Transportation Electrification

2024 Annual Report

Submitted to the Washington Utilities and Transportation Commission

March 31, 2025

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<u>About Avista</u>

Avista Corporation is an energy company involved in the production, transmission and distribution of energy as well as other energy-related businesses. Its largest subsidiary, Avista Utilities, serves more than 600,000 electric and natural gas customers across 30,000 square miles in eastern Washington, northern Idaho and parts of southern and eastern Oregon.

Avista's legacy begins with the abundant renewable energy we've generated and delivered since our founding in 1889 – and grows with our mission to enable vibrant communities through innovative energy solutions. Safely, Responsibly, and Affordably, putting those we serve at the center of everything we do.

I. Executive Summary and Future Direction

Avista's TE programs and activities were successful in 2024, achieving results and objectives aligned with the Transportation Electrification (TE) Plan[1] and tariff schedule 077. The table below summarizes key results for the calendar year ending December 31, 2024:

7,161	Number of light-duty passenger and truck EVs registered in Avista's service territory in Washington State (as of December 31, 2024)
45%	% annual growth light-duty EVs
46	Number of medium- and heavy-duty (MHD) EVs[2]
$12.8 million	Regional transportation cost savings
37,428	Avoided tons of CO_2 emissions
23,067	MWh charging consumption
4.0	MW peak load from light-duty EVs
5.3	MW peak load from MHD EVs[3]
$1,856,694	Utility revenue from light-duty EV charging
$1,165,568	Utility revenue from MHD charging[3]
$154,114	Grant reimbursements received
$243,230	Clean Fuel Standard (CFS) monetized credits
$1,927,067	TE Capital investments
$716,051	TE Operating & Maintenance expenses
818	Residential AC Level 2 (ACL2) ports in service
647	Commercial ACL2 ports in service
43	DC Fast Charging (DCFC) ports in service
98%	ACL2 non-networked equipment uptime
91%	ACL2 networked equipment uptime
91%	DCFC equipment uptime
95%	Customer satisfaction with Avista TE programs
10,377	Customer web page visits
15	Fleet consultations
14	Forklift incentives
14	Active Community-Based Organization (CBO) partnerships
94,660	Travel services provided by CBO partners (passenger-miles)
201	Public charging ports in Named Communities and CBOs
20	Community and stakeholder education and outreach engagements

Table 1: 2024 TE Results

[1] See www.myavista.com/transportation for a web link to the TE Plan.
[2] 43 mass transit and 3 electric school buses in service, as of December 31, 2024
[3] Includes an estimated 1,034 electric forklifts representing 2.9 MW avg peak load and $732,071 billing revenue

Estimates for MHD electric transportation are approximate as complete registration data for MHD vehicles is not available. Listed charging equipment reflects Avista-owned equipment, not including those installed through the make-ready program which are owned and operated by customers, or by third parties that did not participate in Avista's programs. See the ACL2 and DCFC sections of this report for more details.

Light-duty EV growth of 45% exceeded the high adoption scenario forecasted in the TE Plan, reaching 7,161 EVs by year-end. Electric transportation including known MHD applications resulted in transportation cost savings of $12.9 million while avoiding 37,428 tons of emissions and providing over $3 million in utility billing revenue. Globally, the shift to electric transportation continues to accelerate. While changes in federal policies create uncertainty, somewhat dampened but steady growth is expected over the next several years in the region, and exponential growth over the next several decades. Avista completed a comprehensive load study at the feeder level in 2024, estimating EVSE nameplate capacity additions of 2,407 MW and peak load impact of 200 MW by 2045.

Overall, TE spending of $2.9 million was within the guidelines of the TE Plan. Benefits to communities and low-income customers reached 50% of total spending in 2024, exceeding the aspirational goal of 30%. This included the use of $173,351 out of $243,230 in monetized Clean Fuels Standard (CFS) credits, with the remaining $69,879 applied to TE programs in 2025 along with expected additional CFS credit funding. Grant reimbursements based on eligible TE spending totaled $154,116 and are expected to increase substantially in 2025 with the implementation of the WAEVCP grant administered by the WA Dept of Commerce, installing 10 DCFC and 184 ACL2 ports at 78 sites throughout Eastern Washington for use by the public, fleets, workplace and multiple-unit dwellings (MUD).

ACL2 and DCFC charging infrastructure programs achieved favorable results in terms of quality installations, maintaining high customer satisfaction, equipment reliability, and cost effectiveness. However, ACL2 program growth in terms of volume has not kept pace with overall market growth, indicating the need for improved education and outreach efforts to inform customers and promote awareness of Avista's programs.

The complex issues surrounding networked EVSE and vendor performance continue to pose challenges and will require ongoing vigilance in program oversight and problem remediation, as well as redundancies and diversity in supply chains, to maintain and improve equipment uptime and customer experience. While non-networked EVSE represented 92% of total ports in service, they caused only 10% of problems identified and achieved 98% uptime. In contrast, networked EVSE representing just 8% of ports in service caused 90% of problems and were less reliable at 91% uptime. While this is well above the national average of 84% uptime, it is not adequate to support mass-market adoption of EVs.[4]

The region saw increased levels of private investment in DCFC and if sustained is on an encouraging trajectory to meet the needs of accelerating market growth. Avista currently operates 43 of 160 DCFC ports in the region (27%) and will continue to support a coordinated buildout of strategic DCFC infrastructure through ongoing engagement with industry and local stakeholders including the Spokane Regional Transportation Council, Tribes, Municipalities, CBOs, Avista's Equity Advisory Group (EAG), and customers, and with guidance from the Washington State Department of Transportation and the State's Transportation Electrification Strategy.[5]

Vehicle-to-grid integration (VGI) demonstration projects including telematics technologies is an area of focus, with the goal of providing value to participating customers while achieving cost-effective load shifts of 50% or more to off-peak. The Company is in the process of offering a Smart Charging program to residential customers coupled with the pilot TOU rate offering, as well as developing an innovative demand response capability for DCFC.

In the future, Avista will focus resources on expanding fleet advisory services, increasing the volume of ACL2 installations, piloting VGI platforms, and identifying commercial TE loads for System Planning purposes. A comprehensive review of the market landscape and longer-term strategy is also planned for 2025, with a revised TE Plan submitted by year-end.

[4] Gurerra, Maria. "The EV Charging Experience is Often Awful: Here's Why." Battery Technology, Aug 4, 2024. www.batterytechonline.com.
[5] https://www.commerce.wa.gov/growing-the-economy/energy/clean-transportation/ev-coordinating-council/transportation-electrification-strategy/

II. TE Adoption and Load Forecasts

Light-duty registered vehicles in Washington counties served by Avista are summarized below for the years 2022 – 2024, based on Washington Department of Licensing data.[6] Registered EVs reached 7,161 by year-end, exceeding the high adoption scenario in the TE Plan, in which 6,114 EVs were predicted by year-end. Of the 7,161 total EVs, battery electric vehicles (BEVs) accounted for 4,997 registrations, while plug-in hybrid electric vehicles (PHEVs) accounted for 2,164 registrations.

	6/30/22	**12/31/22**	**6/30/23**	**12/31/23**	**6/30/24**	**12/31/24**
Total Passenger Vehicles	418,481	410,031	411,363	404,194	406,821	403,982
Total Truck Vehicles	150,458	147,073	147,912	144,587	145,629	144,033
Total All Vehicles	568,939	557,104	559,275	548,781	552,450	548,015
Total EV Passenger Vehicles	2,834	3,288	3,954	4,880	5,724	6,945
Total EV Truck Vehicles (light duty)	3	26	48	75	137	216
Total EVs	2,837	3,314	4,002	4,955	5,861	**7,161**
% EVs of Total	0.5%	0.6%	0.7%	0.9%	1.1%	1.3%
% EV Growth	32.9%	33.6%	41.1%	49.5%	46.5%	44.5%

Table 2: Comparison of EVs to all Registered Light-Duty Vehicles in Washington Counties Served by Avista

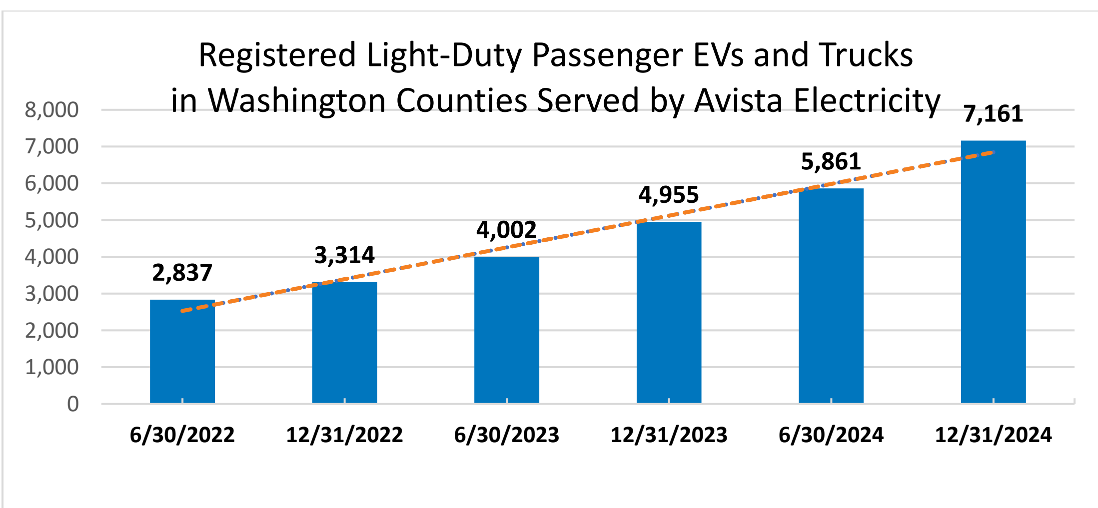


Figure 1: Light-duty Registered EVs in Washington Counties Served by Avista, 2020-2024

[6] See Electric Vehicle Population Size History by County | Data.WA | State of Washington

Nationwide, light-duty (Class 1-2A) EV market share exceeded 10% in 13 states and the District of Columbia for Q3 2024. Increasing model variety and inventory stock contributed to strong growth, including greater availability of truck EVs, with the Tesla Cybertruck and Ford F-150 Lightning reaching fifth and sixth best-selling EVs in the U.S. for the year.[7] Altogether, 377k electric vehicle sales sold domestically in Q3, which accounted for 10.2% market share nationally.[8] However, this momentum was not sustained during the fourth quarter. Q4 light-duty (Class 1-2A) EV market share only exceeded 10% in 4 states and the District of Columbia.[9]

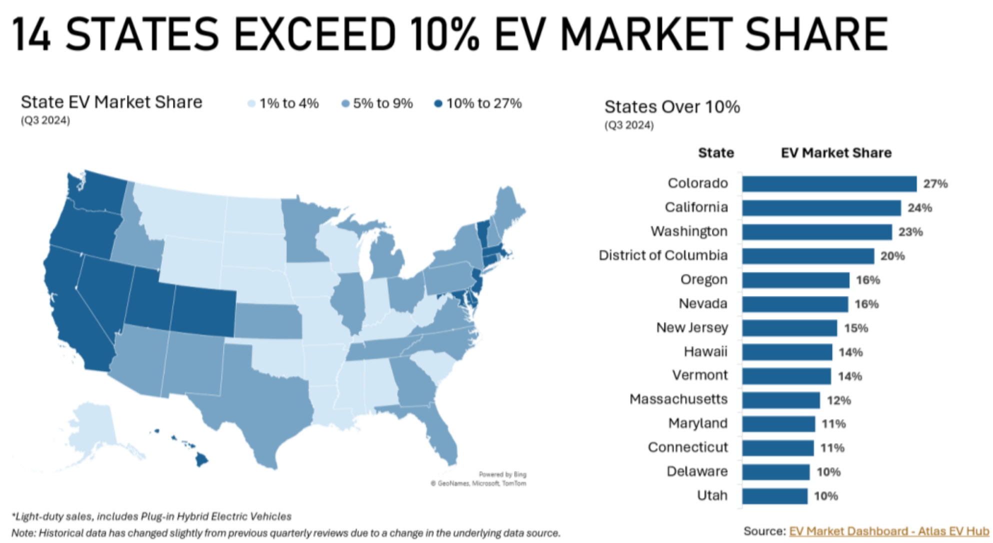


*Figure 2: 2024 Q3 Light-duty EV Market Share Data by State (*www.atlasevhub.com*)*

Figure 3: Ford-150 Lighting (www.ford.com)

[7] America Set EV Sales Record in 2024 - Kelley Blue Book
[8] Quarterly Review of EV Market – Atlas EV Hub
[9] EV Market Dashboard – Atlas EV Hub

Medium-duty (Class 2b-6) EV market share is significantly lower but has reached 8.3% in California and 8.0 % in Washington, the two states with the highest market share in the segment. The heavy-duty segment trails behind with only 1.5% market share in the leading state of California.[10] Vehicle segments like mass-transit buses and school buses continued to electrify in 2024. Long-term, strong growth in the region is expected in all segments. However, the recent policy shifts at the federal level are likely to dampen market adoption to some degree in the shorter term.

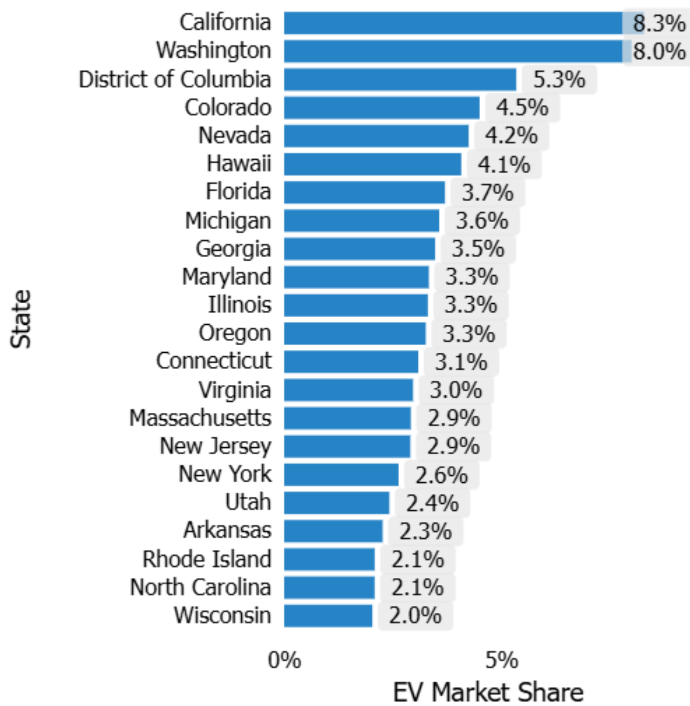


*Figure 4: Class 2B-6 Market Share Data by State, 2024 Q4 (*www.atlasevhub.com*)*

Globally, EV sales are forecasted to increase from 13.9 million in 2023, to over 30 million in 2027.[11] EV technology and costs continue to improve, with many new and affordable EV models set to launch within the next few years. Global sales of internal combustion vehicles are forecasted to peak in 2017 and then fall 29% by 2027. Steady TE adoption worldwide is forecasted for all vehicle classes, except for long-haul freight transport which has yet to demonstrate scalable technology and economics. Although EV sales exhibit the traditional 'S-curve' for adoption, each country or region begins this curve and transitions to a steep adoption

[10] EV Market Dashboard – Atlas EV Hub

[11] Quong, Leonard, Vinicius Nunes, and Takehiro Kawahara. "Electric Vehicle Outlook 2024." BloombergNEF, June 12, 2024, 3-3.

trajectory in different ways. The varied start time and market slowdown points between countries or regions results in a global average that appears more linear than the adoption in any individual country.[12]

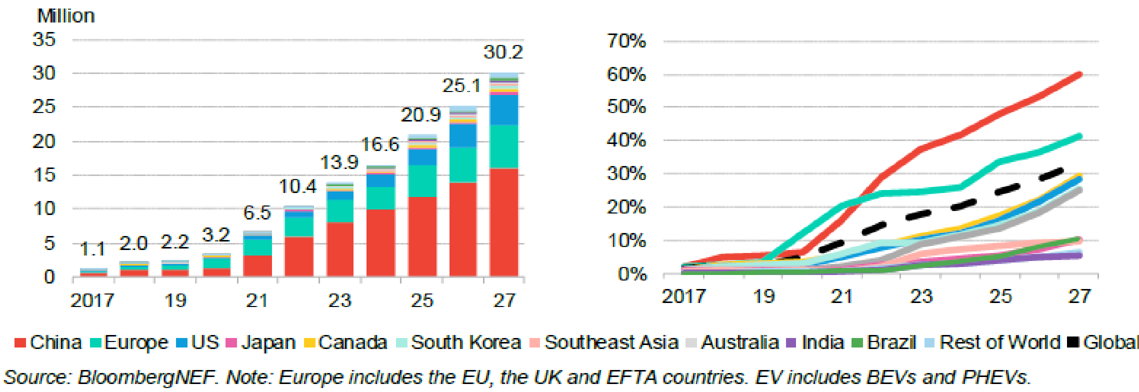


Figure 5: Global Annual Passenger EV Sales & Market Share Forecasts (BloombergNEF, 2024)

A detailed study of adoption and load forecasts from transportation electrification and other distributed energy resources was completed in 2024 at the feeder level across Avista's service territory.[13] Summary results are shown below, indicating significant loads from TE adoption over the next several decades, consistent with previous studies forecasting 20% or more of overall system load from TE by 2050.

Resource	Nameplate Capacity (MW)	Annual Load Impact (GWh)	Share of Nameplate Capacity in Named Community[3]	July Peak Load Impact[a] (MW)	December Peak Load Impact[a] (MW)
Customer Solar	105	-127	46%	-33	0
Customer Battery Storage	96	2	58%	-3	-9
Customer Wind	1	-0.3	45%	-0.1	0
Residential EVSE	1,544	853	38%	62	62
Fleet EVSE	692	841	67%	101	105
Public and Workplace EVSE	171	206	60%	33	33

Figure 6: Avista DER Potential Results Summary, 2045 Reference Scenario (Applied Energy Group, 2024)

[12] Quong, Leonard, Vinicius Nunes, and Takehiro Kawahara. "Electric Vehicle Outlook 2024." BloombergNEF, June 12, 2024, 3-3.
[13] Avista DER Potential Study, Final Report (Applied Energy Group, 2024)

III. Expenses and Revenues

Total spending of $2.8 million was within the TE Plan's guideline of $2 million to $6 million total spending per year, commensurate with market conditions and adoption over the 2021 – 2025 timeframe. Spending benefiting communities and low-income customers reached 50% in 2024,[14] exceeding the aspirational goal of 30%. See respective sections of this report for details of the programs and activities listed below.

	Capital	O&M	Total	Portion Benefiting Communities and Low-Income Customers
Charging Infrastructure and Maintenance				
Residential L2	$35,768	$10,010	$45,778	$4,521
Commercial L2	$655,782	$57,052	$712,833	$341,982
DCFC	$864,975	$37,415	$902,389	$435,403
DCFC meter billing	$0	$97,247	$97,247	$46,922
Community and Low-Income Support	$334,775	$62,364	$397,139	$397,139
Subtotal Charging Infrastructure Installations and Maintenance	$1,891,300	$264,087	$2,155,387	$1,225,966
Community and Low-Income Support (other)	$0	$0	$173,351[15]	$173,351
Education and Outreach	$0	$123,905	$123,905	-
Fleet Services	$0	$49,275	$49,275	-
Load Management and Grid Integration	$35,768	$82,434	$118,201	-
Market and Technology Monitoring and Testing	$0	$90,403	$90,403	-
Analysis and Reporting	$0	$105,947	$105,947	-
Subtotals	**$1,927,067**	**$716,051**	**$2,816,469**	**$1,225,966**
% Benefiting Community & Low-Income Customers to Total Spending				**50%**

Table 3: 2024 TE Spending

[14] Based on support for partnerships with Community-based organizations (CBOs) and charging infrastructure in Named Communities.

[15] Funded by CFS, separate from Capital and O&M funding

Avista provides electricity to approximately 88% of households in the Washington counties it serves. Taking this percentage of 5,861 light-duty EVs registered in counties served by mid-year (as an average for 2024), and $340.52 average utility billing revenue per EV, provides an estimate of $1,756,314 billing revenue for light-duty EVs. In addition, DCFC user fee revenue of $100,380 results in utility revenue of $1,856,694 from light-duty EV charging in 2024. A total of 45 known MHD EVs served by Avista were identified in 2024, including 43 mass transit buses and three school buses in-service. Metering data shows a total of $433,497 billing revenue for these MHD EVs. Based on load profile data, an estimated 1,034 electric forklifts contributed $732,071 in billing revenue.

In addition to electric billing revenue from various forms of EV charging, grant reimbursements of $154,116 and monetized Clean Fuel Standard (CFS) credits of $243,230 were received. CFS funds are separate from rate-based capital and O&M funding, utilized to supplement programs consistent with the TE Plan. A remaining balance of $69,879 in CFS funds after spending in 2024 will be applied to programs in 2025.

Light-duty charging	$1,756,314
MHD charging	$433,497
Forklift charging	$732,071
DCFC user fees	$100,380
Total TE Billing Revenue	**$3,022,261**

Table 4: 2024 TE Billing Revenue

IV. AC Level 2 Charging

Avista updated its ACL2 charging infrastructure program options in 2024 to meet changing market conditions, create efficiencies, and improve customer experiences. The residential EV charging program was discontinued for new applicants at the end of 2023, though installs continued in the first part of the year for applications received in 2023. Commercial ACL2 programs were updated to provide two program options, providing a compelling value proposition for customers and options for more choice in equipment and ownership. The table below summarizes ACL2 ports installed in 2024 and total cumulative ports in service, as well as the average cost and lead time for residential and commercial installations.

	Residential ACL2	Commercial Turn-Key ACL2	Commercial Make-Ready ACL2*
# Ports Installed	62	97	21
Total # Ports In-Service	818	645	47
Installation Cost per Port including charger*	$1,971	$6,476	$4,784
Lead Time	7.9 weeks	19.7 weeks	10 weeks
**Charger cost not included in Make-Ready program costs.*			

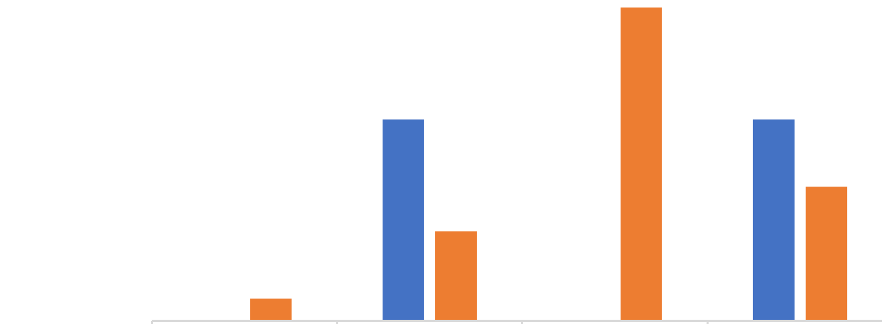
Table 5: Charging Installation Results for 2024

Avista completed installations for residential customers who had applied for the ACL2 program before December 31, 2023, and provided an opportunity for all customers who had received a quote, time to decide to proceed or withdraw from the program. With over 800 residential participants, Avista has a solid pool of customers to continue load profile studies and ongoing load management experiments which shift charging load to off-peak hours and thereby provide additional benefits to all customers.

In 2025, Avista revised commercial ACL2 offerings to improve the value of the Make-Ready Program relative to the Turn-Key Program. The Turn-Key Program is available to small business owners, non-profit organizations, and eligible rural access sites, utilizing non-networked chargers that deliver high-reliability at low cost. The Make-Ready Program is intended for larger organizations, customers preferring networked chargers, and organizations that prefer to own and operate EVSE themselves. A higher incentive is available for infrastructure up to the charger for Make-Ready Program participants, as the participant pays more for the EVSE itself and ongoing maintenance. Turn-Key Program participants have a cost share requirement for infrastructure up to the EVSE, but Avista purchases, owns, and operates the EVSE – providing a low-risk option that many customers value.

Installations and Costs

The chart below shows completed and withdrawn commercial applications for 2024, categorized by primary use type.



	MUD	Workplace	Fleet	Public
Withdrawn		9		9
Complete	1	4	14	6

Figure 7: Commercial ACL2 charging installations by use type (2024)

A total of 118 ACL2 ports were installed at 35 commercial facility locations, averaging 2.7 ports per location compared to 2.8 ports per location in 2023.

Program interest was consistent across use cases except for MUD. New construction projects are not eligible for Avista's commercial ACL2 programs and generally require ACL2 per building code. 100% of fleet applications moved forward with installation, consistent with 2023 results. This indicates Avista's program is well structured for fleet applications. Public and workplace applicants withdrew 69% and 60%, respectively. Despite strong program incentives, customers find it difficult to recover ongoing operations and maintenance costs and the majority decide to withdraw as a result. These costs include networking fees, electric bills, and unscheduled repairs. Review and improvement of the programs' customer value proposition help increase conversation rates with future applicants.

Avista's TE Plan includes an aspirational goal for 30% of funding supporting communities and low-income customers. Installation counts reflected this target for 2024, with 1/3 of projects as community projects, 1/4 as commercial Make-Ready Program projects, and the remaining projects categorized under the Turn-Key Program.

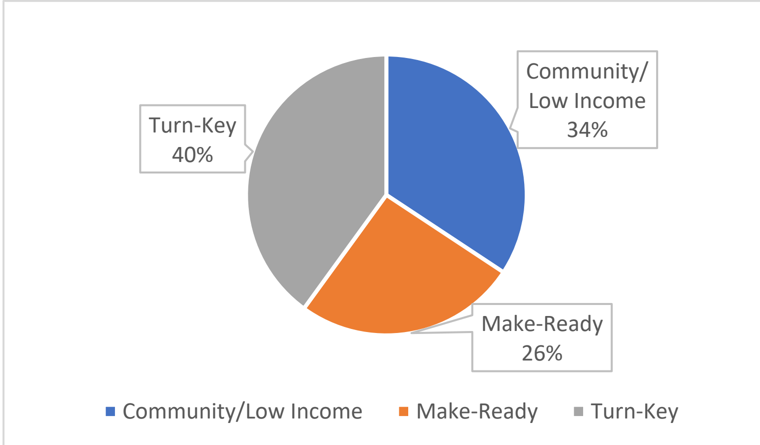


Figure 8: Commercial ACL2 charging installations by program type (2024)

These projects supported non-profits and CBOs that utilized electric vehicles for their fleet operations or provided public charging in rural or shared community locations. More information on Avista's community programs is included in the respective section of this report.

Figure 9: Community public charging installation at the Medical Lake Library

Customers utilizing the Make-Ready Program either had a desire to own their own charger or were large companies expected to have a significant number of chargers in the future. For large companies, eliminating the risk of future confusion with stations owned by the utility and by the business is prudent. The Turn-Key Program continues to offer low cost, low hassle installations with ongoing operations and maintenance support, which is a valuable offer for small businesses with little experience or support in EVSE operations.

As interest in the programs grows, multiple program options meeting the varying needs and interests of business customers will be of great value.

Figure 10: Make-Ready fleet charging installation at City of Spokane Park Operations.

Commercial installation costs averaged $6,476 per port, including the charging equipment for turn-key installations and $4,784 per port excluding the charging equipment for make-ready installations. Turn-key installations show a 15% increase in project costs compared to 2023. Make-ready installations are 15% lower than 2023 turn-key costs. This is to be expected as customers utilizing the Make-Ready Program purchase their own chargers and therefore equipment cost is not available for comparison. The low installation costs of both programs are reflective of Avista's installation experience and best practices established with effective electrical contractors since 2016, as well as the high utilization of low-cost, reliable non-networked chargers. Furthermore, relatively steady workloads have enabled consistent staffing with well-trained technicians, leading to more effective work and lower costs overall.

Customer Surveys

Commercial ACL2 program participants have shown a decreasing trend in willingness to provide feedback on post-installation surveys. Only four post-installation commercial responses were received in 2024, however responses indicated 100% of participants were satisfied or highly satisfied and gave a perfect net-promoter score. Annual survey responses also remain low. While the positive responses are encouraging, work must be done in 2025 to develop a better feedback method to increase response rates and ensure valuable feedback is captured.

	Response Rate	Net-promoter Score	Satisfied or Highly Satisfied
Commercial	11% (4 of 35)	100	100%

Table 6: 2024 post-installation customer survey results

In addition to the post-installation survey, in July 2024, Avista sent an annual survey to residential and commercial customers with an EV charger installed for six months or more.

	Response Rate	Satisfied or Highly Satisfied
Residential	22% (151 of 702)	94%
Commercial	8% (11 of 142)	91%

Table 7: 2024 annual customer survey results

Customer engagement for the annual survey increased in 2024 compared to response rates in 2023. Overall satisfaction remains high for both residential and commercial programs, however a larger sample size would provide better feedback and confirmation of customer experience. Residential customers provided similar feedback in previous years, reflecting ongoing educational opportunities, recommended public charging locations, and issues or suggestions regarding charger reliability. Commercial customers provided comments on the ease of the program as well as the positive benefits realized by having charging available for their business fleet vehicles, employees, and visitors.

V. DC Fast Charging

13 new DCFC charging ports were added to the Avista charging network in 2024, bringing the total number of charging ports in-service to 43.

Four sites completed under the Washington State Clean Energy Fund III Electrification of Transportation Systems (ETS) grant in 2024 included the Yokes Fresh Market in Deer Park, The Martin Luther King Community Center and Manito Shopping Center in Spokane, and the Harvester Restaurant in Spangle. The Yokes and

Harvester sites were designed using a 1MW[16] standard design. Due to parking lot size and restrictions on the distribution grid, the MLK Community Center site was limited to 500kW and the Manito Shopping Center site to 225kW.

Station Name	Status	Completion/ Target Date	Site Type
Deer Park – Yokes	Completed	4/23/2024	Corridor / Rural Access
MLK Community Center	Completed	8/20/2024	Community
Manito Shopping - WA Trust Bank	Completed	10/30/2024	Retail
The Harvester Restaurant	Completed	10/30/2024	Corridor / Rural Access
Gonzaga University Baseball	Under Construction	Q1 2025	Corridor / Community
Two Rivers Resort	Under Construction	Q1 2025	Corridor / Rural Access
City of Colville	Under Construction	Q1 2025	Corridor / Rural Access
Town of Wilbur	Construction Pending	Q2 2025	Corridor / Rural Access
City of Kettle Falls	Construction Pending	Q2 2025	Corridor / Rural Access
Gonzaga University Fleet	Construction Pending	Q3 2025	Fleet / Community
Lincoln Heights Shopping	Construction Pending	Q3 2025	Retail
E. Sprague Shopping	Construction Pending	Q3 2025	Retail
5 Mile STA Park and Ride	Construction Pending	Q4 2025	Community
Moran Prairie STA Park and Ride	Construction Pending	Q4 2025	Community
City of Colfax	Construction Pending	Q4 2025	Corridor / Rural Access
City of Othello	Site acquisition	2026	Rural Access
Town of Davenport	Site acquisition	2026	Corridor / Rural Access
N. HWY 2/Mead	Site acquisition	2026	Corridor / Retail

Table 8: DCFC Site Acquisition and Construction

Avista is shifting to designs utilizing higher-powered 320kW dual-port units consistent with industry and customer needs. These EVSE may charge two EVs simultaneously at 160kW each, or one at 320kW, bringing these stations closer to the gas station experience in terms of lower refueling time. All new sites are designed

[16] Design specs for the 1MW and 500kW stations can be found in appendix A.

with the capability to support up to three 320kW units, unless warranted otherwise by local grid constraints or other special circumstances.

Figure 11: Yokes Fresh Market Deer Park Charging Station

Avista's regional buildout plan includes charging stations every 30 to 50 miles along major travel corridors. The charging station in Deer Park adds another stop on the US-395 travel corridor, south of the Chewelah site. Two additional stations in Colville and Kettle Falls will electrify this corridor to within 35 miles of the Canadian border. The station in Kettle Falls will also provide charging to those traveling east-west on Route 20 and north-south on Route 25. When feasible, pull-through charging lanes are included in the design of corridor charging stations. The station in Deer Park is set up for a pull-through lane that can accommodate larger MHD vehicles, and the planned station in Kettle Falls will be able to accommodate a full-size pickup with a 35' travel trailer. These pull-through lanes promote the use of electric vehicles for recreational activities as well as commercial deliveries by fleet EVs to outlying communities.

Figure 12: The Harvester Restaurant – Spangle WA

The new station in Spangle provides a charging stop 20 miles south of Spokane on the US-195 corridor added to the sites established in Clarkston, Pullman, and Rosalia on the US-195 corridor. A planned station in Colfax will fill another gap and allow drivers to travel confidently through the Palouse, near the Idaho/Oregon border at Clarkston.

Figure 13: Wendle Ford DCFC Installation

Avista's Make-Ready Program for DCFC saw the completion of six projects that added 20 new DCFC ports. This program covers the cost of a dedicated transformer and up to $20,000 for the utility line extension. These funds are in addition to the standard Schedule 51 line extension allowances. In exchange for this financial assistance, the customer designates Avista as the credit generator for any CFS credits and agrees to a price per kWh in user fees. Wendle Ford in Spokane was one customer that participated in this program, installing three 180kW DCFC dual port units, available to the general public and improving access on the primary north-south corridor through Spokane.

No. of DCFC Ports/Connection Type					
Station Owner	**CHAdeMO**	**CCS**	**NACS**	**Total**	**% of Total**
Avista	6	37	0	43	27%
Tesla	0	0	32	32	20%
Rivian	0	7	0	7	4%
Electrify America	2	28	0	30	19%
Other	5	43	0	48	30%
Totals	**13**	**117**	**32**	**160**	**100%**

Table 9: Regional DCFC owner/operator and connector type

The 2024 construction season saw significant investment in the regional DCFC charging network, improving access to reliable charging and enabling higher future adoption levels. An additional 56 DCFC ports were installed, bringing the total to 160. Avista's DCFC installations accounted for 18% of new ports installed in 2024, and third-party investors including Tesla, Rivian, Electrify American and others accounted for 82%. Avista currently operates a cumulative total of 43 DCFC ports representing 27% if the total 160 DCFC ports in-service. The Company will continue to support the development and implementation of the region's DCFC charging network, through ongoing engagement with local stakeholders including the Spokane Regional Transportation Council (SRTC), Tribes, Municipalities, CBOs, Avista's Equity Advisory Group, and customers, and with guidance from the Washington State Department of Transportation and the State's Transportation Electrification Strategy.

VI. Reliability and Utilization

Station reliability continues to be a top priority, from both a customer and policy perspective. Grant funding opportunities routinely tie ongoing station reliability to funding awards. While this is an important condition, execution and accountability can be difficult. There are multiple entities involved in charging station operations. Utility power providers, EVSE manufacturers and network providers, cellular communications, the credit card payment provider, vehicle OEMs, EVSE owner/operators and site hosts all have a role to play and must be well coordinated to ensuring stations are functional and well maintained. Avista has placed a high priority on the importance of maintaining a robust charging network, with high uptime and customer experience – 95% uptime (online and functional) in the near-term, with a longer-term goal of 99% uptime on a per-unit basis. Networked stations fell short of the 95% uptime goal for 2024, due in large part to several network providers exiting or announcing plans to exit the market, thus leaving networked stations with little to no support for issues. DCFC uptime was 90.7% in 2024, an increase from 86.3% in 2023. The number of problems remains high, year over year, however, issues often impact one station and therefore, the overall uptime across the network is not as severely impacted by any one station being offline as in years past.

EVSE Type	Ports in Service (year-end)	Uptime %
Residential ACL2	818	99.9%
Commercial non-networked ACL2	562	98.4%
Commercial networked ACL2	85	90.9%
Networked DCFC	43	90.7%

Table 10: Uptime by charger type (2024)

Avista has found that many commercial ACL2 site hosts do not need charging data or require user fees for charging sessions and thus, for these sites, non-networked stations are a less expensive and more reliable option without sacrificing core functionality. Many employers offer charging as an amenity to employees and fleet operators do not need to establish pricing policies for their own fleet vehicles. As long as site hosts have the ability to restrict charger access to eligible employees or vehicles, non-networked solutions are an excellent option. Access can be managed through simple methods such as placing chargers within gated or fenced facilities, installing small locks on charge cords with the code or key provided to employees, or via a simple pre-programmed station and a radio-frequency identification card (RFID). Many network-capable stations can be pre-programmed from the manufacturer or programmed via direct station access with specific RFID card parameters. The station then utilizes this information to manage access without the ongoing complications of maintaining network connectivity and the need for ongoing station monitoring by a third-party network software provider, saving hundreds of dollars a year per charging unit.

Avista's Turn-Key Program is designed around the non-networked charger model. Avista continues to evaluate and leverage the various options to assist site hosts in ensuring the access method deployed meets their needs and goals for the charging infrastructure. Non-networked charging infrastructure has maintained over 98% uptime, highlighting the value this low-technology solution provides. In most cases, a submeter is installed for dedicated charging circuits, allowing for CFS credit receipts and providing the site hosts with valuable usage information. Avista expects these types of solutions to be utilized as best practice for many use cases well into the future.

Site hosts have shown a growing interest in establishing pricing policies and/or restricting station access to eligible drivers. Over the past few years, Avista has worked with some site hosts to establish a simple donation method to recover energy costs, using a sign with a QR code that drivers can scan to make a donation. This approach offers a low-cost solution to recover operational costs. Unfortunately, driver donations have proven insufficient in most cases to cover the site host's electricity costs, and network fees where applicable. For some site hosts, particularly small businesses or rural towns, the added expense of even a low-utilized station exceeds budget. For customers that require payment for use or the existing access control options are not viable, networked chargers are the best solution. Networked stations involve risks of connectivity and reliability, increased maintenance costs, as well as ongoing software fees. Site hosts must carefully weigh the benefits, risks, and costs of either option. Avista's Make-Ready Program supports customer choice, ideal for customers who elect to pursue a network charger option, receiving additional financial support for the infrastructure up to the charger to aid in offsetting the higher EVSE costs and ongoing expenses.

The exit of two major EVSE and network providers in 2024 is notable and highlights ongoing industry challenges in meeting acceptable EVSE performance standards. The first company, EnelX, both an EVSE and network provider, made an abrupt exit from the US and Canadian markets in October. Only two Avista chargers were affected and the site host supported transitioning the stations to non-networked functionality, which resulted in zero impact to station operability. Previous attempts to switch networks for these chargers were unsuccessful. The second company, Shell Recharge (formerly Greenlots), is a network provider only and made an announcement in December, a few months in advance of their planned market exit in the U.S. and Canada effective April 30, 2025. 29 EVSE were affected, representing 37 ACL2 and 3 DCFC ports, and significant equipment downtime was experienced as the network became inoperable sooner than expected. However, the effects were greatly mitigated by Avista's efforts over the last several years to diversify its EVSE supply chain in terms of both EVSE hardware and software. All affected EVSE were removed from the network as of February 2025, accomplished primarily by transitioning to "free-vend" mode (allowing the EVSE to function in a non-networked status), and unit replacements where switching the network provider was not practical. Currently, Avista purchases extended warranties on equipment and enters into service-level agreements (SLAs) with hardware and software vendors at the 98% uptime level. This helps reduce – but does not eliminate – performance and supply chain risk, as vendors may still underperform or in some cases cease operations as demonstrated by the exits of EnelX and Shell Recharge. This highlights the ongoing need for interoperable hardware and software, supply chain diversification, site equipment redundancy (particularly in more remote areas), capable inspection/auditing, problem notification and remediation processes/systems, and strong oversight by the EVSE owner/operator.

Avista staff monitors public comments on PlugShare.com and completed 350 ACL2 and 48 DCFC field inspections in 2024 in order to maintain uptime and customer experience, as many ACL2 are non-networked and even when networked, remote EVSE monitoring cannot detect all problems, e.g. broken connectors, damaged screens, etc.

Figure 14: Connector cable damage identified during an inspection.

Due to known reliability issues and added complexity, networked stations are inspected more frequently, however all EVSE should have an on-site inspection every 12 to 18 months. Of the 398 inspections, 13%

identified problems and thereby failed inspection. Networked EVSE saw a 21% failed inspection rate while non-networked stations saw a 5% failure rate. Vandalism remains a fairly rare occurrence, to some degree as a result of careful site selection that avoids areas of known criminal activity.

Figure 15: DCFC connector cable latch missing

The chart below represents the top resolution categories for the 665 problems that were identified and tracked in 2024, for all EVSE owned and maintained by Avista. Networked EVSE representing 8% of the total ports in service disproportionately exhibited 90% of the problems identified.

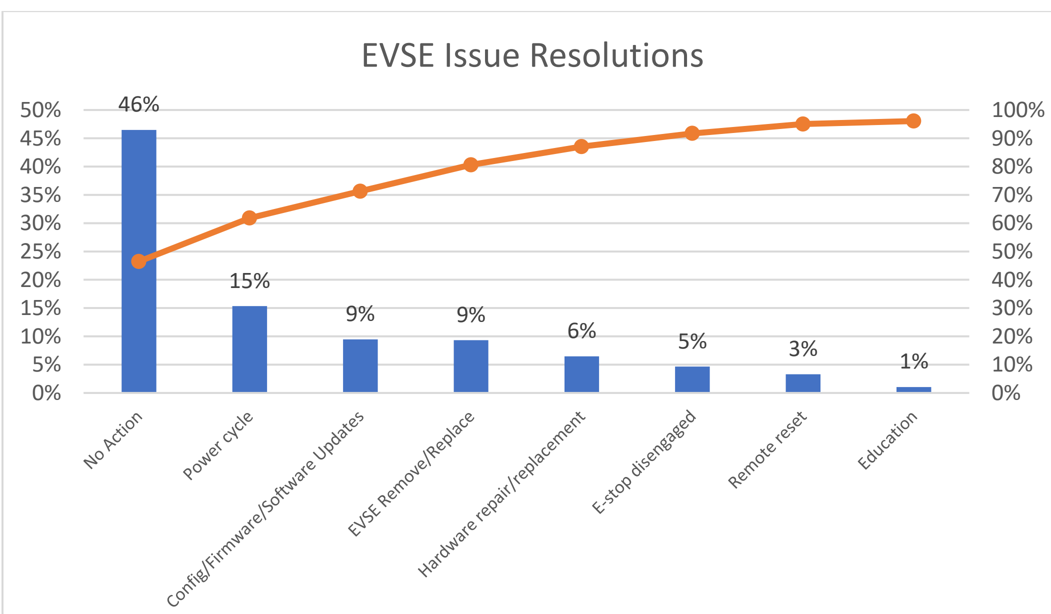


Figure 16: Pareto chart of combined ACL2 and DCFC resolution types (2024)

Year over year, the most common issue for EVSEs are communication failures, accounting for 61% of the problems identified in 2024. Communication failures are typically caused by temporary losses in cellular signal strength or modem malfunctions, often self-resolving after some period of time but then recurring over several days, weeks or months. As the resolution data reflects above, 46% of problems self-resolve and another 15% of issues are resolved by a physical power cycle. The remaining 40% of problems have various resolution methods, ranging from software/firmware updates, to parts/unit replacement, and driver education.

One issue that has seen increased occurrence is E-stops left depressed (5% of problem resolutions), as a result of drivers using the station emergency stop button to stop their charge, reset a station not responding to commands, or nuisance trips by non-drivers. Often the next driver will identify this and reset the E-stop. However, many drivers may avoid the EVSE in this condition as it is shown on Plugshare.com and other status platforms as inoperable or under repair.

Figure 17: Emergency stop message displays on station after driver left the e-stop engaged after a session.

Equipment manufacturers and network providers – particularly those involving DCFC – must provide improved reliability and service capabilities, in order for accelerated EV adoption to occur in the mainstream market. The table below shows the number of problems tracked in 2024 and resolved by the end of the year according to severity, as well as the average and mean number of days to resolve for each. Average days to resolve is significantly longer than the mean, as a result of a relative few problems taking a very long time to resolve compared with the others.

Problem severity	Number of occurrences	Number resolved	Median days to resolve	Average days to resolve
Urgent	2	2	0	1
High	554	550	2	10
Medium	95	95	12	37
Low	14	14	7	37

Table 11: ACL2 and DCFC problems by severity and time to resolve (2024)

Average resolution times have direct correlation to the amount of time and effort required to engage service partners for support and resolution. Avista's EVSE reliability is significantly better than the industry average, but at the cost of persistent tracking and management of issues. As a result, maintaining high uptime will be an ongoing challenge, especially for small business owners or independent station owners without knowledge of EVSE operations and industry relationships. Mass-market adoption of electric transportation depends upon reliable EVSE, which in turn requires substantial improvement not only in commercial hardware and software solutions, but also in well-coordinated, capable service organizations, technicians and analysts in the industry.

DCFC Charger Utilization

Network data indicates several sites with consistent, daily utilization in urban locations as well as along major travel corridors and in areas with more limited DCFC availability. The Kendall Yards station in Spokane and the WSU Visitor Center in Pullman both average three or more sessions per day. Five sites average 1.3 to 1.9 sessions per day, including the Clarkston and The Hive locations, both of which show a slight decrease in session counts compared to 2023. This is likely a result of additional DCFC sites being opened nearby. The remaining 11 sites average less than one session a day but do reflect regular use. Session counts vary by location and proximity to major travel corridors, city centers, desired amenities, and additional nearby charging options. Energy dispensed averages 32 kWh per charging session, a significant increase from the 25kWh average in 2023. This may be reflective of larger battery capacity in newer vehicles and will be monitored over time.

	In-Service Date	# DCFC ports	kW per port	2024 Charging Sessions	Average kWh per Session	Annual kWh
The HIVE	9/1/2022	2	90-180	487	22	10,825
Sprague	5/17/2022	2	90-180	466	28	12,982
Indian Trail Library	8/31/2022	2	90-180	318	30	9,550
NE Community Center	8/30/2022	2	90-180	312	34	10,519
Rosalia	7/12/2022	2	90-180	283	24	6,797
Kendall Yards	9/21/2023	2	90-180	1191	36	42,741
Clarkston	9/29/2023 4/29/2024	4	90-180	698	36	25,116
North Spokane Library	9/22/2023	2	90-180	458	30	13,935
Moran Prairie Library	9/22/2023	2	90-180	312	32	10,058
West Valley School Dist	9/27/2023	2	90-180	189	33	6,156
Liberty Lake Trailhead	9/25/2023	2	90-180	141	46	6,423
Chewelah SpokoFuel	12/11/2023	2	90-180	485	28	13,653
Liberty Lake STA	12/1/2023	2	90-180	277	30	8,309
Deer Park – Yoke's Fresh Market	4/23/2024	2	90-180	210	30	6,351
Pullman WSU Visitor Center	7/10/2024	2	90-180	1380	33	45,865
Martin Luther King Jr Center	8/14/2024	2	90-180	102	41	4,198
The Harvester - Spangle	10/30/2024	4	90-180	22	25	548
Manito – WA Trust Bank	11/23/2024	2	90-180	37	31	1,158
Gonzaga – Hertz Field	7/12/2019	1	50	614	15	9,196
W. Plains STA Transit Ctr	9/18/2018	1	50	782	21	16,053
Wandermere	9/14/2018	1	50	676	18	11,851
Total		**43**		**9,440**	**29**	**269,583**

Table 12: DCFC site utilization and energy consumption (2024)

VII. Community and Low-Income Support Programs

TE programs benefiting communities and low-income customers include partnerships with CBOs, charging infrastructure at CBOs and in Named Communities, and in areas of that provide community benefits such as school buses, mass-transit, ride/car sharing, and micro-mobility. 2024 spending in this category was $1,399,317 out of $2,816,469 in total spending, or 50% of the total. This exceeded the aspirational goal of 30% of overall TE spending for the year. Much of this was due to charging infrastructure costs for installations in Named Communities, which was not counted in prior years. Accordingly, this methodology will be used to update figures in years 2021-2025 for purposes of the TE Plan update in 2025.

Community EV Program

Each year, Avista engages a local network of CBOs, soliciting proposals utilizing electric transportation to serve communities. CBO proposals include a variety of transportation services such as non-emergency medical appointments, food deliveries, and shelter transport. In this program, Avista provides resources such as an EV and charging infrastructure tailored to the CBO's needs. The CBO is responsible for managing transportation services as well as insurance, fuel, maintenance, and utilizing volunteer and/or staff resources as drivers.

Figure 18: Tri-County Economic Development District's EV Bolt Charging in Ritzville, WA CBO Partner with Avista (2023)

This model effectively leverages resources of the CBO, providing expanded clean transportation services to disadvantaged groups at lower operating costs for the CBO. It also provides an added benefit of education and outreach for CBO management, staff, and passengers, increasing positive awareness of electric transportation and support for broader electrification of passenger fleets as well as personal vehicles. Annual reports and feedback are provided by the CBO, including narratives such as the following example from the International Rescue Committee in Spokane, which partnered with Avista in 2023:

> "This vehicle has been indispensable for serving our clients. For most of our staff and clients this is the first experience they have had in an electric vehicle. Most of our trips are shorter than we anticipated, which is well suited for the EV . . . Our dedicated Level 2 EVSE allowed us to schedule charging nightly (off-peak), and to have a full battery at the start of each day. We expect that use will increase substantially as our staff is growing and are now aware of the resource, we have implemented an online reservation system, and are actively encouraging all staff to prioritize the use of the EV for all work-related trips. The interest has increased so much that we will be applying for a second vehicle to make full use of the charging infrastructure at our office and reduce our costs."

The CBO program expanded in 2024, resulting in four additional partnerships, for a total of fourteen active CBO partnerships to-date. Services picked up substantially to 3,300 trips in 2024, providing 94,660 passenger-miles served. Engagement with local CBOs has increased in outreach to over 100 organizations annually. The program was funded in 2024 using monetized CFS credits and may be expanded in future years, with increased CFS volume and credit prices.

CBO Partnership	Year Started
Transitions for Women	2018
Spokane Regional Health District	2018
Asotin Co. Health District	2021
Rural Resources	2021
Whitman Community Action Center	2021
Compassionate Addiction Treatment	2022
COAST Public Transportation	2022, 2024
International Rescue Committee	2023
Spokane Neighborhood Action Partners	2023
Tri-County Economic Development District	2023
Meals on Wheels	2024
Career Path Services	2024
ZEV Co-op (public carshare)	2024

Table 13: Active CBO partnerships utilizing EVs and charging provided by Avista (2024)

Charging Infrastructure

Support for communities and low-income customers includes charging installed at public libraries and community centers, underserved rural towns, CBO partnerships, low-income MUDs, and for customers receiving low-income assistance. By year-end 2024, 201 ACL2 public charging ports were installed in Named Communities, and 76 were installed at underserved rural towns and CBO partnerships.   ACL2 public charging and DC fast charging were also installed in a number of sites benefiting local communities such as the MLK Community Center and in Spangle, WA. Where feasible, charging infrastructure installed at CBOs and in Named Communities is leveraged with emerging opportunities to support innovative community transportation options including ride hailing, ride and car sharing, and micro-mobility. Charging for electric bikes was installed at the MLK Center and in Clarkston, as well as charging for carsharing services on the campus of Gonzaga University with the partnership of ZEV Co-op and Gonzaga.

Public Transportation

Electrification of public transit buses continues in the area. In the Spokane area, STA launched its historic City Line battery-electric, rapid transit service in 2023, and now operates 40 battery-electric buses representing 25% of the coach fleet. Elsewhere, Pullman Transit operates three BEV transit buses and is exploring grant opportunities to further electrify. Avista's commercial EV TOU rates are instrumental in addressing the adoption barrier of high demand charges for transit buses, while promoting off-peak charging benefiting all customers. In addition, the Company collaborates and supports transit agencies in grant applications to procure buses, develop fleet electrification plans, and to install charging infrastructure that minimizes local grid impacts. In the future, transit shuttles and carpool vans may be electrified as well as vehicles operated by smaller transit services and Tribes, with Avista's collaboration and support that may include appropriate charging infrastructure investments and grant application partnerships.

Regarding electric school buses, Avista continues to provide outreach awareness to a large number of school districts in its service territory, as well as comprehensive fleet advisory services and grant application support for several districts. For Washington customers, Avista provides a full range of services including grid capacity assessments, in-depth route analysis and consultation, as well as tailored, multi-year plans for charging infrastructure expansion. The result is an effective and valued service for school districts, making it easier and lower cost to electrify, and in the process strengthening business and community relationships. See the Fleet Services section of this report for more details.

Other Community Support and Emerging Opportunities

Other e-mobility innovations are taking place in areas such as ride- and car-sharing, as well as mini- and micro-mobility serving "last mile" transportation needs. Where feasible, charging infrastructure installed with partners serving local communities may be leveraged to support demonstration projects in these areas. This may provide low-income and underserved communities with new and exciting transportation options, while testing the feasibility of scaling for the future. Following a successful Zero Emissions Access Program (ZAP) state grant to ZEV Co-op, in 2024 the first pilot of EV carsharing services in the Spokane area was launched in partnership with Gonzaga University, Avista, and Urbanova. If successful, this business model may be further deployed at other community centers throughout the region, with the support of Avista's charging infrastructure and Community programs.

Figure 19: ZEV Co-op carsharing service deployment in partnership with Gonzaga, Avista, and Urbanova (2024)

VIII. Education and Outreach

Electric transportation education and outreach efforts align with the objective of acting as a trusted energy advisor for our customers, helping them to make informed decisions for themselves and their communities.

The TE website at myavista.com/transportation is maintained as a robust information source for all customers to explore basic information, review vehicles for personal or fleet use, fuel savings, charging options, and tax incentives, grants, or program options. These tools are useful for residential and business customers at any stage of their journey. An advanced fleet evaluation tool has been added to the suite of website information, which has proven useful to commercial customers as the options for commercial electric transportation grow and become more complex.

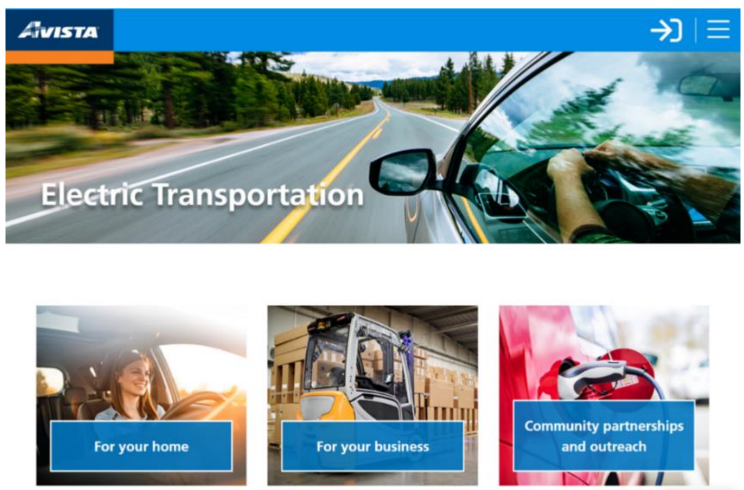


Figure 20: Electric Transportation Website at myavista.com/transportation

Web page visits totaled 10,377 in 2024 compared with 17,061 in 2023. Overall ACL2 program applications and port installations declined somewhat in 2024, despite an increase in education and outreach funding, including a digital placement promoting the fleet charging program. This indicates an increased need to understand customer market segments and use effective channels and methods to raise awareness and interest among those businesses that could benefit from Avista's programs. Potential customers may not be aware of Avista's programs, and/or target customer segmentation is shifting toward the early mass market as most of the early adopters have already considered and participated in these programs, which were first made available in 2016.

A follow-up survey was completed in 2024, similar to the survey completed in 2021 that tracked customer awareness and sentiment across a number of factors. Summary results of the four perception quadrants according to the level of EV awareness (high/low), and perception (positive/negative) are shown below.

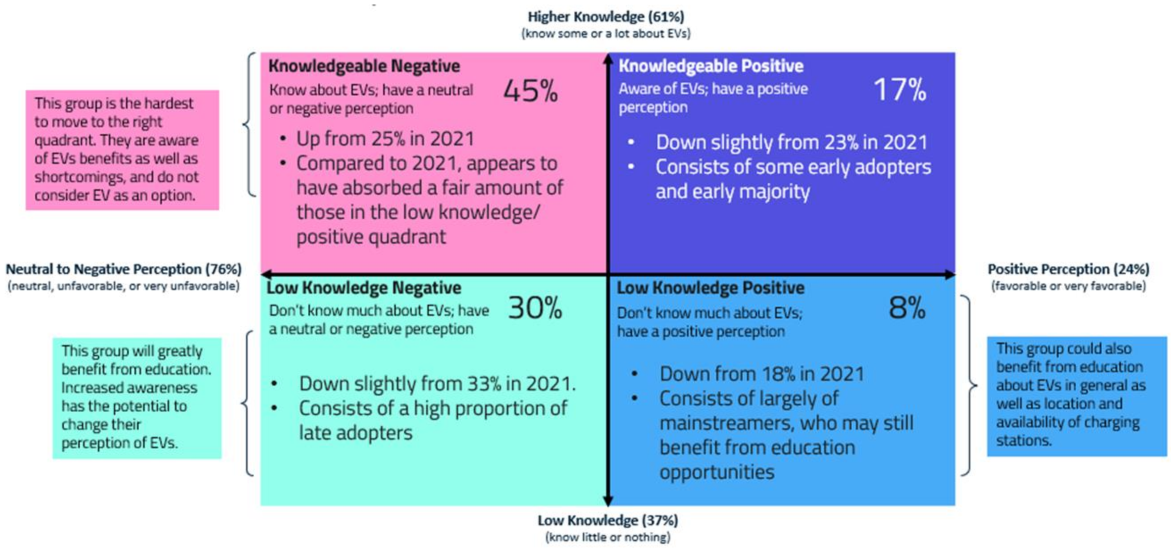


Figure 21: EV perception quadrants based on Avista customer survey responses (MDC Research, 2024)

The results show a 13% decrease in awareness, and a 16% decrease in positive perception since the 2021 survey. These disappointing results are even more prominent in the majority of rural areas served by Avista. For these customers, a focus on economic benefits in terms of transportation cost savings for both individuals and as a region, charging infrastructure availability, and the use of local energy resources can help move perceptions and knowledge levels in a positive direction. This contrasts with an emphasis on environmental benefits which provoke a negative response in a large segment of customers. Overall, it's clear that increased funding with more effective education and outreach strategies will be required to achieve greater positive awareness of Avista's programs, as appropriate to "cross the chasm"[17] and transition to accelerating adoption in the mass market.

IX. Fleet Services

Avista is uniquely positioned to provide fleet advisory services that help customers design and implement practical and cost-effective fleet electrification plans, reducing risks and maximizing off-peak charging for the benefit of all customers. Helpful information is provided to inquiring commercial customers regarding fleet

[17] Crossing the Chasm. Moore, Geoffrey (2014).

electrification, and in many cases more detailed consultation depending on the customer's needs. This includes analysis of fleet routes and duty cycles, EV availability and incentives, charging requirements, long-term planning, utility rates and load management, total cost of ownership (TCO) comparisons, and external referrals to additional technical resources. This is an area of increasing opportunity and growth for light, MHD on-road vehicle fleets, as well as off-road vehicles such as forklifts and other industrial transport equipment. Avista's consultation services are focused on customers with limited means such as smaller commercial businesses, local municipalities, school districts, and public CBOs. Larger commercial customers typically have sufficient resources to properly evaluate fleet electrification options, leaving the issues of optimal rate schedules and off-peak charging, electric grid capacity and planning as primary discussion topics with the utility.

During 2024, comprehensive consultation services were provided to 15 organizations, with an emphasis on electric school busses. This is an excellent opportunity for Avista to provide valuable assistance that benefits school districts and the communities they serve, while strengthening customer and community relationships. Avista attended monthly Transportation Supervisor meetings and conference calls for Educational Service District 101, which provides administrative services for 59 school districts throughout Eastern Washington. Avista also provided timely information about state and federal CSB program rules and application deadlines.

The Company also meets regularly and consults with the Spokane Transit Authority (STA) and the City of Spokane as those organizations continue to pursue fleet electrification. In the future, more fleet advisory services may be provided to public organizations, small businesses, CBOs and Tribes as various types of EVs become more viable and commercial awareness and interest grows.

Electric School Buses

In 2023, state and federal Clean School Bus programs prompted a dramatic increase in customer interest amongst local school districts in Eastern Washington. In August, Loon Lake and Valley School Districts each received one new electric bus from the Washington Department of Ecology CSB Program. In October, Tekoa School District received one electric bus from the federal EPA Clean School Bus Program.

Figure 22: The first electric school bus operating in Eastern Washington (Loon Lake School District)

These initial successes created additional interest and similar results for neighboring school districts. The 2023 round of funding in the EPA Clean School Bus program included the following award announcements in late December:

2023 EPA Clean School Bus Awards Served by Avista	**# of Electric Buses**
Central Valley School District	5
West Valley School District	3
Mead School District	2
Reardan School District	2
Pullman School District	1
Chewelah School District	1
Tekoa School District	1

Table 14: 2023 Clean School Bus Awards

After receiving school bus awards through either the Washington Department of Ecology CSB program or the federal EPA Clean School Bus Program, six school districts took advantage of Avista's fleet consultation program in 2024: Mead SD (x2 buses) , Reardan-Edwall SD (x2 buses), West Valley SD (x2 buses), Kettle Falls SD (x1 bus), Inchelium SD (x1 bus), and Northport SD (x1 bus). This program evaluates each route run by a school district and determines which routes are best suited for electrification with available bus technology. After the analysis is complete and routes are identified, a charging system is designed to fit the school district's immediate needs and sets them up for low-cost future expansion. The system is designed to provide a 19.2kW ACL2 charger for each bus in the fleet. These chargers are connected to a dedicated 208/120V three phase service with a 1200A panel. 12 to 20 runs of conduit are provided for each installation, depending on the size of the school's bus fleet. For smaller school districts, this is enough to provide charging for every bus, and for larger districts is adequate to electrify a sizeable portion of their fleet.

Two rural school districts, Reardan-Edwall and Inchelium, have purchased DC fast chargers in addition to ACL2. The addition of the fast chargers allows these districts to take their electric bus out for field trips or sports trips after school and will provide visiting districts with a charger for their buses to make convenient return trips. When designing the charging system for all schools, half of the provided conduits are sized to serve DC chargers. This allows the school to provide DC chargers if needed in the future.

Of the seven school districts that were provided full consultation services, five had construction start in 2024 with completion in Q1 of 2025. The remaining two will have construction completed by Q3 of 2025.

Figure 23: West Valley SD Charging installation.

Electric Forklift Program

In addition to on-road vehicle electrification, electric forklifts continue to be an important market opportunity to realize benefits of reduced carbon emissions and operational cost savings. Avista's electric forklift program provides point-of-purchase incentives for Class 1 forklifts powered by either traditional lead-acid batteries ($2,000 incentive) or lithium-ion batteries ($3,000 incentive). Additional goals of this program include data gathering, load-profiling, and promotion of off-peak charging. In 2024, incentives for 14 electric forklifts were processed (11 lead-acid and 3 lithium-ion). Dealer interviews indicate the incentives were effective in achieving growth in market share, in several cases making the critical difference in the customer's purchase decision over a propane or diesel forklift. Market share for electric forklifts is currently in the low 40% range, still lagging the national average of 60%. An estimated 30% of forklifts in-service are electric, equating to approximately 1,034 electric forklifts representing 2.9 MW avg peak load and $732,071 billing revenue system-wide.

In addition to supporting beneficial adoption, the forklift program allows Avista to develop load profiles for grid impact modeling and to experiment with load management techniques that maximize off-peak charging. Especially in the case of lifts powered by lithium-ion batteries, the ability to charge 100% off-peak is feasible with all but those businesses running 24/7 shifts, as a full charge can usually be achieved in 4 to 5 hours. Even with these types of operations, battery swapping can often prove effective in eliminating on-peak loads.

Further details on forklift load profiling and off-peak charging are provided in Appendix D. Load profile data shows high utilization, consuming an average of 5,900 kWh per year at a peak load of 2.76 kW each and $708 annual billing revenue. This provides a utility incentive payback period of approximately 3.5 years. Customers realize average annual operational savings of $3,540 and 12 avoided tons of emissions for each forklift, contributing significantly to overall regional transportation cost savings and emissions reductions.

X. Load Management and Grid Integration

Demand Response for DCFC

Each DCFC installed on Avista's network has energy management controls built into its operating system, which allows for remote curtailment of DCFC output power in an emergency or other controlled demand response event. Controls are accessed through an online portal and changes to energy output set manually when an event occurs. This type of manual control is feasible with a small number of DCFC for demonstration purposes but is not practical with a larger number of DCFC across the entire network, especially with multiple equipment vendors and network platforms that must be uniquely accessed. Such a capability could prove valuable in several ways, not only in the event of unexpected emergencies, but also to allow for siting of DCFC in areas where local distribution constraints would not normally allow for the addition of DCFC connected loads, i.e. it may provide a way to prudently site DCFC in certain remote, strategic locations that would not otherwise be possible.

Recent technology offers an onsite controller that can connect to each charger via an ethernet cable and manage multiple brands of chargers from one dashboard. The controllers and integrating software are designed to optimize fleet charging, controlling and coordinating individual charger outputs to stay within a site level limit. This technology may be modified to control a network of DCFC such as Avista's, and a demonstration project is currently underway in partnership with industry vendors and Avista's Innovation Lab. Future work will include accessing the site controller's ability to accept feeder loading signals from the utility, which will allow the controller to modulate station output in real time and enable system-wide automation.

VGI – Residential Smart Charging

Vehicle-to-grid integration (VGI) demonstration projects including telematics technologies is an area of focus, with the goal of providing value to participating customers while achieving cost-effective load shifts of 50% or more to off-peak. The Company is in the process of expanding the Smart Charging program to residential customers coupled with the pilot TOU rate offering, and including a direct load control capability. 2024 results with a pool of 111 customers averaged 89% off-peak charging – very encouraging in terms of customer's ability to charge off-peak without inconvenience. In the near-term, cost-effectiveness is the primary challenge, as daily load shifts at this level result in the range of $50 to $100 cost savings per customer to the grid per year ($5 to $10 per month), easily overcome by costs including customer incentives, program marketing, vendor costs and program administration. By coupling the Smartcharging program with the TOU pilot rate, it may be possible to offer a compelling value to customers by leveraging the program to optimize TOU billing savings, as well as battery longevity by normally maintaining the battery SOC below 80%. Furthermore, it may be demonstrated that beyond daily load shifts, in extreme events it may be acceptable for many customers to shift load for several days, given that typical battery packs today are above 60kWh and average daily use is on the order of 10kWh. Utility savings in these extreme events could very well provide the most value, well above costs to operate the program. See Appendix B for load profiles based on telematics data from the Smartcharging program in 2024.

Commercial EV Time-of-Use (TOU) Rates

The following summarizes the parameters of commercial EV TOU rate schedules 013 and 023:

	Schedule 013	Schedule 023
Basic Charge	$25	$750
On-Peak Energy Charge, per kWh	$0.22327	$0.15323
Off-Peak Energy Charge, per kWh	$0.08891	$0.06192

Period	Morning Peak	Afternoon-peak
Apr 1 – Oct 31	NA	3pm – 7pm
Nov 1 – Mar 31	7am – 10am	5pm – 8pm

Table 15: Commercial EV TOU Rate Parameters

Customers indicate these rate options are essential in their decision to invest in public DCFC, larger fleet and workplace charging. Participation has steadily increased each year since implementation in 2021, with overall meter data showing 74% of usage off-peak.

Experience has shown that education for each customer is necessary to help maximize off-peak charging, which benefits both the customer and the grid. Fleet operators often have some operational needs to charge on-peak to some degree but typically are able to shift a high percentage charging load to off-peak. For example, delaying charging at the end of regular shifts in the afternoon and early evening, to commence later in the evening and overnight.

Year	# Customers	Annual kWh	% On-peak	% Off-peak
2021	16	258,260	22%	78%
2022	21	587,689	21%	79%
2023	54	1,980,063	26%	74%
2024	94	5,273,707	26%	74%

Table 16: Commercial EV TOU Rate Participation and Energy Use

Transformer loading study

The following study was carried out in 2024 to determine how the number of EV customers may affect transformer loading, to inform transformer sizing and changeout policy.

In a residential neighborhood it is common for multiple homes to be served by one transformer, as many as 12 or more homes in some cases. The following table shows the average number of homes served by each residential transformer size and the average kW each residential home is allotted, according to system data:

Transformer kVA	Average # Homes	kW per home
15	2	6.73
25	4	6.66
38	7	5.77
50	8	6.13
75	10	7.39
100	11	9.09

Table 17: Average # of Homes and allotted kW demand for common transformer sizes

The next table shows the minimum number of connected homes per transformer size and the maximum number of homes.

Transformer kVA	Min # Homes	Max # Homes
15	1	7
25	1	11
38	2	21
50	1	23
75	5	25
100	3	19

Table 18: Min and Max # of Homes for common transformer sizes

The current sizing system has worked well for many decades due to load diversity, as not all connected homes reach their maximum power consumption at the same time, paired with a large amount of water and space heat served by natural gas appliances. Dividing the kVA output of the transformers (excluding the 100 kVA units) by the maximum # of connected homes yields an average kVA allowance of 2, which is the average rating for an electric stove. If all customers were to consume energy equally at the same time, the transformer would reach max loading and potentially overload. Load diversity allows transformers to serve the households shown in table 2 without overloading. It also allows for one connected customer to charge an EV at 3.6 kW to 11 kW without issue.

May the current sizing system allow transformers to serve additional customers with EV charging loads, and/or at what point may the transformers be overloaded? Based on load profile data, is likely that each EV residential customer will do most of their charging in the evening and overnight. If two or more of those customers are served by a single transformer it is also likely that their charging loads will at some point in time occur simultaneously, with the potential to take the transformer loading to its nameplate capacity or beyond.

A data pool of 256 transformers and 1,626 residential customers were used for this study. To reduce computational requirements, a sample of each transformer size was chosen at random. The following table details the count of each transformer size identified and the corresponding transformer sample size used.

kVA	Count	Sample Size
15	22	4
25	49	10
38	61	12
50	92	18
75	28	5
100	4	1

Table 19: Residential Transformer Sizes and Counts

The 50 transformers chosen for this study based on the sample sizes above serve a total of 335 customers – 50 customers with EV charging and 285 non-EV customers. Five years of AMI data at hourly intervals was pulled for each customer and used to build average daily load profiles for each transformer size. The following chart shows the average annual load profile, pre- and post-EVSE, for the 50kVA transformers in this study.

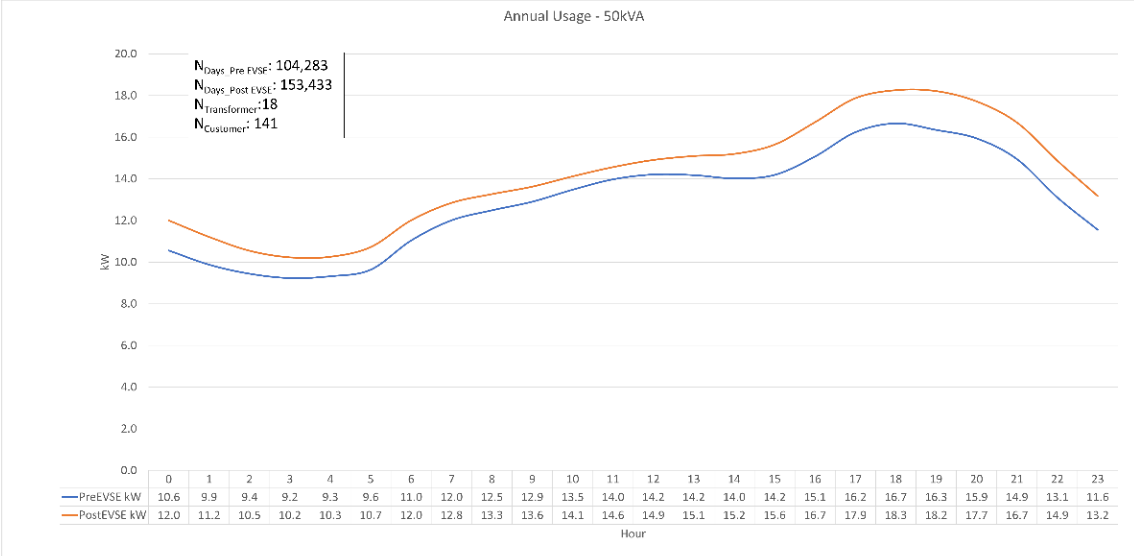


Figure 24: 50kVA Residential Transformer – Avg. Annual Load, Pre- and Post- EV Charging

Average daily load profiles are useful in determining customer usage patterns along with peak loading times and duration. The profile above shows that this group of residential customers follows a very consistent pattern of electric usage, as expected for residential customers. This chart also shows that the average usage increased between the pre- and post-EVSE periods, indicating that the addition of the charging load did increase the overall loading of each transformer. While these average patterns are useful in understanding how transformers are affected more generally, they do not provide information on what a specific peak loading day looks like, how often those days occur, or how the addition of EV charging has increased those peak loads.

To address these shortcomings, an analysis was conducted to determine the load profile when the daily peak load exceeded 80% of the nameplate capacity. This analysis was completed for the pre- and post- EVSE period and for two additional scenarios where two and three EV charging loads were added to the transformer. The 2EV and 3EV scenarios assume the worst case of loading coincidence with charging loads stacked on each other.

Figure 5 presents peak load profiles: Pre-EVSE, Post-EVSE 1EV, Post-EVSE 2EV, and Post-EVSE 3EV, for the 50kVA transformers in the study. The shape of these profiles matches the average annual profiles with evening peaks occurring between 6pm and 7pm. Before EV charging, the average peak load was 36.4kW, or

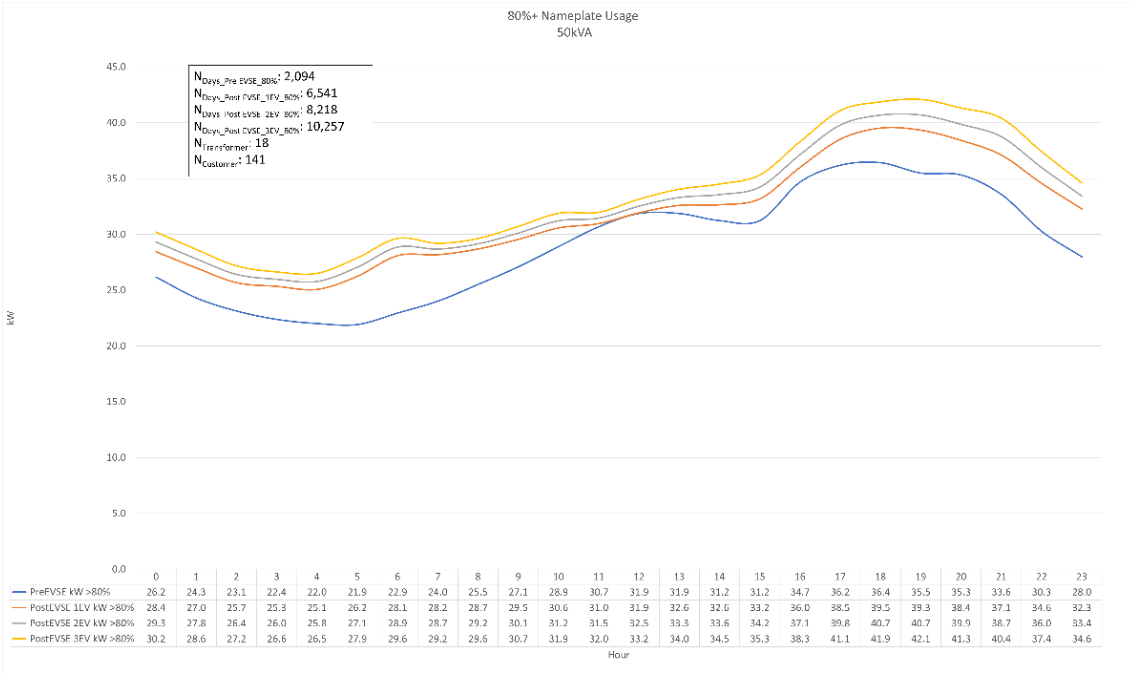


Figure 25: 50kVA Residential Transformer – 80% Nameplate loading

73% of nameplate. The addition of 1 EV charger moved that peak to 39.3kW, 2EVs peaked at 40.7kW, and 3EVs at 42.1kW, resulting in 79%, 81%, and 84% of transformer nameplate capacity respectively. As expected, each charging load that is added increases the peak load. To fully understand the impact of these additional loads, the frequency that they occur needs to be understood.

	Total Days		**No. of Days with Peak kW above 80%**			
Transformer kVA	Ndays_ Pre-EVSE	Ndays_ Post-EVSE	Ndays_Pre -EVSE_80%	Ndays_Post-EVSE_80%	Ndays_Post-EVSE_80% 2EV	Ndays_Post-EVSE_80% 3EV
15	3,689	5,286	0	12	37	305
25	20,274	23,217	341	517	786	1869
38	72,845	87,468	2,631	6,712	7,402	8,591
50	104,283	153,433	2,094	6,541	8,218	10,257
75	26,225	45,025	0	64	64	80
100	16,516	17,082	0	0	0	0

Table 20: # of days peak load exceeds 80% transformer nameplate capacity

The total number of days for the pre- and post- periods are broken down by transformer size and presented in the table above. It also shows how many days the peak load exceeded 80% of nameplate capacity for each scenario modeled. For the 50kVA transformer group, Pre-EVSE daily peak loading above 80% of name plate capacity occurred 2% of the time, equating to one day every 1.5 months. After the charger was installed, that percentage increased to 4.3%, or one day every 3.5 weeks. As more EV chargers are added we see a steady increase in the number of days the transformer is above 80% loading. With 2EVs we see peak loading 5.4% of the time (one day every 2.5 weeks), and with 3EVs that peak loading increases to 6.7% of the time (one day every 2 weeks). As more EV chargers are added to these transformers, we would expect to see the peak load continue to move towards 100% of nameplate capacity and the occurrence of those peak loads to increase in kind. For a transformer to be at risk of overloading, the peak load would need to be at or above 100% for several hours. The scenarios modeled in this study show that that is unlikely to happen for transformers with the average # of connected customers.

Two transformer sizes stand out in this study as outliers. The 100kVA unit in this study has 19 connected customers, which is the max shown in figure 2. Even with the max # of homes connected, this unit never reached 80% of nameplate loading for any of the scenarios presented, as 40% of nameplate was the maximum. This shows that even when serving 19 homes, the addition of EV charging does not have a large enough effect on the peak loads to cause concern of overloading. On the other hand, as EV charging loads are added to the 15kVA transformer we see a much more dramatic effect. Before EV charging was added peak loading never exceeded 80% nameplate. Once EV charging was added the peak load exceeded 80% nameplate 0.2% of the time, 2 EV chargers moved that to 0.7%, and 3 EV chargers pushed it to 5.8%. If this trend were to continue, a 4th EV charger would push the transformer to peak loading 42% of the time. For those 15kVA transformers that serve the max # of homes it is likely that the transformer will be loaded past 100% of nameplate as electrification continues and risks failure. One conclusion of this study is that these 15kVA transformers should be prioritized for replacement, identified and upsized proactively to reduce this risk.

The results of this study show that residential transformers that serve the average number of customers (as shown in table 1) are sized appropriately for their existing connected load and can serve additional future EV loads without issue. If the number of connected customers exceeds the average, the transformer will likely need to be replaced with a larger unit as EV adoption increases.

Additional charts showing the 80% peak loading for the 15kVA, 25kVA, 38kVA, and 75kVA, transformers can be found in Appendix E.

Appendix A – Standard Design Specifications for DC Fast Charging Sites

180kW dual port with expansion capacity to 1MW

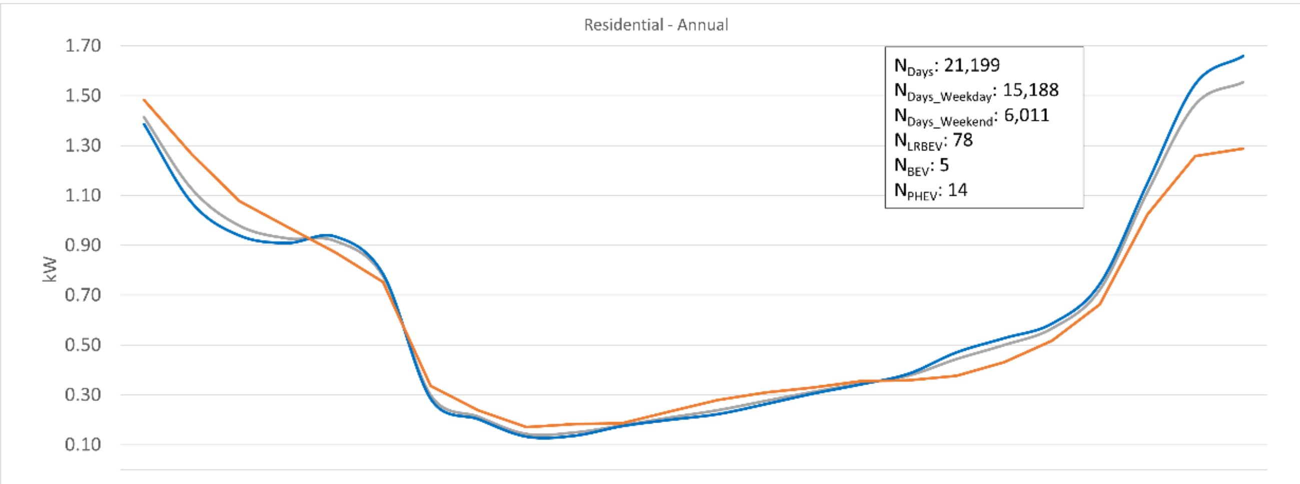
A 1MW standard design is broken down into three phases over several years. This phased construction is completed as justified by future demands and helps minimize total costs over time. Phase I includes the installation of a 300kW transformer on a concrete pad sized for a future 1MW transformer upgrade, 800A-480V three phase switchgear, step down transformer and 208V three phase panel, one 180 kW dual port DCFC, two 19.6kW ACL2 chargers as backup, and associated conduit from electrical panels to the chargers, including conduit to future charger locations in Phases II and III. Once demand justifies expansion, Phase II installs a second 180 kW dual port DCFC and replaces the 300kW transformer with a 500kW unit.. This is accomplished at low cost without ground disturbance, pulling wire through existing conduit installed in phase I, and mounting and commissioning the DCFC at the predetermined location. In Phase III the 500kW transformer is replaced with a 1MW unit, 800A switch gear with 1600A equipment, and two 350 kW DCFC are installed. The utility transformers are redeployed and the 800A switch gear is redeployed or sold for salvage value.

320kW dual port with expansion capacity to 1MW

Phase I includes the installation of a 500kW transformer on a concrete pad sized for a future 1MW transformer upgrade, 800A-480V three phase switchgear, step down transformer and 208V three phase panel, one 320 kW dual port DCFC, two 19.6kW ACL2 chargers as backup, and associated conduit from electrical panels to the chargers, including conduit to future charger locations in Phases II and III. Once demand justifies expansion, Phase II installs a second 320 kW dual port DCFC and swaps out the 500kW transformer for a 750kW unit. This is accomplished at low cost without ground disturbance, pulling wire through existing conduit installed in phase I, and mounting and commissioning the DCFC at the predetermined location. In Phase III the 750kW transformer is replaced with a 1MW unit, 800A switch gear with 2000A equipment, and one additional 320 kW DCFC is installed. The utility transformers are redeployed and the 800A switch gear is redeployed or sold for salvage value.

Appendix B – Smart Charging Program Residential Load Profiles based on Telematics Data

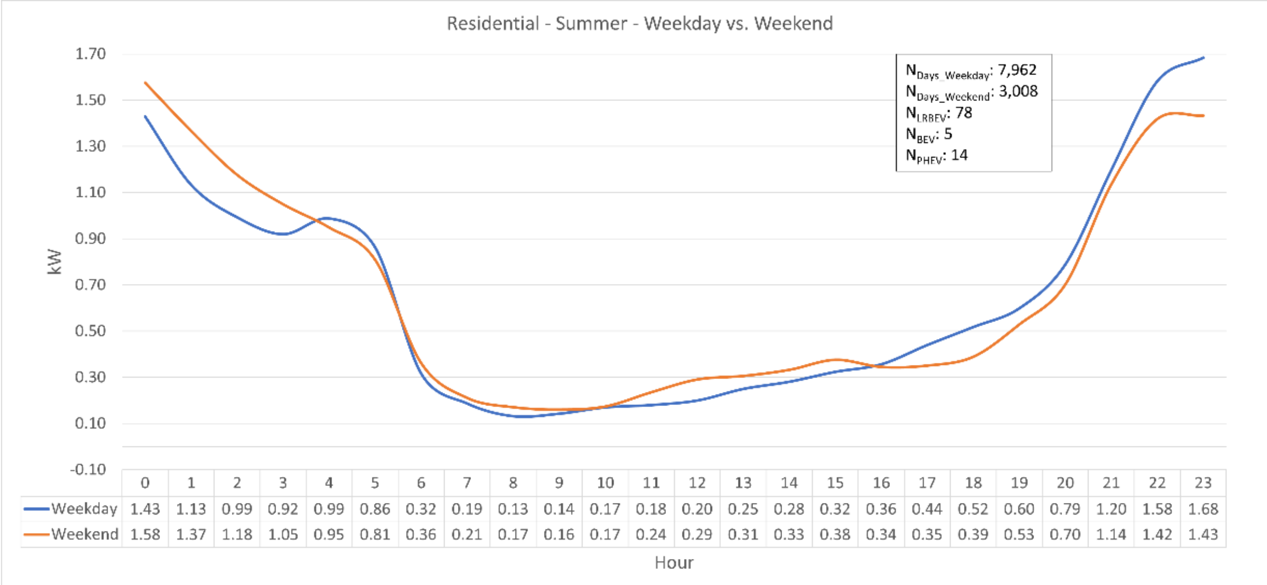
The following graphs were developed using telematics data gathered through Avista's Smart Charging load management program. Every customer in this program has been influenced to shift their charging loads to Avista's off-peak hours via periodic email updates and prompts.



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Annual	1.41	1.13	0.98	0.93	0.92	0.78	0.30	0.21	0.14	0.15	0.18	0.21	0.24	0.28	0.31	0.35	0.38	0.44	0.50	0.57	0.72	1.11	1.46	1.55
Weekday	1.39	1.07	0.94	0.91	0.93	0.78	0.28	0.20	0.13	0.14	0.17	0.20	0.22	0.26	0.30	0.34	0.38	0.47	0.53	0.59	0.74	1.15	1.55	1.66
Weekend	1.48	1.26	1.08	0.97	0.87	0.75	0.34	0.24	0.17	0.18	0.19	0.23	0.28	0.31	0.33	0.35	0.36	0.38	0.43	0.52	0.66	1.02	1.26	1.29

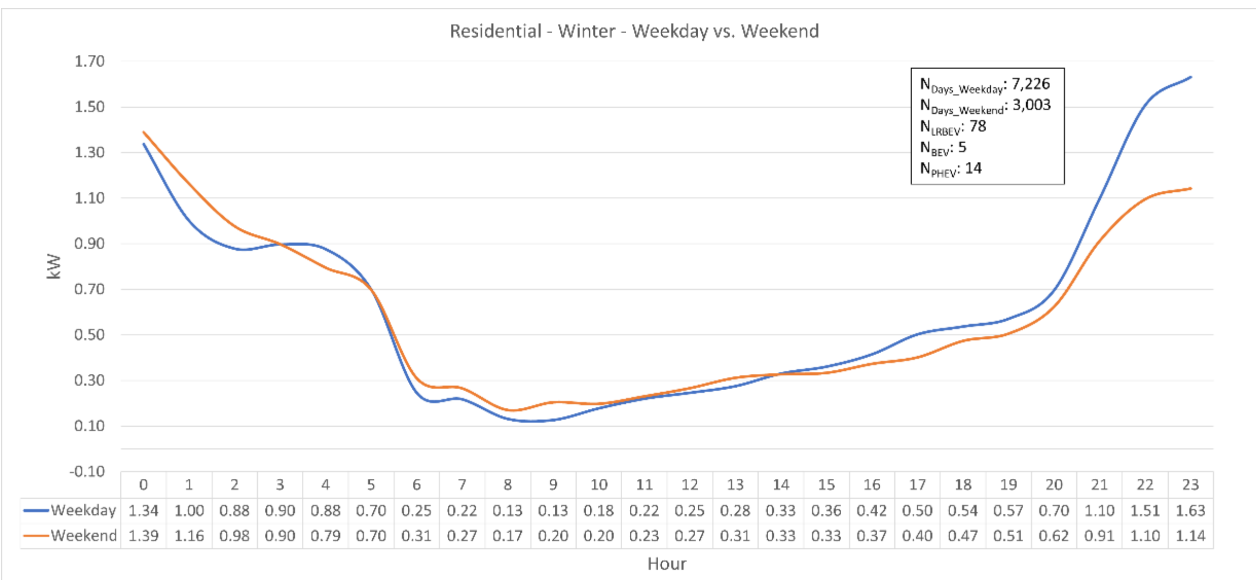
Figure B1: Residential Customer –Annual Charging & Weekday vs. Weekend

88% of charging occurs during off-peak hours for these customers, a significant shift from uninfluenced load profiles. The Weekday and Weekend profiles follow a similar curve except for an increase in charging during the evening hours starting at 9pm, and another increase in the early morning hours, 3am to 5am. The increase in the evening charging load can be attributed to the additional miles driven during the week when commuting to work, and the morning increase indicates that drivers are using a "ready by" feature that will precondition their vehicle by a set time while maintaining the required state of charge (SOC) of the battery.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	1.43	1.13	0.99	0.92	0.99	0.86	0.32	0.19	0.13	0.14	0.17	0.18	0.20	0.25	0.28	0.32	0.36	0.44	0.52	0.60	0.79	1.20	1.58	1.68
Weekend	1.58	1.37	1.18	1.05	0.95	0.81	0.36	0.21	0.17	0.16	0.17	0.24	0.29	0.31	0.33	0.38	0.34	0.35	0.39	0.53	0.70	1.14	1.42	1.43

Figure B2: Residential Customer – Summer Charging – Weekday vs. Weekend



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	1.34	1.00	0.88	0.90	0.88	0.70	0.25	0.22	0.13	0.13	0.18	0.22	0.25	0.28	0.33	0.36	0.42	0.50	0.54	0.57	0.70	1.10	1.51	1.63
Weekend	1.39	1.16	0.98	0.90	0.79	0.70	0.31	0.27	0.17	0.20	0.20	0.23	0.27	0.31	0.33	0.33	0.37	0.40	0.47	0.51	0.62	0.91	1.10	1.14

Figure B3: Residential Customer –Winter Charging – Weekday vs. Weekend

The charts above compare weekday to weekend use during the summer and winter months. These profiles follow a similar pattern to the annual load profiles, indicating that this group of customers do not change their charging patterns seasonally.

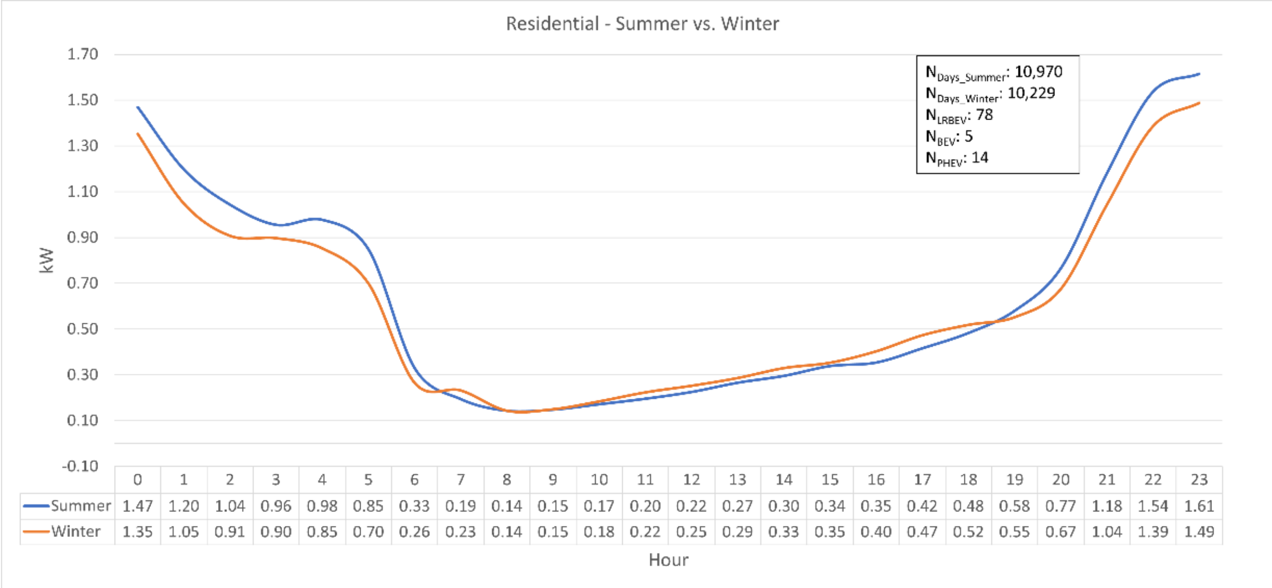
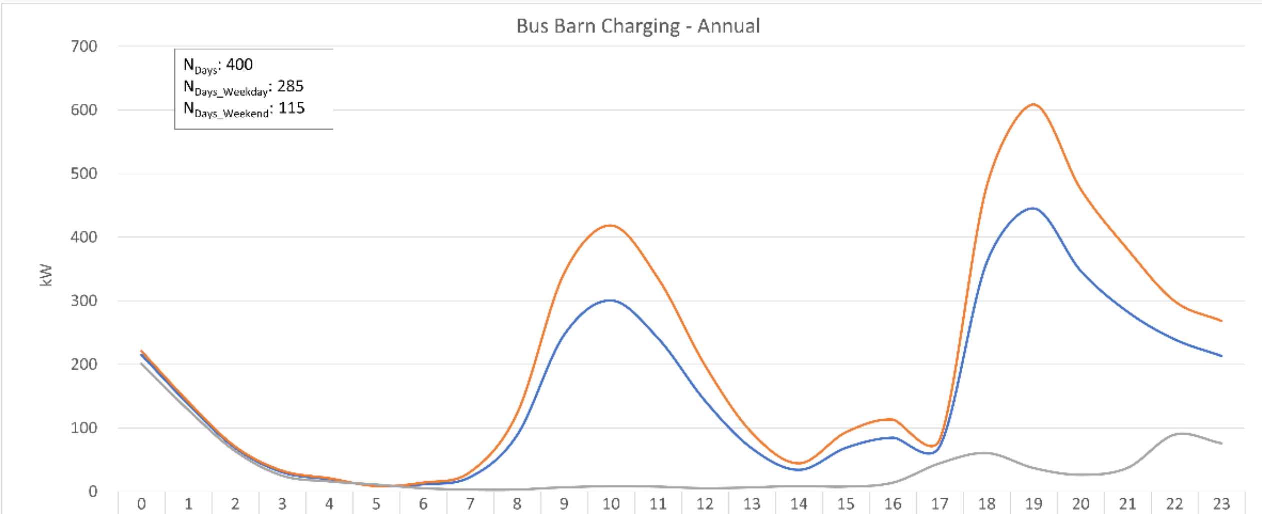


Figure B4: Residential Customer – Summer vs. Winter

The figure above shows that this group of customers used more energy for charging during the summer months, which is the opposite of the findings from last year's study. This change in usage could be attributed to the warmer than average summer and winter months that were experienced in 2024. With warmer temperatures in the winter months the need to condition the cabin of the vehicle and the battery compartment is decreased, which would drive the battery usage down. That paired with an increase in air conditioning load is one explanation for the change between 2023 and 2024 results.

Appendix C – Transit Load Profiles

The following graphs were developed using dedicated EV charging meter data for each customer. These meters utilize commercial EV TOU rate schedules 013 or 023.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Annual	215.2	137.4	68.5	30.5	19.6	9.3	11.5	22.9	89.0	246.7	300.6	241.2	142.9	67.9	34.2	68.9	84.8	71.7	361.0	445.5	347.2	282.7	239.5	213.3
Weekday	220.9	141.1	70.6	32.7	21.0	8.7	14.1	30.9	123.3	343.5	418.6	335.4	198.4	92.4	44.4	93.4	113.2	82.6	481.1	608.9	475.5	380.9	299.4	268.3
Weekend	201.0	128.1	63.3	24.9	16.0	11.0	5.2	3.1	3.1	6.7	8.3	7.7	5.2	6.6	8.7	7.8	14.0	44.5	60.6	37.0	26.3	37.4	89.6	75.8

Hour

Figure C1: Depot Charging–Annual

This profile shows that there is significant charging during two distinct periods of the day. The first peak occurs from 8am to 1pm, and the second from 6pm to 3am. The first is attributed to in-route charging using the two pantograph chargers located at the depot, and the second peak is the expected overnight charging that is required for the buses to be ready for their morning routes. As battery technology improves and ranges are extended we would expect the morning peak to flatten out. This profile also shows a significant decrease in charging load over the weekend compared to the weekday. The transit agency operates the same weekday schedule on Saturdays and a reduced schedule (fewer buses and shorter operating hours) on Sundays. This reduced schedule on Sunday is the likely cause for the reduction in charging usage over the weekend. The next two figures compare weekdays to weekend charging for the summer and winter months. The profile shapes follow those seen for the annual profile, and the same conclusions may be drawn.

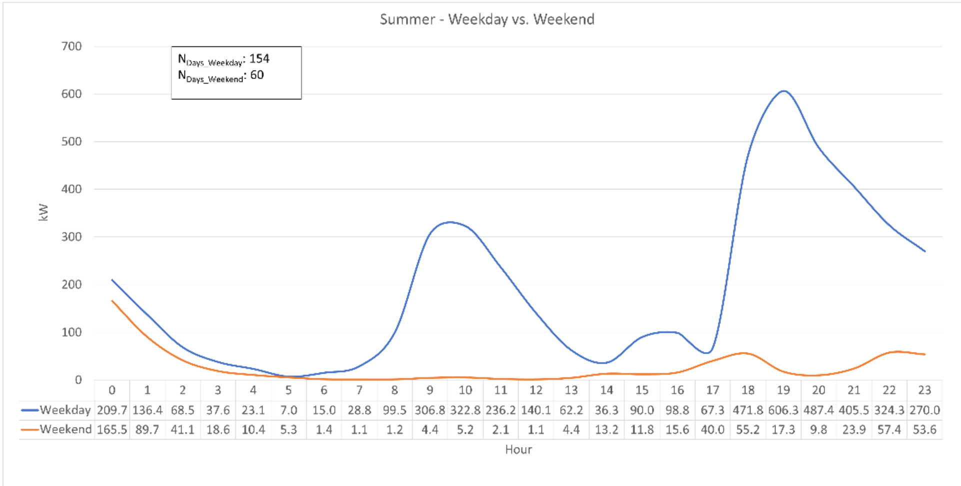


Figure C2: Depot Charging –Summer – Weekday vs. Weekend

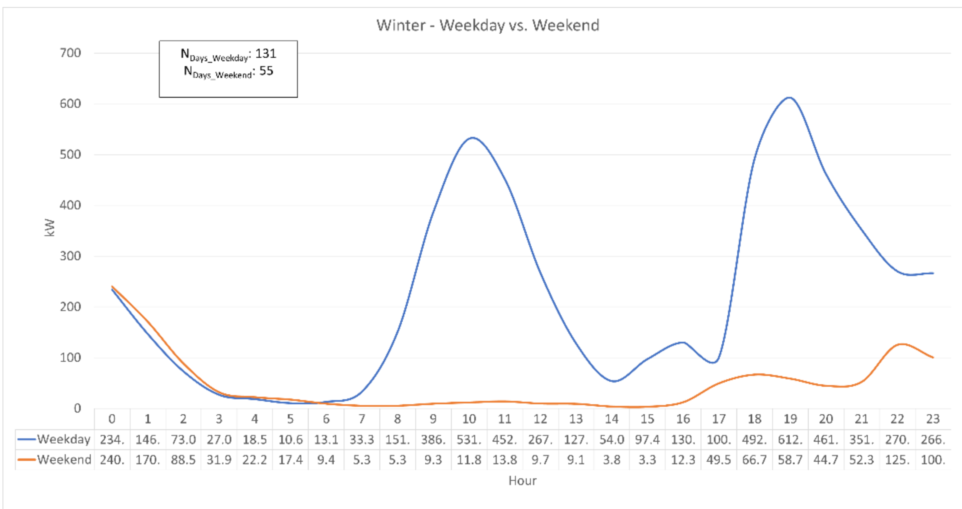


Figure C3: Depot Charging – Winter – Weekday vs. Weekend

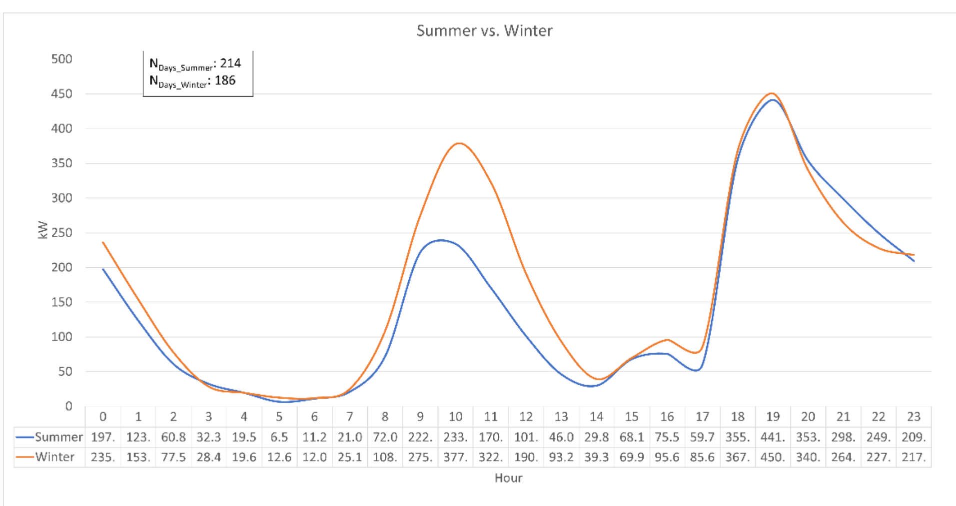
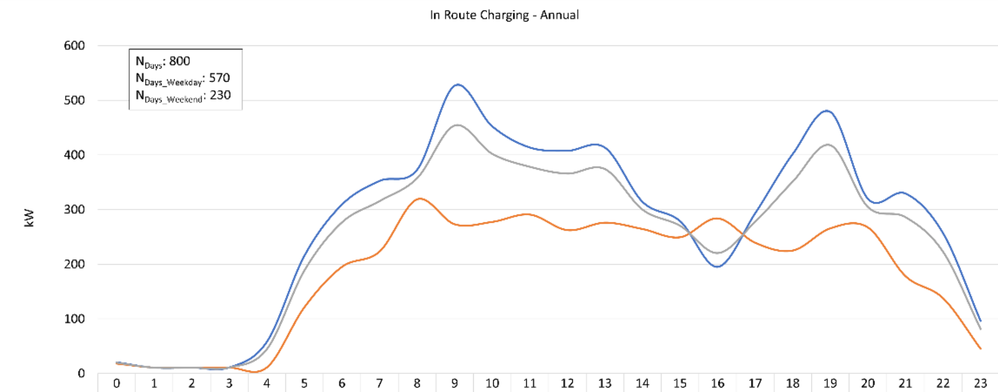


Figure C4: Depot Charging – Summer vs. Winter

This figure compares the winter charging loads to the summer. The winter charging load is, on average, 18% larger than the summer charging load. This increase in load is attributed to additional load from the cabin heaters and the heaters in the battery compartment.

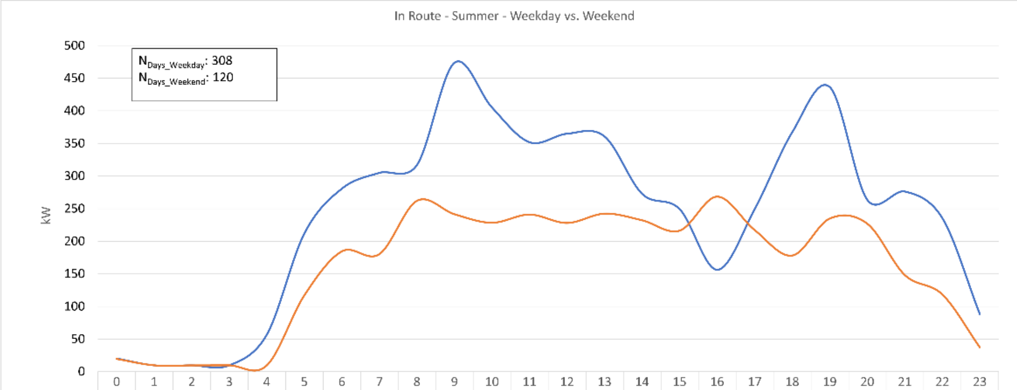


	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	20.4	10.6	10.7	11.0	58.1	215.7	309.4	352.5	373.1	527.0	452.3	413.7	407.8	413.4	314.2	278.9	195.1	293.4	402.0	478.7	319.7	329.4	256.8	96.0
Weekend	18.0	10.7	10.5	10.7	11.1	121.3	195.2	223.2	318.7	273.0	277.3	290.8	262.2	275.9	264.3	249.2	283.7	239.1	225.0	265.6	267.1	178.0	137.7	45.1
Annual	19.7	10.6	10.6	10.9	44.6	188.7	276.7	315.6	357.5	454.0	402.0	378.3	365.9	374.1	299.9	270.4	220.4	277.9	351.5	417.8	304.7	286.2	222.8	81.5

Hour

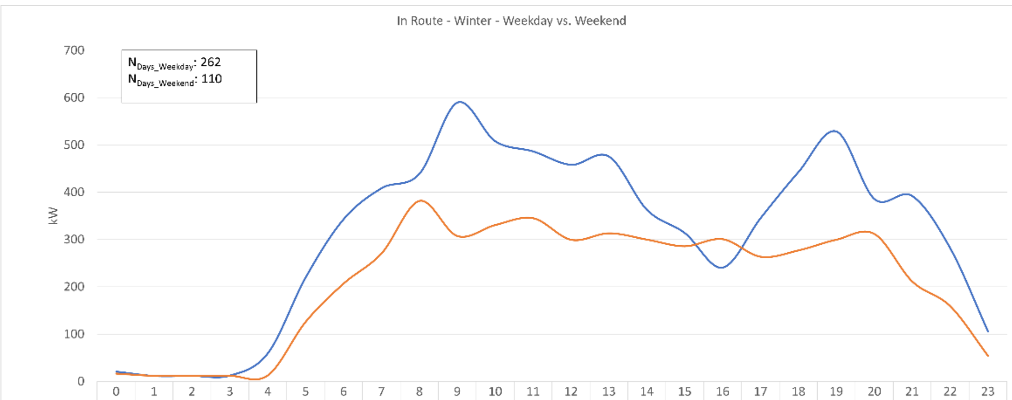
Figure C5: In Route Charging –Annual

In-route charging is used to keep buses on the road and are placed strategically along routes as needed. Charging at these stations occur throughout the day with peak hours occurring at 9am and 7pm. These peaks closely align with those seen at the depot charging, indicating that the transit agency is utilizing all of their charging assets to keep routes in operation. The weekend charging load is lower than the weekday load for in-route charging as well, with the reduced Sunday schedule explaining this reduction. The next two figures compare weekdays to weekend charging for the summer and winter months. The profile shapes follow those seen for the annual profile, and the same conclusions may be drawn.



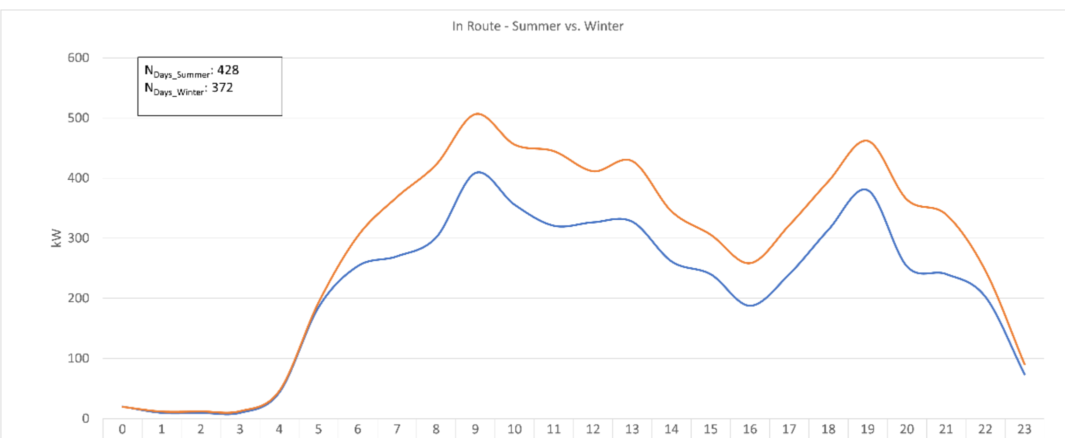
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	20.2	9.7	9.6	9.7	56.7	211.8	280.6	304.9	316.8	473.7	405.2	351.8	364.9	360.7	272.8	249.3	156.2	249.2	367.2	436.4	263.6	276.3	235.5	88.1
Weekend	19.5	9.7	9.6	9.7	9.6	116.9	184.5	180.2	261.9	241.4	228.3	240.9	228.0	242.3	232.2	216.2	268.3	217.1	178.1	234.8	226.9	148.2	118.3	37.2

Figure C6: In Route Charging –Summer – Weekday vs. Weekend



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	20.7	11.6	11.9	12.4	59.7	220.3	343.2	408.6	439.3	589.7	507.8	486.4	458.2	475.4	362.9	313.7	240.8	345.4	443.1	528.5	385.8	392.0	281.9	105.4
Weekend	16.3	11.7	11.5	11.8	12.7	126.2	207.0	270.8	381.8	307.4	330.8	345.1	299.6	313.3	300.0	285.9	300.8	263.6	277.1	299.8	311.9	211.2	159.2	53.8

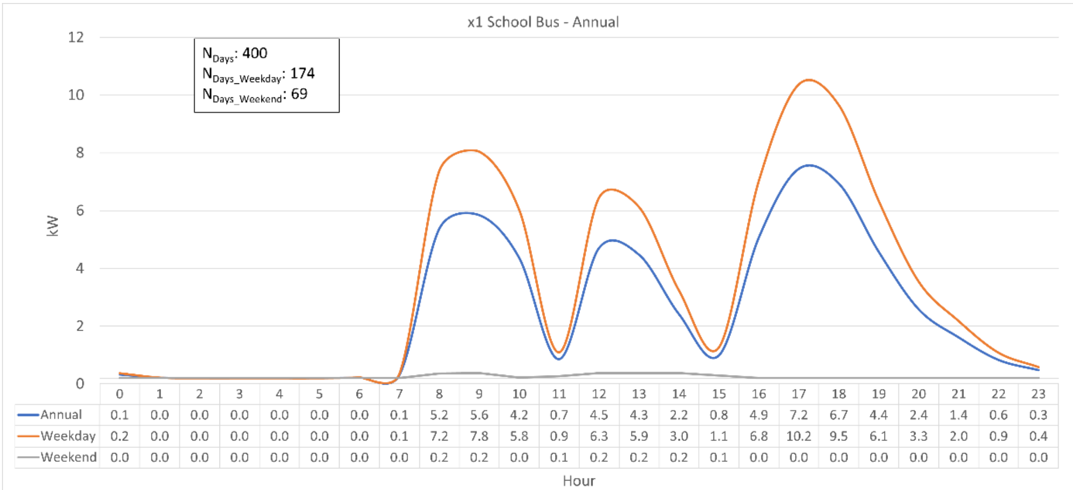
Figure C7: In Route Charging – Winter – Weekday vs. Weekend



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Summer	20.0	9.7	9.6	9.7	43.5	185.2	253.7	269.9	301.4	408.5	355.6	320.7	326.5	327.5	261.4	240.0	187.7	240.2	314.1	379.9	253.3	240.3	202.6	73.8
Winter	19.4	11.6	11.8	12.2	46.0	192.9	303.4	368.4	422.5	506.2	455.5	444.6	411.3	428.1	344.5	305.6	258.3	321.5	394.6	461.7	364.2	339.2	246.1	90.3

Figure C8: In Route Charging – Summer vs. Winter

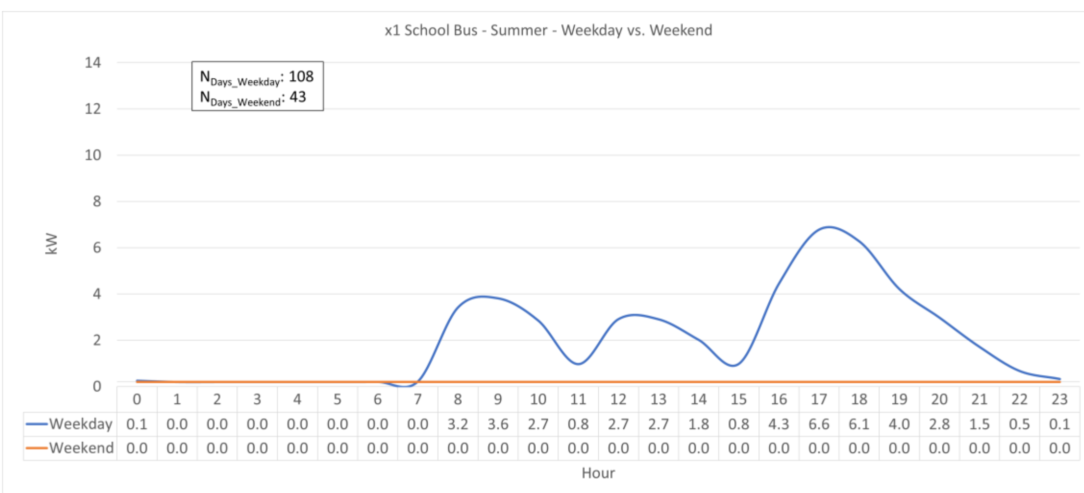
Similar to depot charging, the winter charging load is 30% higher than the summer load. Cabin heaters and battery conditioning also accounts for this increase.



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Annual	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	5.2	5.6	4.2	0.7	4.5	4.3	2.2	0.8	4.9	7.2	6.7	4.4	2.4	1.4	0.6	0.3
Weekday	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	7.2	7.8	5.8	0.9	6.3	5.9	3.0	1.1	6.8	10.2	9.5	6.1	3.3	2.0	0.9	0.4
Weekend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	0.1	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure C9: School Bus Charging x1 Bus –Annual – Weekday vs. Weekend

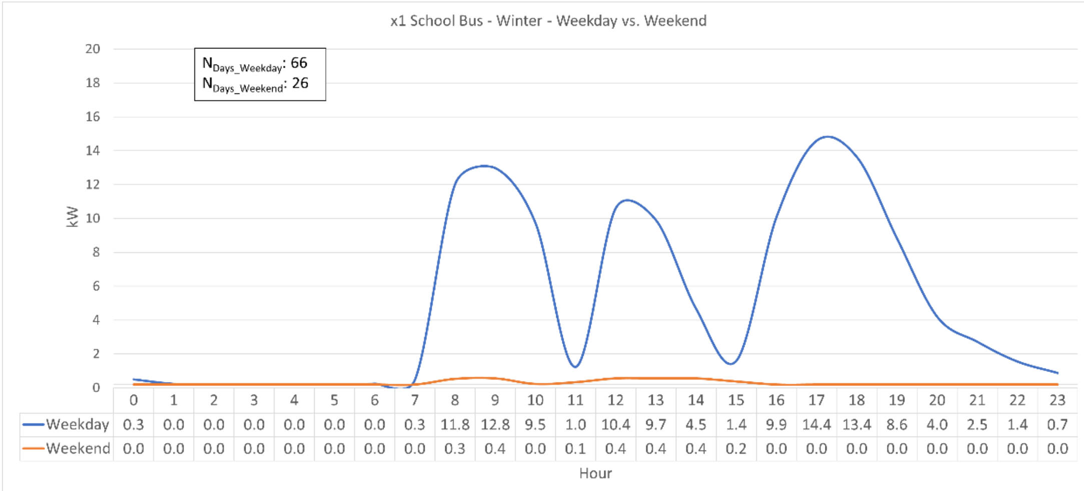
This school district operates one bus in a rural area, used to run three separate routes during the day based on observed charging loads. This indicates that while the bus is meeting their needs, a model with a larger battery and longer range would be preferable. The school district is not using this bus during weekends as indicated by almost no charging during this time.



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.2	3.6	2.7	0.8	2.7	2.7	1.8	0.8	4.3	6.6	6.1	4.0	2.8	1.5	0.5	0.1
Weekend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure C10: School Bus Charging x1 Bus –Summer – Weekday vs. Weekend

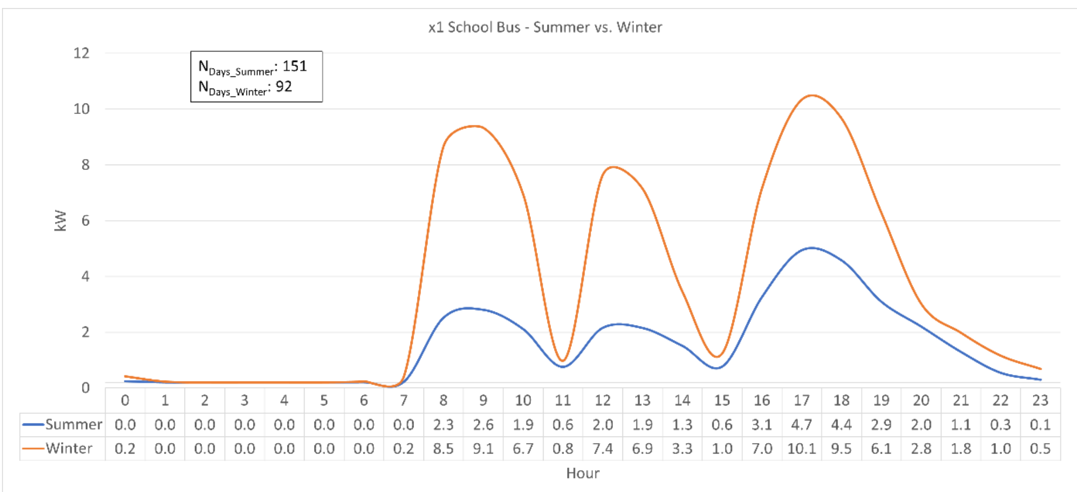
The charging loads during the summer months are significantly lower than those for the rest of the year, as expected with the school year ending in June and the buses unused in the summer until September.



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.3	11.8	12.8	9.5	1.0	10.4	9.7	4.5	1.4	9.9	14.4	13.4	8.6	4.0	2.5	1.4	0.7
Weekend	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.4	0.0	0.1	0.4	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

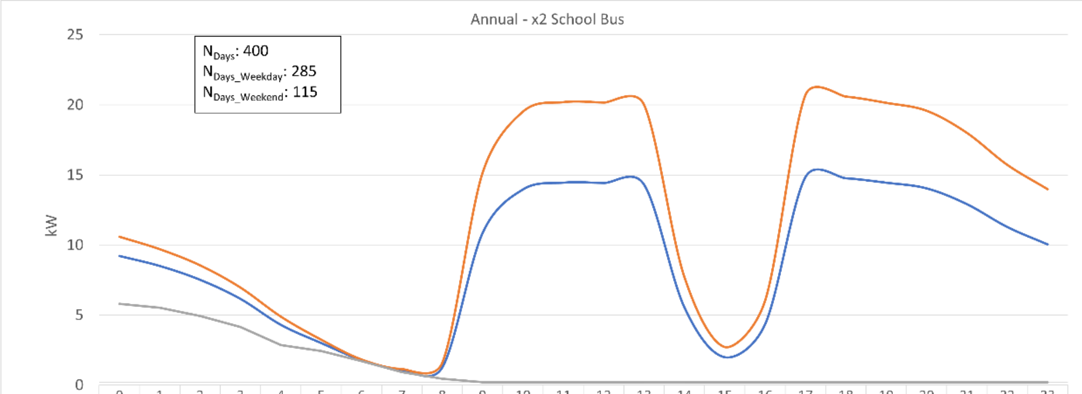
Figure C11: School Bus Charging x1 – Winter – Weekday vs. Weekend

The charging load is, on average, 15% higher than the annual charging load. Like the transit buses, this increase is due to cabin heaters and battery conditioning.



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Summer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.3	2.6	1.9	0.6	2.0	1.9	1.3	0.6	3.1	4.7	4.4	2.9	2.0	1.1	0.3	0.1
Winter	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.2	8.5	9.1	6.7	0.8	7.4	6.9	3.3	1.0	7.0	10.1	9.5	6.1	2.8	1.8	1.0	0.5

Figure C12: School Bus Charging x1 – Summer vs. Winter

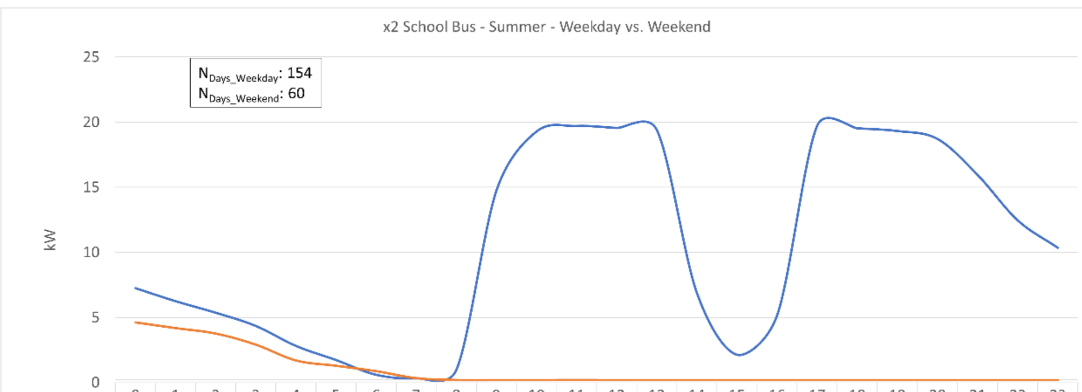


	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Annual	9.0	8.3	7.3	6.0	4.1	2.8	1.6	0.9	1.1	10.6	13.8	14.2	14.2	14.1	5.4	1.8	4.1	14.6	14.6	14.2	13.8	12.7	11.1	9.8
Weekday	10.4	9.5	8.3	6.8	4.7	3.0	1.6	0.9	1.4	14.9	19.3	20.0	20.0	19.8	7.5	2.5	5.8	20.5	20.4	19.9	19.4	17.8	15.5	13.8
Weekend	5.6	5.3	4.7	3.9	2.7	2.2	1.5	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Hour

Figure C13: School Bus Charging x2 Bus –Annual – Weekday vs. Weekend

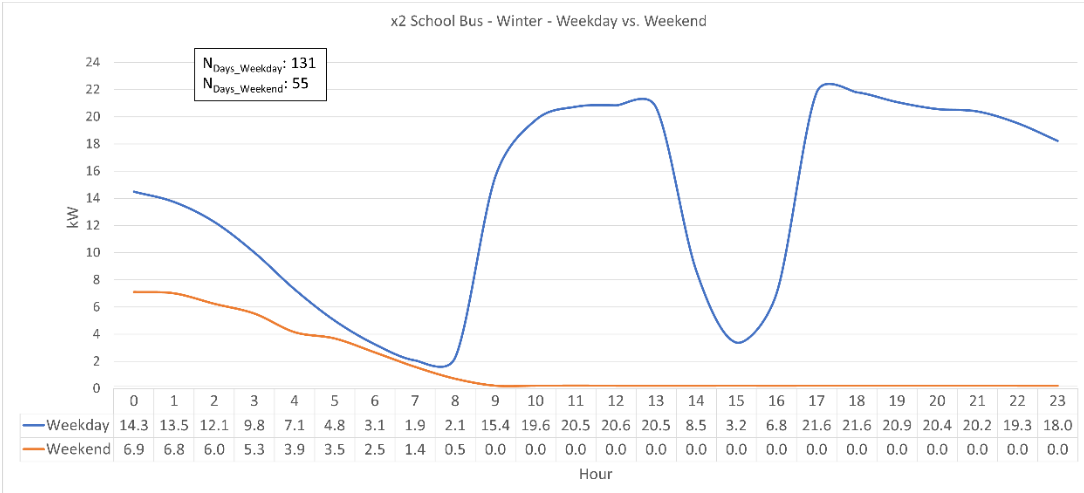
Figure C13 shows annual charging along with weekday and weekend charging for a school district that operates two school buses. The annual and weekday profile show that midday charging is required for the buses to complete their afternoon route. In this case, the afternoon peak could be shifted to off-peak hours if programmable EVSE or the bus itself were functional. These capabilities require additional investigation to determine if the added costs may be lower than the savings from greater off-peak charging.



	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	7.1	6.1	5.2	4.2	2.6	1.5	0.4	0.1	0.8	14.5	19.1	19.5	19.4	19.2	6.7	1.9	5.0	19.5	19.3	19.1	18.5	15.7	12.3	10.2
Weekend	4.4	4.0	3.6	2.7	1.5	1.1	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

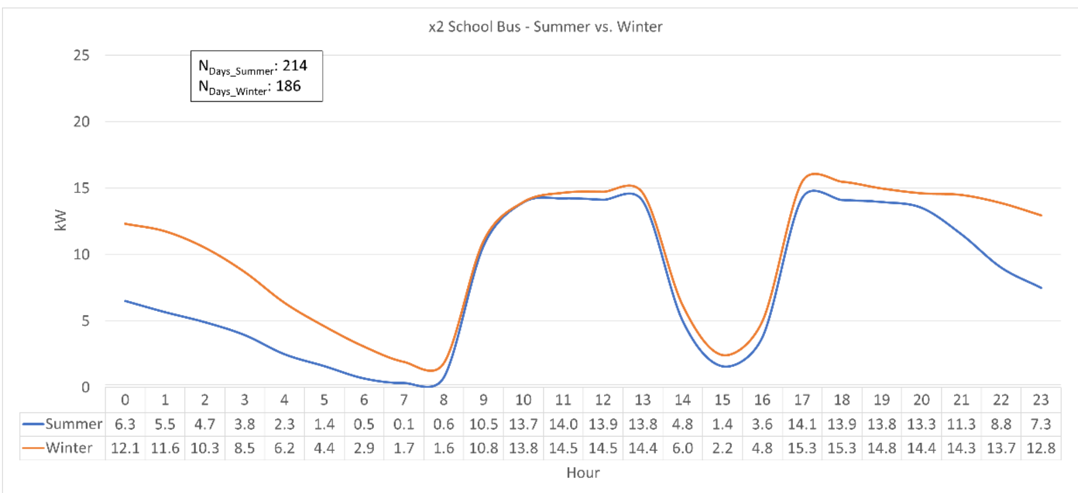
Hour

Figure C14: School Bus Charging x2 Bus –Summer – Weekday vs. Weekend



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Weekday	14.3	13.5	12.1	9.8	7.1	4.8	3.1	1.9	2.1	15.4	19.6	20.5	20.6	20.5	8.5	3.2	6.8	21.6	21.6	20.9	20.4	20.2	19.3	18.0
Weekend	6.9	6.8	6.0	5.3	3.9	3.5	2.5	1.4	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Figure C15: School Bus Charging x2 – Winter – Weekday vs. Weekend



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
Summer	6.3	5.5	4.7	3.8	2.3	1.4	0.5	0.1	0.6	10.5	13.7	14.0	13.9	13.8	4.8	1.4	3.6	14.1	13.9	13.8	13.3	11.3	8.8	7.3
Winter	12.1	11.6	10.3	8.5	6.2	4.4	2.9	1.7	1.6	10.8	13.8	14.5	14.5	14.4	6.0	2.2	4.8	15.3	15.3	14.8	14.4	14.3	13.7	12.8

Figure C16: School Bus Charging x2 – Summer vs. Winter

Appendix D – Forklift Load Profiles

These profiles were developed using energy usage directly measured at the electrical panel via data logging devices in 2023. Each forklift on average requires 5,900 kWh annually 2.8 kW average daily demand.

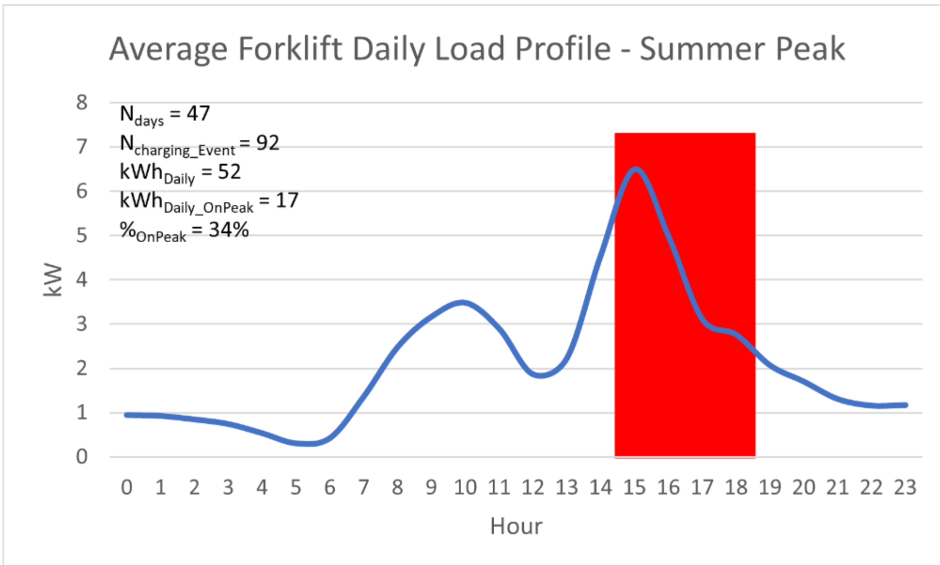


Figure D1: Forklift Load Profile Compared to Summer Peak 3pm - 7pm – Food Distributor

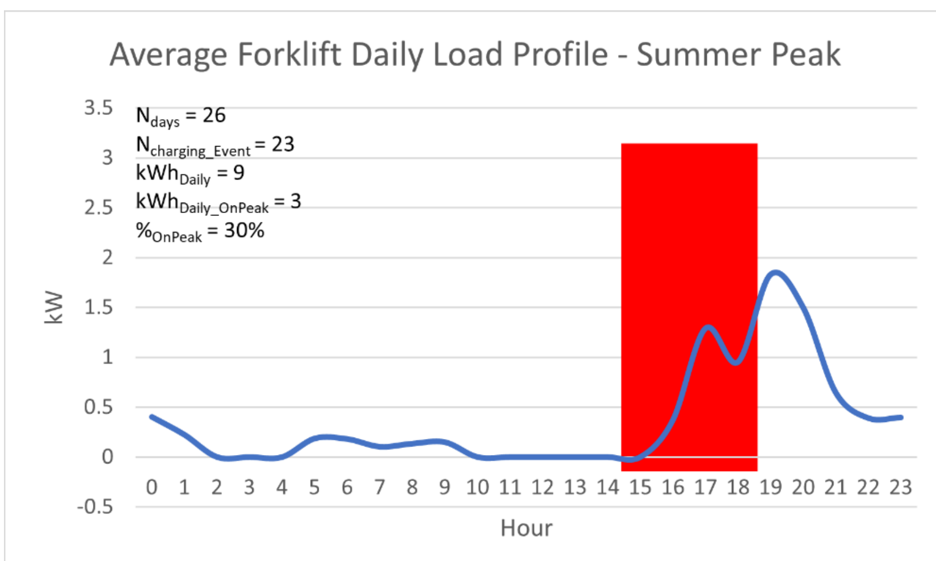


Figure D2: Forklift Load Profile Compared to Summer Peak 3pm - 7pm – Retail

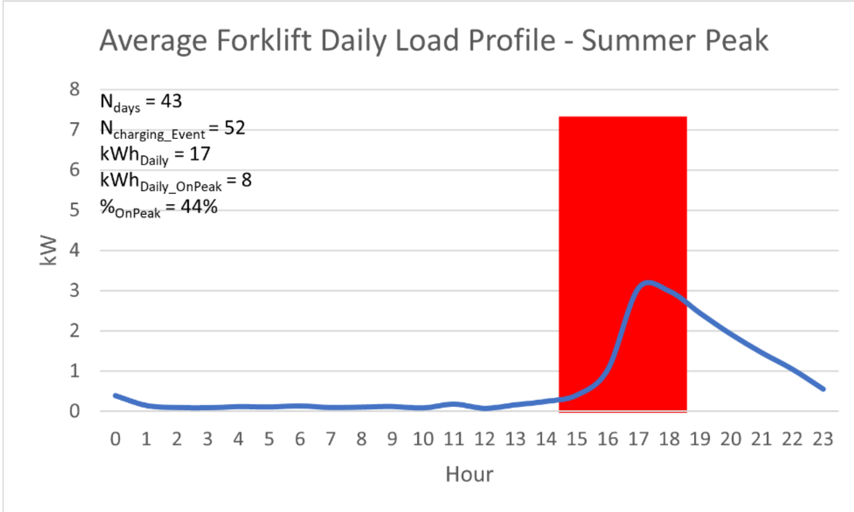


Figure D3: Forklift Load Profile Compared to Summer Peak 3pm - 7pm – Warehouse

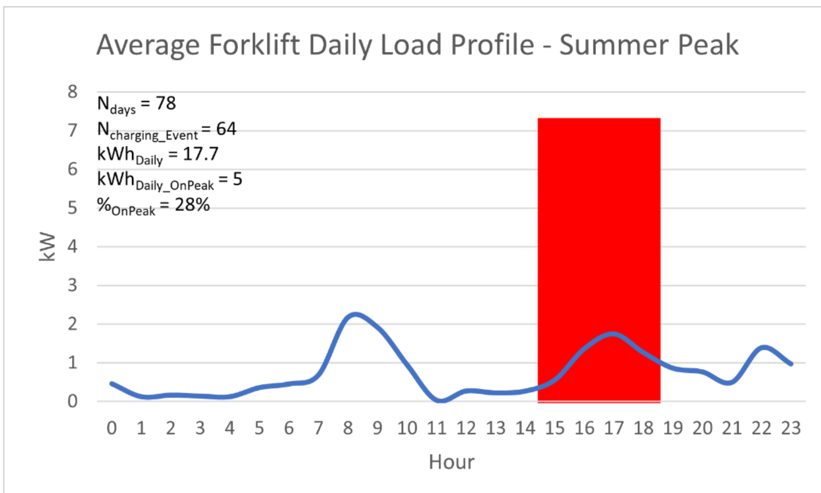
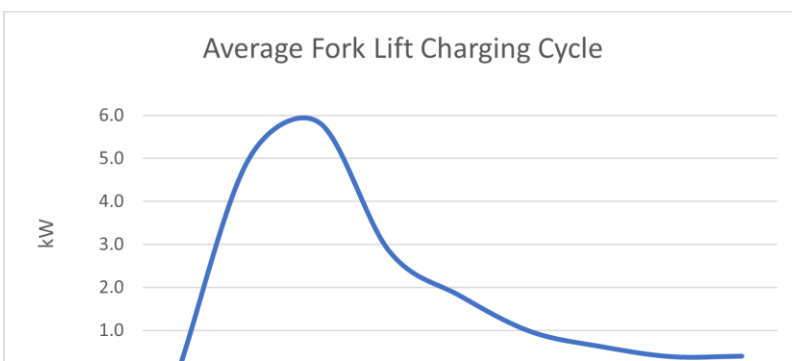


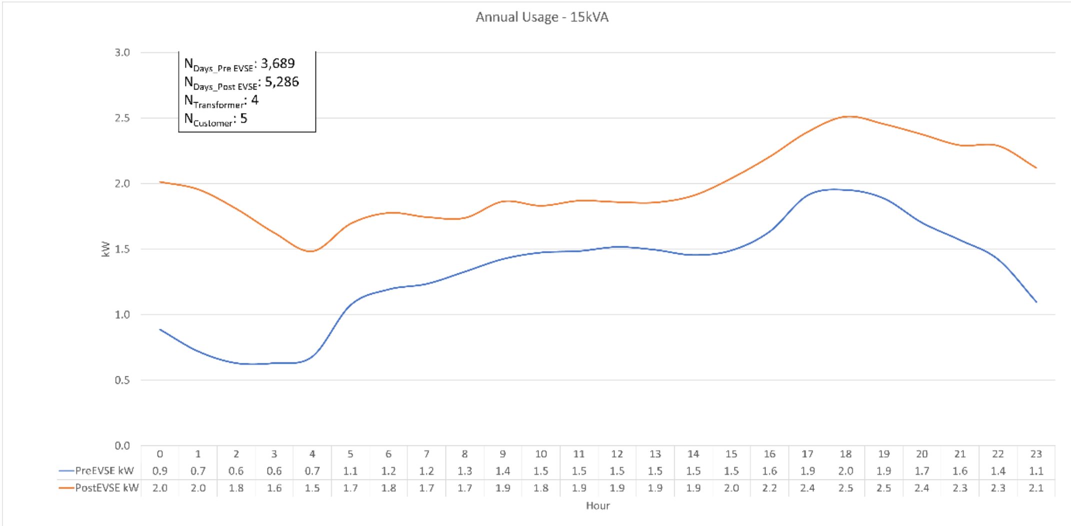
Figure D4: Forklift Load Profile Compared to Summer Peak 3pm - 7pm – Manufacturing



	0	1	2	3	4	5	6	7	8
Total	0.00	4.97	5.84	2.84	1.81	0.97	0.62	0.39	0.40

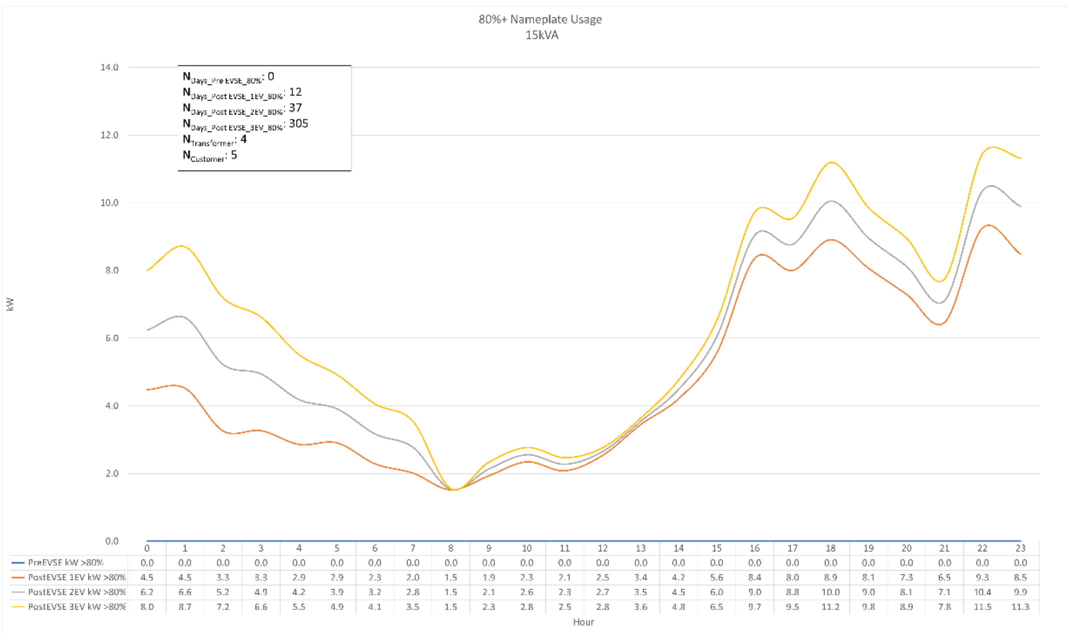
Figure D5: Average Forklift Charging Profile

Appendix E – Transformer Study Load Profiles



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
PreEVSE kW	0.9	0.7	0.6	0.6	0.7	1.1	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.5	1.5	1.6	1.9	2.0	1.9	1.7	1.6	1.4	1.1
PostEVSE kW	2.0	2.0	1.8	1.6	1.5	1.7	1.8	1.7	1.7	1.9	1.8	1.9	1.9	1.9	1.9	2.0	2.2	2.4	2.5	2.5	2.4	2.3	2.3	2.1

Figure E1: 15kVA Residential Transformer – Avg. Annual Load Pre and Post EVSE Charging



Hour	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
PreEVSE kW >80%	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PostEVSE 1EV kW >80%	4.5	4.5	3.3	3.3	2.9	2.9	2.3	2.0	1.5	1.9	2.3	2.1	2.5	3.4	4.2	5.6	8.4	8.0	8.9	8.1	7.3	6.5	9.3	8.5
PostEVSE 2EV kW >80%	6.2	6.6	5.2	4.9	4.2	3.9	3.2	2.8	1.5	2.1	2.6	2.3	2.7	3.5	4.5	6.0	9.0	8.8	10.0	9.0	8.1	7.1	10.4	9.9
PostEVSE 3EV kW >80%	8.0	8.7	7.2	6.6	5.5	4.9	4.1	3.5	1.5	2.3	2.8	2.5	2.8	3.6	4.8	6.5	9.7	9.5	11.2	9.8	8.9	7.8	11.5	11.3

Figure E2: 15kVA Residential Transformer – 80% Nameplate loading

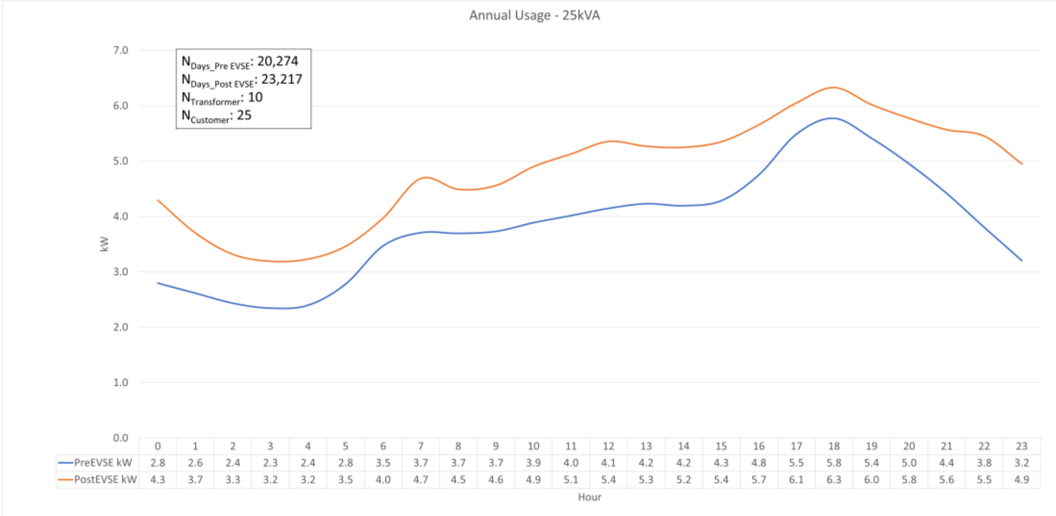


Figure E3: 25kVA Residential Transformer – Avg. Annual Load Pre and Post EVSE Charging

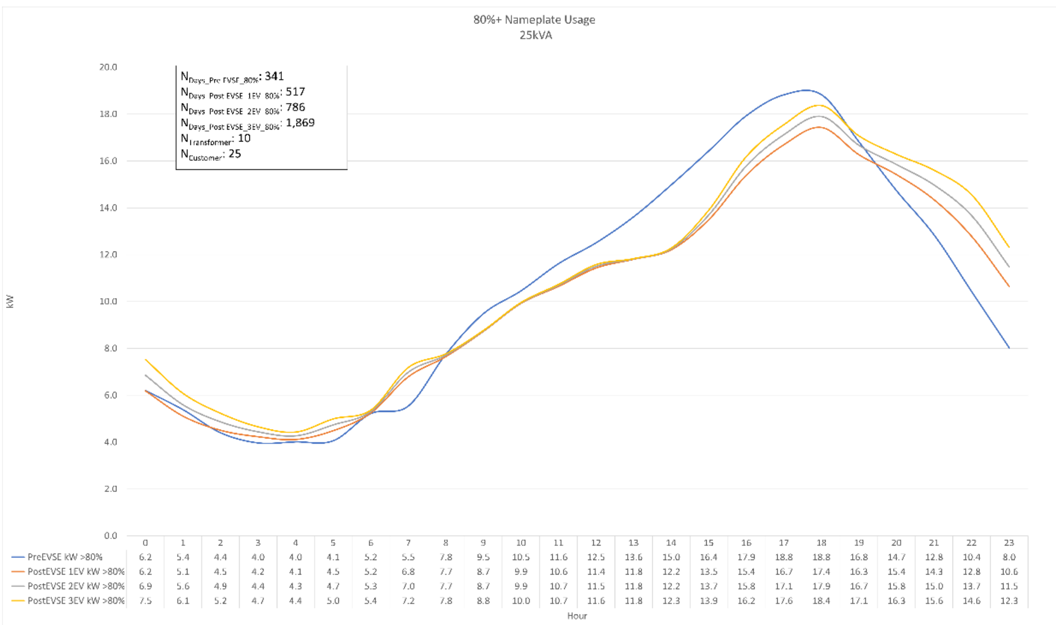


Figure E4: 25kVA Residential Transformer – 80% Nameplate loading

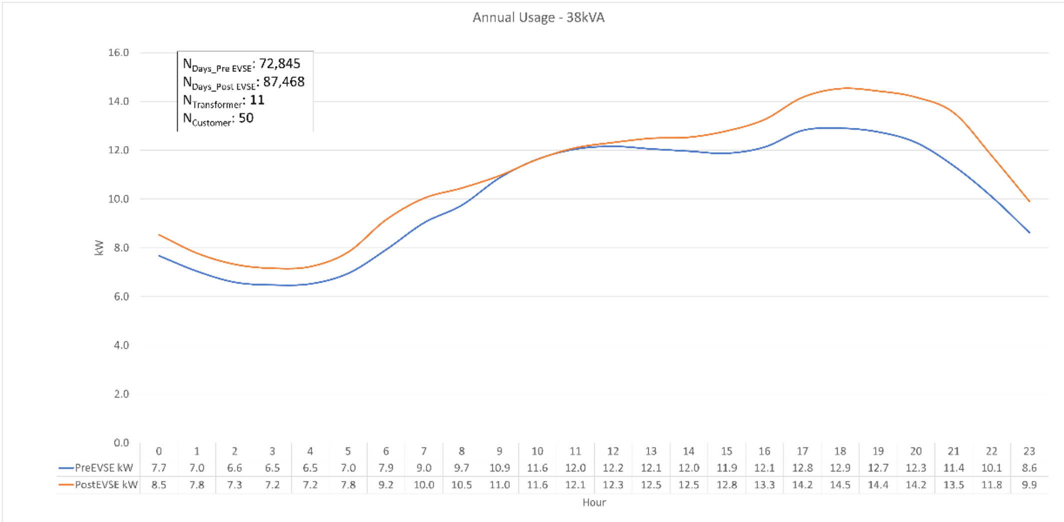


Figure E5: 38kVA Residential Transformer – Avg. Annual Load Pre and Post EVSE Charging

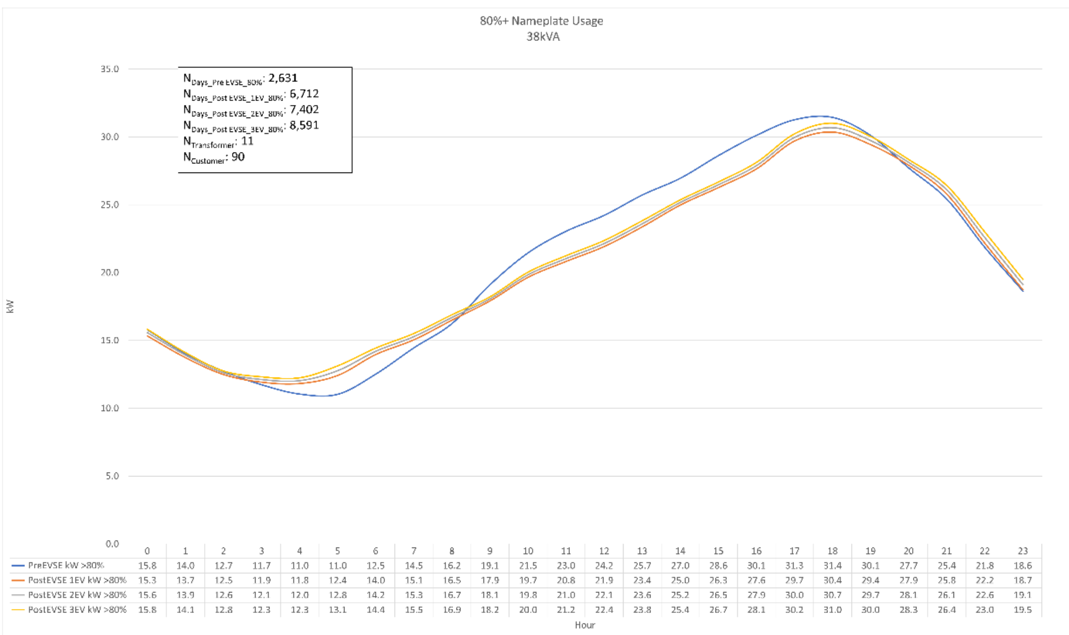


Figure E6: 38kVA Residential Transformer – 80% Nameplate loading

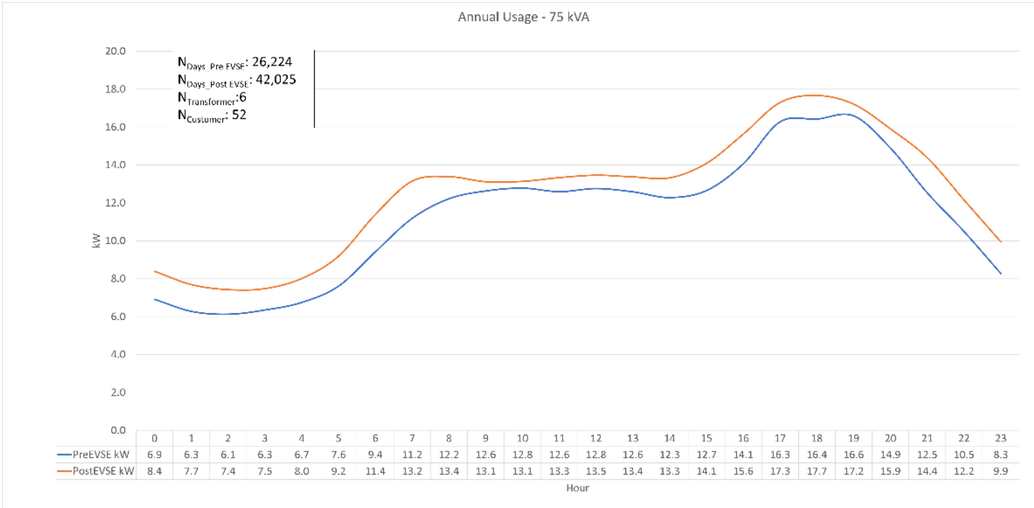


Figure E7: 75kVA Residential Transformer – Avg. Annual Load Pre and Post EVSE Charging

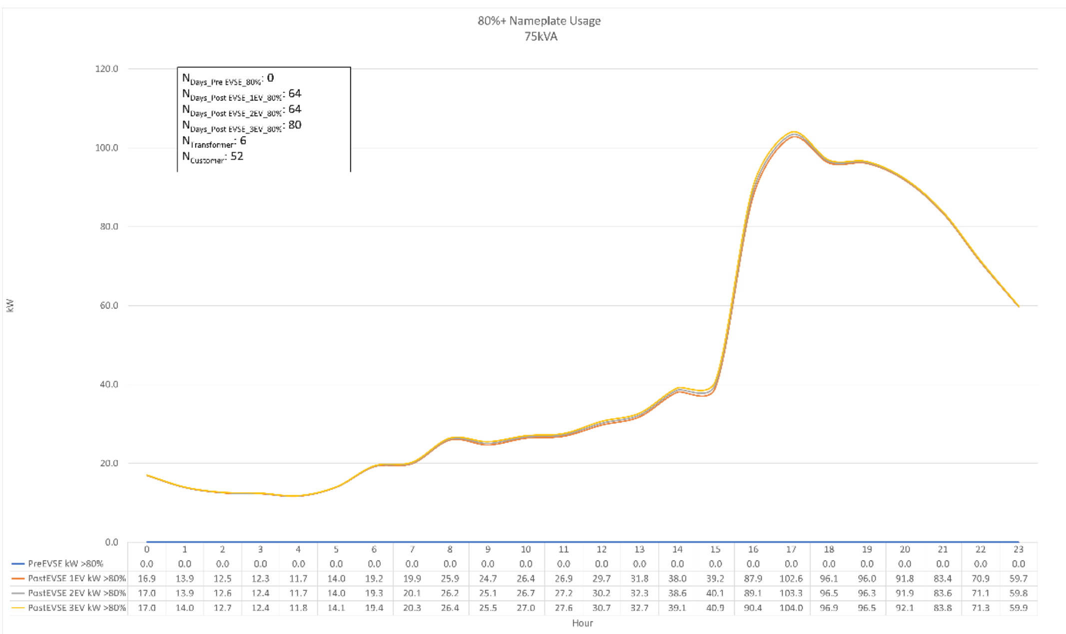


Figure E8: 75kVA Residential Transformer – 80% Nameplate loading

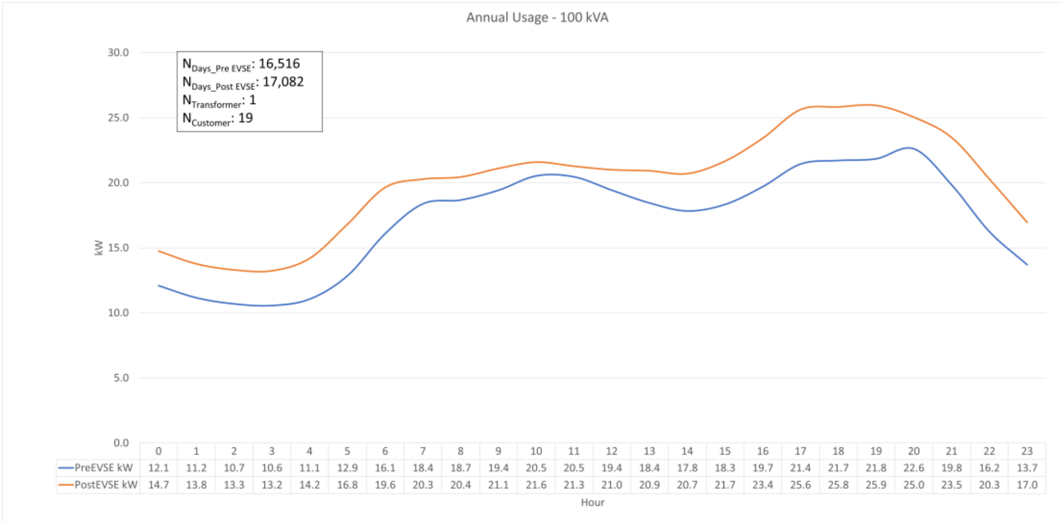


Figure E9: 100kVA Residential Transformer – Avg. Annual Load Pre and Post EVSE Charging