

# Memorandum

To: Columbia-Willamette Clean Cities Coalition

From: Cadeo

Date: July 5, 2024

Re: EVSE and Workplace Amenities Costs Comparison

We present below updated costs as options to include in the updated Workplace EV Charging Project Scenario Checklist. These represent values from additional research conducted by Cadeo. As background, workplace charging can be seen as an amenity for employees, yet viewed as a cost-prohibitive addition to a workplace even when the non-monetary benefits of workplace charging are known. The below memorandum summarizes the costs of workplace charging as compared to many commonplace workplace amenities available to employees today.

## Updated EVSE Cost Estimates

Table 1 summarizes the updated EV charging station figures for Level 1 (L1), Level 2 (L2) and DC Fast Charging (DCFC) stations. All costs are per individual charging port.

Network, Labor, Materials, Permit, and Taxes costs remain unchanged from the 2019 ICCT paper,<sup>1</sup> as all the references listed still use the same figures from this paper. Refer to Appendix A for a list of all sources covered.

**Table 1: Updated EVSE Cost Estimates by Level**

Costs	Level 1	Level 2	DCFC
<b>Equipment</b>	\$400-\$2,000	\$500-9,000	\$25,000– \$167,400
<b>Network</b>	n/a	\$1,945	included
<b>Installation</b>	\$600	\$400-6,600	\$10,797– \$117,900
<b>Labor</b>	n/a	\$2,471	\$19,200– \$27,840
<b>Materials</b>	n/a	\$1,235	\$26,000– \$37,700
<b>Permit</b>	n/a	\$283	\$200–\$290

<sup>1</sup> [https://theicct.org/sites/default/files/publications/ICCT\\_EV\\_Charging\\_Cost\\_20190813.pdf](https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf)

<b>Taxes</b>	n/a	\$156	\$106–\$154
<b>Maintenance/Warranty</b>	n/a	\$400/year	\$300– \$3,000/year
<b>TOTAL Cost (excl. annual costs)</b>	<b>\$1,000-\$2,600</b>	<b>\$6,990- \$21,690</b>	<b>\$81,303– \$351,284</b>

## Updated Workplace Amenities

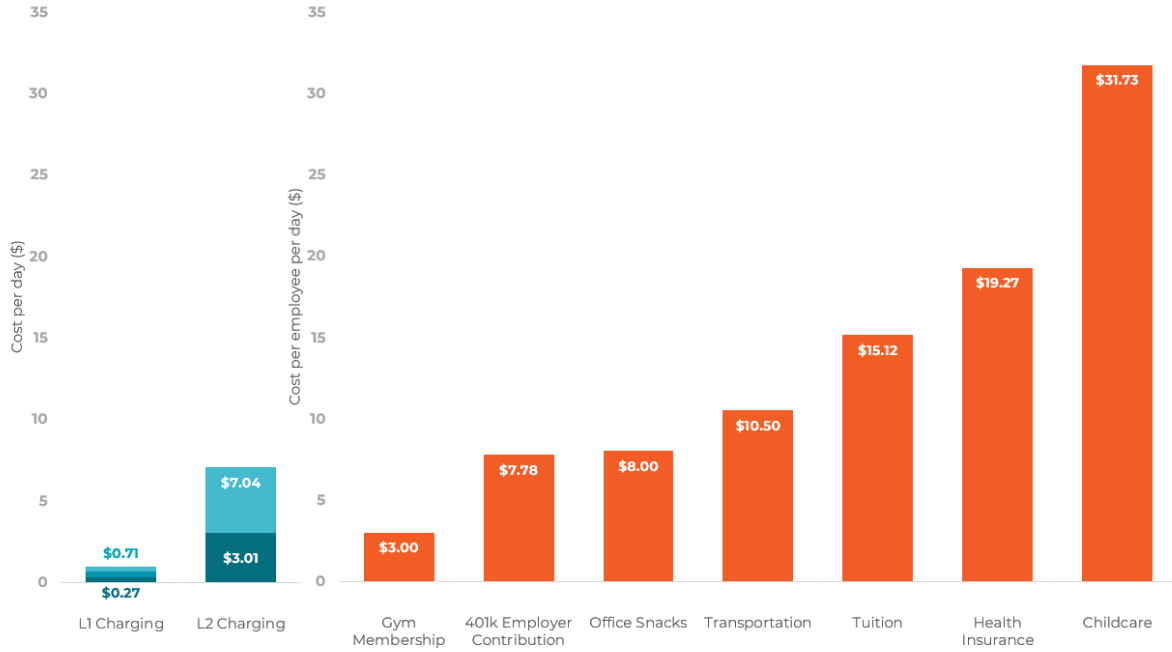
The team conducted research to update the workplace amenities costs graph. We used the costs presented in Table 1 to update the cost of workplace charging on a per-day basis. The costs do not include the electricity costs of charging the EV. In other words, the assumption is that the electricity costs from charging the EV are borne by the employee. Furthermore, we assume an 8-hour workday, with one charger per employee per workday, with the caveat that this will depend on workplace charging policy and type of organization. A workplace with charging policy mandating moving the car after 4 hours of charging can increase the number of benefited employees per day for the same daily charger cost. Similarly, a workplace such as a hospital can accommodate 3 employees per day for the same daily charger cost if we consider 8-hour shifts.

Cost comparison results are summarized in Table 2 and showcased in a graph in Figure 1 and Figure 2. Additional assumptions and sources for the other workplace amenities can be found in Appendix B.

**Table 2: Updated Workplace Amenities Daily Cost Per Person**

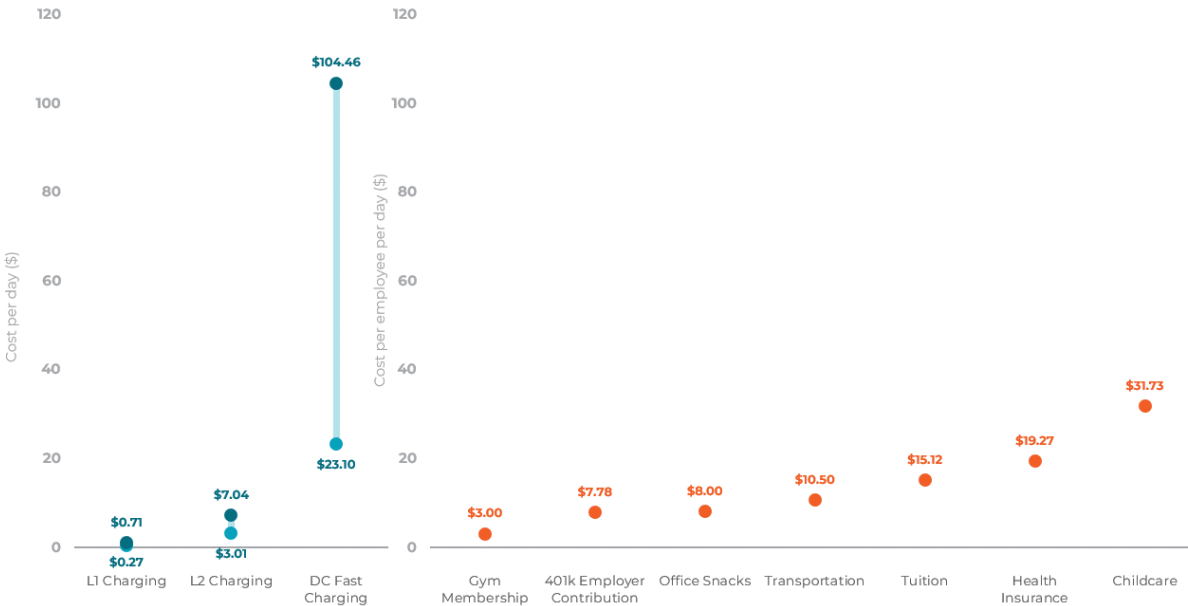
<b>Workplace Amenity</b>	<b>Range Low (\$/day)</b>	<b>Range High (\$/day)</b>
L1 Charging	0.27	0.71
L2 Charging	3.01	7.04
DC Fast Charging	23.10	104.46
Gym Membership	1.70	3.00
401k Employer Contribution		7.78
Office Snacks	3.00	8.00
Transportation		10.50
Tuition		15.12
Health Insurance		19.27
Childcare		31.73

**Figure 1: Cost of charging vs. other employer-provided benefits**



Assumptions include an 8-hour workday, one charging port per employee per workday, and electricity costs borne by the employee.

**Figure 2: Cost of charging vs. other employer-provided benefits including DCFC chargers**



Assumptions include an 8-hour workday, one charging port per employee per workday, and electricity costs borne by the employee.

# Appendix A

## Sources for updated cost figures in Table 1

### NREL, 2023

[The 2030 National Charging Network: Estimating U.S. Light-Duty Demand for Electric Vehicle Charging Infrastructure](#)

"Note: Cost estimates exclude cost of front-of-meter utility upgrades (such as new transformers and line extensions), distributed energy resources (such as on-site storage or generation), operating costs (such as utility energy and demand charges), maintenance costs (necessary for ensuring a high level of reliability), and certain construction soft costs (such as delays associated with local permitting utility service connection)."

**Table 5. EVSE Capital Cost Assumptions**

Charger Hardware		Unit Cost per Port	Install Cost per Port <sup>a</sup>	References
L1 residential	Low:	\$0	\$100	(Fixr.com 2022; Courtney 2021; HomeAdvisor 2022)
	High:	\$0 <sup>b</sup>	\$1,000	
L2 residential	Low:	\$400	\$500	(Borlaug et al. 2020; Fixr.com 2022; Courtney 2021; HomeAdvisor 2022)
	High:	\$1,200	\$1,700	
L2 commercial	Low:	\$2,200	\$2,200	(Nicholas 2019; Nelder and Rogers 2019; Borlaug et al. 2020; Bloomberg New Energy Finance 2020; Pournazeri 2022)
	High:	\$4,600	\$6,000	
DC 150 kW	Low:	\$66,400	\$45,800	(Nicholas 2019; Nelder and Rogers 2019; Borlaug et al. 2020; Bloomberg New Energy Finance 2020; Borlaug et al. 2021; Gladstein, Neandross & Associates 2021; Bennett et al. 2022)
	High:	\$102,200	\$94,000	
DC 250 kW	Low:	\$91,400	\$54,750	Inferred from DC 150-kW and 350-kW costs
	High:	\$134,800	\$105,950	
DC 350+ kW	Low:	\$116,400	\$63,700	(Nicholas 2019; Bloomberg New Energy Finance 2020; Borlaug et al. 2021; Gladstein, Neandross & Associates 2021; Bennett et al. 2022)
	High:	\$167,400	\$117,900	

<sup>a</sup> These ranges do not span the set of all possible situations. They are meant to be plausible optimistic (low) and pessimistic (high) estimates for assessing network capital costs at scale. In some cases, it was not possible to verify exactly what was included within each study's estimate for installation costs, thus some discrepancies may be present across sources.

<sup>b</sup> L1 chargers tend to be included with the purchase of a PEV and are thus excluded as an infrastructure cost from this analysis.

### Idaho National Laboratory (INL), 2022

[Breakdown of Electric Vehicle Supply Equipment Installation Costs](#)

"The data in this report was obtained from three main sources: Smart Charge America (SCA), the WestSmart EV project and The EV Project."

Paper provides distributions with ranges, but summarized in table below:

Table 7. Summary of EVSE Costs

	ACL1		ACL2		DCFC
	residential	commercial	residential	commercial	
Basic cordset	\$190	NA	\$300	NA	price highly dependent on power rating, features, and network
Basic wallmount EVSE	NA	NA	\$500 <sup>1</sup>	NA	
Smart (networked) wallmount EVSE	NA	NA	\$575 <sup>1</sup>	\$1,500	
Basic pedestal EVSE	NA	\$1,500	NA	\$1,750	

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Smart networked pedestal EVSE	NA	NA	NA	price highly dependent on features and network with low end costs about \$2,500, average at \$3,127 and increasing with high end above \$8,000	
<p>1. EVSE costs typically increase with increasing power rating at approximately \$7.5/amp                  2. EVSE accessories such as pedestals (\$400 - \$900), retraction mechanisms (\$550 - \$1,600), wheelstops (\$35 - \$50), signage (\$10 - \$26) add to equipment costs</p>					

Table 8. Installation Cost Summary

	Residential	Commercial	DCFC
Median Installation Cost	\$1,100	\$4,000	\$20,000
Power Rating	+ \$92/kw above 4 kW	+\$380 per/kW above 4 kW	Indeterminate
Accessories	5% added \$49 - \$900	50% added \$980	Indeterminate
Labor	Dependent on local rates	Indeterminate	+\$350/\$ increase in rate
Circuit Upgrade	Rare but \$2,600 when needed	Rare but \$2,660 when needed	Adds 29% to project
Circuit Length	Adds \$12 per foot	Adds \$16 - \$20 per foot	Adds \$200 per foot
Hardscape Factors	Indeterminate	Indeterminate	Adds 21% to project
Permit fees	3.5% of project cost	Indeterminate	Add 5 – 10% to project
DTI	21 days	102 days	NA
Electrician's Man-hours	5.4 hours	22.3 hours	NA

## Residential

Total cost of installations was available from each of the charging sites in the SCA dataset. Installation costs ranged from a low of about \$150 for an easy installation to about \$18,000 for a particularly challenging installation. The distribution of installation costs is shown in Figure 10.

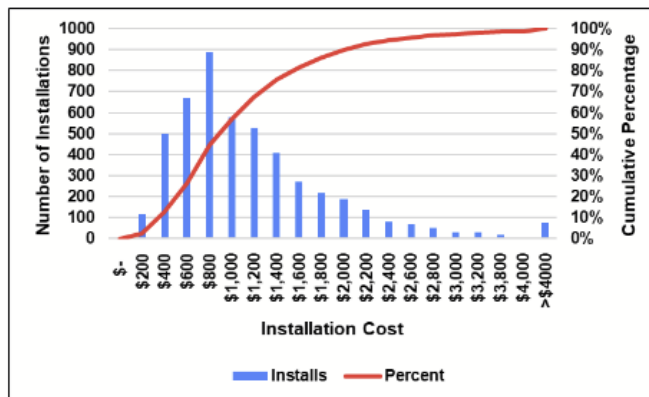


Figure 10. Distribution of Residential Installation Costs

While the average installation cost is \$1,310 and the median cost is \$1,098, 45% of installation costs are less than \$800. Costs here may be higher than that found in the ICCT working paper because of the costs for many of the installations exceeding the high end of their study of \$2,423 for factors related to installations discussed in Section 3.4.

## Multi-family

For single unit EVSE, installation costs for ACL2 circuits ranged from \$544 to \$13,537 and are shown in Figure 11. Fifty-four percent of these installations were under \$4,000. The average installation cost was \$4,548 and the median installation cost was \$3,983.

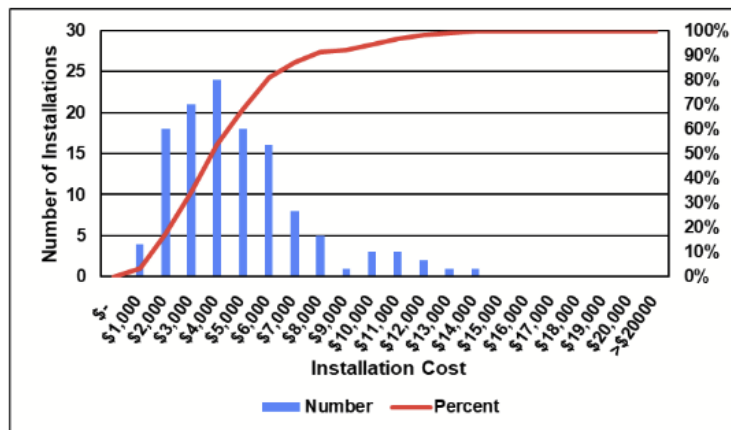


Figure 11. Condominium Installations (Single EVSE)

The ICCT working paper (Nicholas, 2019) also identified average apartment installation costs as \$600 for an ACL1 circuit and \$3,300 for ACL2 circuit. The average installation cost found in the SCA data is approximately \$1,250 higher than that found by ICCT. This could be due to some of the cost factors explored in Section 3.5 such as circuit length or higher power circuits.

## Commercial

"Twenty-five installations by SCA involved two or more EVSE. The cost per EVSE ranged from \$1,475 to \$5,220."

## DCFC

SCA supplied installation data for 17 DCFC. Five of these installations involved the installation of ACL2 EVSE or additional DCFC, and the data does not provide a breakdown between different power levels or DCFC types. Once installation included the installation of 18 Tesla superchargers at an installation cost of \$301,135 or an average of \$16,729 per DCFC. For the remaining 12 single unit DCFC sites, a summary of the installation work is shown in Table 6. Details of the installation costs, such as the circuit was already installed, are not available.

Table 6. SCA DCFC Installations

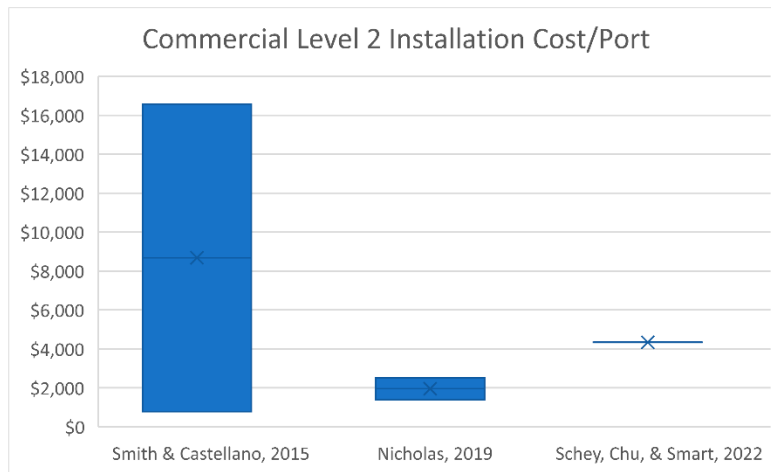
Description	State	EVSE Provider	Power Rating	Installation Cost
Install Proterra EVSE	Oregon	Proterra		\$4,083
Install CPE250 + CT4021	Colorado	ChargePoint	62.5 kW	\$4,700
Tie in Dual EFACEC	California	EFACEC	160 kW	\$8,939
Install CPF25 – CPE100	Texas	ChargePoint	24 kW	\$9,234
Install CPE250	Texas	ChargePoint	62.5 kW	\$9,716
Install Tesla Superchargers	Texas	Tesla	~150 kW	\$10,797
Install Tesla Superchargers	Texas	Tesla	~150 kW	\$15,372
Proterra	California	Proterra		\$16,835
Proterra	California	Proterra		\$22,748
Install CPE250 + CT4021	Colorado	ChargePoint	62.5 kW	\$35,653
Tesla Supercharger	Texas	Tesla	!150 kW	\$35,820
Tie-in Proterra	Oregon	Proterra		\$103,271

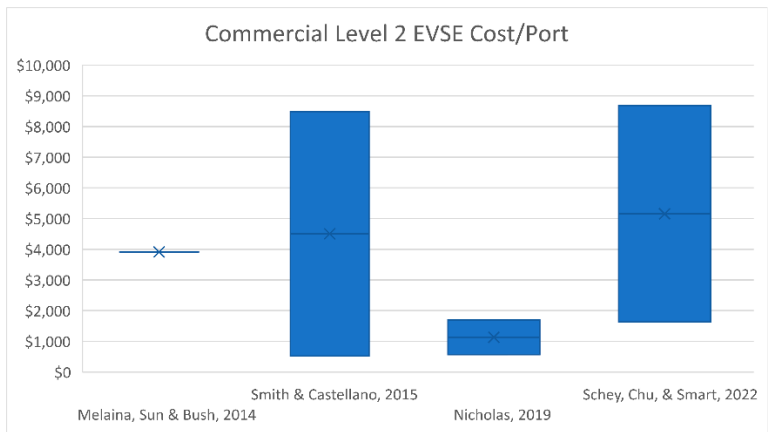
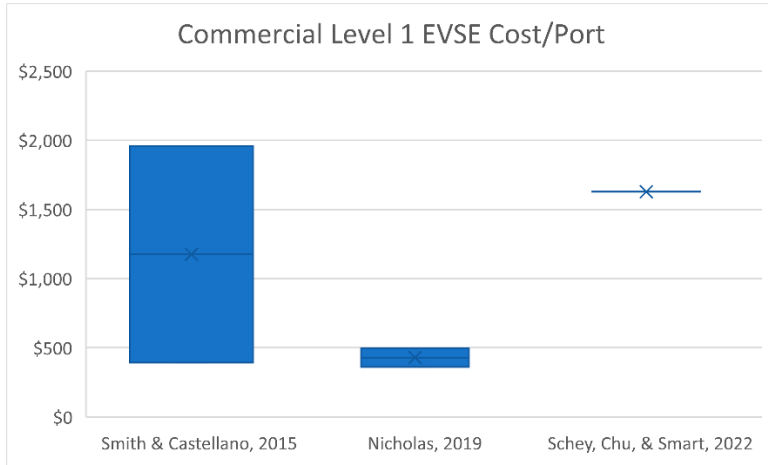
## Lyons et al., 2023

[The Current State of Light-Duty Electric Vehicle Supply Equipment Costs: An Assessment of Contemporary Understanding](#)

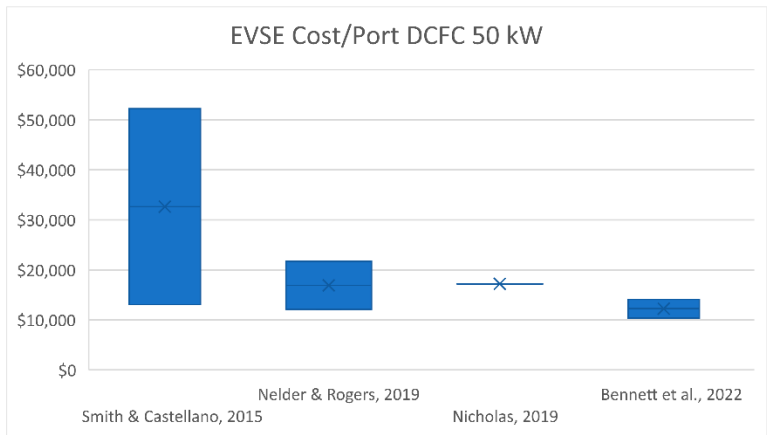
Meta-analysis of 13 prior papers, ranging from 2013-2023

### Commercial L1/L2

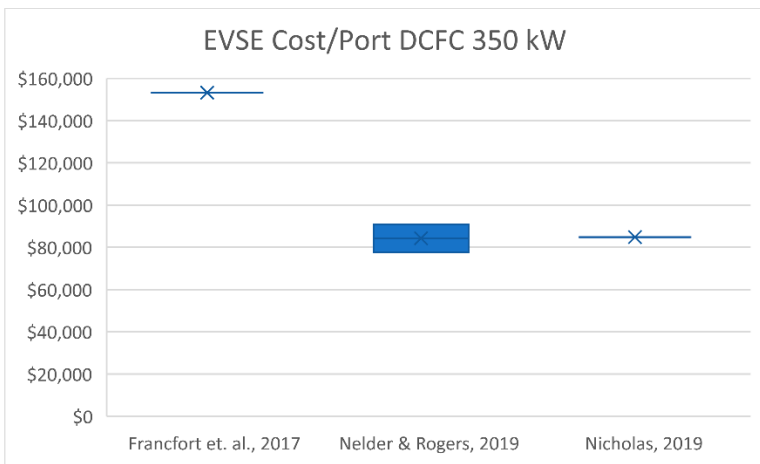
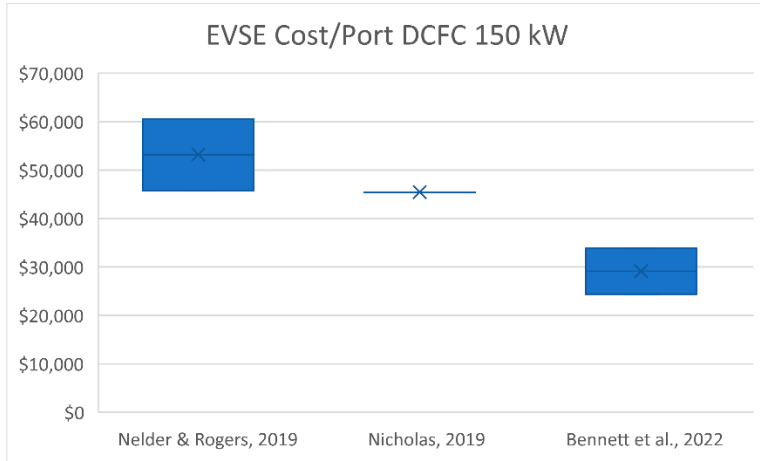




## DCFC







### Cadeo Prior Study Data

Cadeo also conducted a study of workplace L2 charging, with results summarized here for reference. Based on primary data collection conducted by Cadeo, the majority of per-charging-port costs of installing L2 chargers were below \$10,500. The majority of costs for infrastructure upgrades were between \$1,000 to \$11,500 per charging port.

## Appendix B

Workplace Amenity	Range Low	Range High	Source
Monthly cost of Gym membership per person	\$51	\$90	<a href="#">2021 IHRSA Media Report: Health and Fitness Consumer Data &amp; Industry Trends Before and During The Covid-19 Pandemic</a>
<b>Daily gym membership cost per person</b>	<b>\$1.70</b>	<b>\$3.00</b>	
Annual cost of health insurance per person		\$7,034	<a href="#">KFF, "2023 Employer Health Benefits Survey"</a> See Figure B, "ALL PLANS".
<b>Daily health insurance cost per person</b>		<b>\$19.27</b>	
Annual cost of office snacks for company with 100 employees, per person		\$2,080	<a href="#">CNBC, 'Companies find that the next frontier in attracting talent lies in giving them free food', 2017</a> Article also lists \$208,000 annually for 100 employee company, equivalent to \$5.70/person/day.
<b>Daily office snacks cost per person</b>	<b>\$3.00</b>	<b>\$8.00</b>	
Average annual 401k employer contribution		\$2,840	<a href="#">Fidelity, "Building Financial Futures", 2024</a> Annual value is the average employee contribution from above; we assume this is 100% matched by employer. This can be justified as average employee savings rate is 9.4% and average employer contribution is 4.8% -- approximately an even match.
<b>Daily 401k employer contribution per person</b>		<b>\$7.78</b>	

Workplace Amenity	Range Low	Range High	Source
Average annual cost of childcare (one child)		\$11,582	<a href="#">ChildCare Aware of America, "Annual Child Care Landscape Analysis", 2023</a>
<b>Daily childcare cost per person</b>		<b>\$31.73</b>	Assuming 100% coverage by employer and no coverage by the federal <a href="#">Employer-Provided Childcare Tax Credit</a> .
Monthly cost of transportation per person		\$315	Maximum federal limit for tax-exempt employee transportation benefits:
<b>Daily transportation reimbursement cost per person</b>		<b>\$10.50</b>	<a href="https://www.irs.gov/pub/irs-prior/p15b--2024.pdf">https://www.irs.gov/pub/irs-prior/p15b--2024.pdf</a> .
Annual average employer per person		\$5,520	Multiple sources, e.g., <a href="https://graduate.northeastern.edu/resources/tuition-reimbursement/">https://graduate.northeastern.edu/resources/tuition-reimbursement/</a> .
<b>Daily tuition reimbursement cost per person</b>		<b>\$15.12</b>	