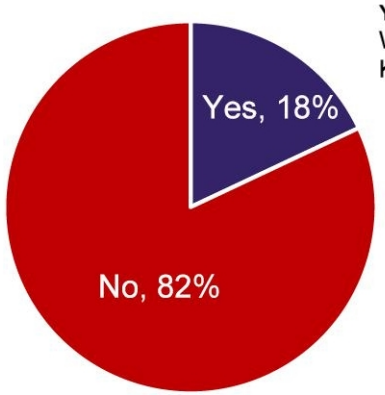
"Has the number of charging ports felt sufficient to serve drivers' charging needs at your location?"



"Why not?"

- With over 2,700 parking spaces at the site and only 2 charging stations it does not support the demand. I understand this was a cost and power limitation issue. *[Queen Kaahumanu Center]*
- It is enough at this time however may need to consider an additional port. *[Waimea KTA]*

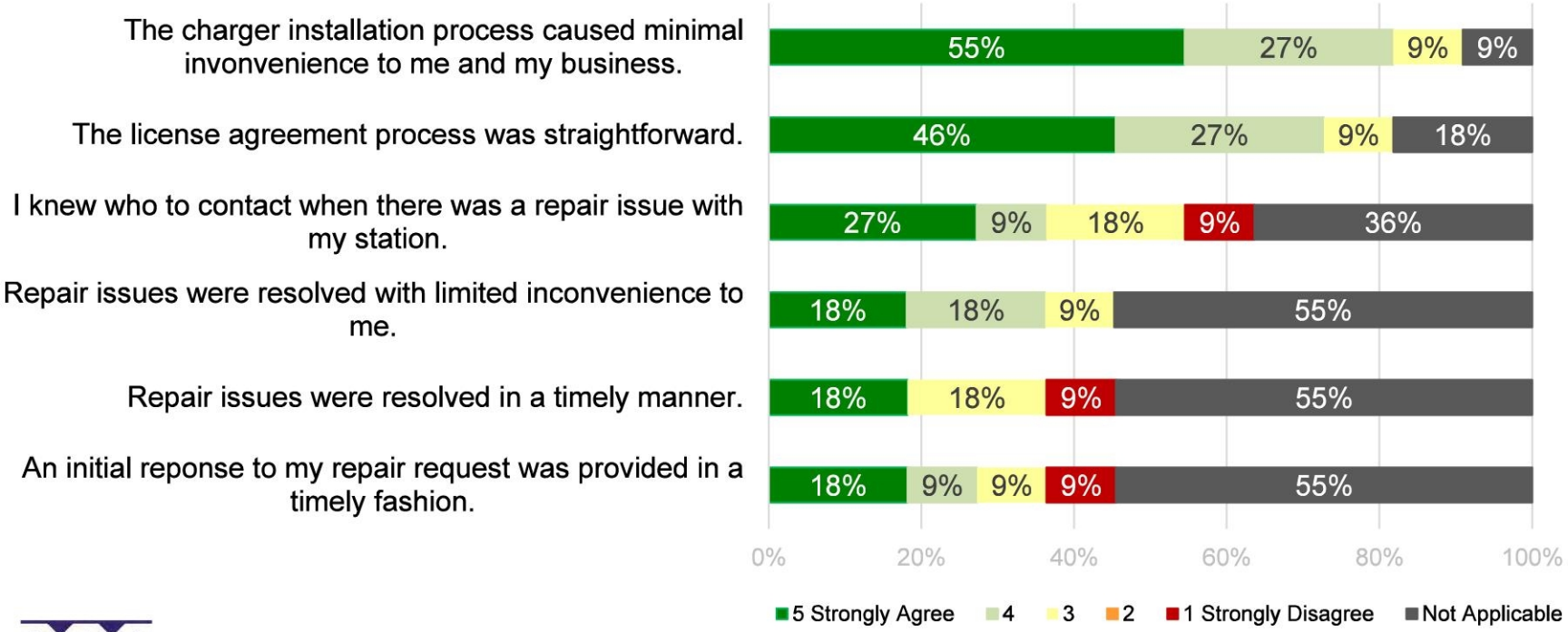
"Do you foresee a need to install additional ports at your location over the next 5 years?"



Yes
Waimea KTA
Kaahumanu Shopping Center

Ratings of Site Hosting Program Experience

"Rate the following statements / program experiences 1 to 5 where 5 is strongly agree and 1 is strongly disagree?"



Improving the Public EV Charging Site Host Experience

"How can Hawaiian Electric improve the experience for public EV charging site hosts as they design the next phase of their program?"

- Additional advertising about locations
- Maybe have better signage or a dedicated logo that sticks out. Maybe paint the EV chargers bright green for ease of finding as well as marketing?
- Provide more locations as the need increases with the uptick in vehicles.
- Quicker response times to repairs.
- Single HECO point of contact versus multiple
- They were awesome to work with.

Hawaiian Electric

Electric Vehicle Driver Surveys

Prepared by **Market Research**

June 2021

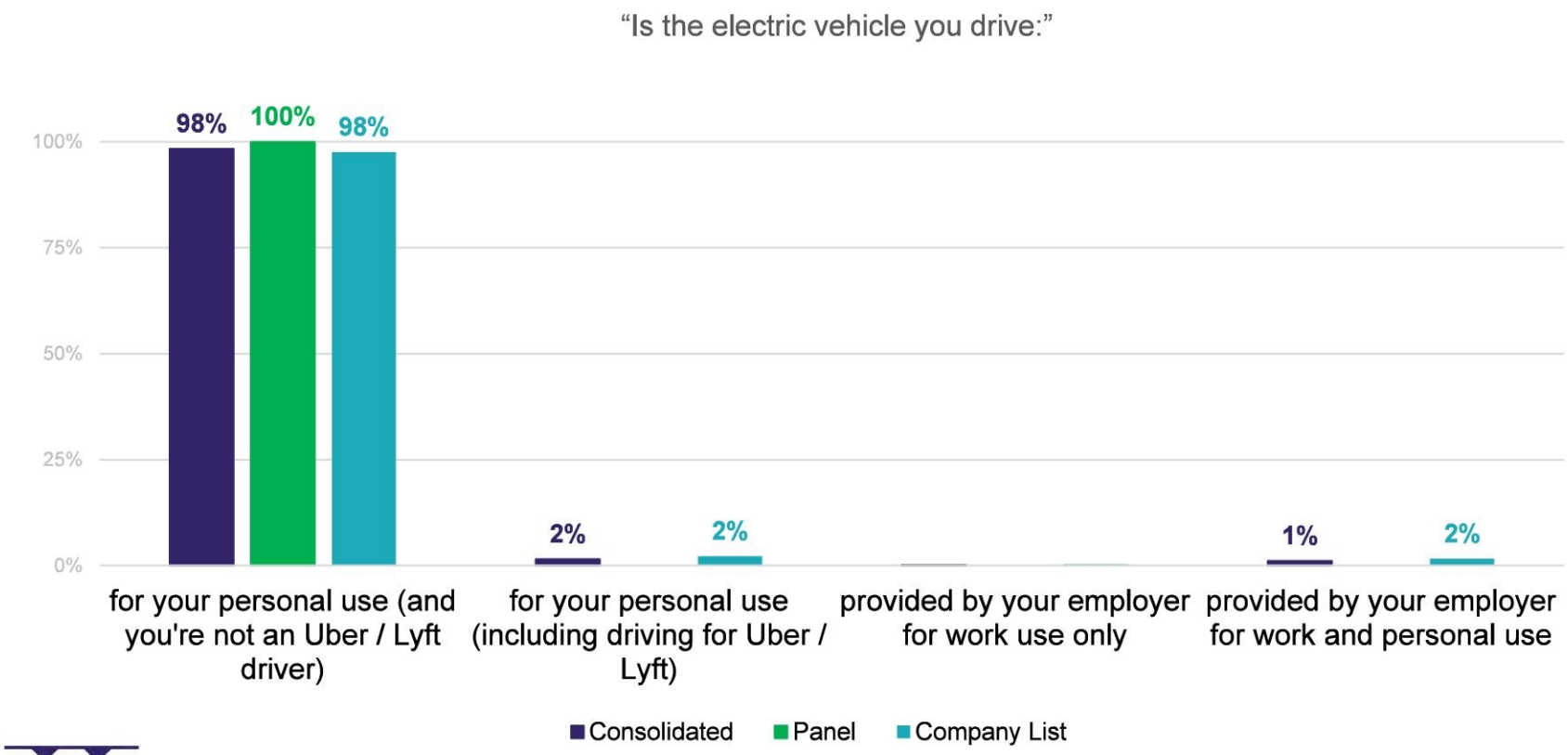
Overview of Surveys

- The objective of the research was to determine awareness, usage, and preferences for Hawaiian Electric's public charging among electric vehicle drivers.

- **Online Panel Survey**
  - Online panel survey conducted with randomly selected Hawaiian Electric Company residential customers on Oahu, Maui County, and Hawai'i Island.
    - Survey Fielding: **May 26 – June 11, 2021**
    - **146 completed surveys** from 195 invited panelists identified as EV drivers

- **Online Survey with Company Contact List**
  - Online survey conducted with EV program participates among Hawaiian Electric Company residential customers on Oahu, Maui County, and Hawai'i Island.
    - Survey Fielding: **June 16 – 18, 2021**
    - **316 completed surveys** from 1,399 invited contacts identified as EV drivers

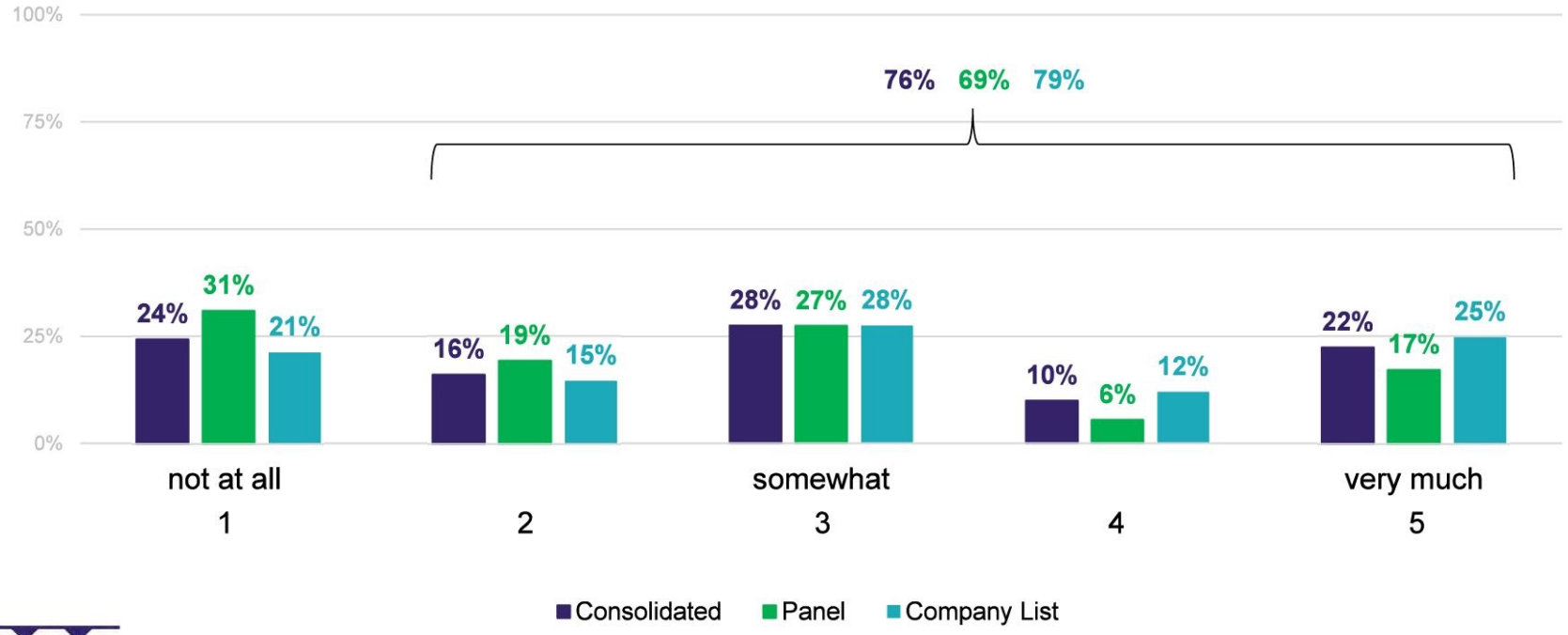
Electric Vehicle Use



Percentages exceed 100% due to multiple response

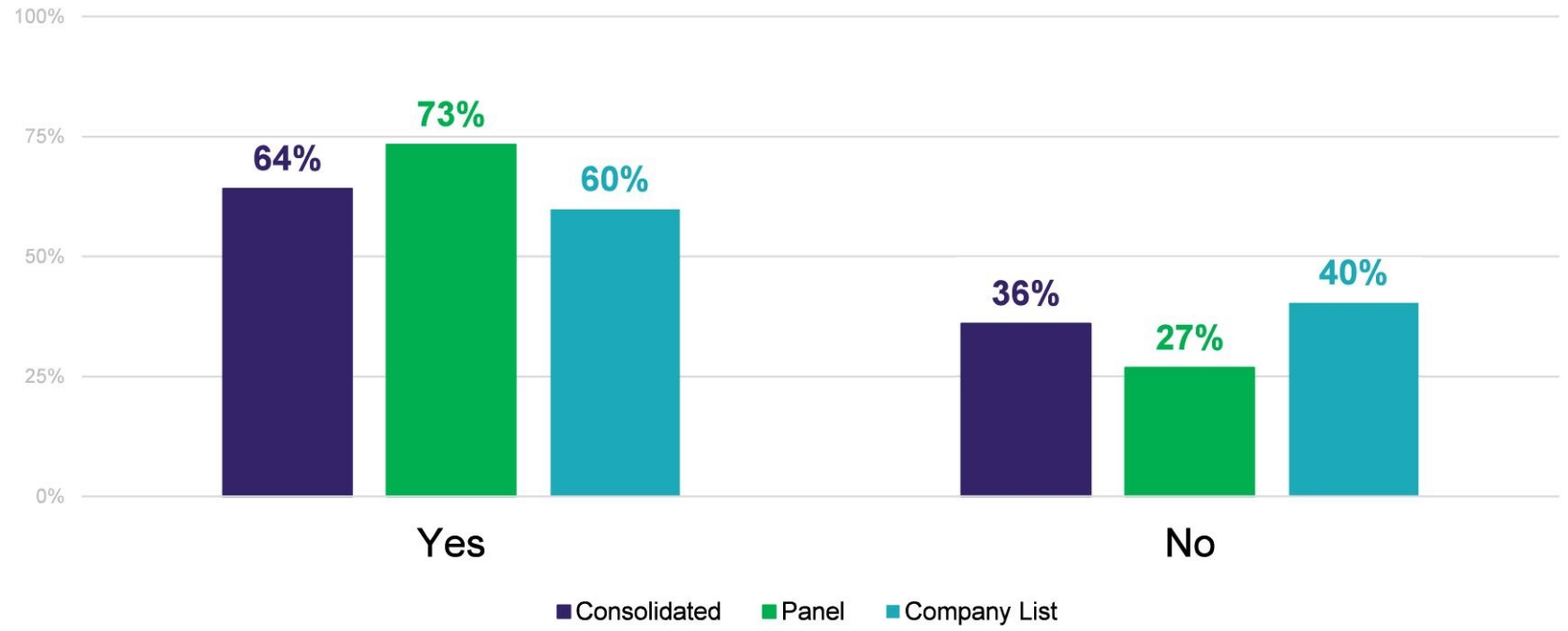
Public Fast Charging Influence on EV Purchase

"How much did the availability of public fast charging influence your decision to drive an electric vehicle?"

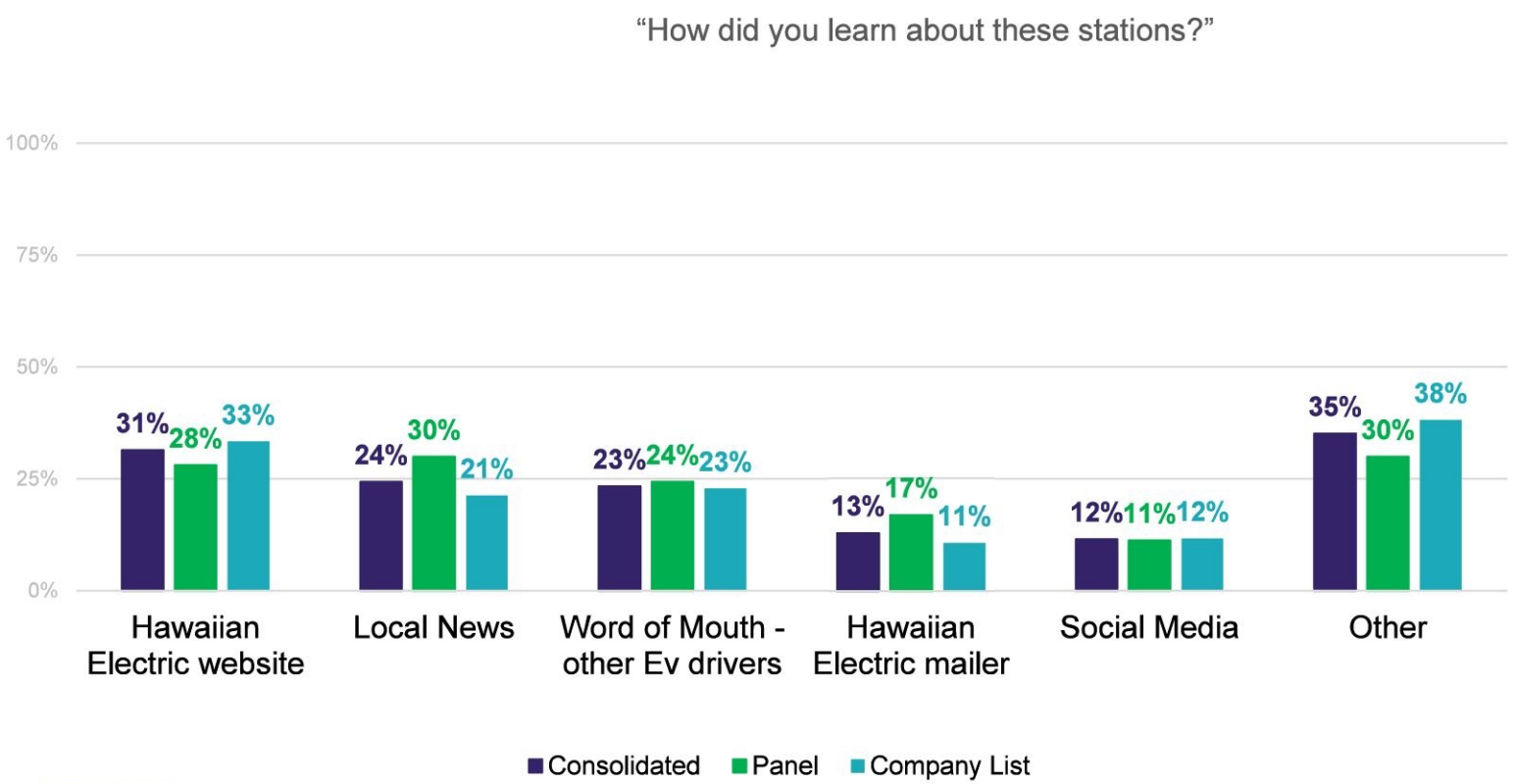


Awareness of Hawaiian Electric's Public Fast Chargers

"Are you aware that Hawaiian Electric provides public fast chargers?"



Sources for Awareness of Hawaiian Electric's Public Fast Chargers



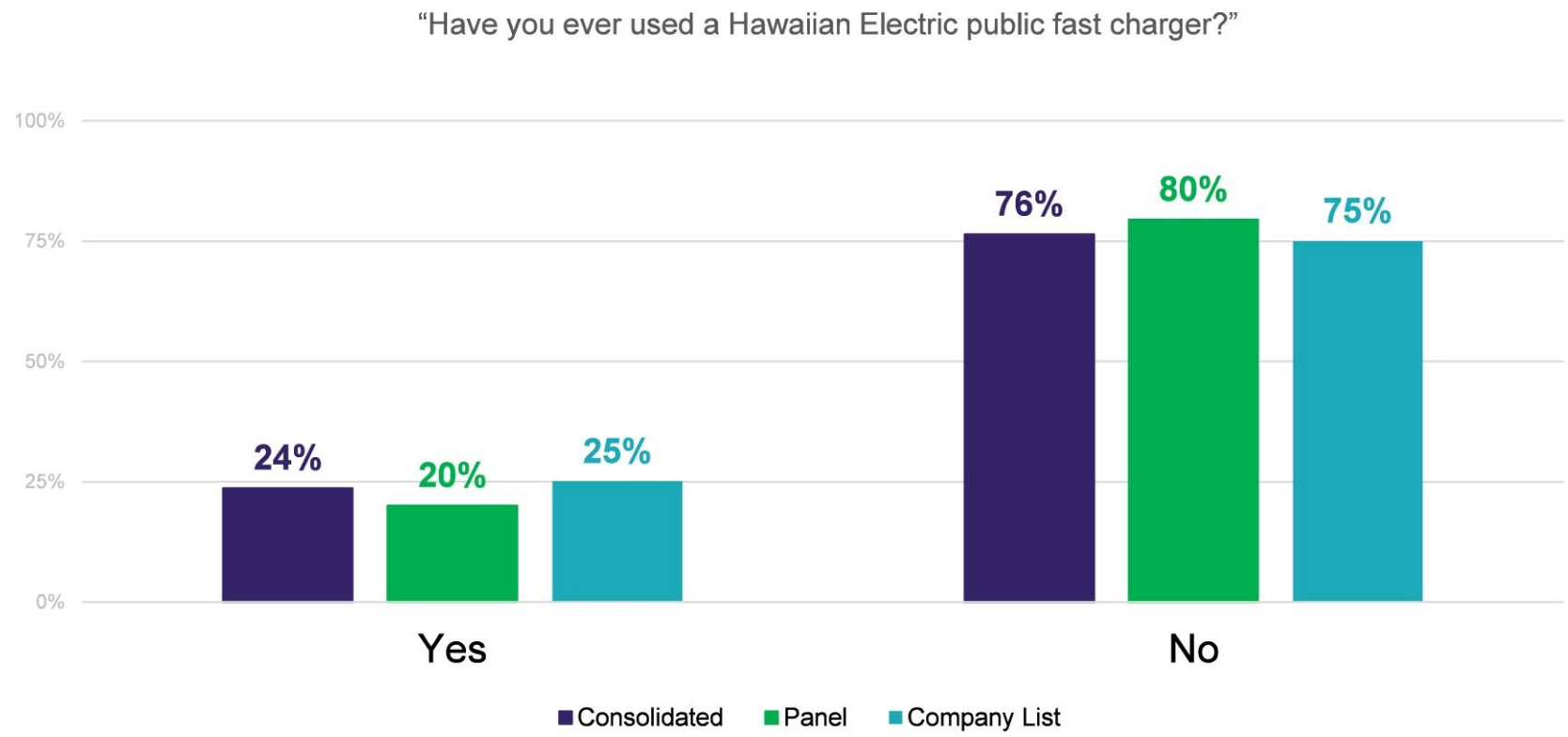
Subset: aware of Hawaiian Electric's public fast chargers

Other Sources

- Saw them
- Internet search
- Google Maps
- Mobile App
- Dealership

Percentages exceed 100% due to multiple response

Used Hawaiian Electric's Public Fast Chargers



Reasons for Not Using Hawaiian Electric's Public Fast Chargers

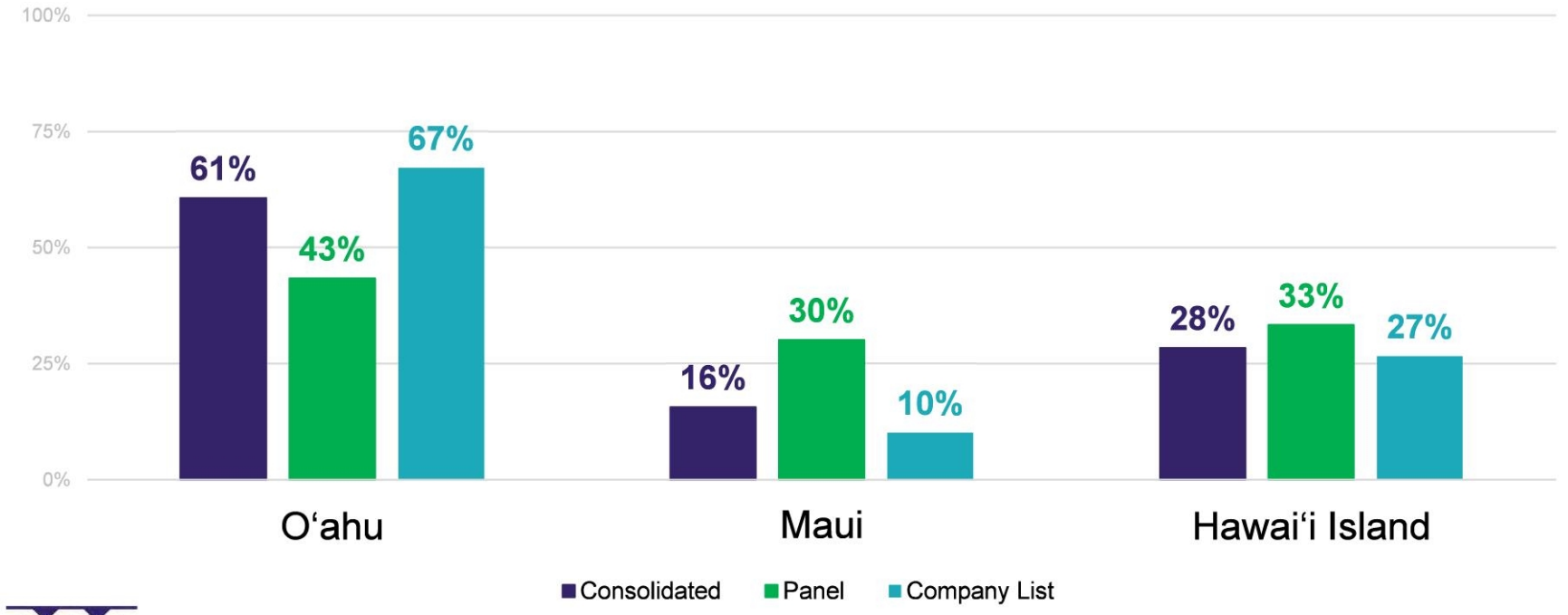
"Have you ever used a Hawaiian Electric public fast charger? NO – Why not?"

- Where? What's the cost? What's the charge rate?
- Not conveniently located for me
- Too expensive. It's cheaper for me to charge at home.
- We've only used free charging stations so far.
- Due to the pandemic, I have driven very little in the last year, have not needed a public charger.
- They are so popular - and limited supply (?) - that one is never available for me to use.
- Not easy to get to and have to wait in line to charge
- They are difficult to find, non-operational or require difficult to understand membership on Maui.
- Your chargers didn't accommodate my Tesla.
- I would need to pay for an expensive adapter ($400) just to connect to my car. Super bummers about that. Not sure if Tesla Super Chargers will ever show up but that would have been a nice standard to work with.
- Toyota Prius Prime PHEV can use only Type-1 or Type 2 chargers due to vehicle charging system design. Current HECO Type 3 fast chargers can not be used.
- With the range and normal usage on Maui, we are not generally needing.
- We charge at home, and with our extended range battery—even managed between 80 and 30% for longevity—we have never needed to charge elsewhere. We did use Whole Food's complimentary charger twice, but the second time it burned our connector.

Hawaiian Electric's Public Fast Charger Usage by Island

"On which island(s)?"

Subset: used Hawaiian Electric's public fast chargers

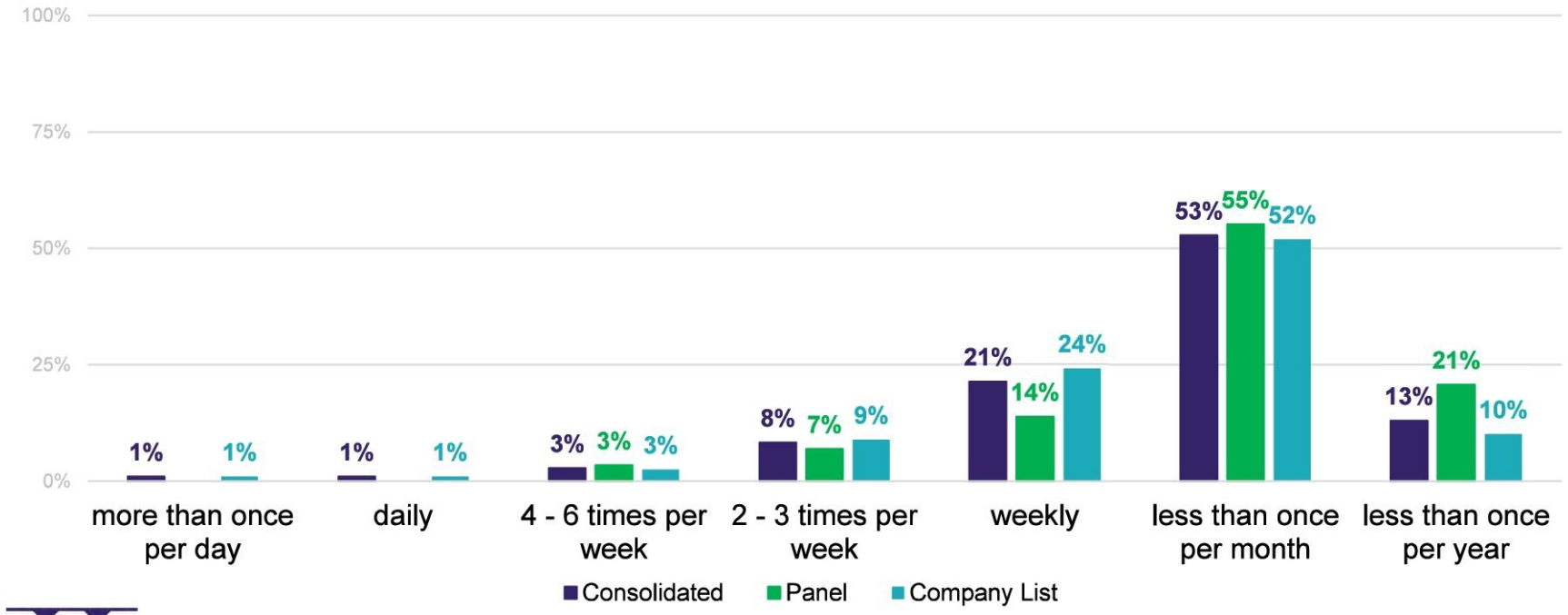


Percentages exceed 100% due to multiple response

Hawaiian Electric's Public Fast Charger Usage Frequency

"How often do you use a Hawaiian Electric public charging station?"

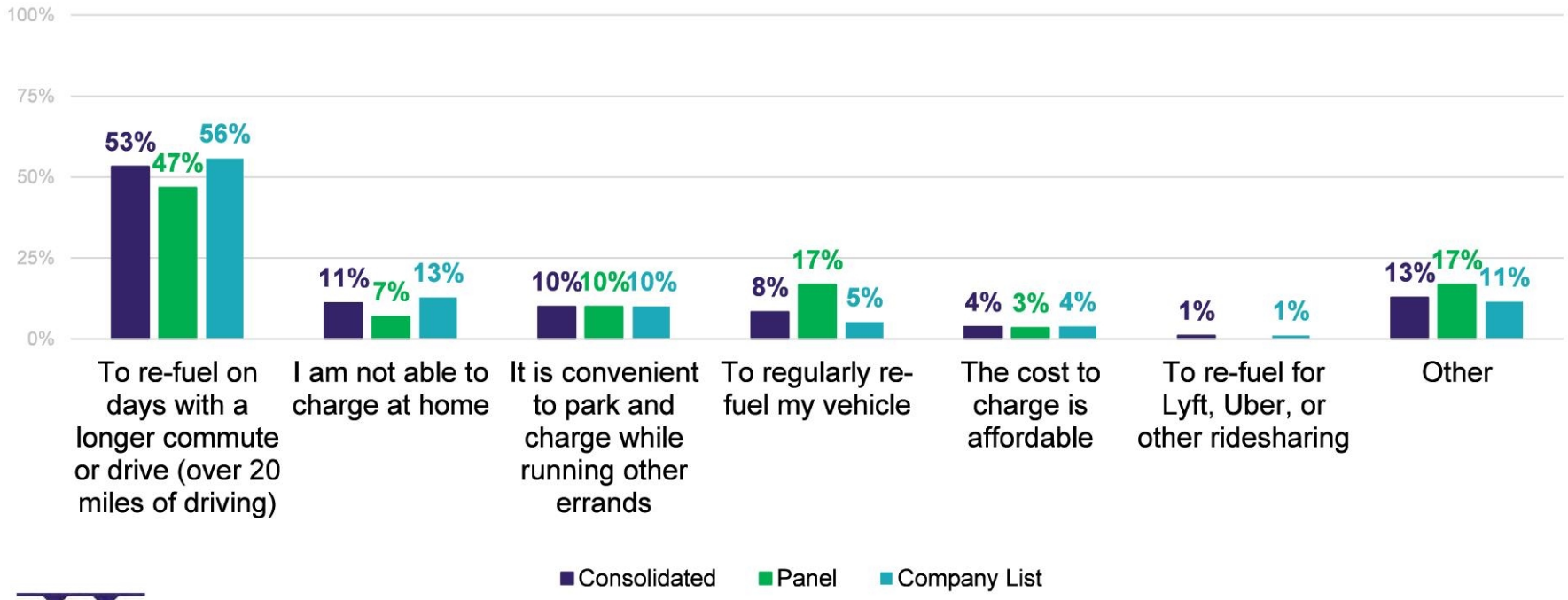
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons: #1 Rankings

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons: Other

"Please rank your reasons for using Hawaiian Electric's public fast chargers. OTHER"

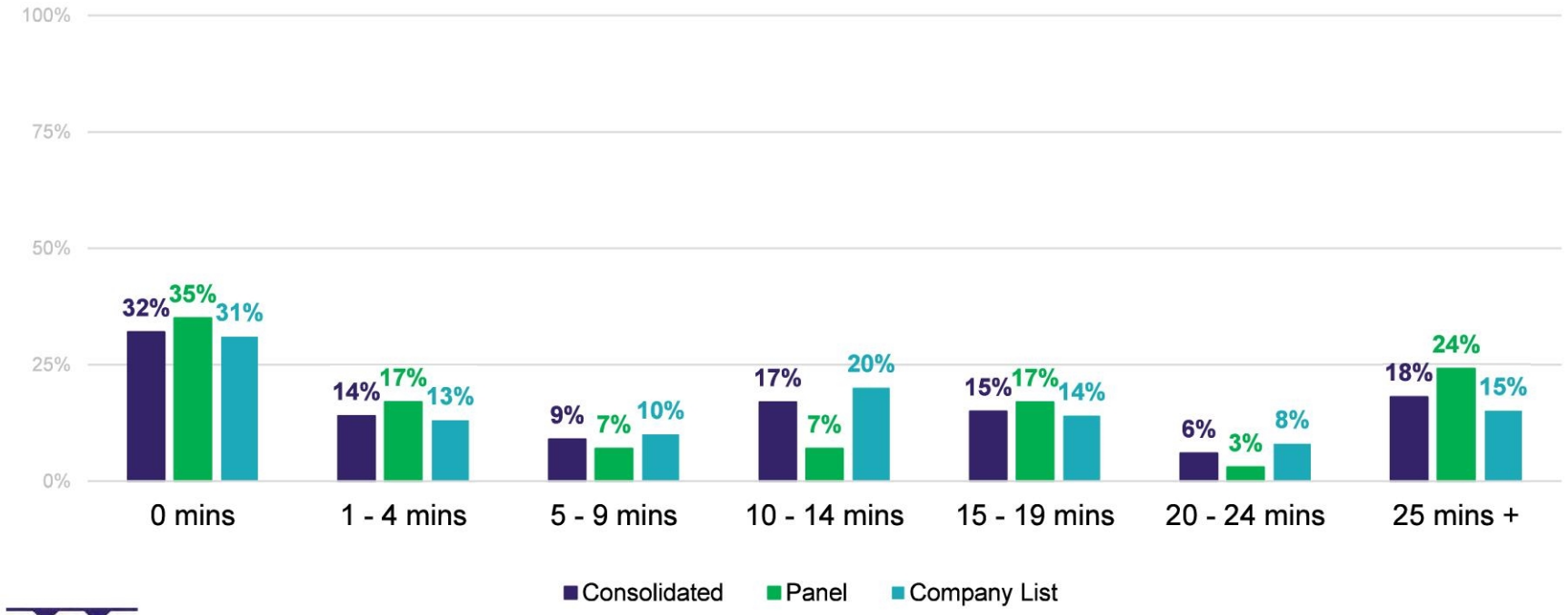
Subset: used Hawaiian Electric's public fast chargers

- When cheaper or free are not available.
- Charging at home is a slow charge. Need a fast charge if I'm in a hurry.
- When I just can't get home on a comfortable battery margin.
- When an unexpected trip is required and I'm low on charge.
- Trips of over 200 miles
- I normally charge at home but my Leaf no longer has the range needed to make longer round trips.
- If my own charger were to be temporarily unavailable
- For emergencies.
- Free for 30 minutes per day with Nissan's "No Charge to Charge" program
- I have made my cars available for rent via Turo. My renters who stayed in hotels relied heavily on DCFC.
- HOA unable to justify cost to install EV chargers on property due to installation cost too high.

Average Wait to Use Hawaiian Electric's Public Fast Chargers

"On average, how long do you wait to plug in at Hawaiian Electric's public fast chargers?"

Subset: used Hawaiian Electric's public fast chargers

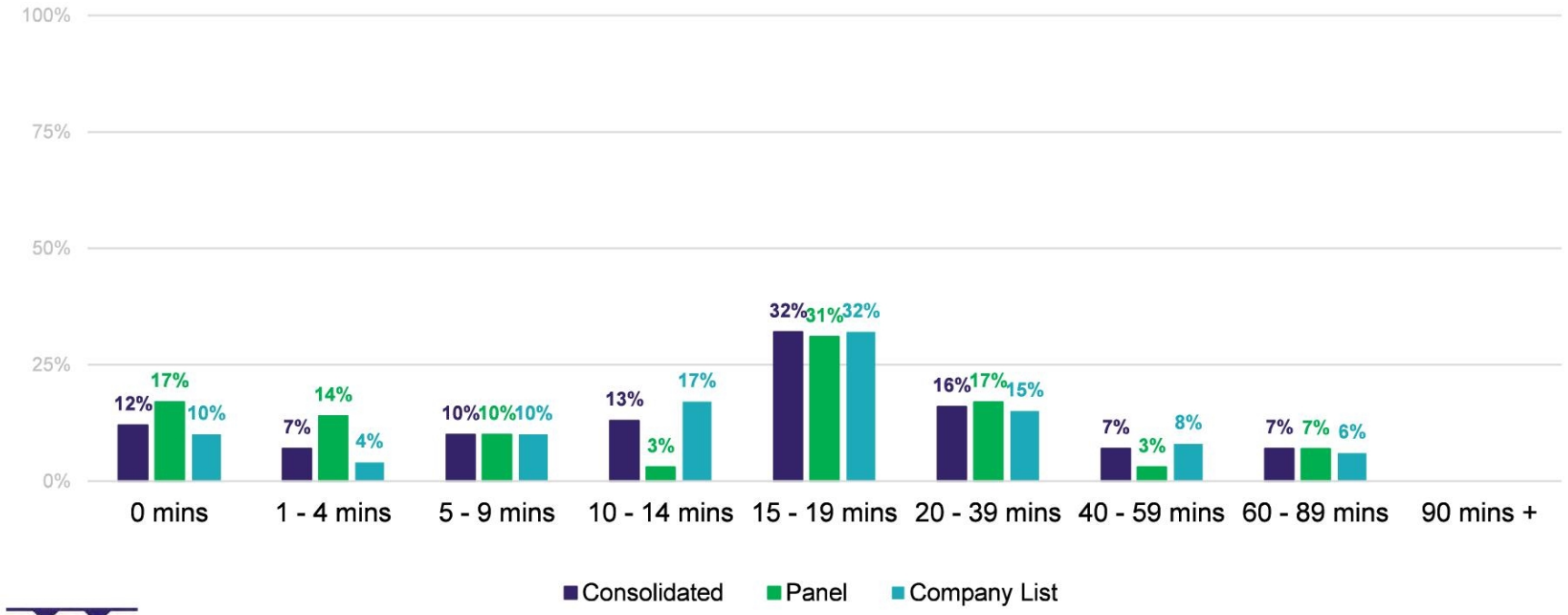


Percentages exceed 100% due to multiple response

Longest Wait to Use Hawaiian Electric's Public Fast Chargers

"What is the longest you have waited to plug in at a Hawaiian Electric public fast charger?"

Subset: used Hawaiian Electric's public fast chargers

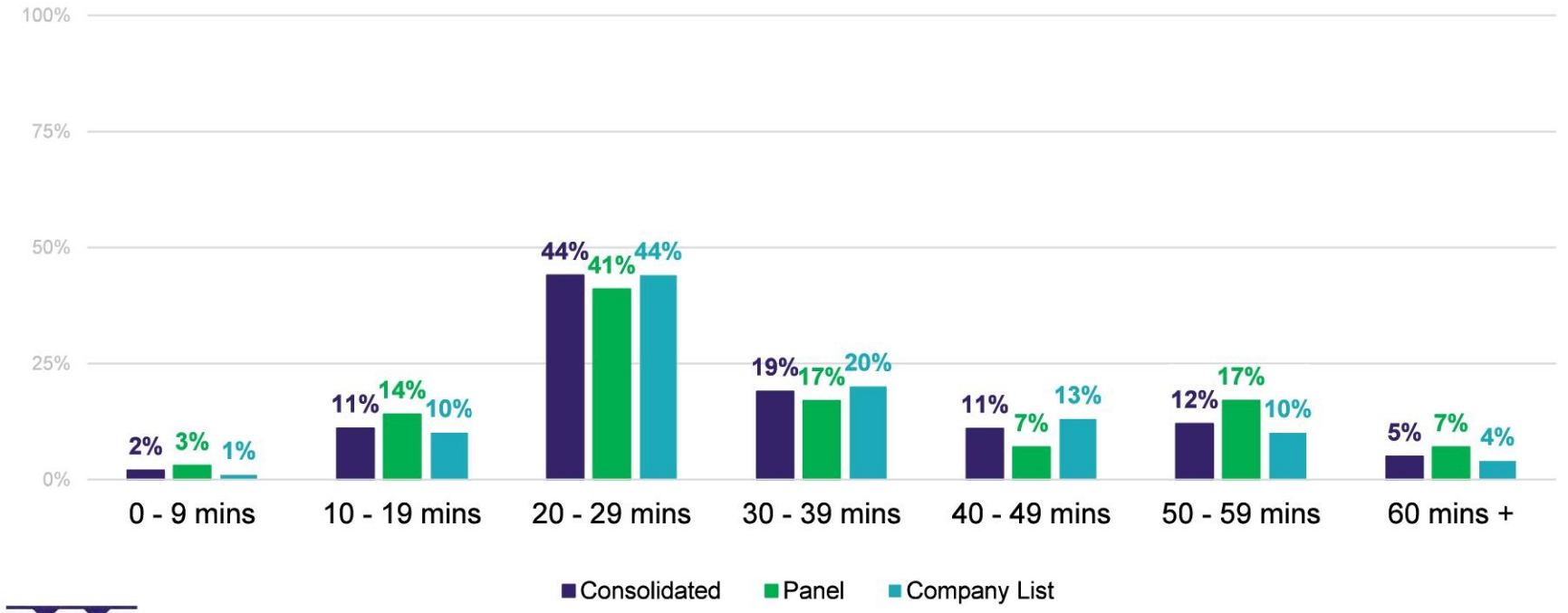


Percentages exceed 100% due to multiple response

Average Charge Time at Hawaiian Electric's Public Fast Chargers

"On average, how long do you charge your vehicle when using a Hawaiian Electric public fast charger?"

Subset: used Hawaiian Electric's public fast chargers



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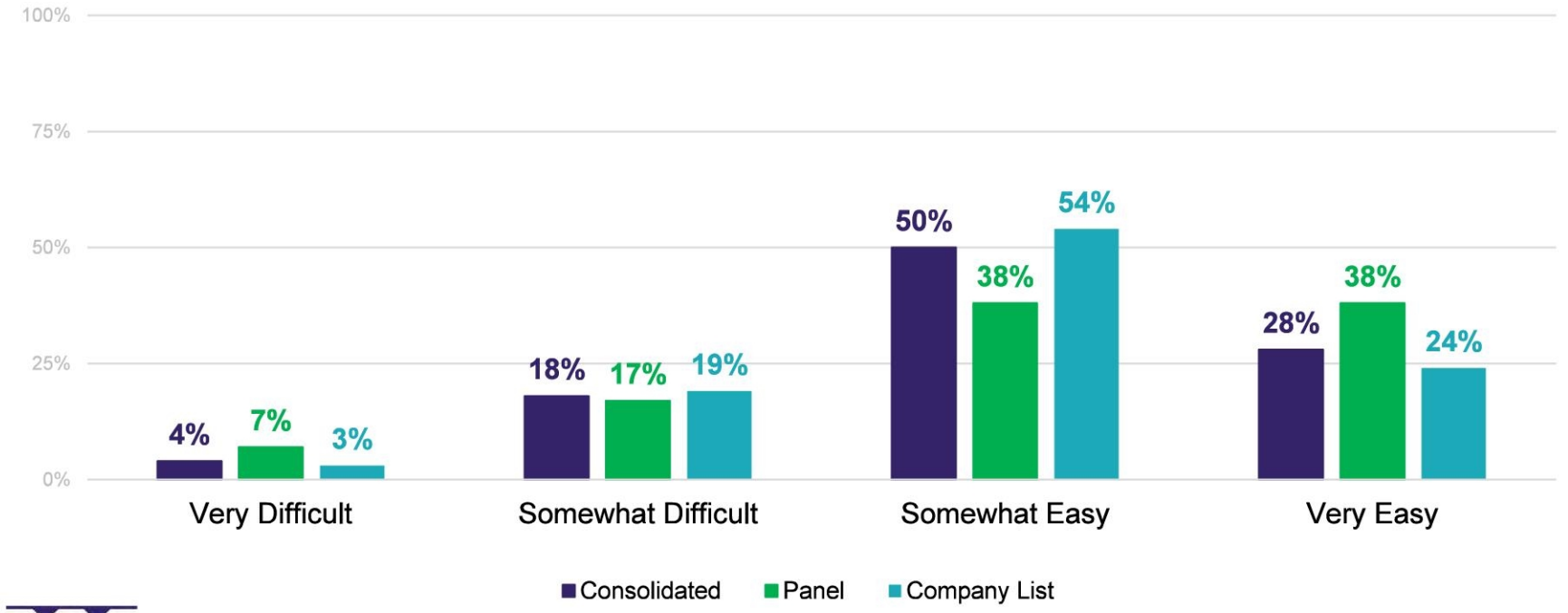
Hawaiian Electric's Public Fast Chargers Ease of Use

"How easy have you found Hawaiian Electric fast chargers to use?"

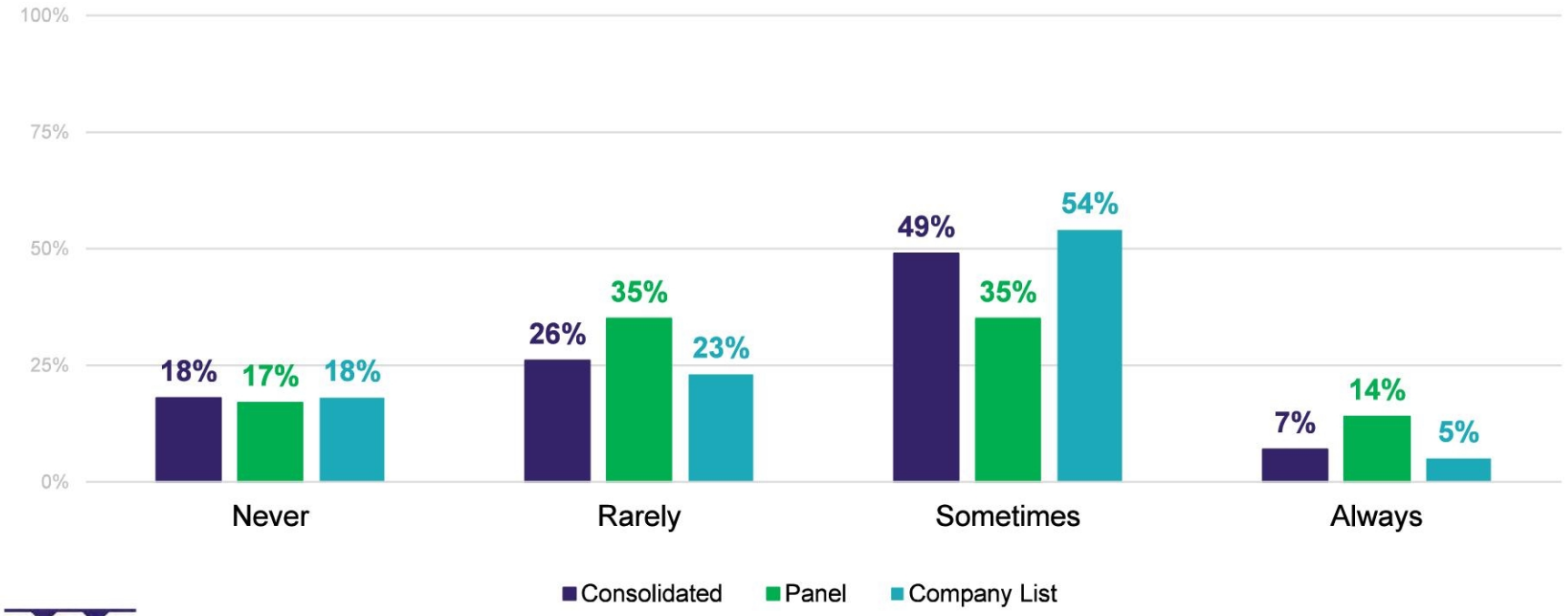
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Chargers Not Functioning

"How often when you arrive to use a Hawaiian Electric charger do you find that it is not functioning?"

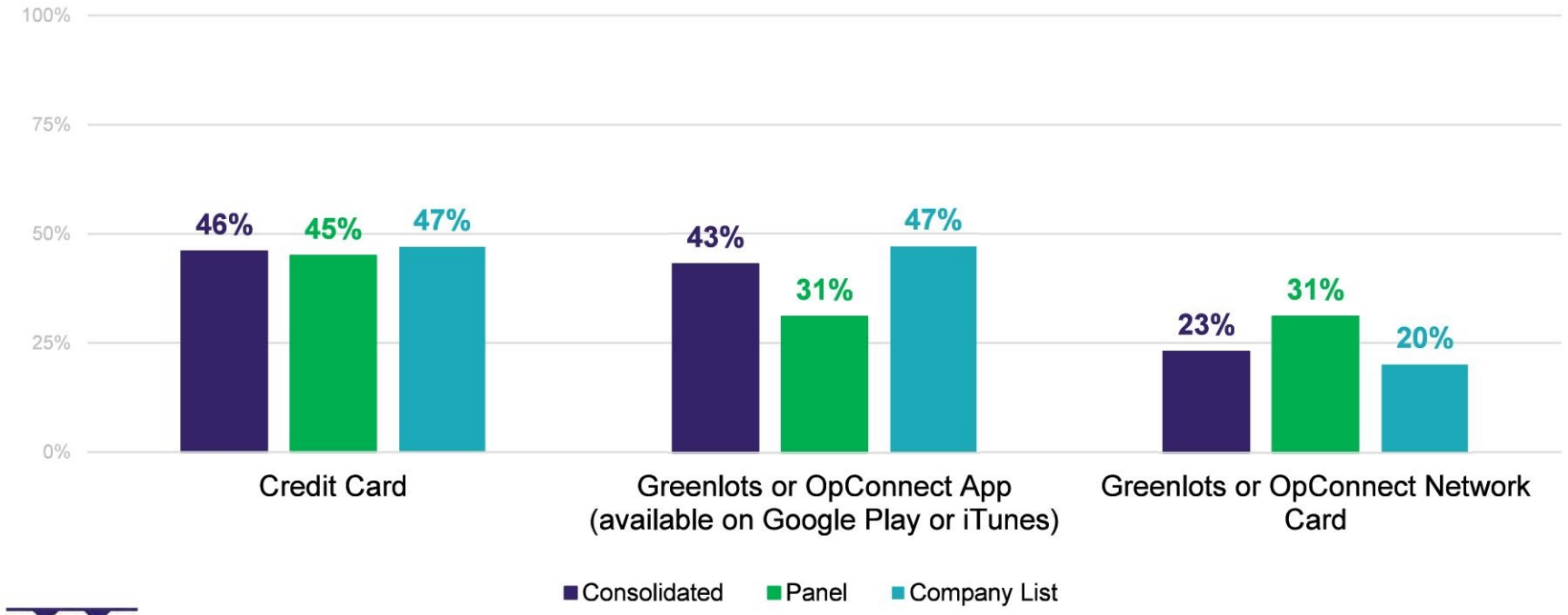
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Payments

"What payment option do you most commonly use?"

Subset: used Hawaiian Electric's public fast chargers



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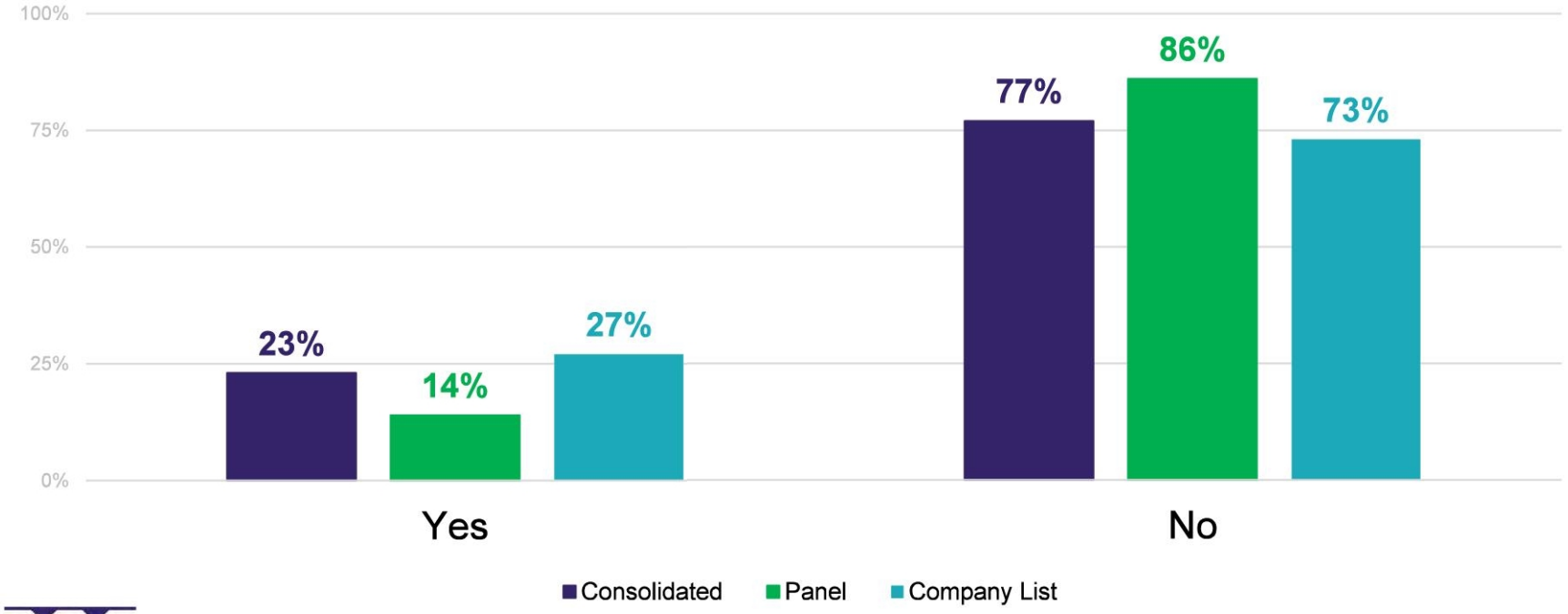
Issues with Two Hawaiian Electric Public Fast Charger Networks

"Has it caused you any issues that the Hawaiian Electric network has two network providers – Greenlots and OpConnect?"

Subset: used Hawaiian Electric's public fast chargers



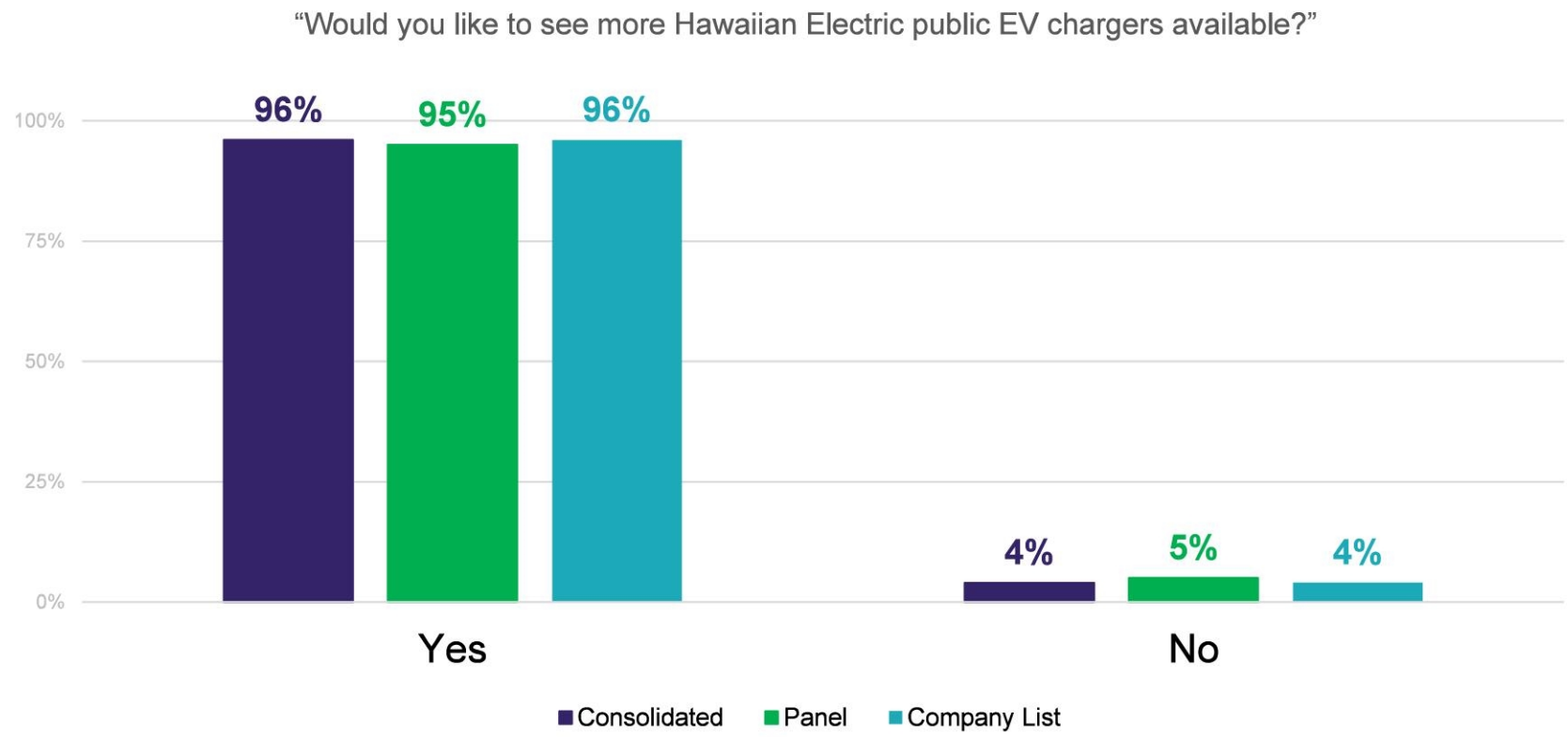
Issue with Two Hawaiian Electric Public Fast Charger Networks

"Has it caused you any issues that the Hawaiian Electric network has two network providers – Greenlots and OpConnect? YES"

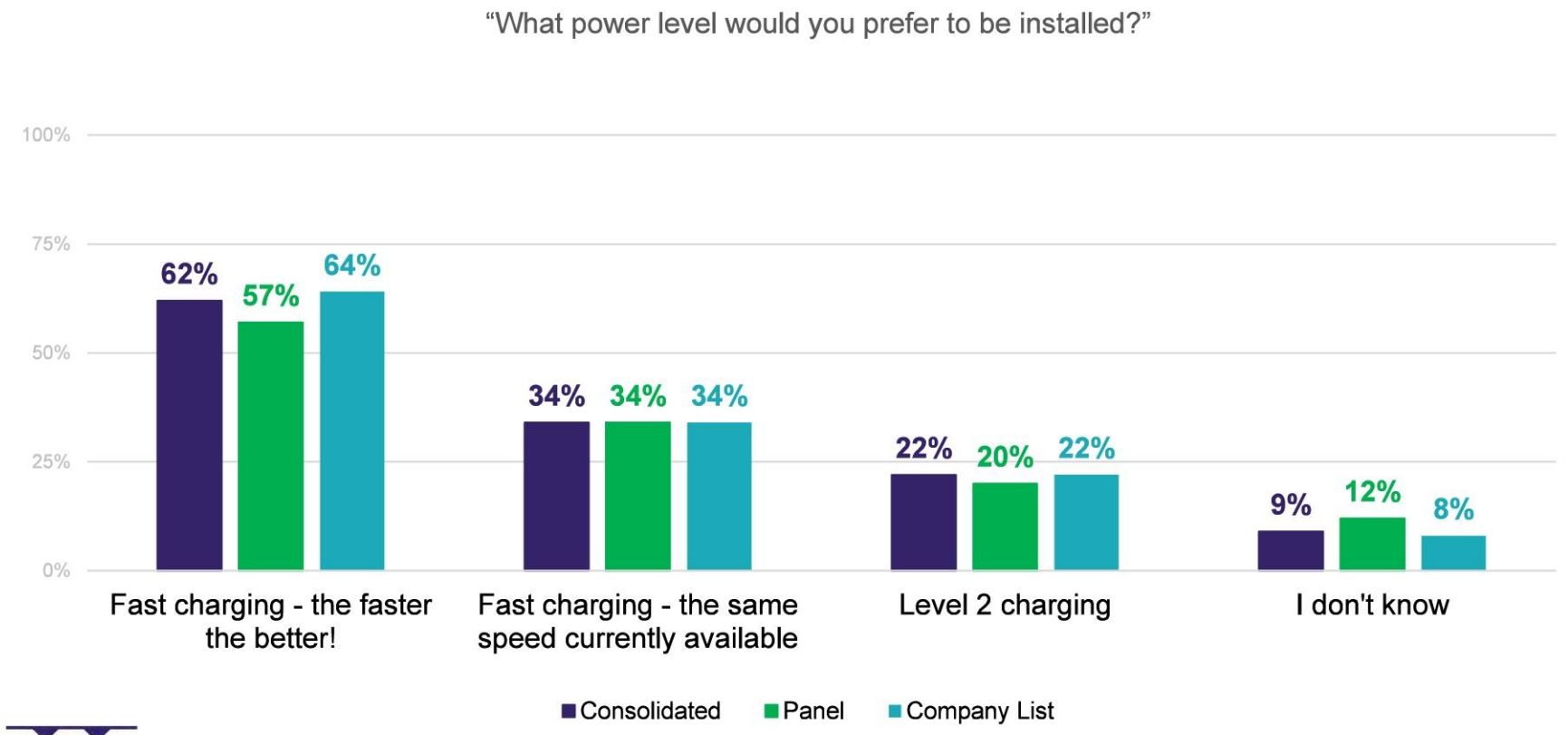
Subset: used Hawaiian Electric's public fast chargers

- Would just prefer one system for all public chargers or at least all DCFC.
- Two different apps, two different accounts, two different passwords, etc.
- Hard to remember which locations are which vendor. Would be better if every location supported all 3 payment modes.
- The screen on some chargers is essentially unreadable when the sun is shining on it. It really should be hooded. I have an OpConnect account but didn't know the charger could use it. Perhaps it said so on the unreadable screen.
- Interface seems a little lame
- Yes, issue because I only have one of providers. But good because I don't want to carry/have multiple network provider services. But if credit card payments are available option, then non-issue about providers.
- They should be synced internally
- Pick one or the other. OpConnect is not reflected at all in the Ford nav system. It's as if they do not exist. This requires the use of third-party software to locate them. Greenlots also supports Plug & Charge for Ford. Far easier to use.
- OpConnect seems to not work often.
- Opconnect never works. It's always messed up and always a headache, I really don't like it.
- OpConnect chargers are problematic. The other charging network, ChargePoint, used by Target and Walmart work fine. Greenlots ID card sometimes doesn't work.
- I received a bonus card via the state green energy program that only worked at OpConnect...and in fact, didn't work very well there either.

More Hawaiian Electric Public EV Chargers

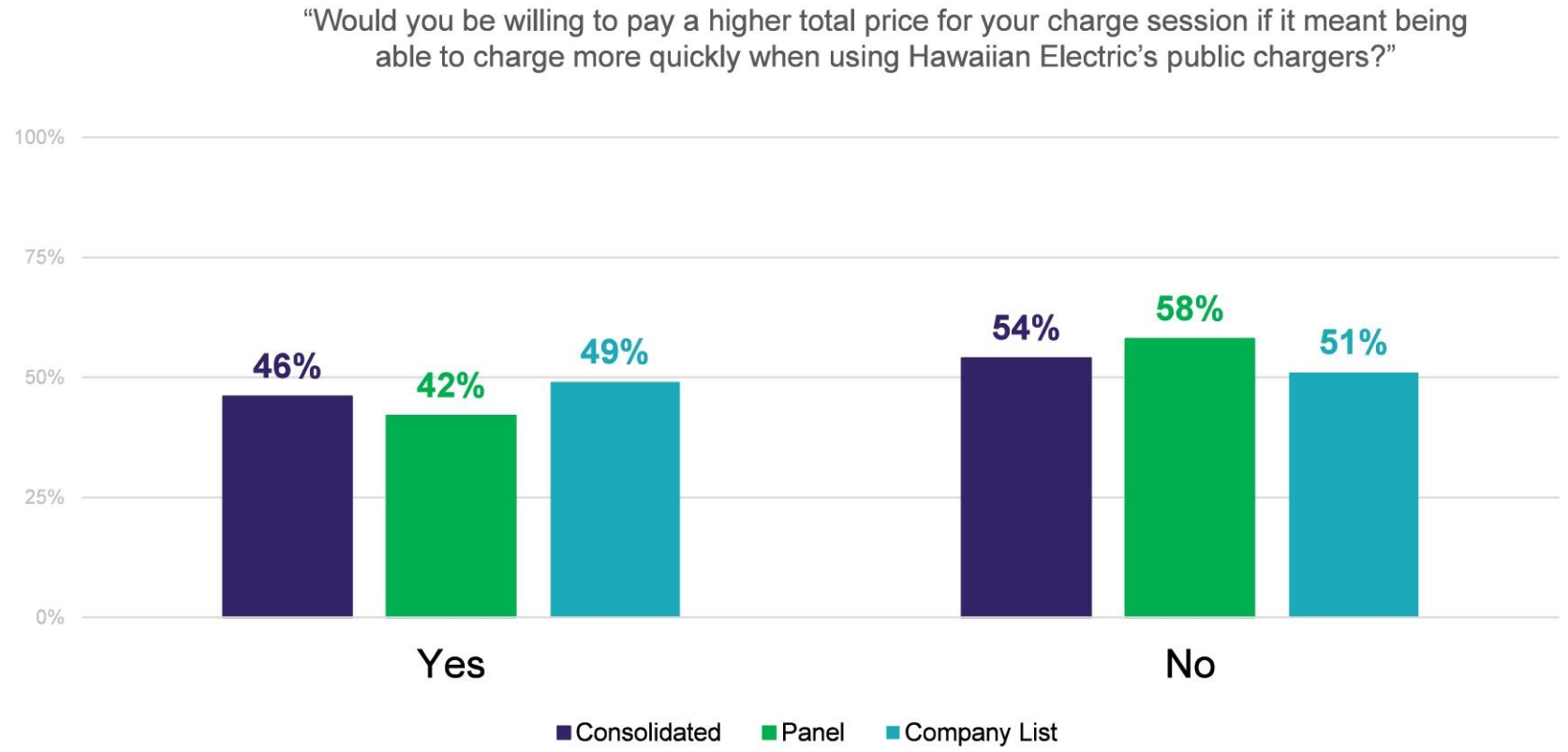


Hawaiian Electric's Public EV Charger Installations



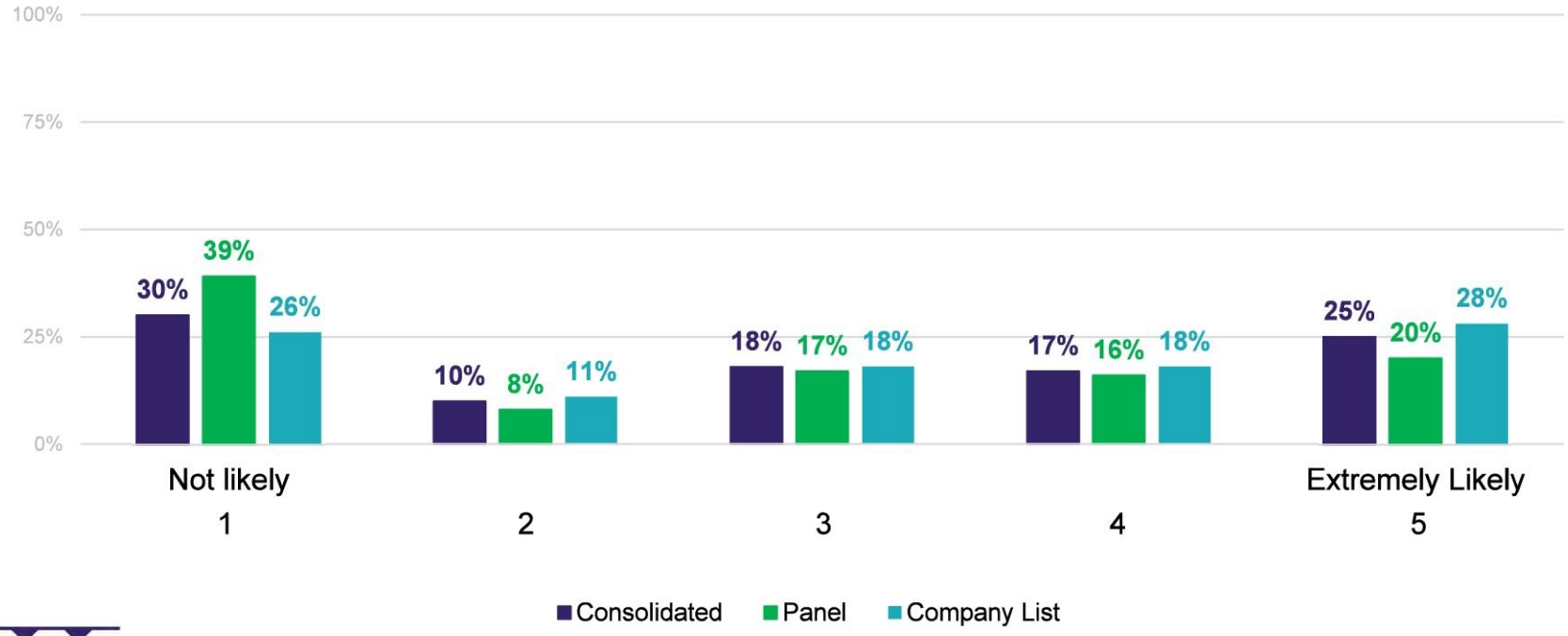
Percentages exceed 100% due to multiple response

Paying More for Faster Charging at Hawaiian Electric Public EV Chargers



Likelihood to Adjust Usage to Take Advantage of the Lower Midday Rate at Hawaiian Electric Public EV Chargers

"How likely are you to adjust your usage at Hawaiian Electric's public charging stations to take advantage of the lower midday (9AM – 5PM) rate?"



Hawaiian Electric Public Charging Improvements

"How can Hawaiian Electric improve the public charging experience for EV drivers as they design the next phase of their program?"

- Make sure the locations are well advertised and clearly visible, and, most importantly, make sure they are well maintained.
- Reliability is the key for me. I find that in general many charging stations, especially in the resort areas, very often don't work. This isn't just the HE charges, but all of them, though the HE chargers are Mauna Lani were down for a long time. It looks like the elements, especially the sun, take a toll on the chargers, making the displays hard to read. Most of the time, I can check the app to see whether a station is working, but overall EV drivers need to know that they'll likely be able to charge, both that the machine is working, able to be used (seeing the display) and not occupied for really long times.
- You need lots of them, and it needs to be low cost. I basically disregard the current public charging infrastructure as useless and only charge at home, because charging at home is cheap, available and reliable, whereas the public charge infrastructure is none of these.
- Too often people leave their cars after the charging is complete. This is frustrating and a waste of time for me. If there is a way you are able to address it, it would instill a lot more confidence. Would like to see additional sites on the north shore of Oahu and a way to know that the stations are functioning as I'd hate to be stranded.
- The process should be far more intuitive and function with good displays, chargers in good condition, and well maintained. Swipe and go like a gas station.
- Integrate Level 2 & 3 charging stations at more locations. Provide more charging "stop & go" lots or incentives for public/private areas/owners/buildings/government so more that drivers can charge & multi-task errands. Work with short-term ride-share/rental companies, integrate EV vehicles into their rental program. Integrate island-wide pickup/dropoff points as charging stations. Provide more public awareness announcements of EV TOU rates. Implement TOU rates for all customers so that they may understand benefit/relationship of TOU rate structure.
- We've owned our Tesla for personal use over 2 years during which we have never needed public charging, not even close to needing it. Our model 3 is the basic model not extended battery. HE need only target business related drivers for this program who need public charging. Personal use drivers can get everywhere on Oahu on single charge done at home.
- You need plugs that can accommodate Tesla vehicles.
- Would like free charging.

Final Comments about Hawaiian Electric's Public Charging

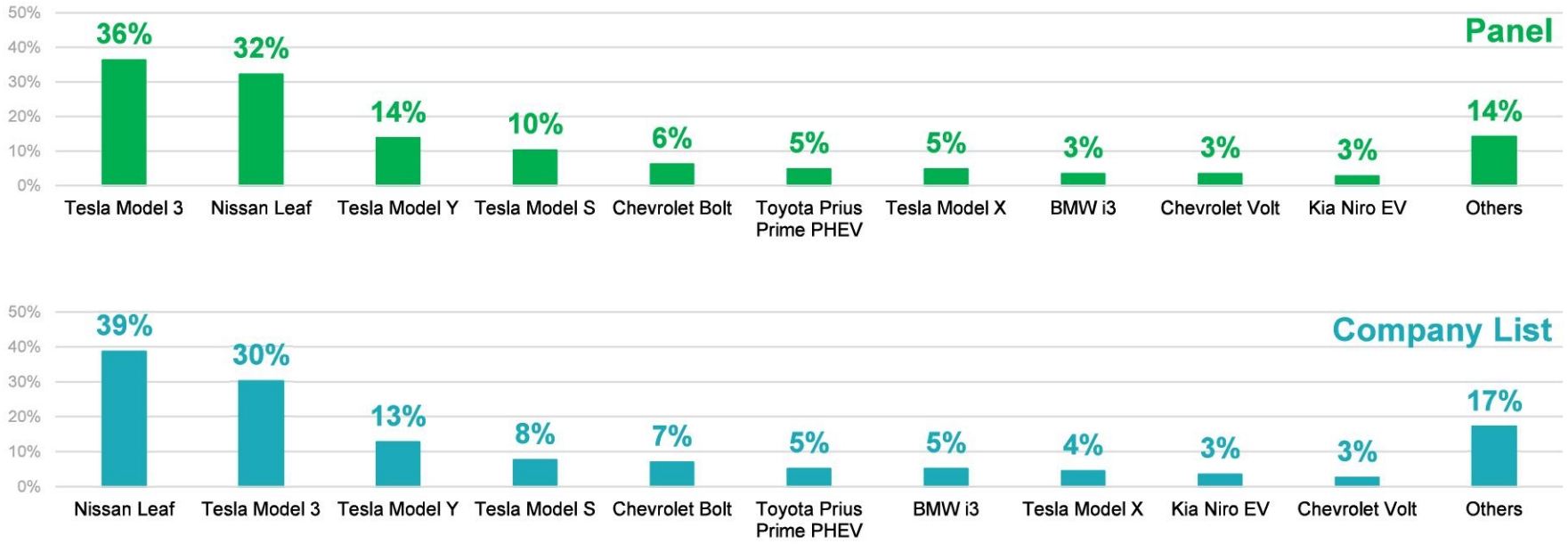
"Do you have any other comments on Hawaiian Electric's public charging offerings?"

- You might be able to influence more EV purchases by placing them in apartment and condo parking lots. Work with the rental car agencies to encourage their adoption of EVs. Sprinkle charge stations liberally in tourist areas. Build PV shade parking structures with the charging lots so that they can be untethered from the grid.
- We had a charger in our garage when we lived in a free-standing house. Since we live in a high-rise, it is much more difficult to charge. Therefore, locating chargers (and enough of them) near high-rises (such as in Waikiki and the Gold Coast) would be tremendously helpful. It would also be useful to support legislation requiring chargers IN high-rises.
- With the high $/kW cost of electricity, I'm still unclear on the economic advantages of EVs. Electricity costs seem to equate to approx. $10/gal (gas). Honestly, the only reason I purchased a PHEV was for the Zipper Lane access. Even with PV panels on my home, I can't seem to make it pencil out.
- Needs to be safe for vehicles. Over-use of fast charge may damage the battery in many older EV's.
- We do not travel around the island because regular charging takes too long and fast charge stations are not available.
- Yes, Ohana discount. Let tourists pay more!!
- Where are the fast charging stations?
- The only one that I have knowledge of is tucked away in a parking lot, and not particularly easy to find.
- We have been almost out of batteries many times and it's nearly impossible to find a charger that works. So having an advertised charger location map or making sure that the charging stations show up on Google maps would be really important.
- Get some Tesla Superchargers … 200KWHRs a whole lot faster than your 50KWHR rate, which I have never seen … Highest was 45 KWHRs
- No, I like the idea that HECO offers it rather than a private charging company.
- Yes, thank you so much for stepping in now that the MEDB EV demonstration program has ended and so to their charging stations.
- Thanks for providing the service. I really enjoy getting a fast charge when I need it. I think you'll need to expand much further as more and more vehicles go electric.

Appendix

Electric Vehicles Driven – Top 10

"What electric vehicle(s) do you drive?"

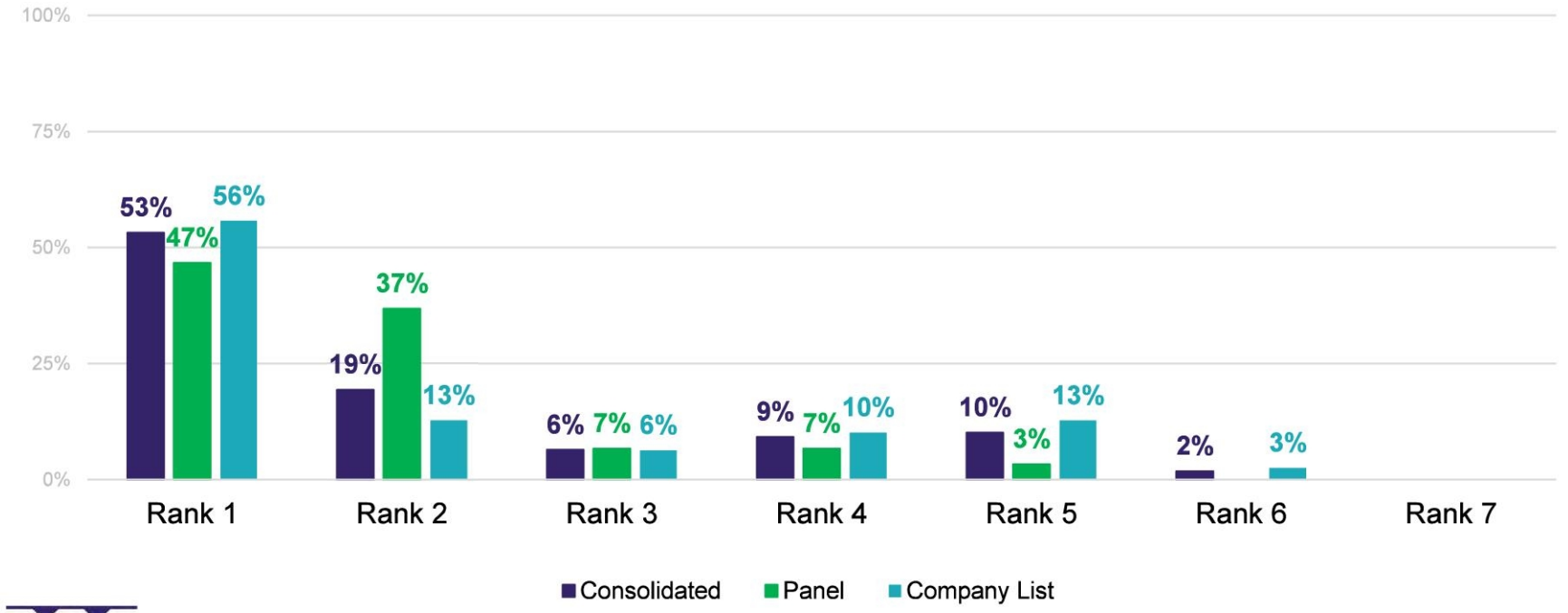


Percentages exceed 100% due to multiple response

Hawaiian Electric's Public Fast Charger Usage Reasons:
To re-fuel on days with a longer commute or drive (over 20 miles of driving)

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

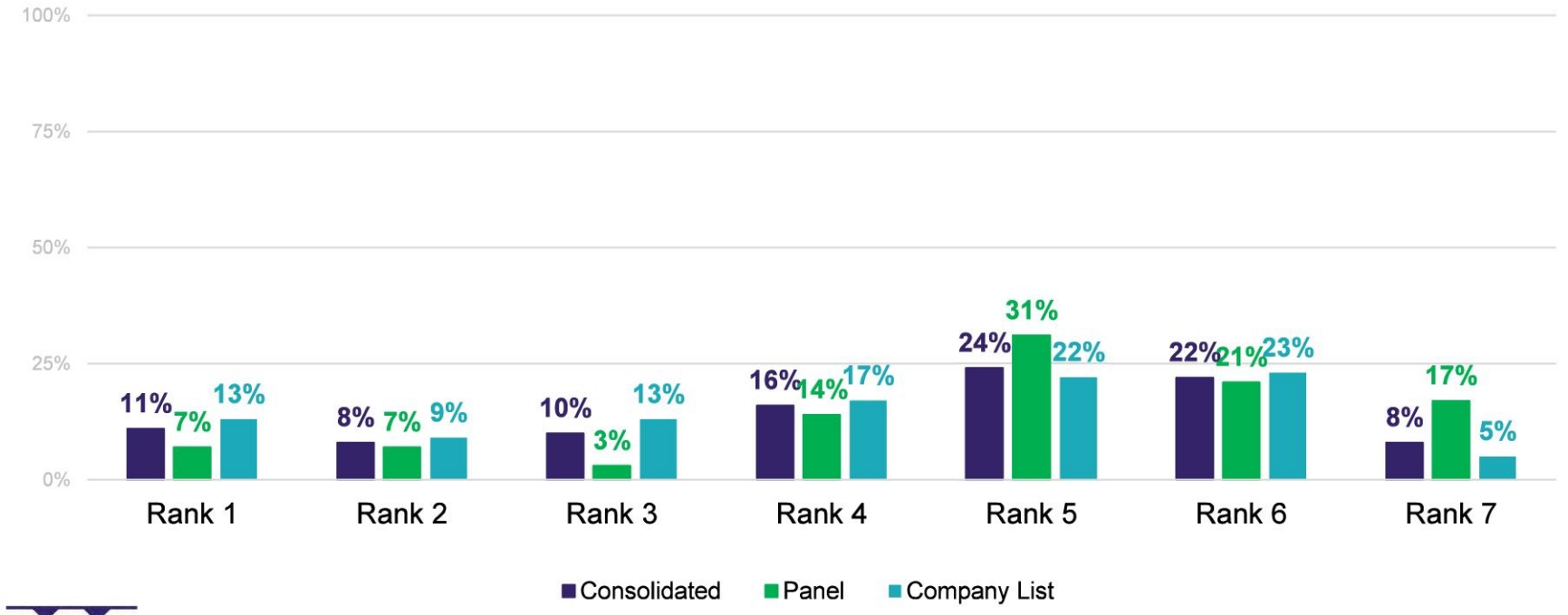
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons:
I am not able to charge at home

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

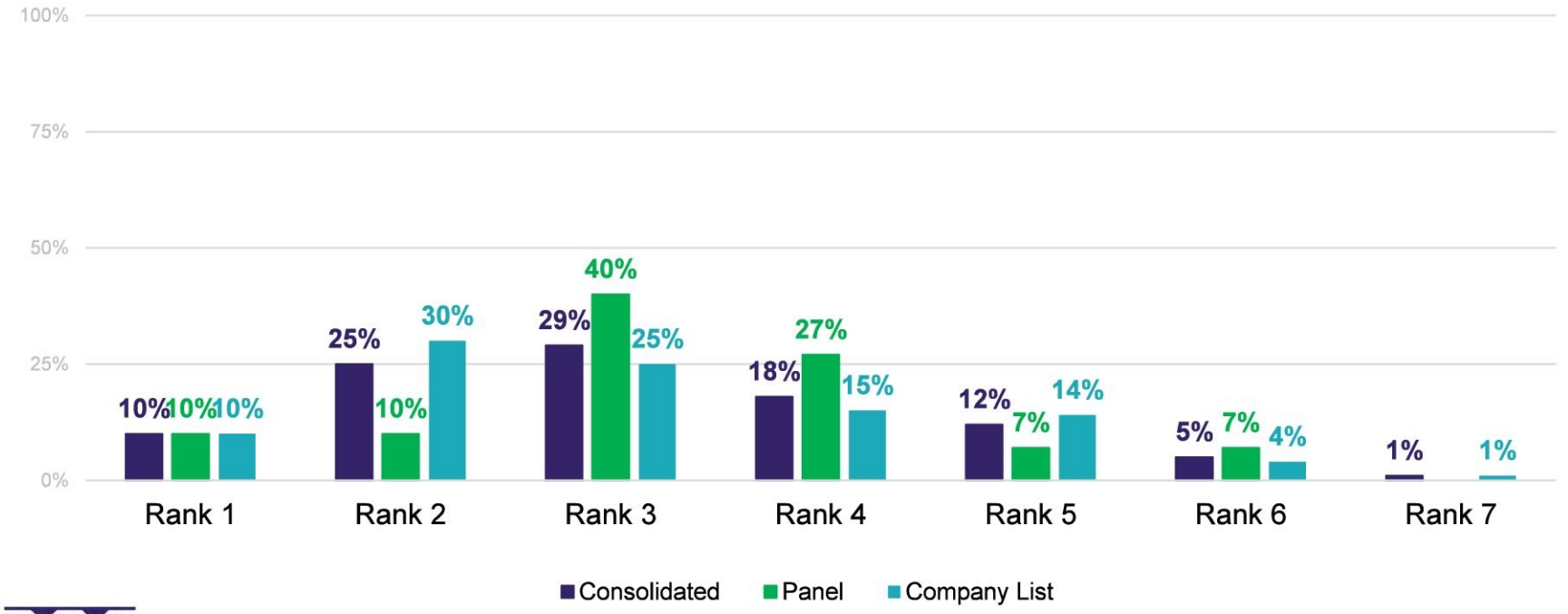
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons:
It is convenient to park and charge while running other errands

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

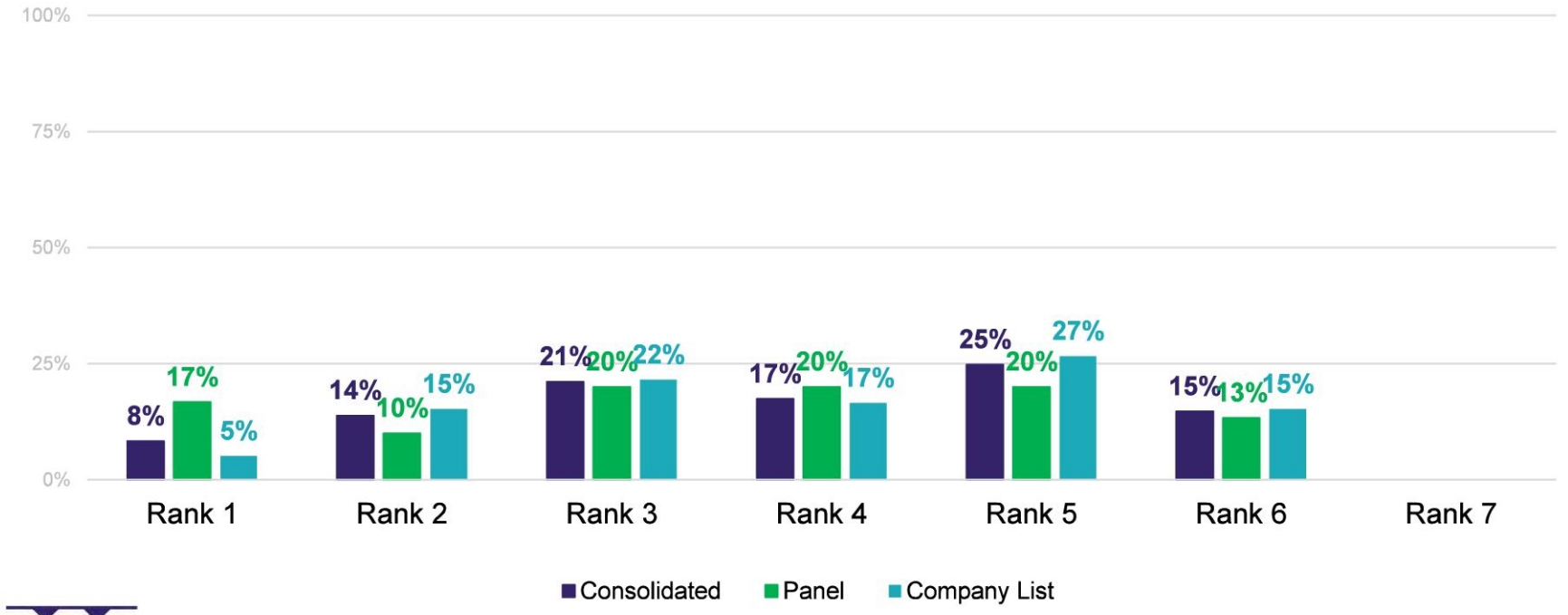
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons:
To regularly re-fuel my vehicle

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

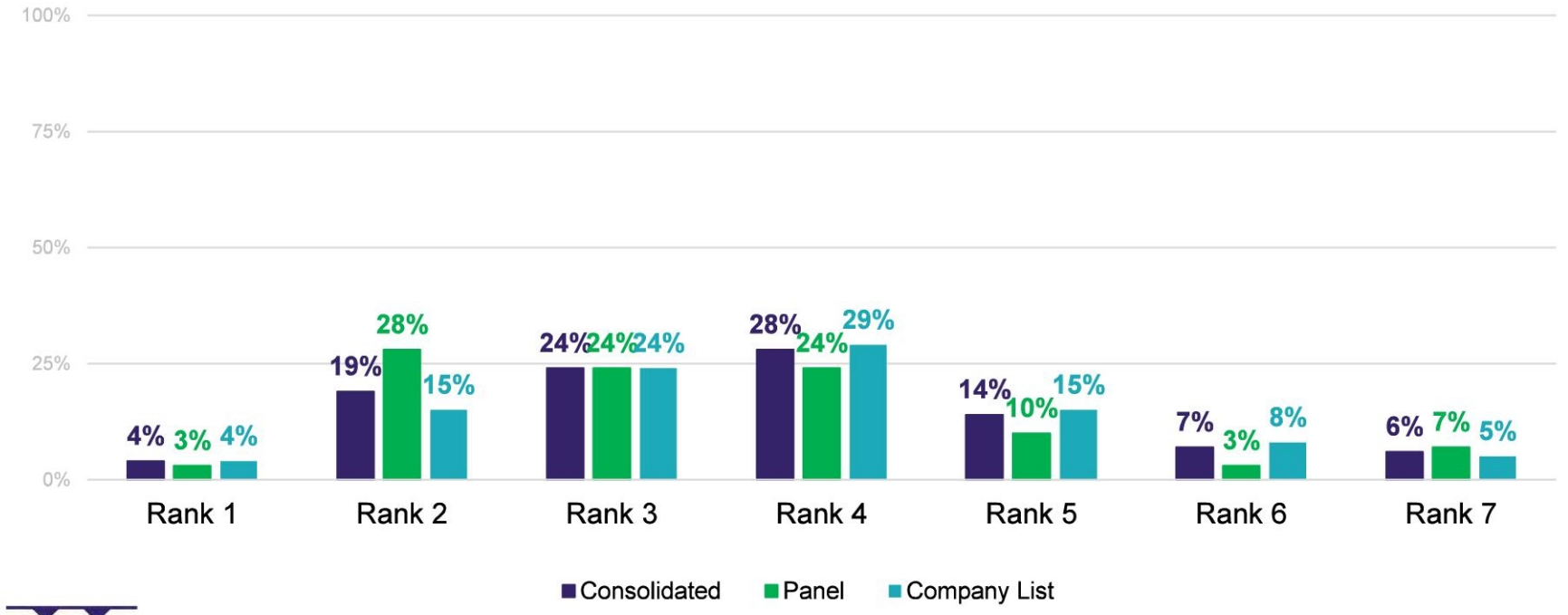
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons:
The cost to charge is affordable

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

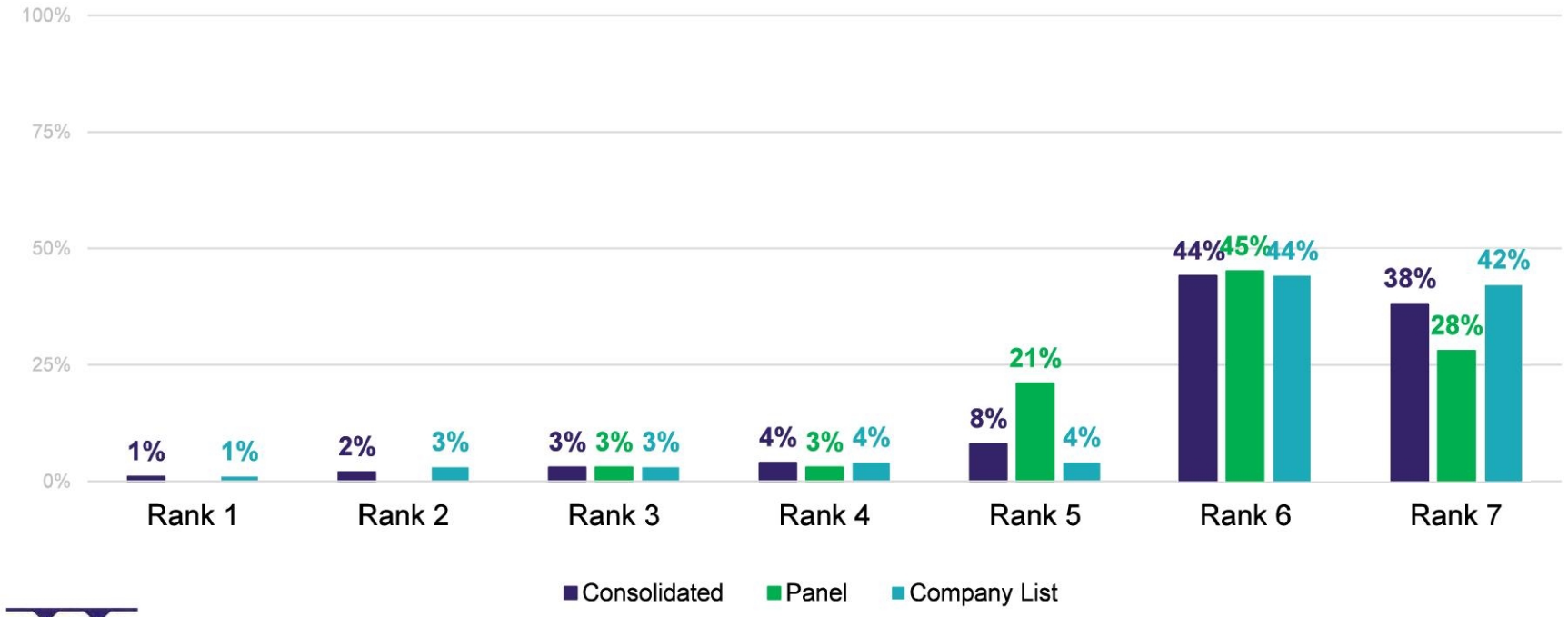
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons:
To re-fuel for Lyft, Uber, or other ridesharing

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

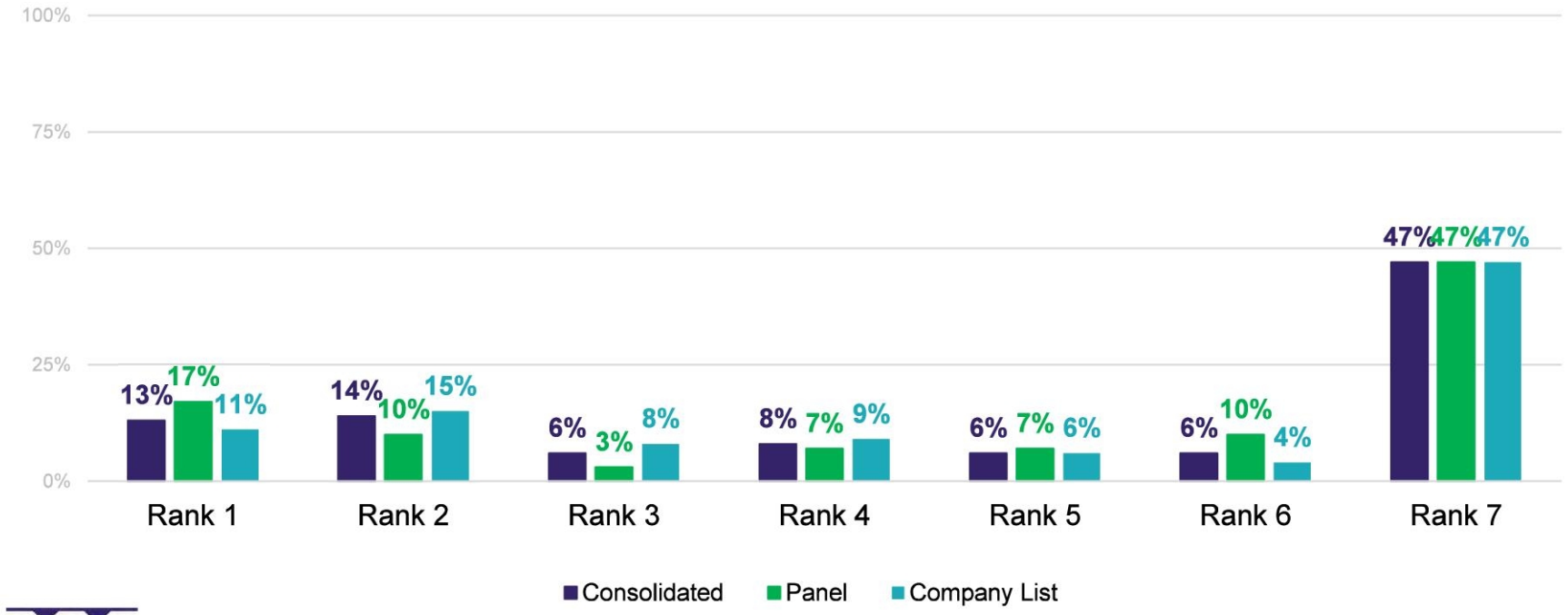
Subset: used Hawaiian Electric's public fast chargers



Hawaiian Electric's Public Fast Charger Usage Reasons: **Other reason(s)**

"Please rank your reasons for using Hawaiian Electric's public fast chargers."

Subset: used Hawaiian Electric's public fast chargers



BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE STATE OF HAWAI'I

In the Matter of the Application of HAWAIIAN ELECTRIC COMPANY, INC. HAWAI'I ELECTRIC LIGHT COMPANY, INC. MAUI ELECTRIC COMPANY, LIMITED dba HAWAIIAN ELECTRIC For approval to commit funds in excess of $2,500,000 for the Public Electric Vehicle Charger Expansion Project, to Recover the Capital and Operations and Maintenance Expense Costs through the Exceptional Project Recovery Mechanism, and Related Requests.	)	DOCKET NO.

CERTIFICATE OF SERVICE

I hereby certify that a copy of the foregoing Application, together with this Certificate of Service, was duly served on the following party, by electronic mail service as set forth below:

Division of Consumer Advocacy
Department of Commerce and Consumer Affairs
335 Merchant Street, Room 326
Honolulu, Hawai'i 96813
dnishina@dcca.hawaii.gov
consumeradvocate@dcca.hawaii.gov

DATED: Honolulu, Hawai'i October 29, 2021

/s/ Richard VanDrunen

Richard VanDrunen
HAWAIIAN ELECTRIC COMPANY, INC.
Regulatory Affairs

FILED

2021 Oct 29 PM 13:14

PUBLIC UTILITIES
COMMISSION

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