Avista Corp.
1411 East Mission   P.O. Box 3727
Spokane, Washington 99220-0500
Telephone 509-489-0500
Toll Free   800-727-9170

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November 1, 2018

Mark L. Johnson
Executive Director and Secretary
Washington Utilities & Transportation Commission
1300 S. Evergreen Park Drive S. W.
P.O. Box 47250
Olympia, Washington 98504-7250

Re: Docket No. UE-160082 – Avista Utilities Semi-Annual Report on Electric Vehicle Supply Equipment Pilot Program

Dear Mr. Johnson,

In compliance with Order 01 and Order 02 in Docket UE-160882, is Avista Corporation's, dba Avista Utilities (Avista or Company) "semi –annual report" on its Electric Vehicle Supply Equipment (EVSE) Pilot Program (program).

Per Commission Order, the semi-annual reports must include the following:

1. For DC Fast Charging stations, Avista shall report the locations and utilization of stations, review and revise the DC fast charging rate, and assess the amount of overall fixed and variable costs recovered through user payments.

2. For all other services offered under the EVSE Pilot Program, Avista shall report participation levels, expenditures, and revenues for each service offered for the duration of the program on a semi-annual basis. Avista will also provide informal quarterly updates to

Staff and other interested parties. A final report must be provided no later than December 31, 2019, with enough information to accurately evaluate the program's success.

This is a semi-annual report, with the next interim update scheduled for February 1, 2019.

Report Topics and Highlights:

1. Residential and Commercial AC Level 2 EVSE – participation levels, cost targets and customer needs continue to be met; residential WiFi networked EVSE communications greatly improved; significant cost savings demonstrated with non-networked EVSE ;
2. DC Fast Charger (DCFC) EVSE – six of seven targeted installations complete, final site acquisition in progress; very reliable performance; low but growing utilization; average total costs of $126,928 per DCFC complete site installation;
3. Customer Surveys – positive and constructive comments/insights from post-install and regular follow up surveys; 94% of residential customers satisfied or highly satisfied with their EVSE installation, compared to 90% for commercial customers; suggestions include requests for utility education and outreach to the public, more public EVSE, and minimized troubleshooting requests when losing EVSE connectivity;
4. Data Analysis – data set growing satisfactorily, uninfluenced load profiles for four driver categories well established; load profiles for various workplace, fleet and public EVSE locations demonstrate situational differences; workplace charging has the effect of 60% load reduction at home during evening peak hours; vehicle telematics data validates accuracy of networked EVSE data, also providing additional insights on vehicle efficiencies related to driving distance and ambient temperature;
5. Demand Response (Load Management) – recent success with residential demand response experiments and ongoing commercial demand response indicate the ability to shift 50% or more of electricity demand to off-peak; experiments expanding to a larger pool of participants;
6. Community Programs –implemented proposals for two separate agencies, providing an EV and EVSE utilized for the benefit of disadvantaged customers including transport to critical medical services, job skills training, shuttle services for overnight shelter, and food

deliveries; very successful results in terms of reduced transportation costs and higher volume of transportation services; wider stakeholder engagement, learning and development of future programs in progress

7. Revenues and Expenditures – program total revenues of $32,158 and expenditures of $2,730,942 to date, details provided in Attachment A.

Overall the program's operations, analytics, customer participation and feedback remain positive. As of October 23, 2018, the number of installations for the various EVSE categories are as follows:

Table 1

	3-Year Allowed Port Installations	# Ports Installed	# Ports Scheduled for Installation	# Ports Remaining
Residential SFH[1]	240	158	12	70
Workplace\Fleet\MUD[2]	175	90	6	79
Public	60	33	4	23
DC Fast Chargers (DCFC)	7	6	0	1

Other general statistics are shown in Table 2 below.

Table 2

Daily Avg. No. of Charge Sessions	89
Daily Avg. kWh Consumed	630
Sessions Charged to Date	39,192
kWh Consumed to Date	308,481
Lbs. of CO_2 Saved to Date	678,658
Gallons of Gasoline Saved to Date	39,153

Residential AC Level 2 EVSE

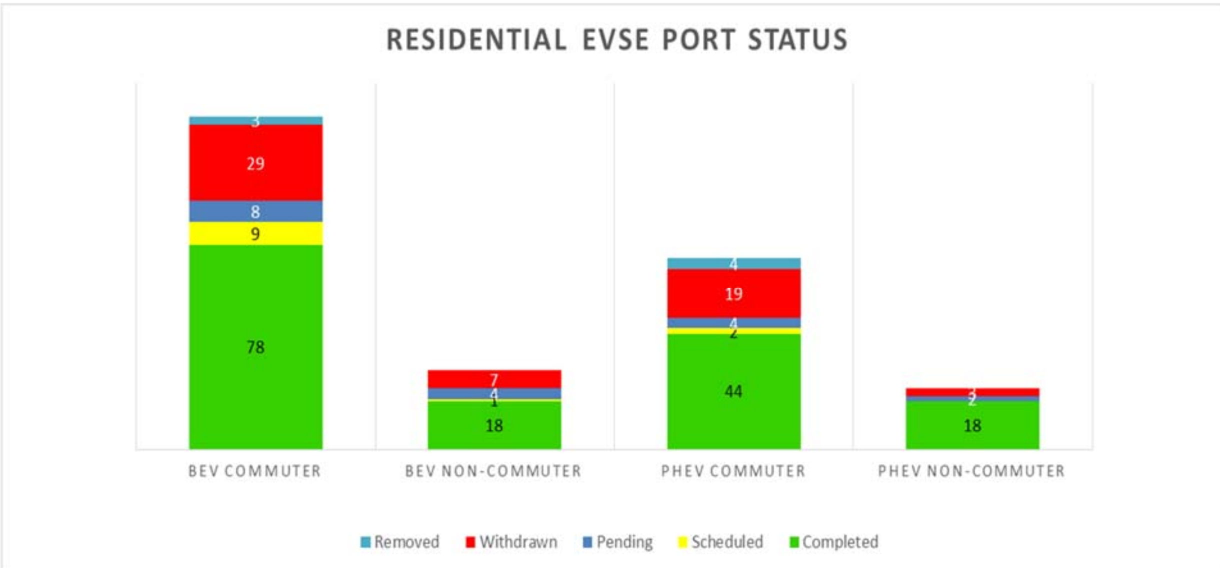
Residential EVSE installations continue to meet customer needs and cost expectations, with all EVSE reliably providing power for electric vehicle ("EV") charging on demand. Some communications reliability issues persist for older networked EVSE, which are in the queue for technician visits and equipment replacement under warranty. Software and hardware updates from

[1] Single Family Home
[2] Multi-Unit Dwelling

the EVSE manufacturer and on-site technician visits have resulted in greatly improved communications uptime and stability over the network. In addition to assisting with EVSE commissioning, Greenlots is providing lab testing verification services, network monitoring, issue notifications, and assisting with corrective action to any connectivity issues as the program's EVSE Network Service Provider (EVSP).

The Company discusses the nature of the program and details of the installation process with each customer before initiating installations. This is essential in streamlining the overall process and providing a positive customer experience. However, some withdrawals from the application and installation process still occur. This most often happens when the customer's installation costs are higher than initially anticipated, for example when a supply panel upgrade is required. EVSE removals are primarily the result of customers that move out of the area, in which case the EVSE is recovered and redeployed. To date, no customers have terminated participation in the program due to dissatisfaction. The following chart shows the status of residential applications and installations by categories of Battery Electric Vehicle (BEV) Commuter, BEV Non-Commuter, Plug-In Hybrid Electric Vehicle (PHEV) Commuter, and PHEV Non-Commuter.

Chart 1

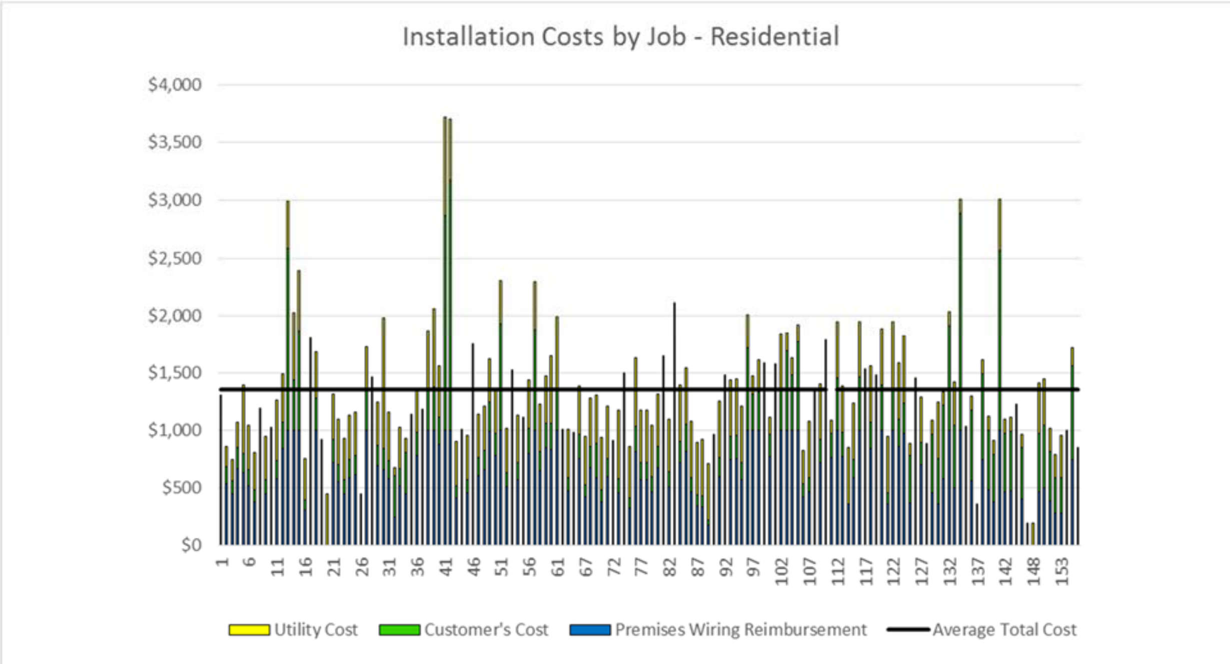


As the pilot progresses, larger data sets in each of these categories will enhance experience with new EVSE on the market as it may become available, improve system impact modeling, and continue to support EV adoption in Avista's service territory.

EVSE from two different manufacturers have been utilized to date for AC Level 2 residential installations, one networked and the other non-networked. Different models, hardware and firmware updates to the EVSE have demonstrated varying degrees of cost and communications reliability. This experience has reinforced the importance of utilizing open communications protocols such as the Open Charge Point Protocol (OCPP) industry standard, to avoid reliance on proprietary systems and encourage competition in the marketplace. It has also reinforced the need to conduct extensive verification testing. To date, the market has been slow to offer EVSE for residential applications that are cost-competitive and utilize open communications capable of demand response.

The chart below shows the residential installation cost components by job, ranging from a total of \$452 to \$3,721. Low costs correspond to installations where an adequate 240V AC circuit is already installed, with higher costs generally corresponding to a greater number of wall and floor penetrations, total circuit distance, and/or service upgrades.

Chart 2



Residential installation cost breakdowns continue to meet expectations as shown by the average costs in the tables below. These costs compare favorably with other pilot programs and studies as detailed in previous reports.

Table 3 – Networked Residential Installations (114 ports installed)

Premises Wiring Reimbursement	Customer's Cost	Utility Hardware & Installation Cost	Total Installation Cost	EVSE Cost	Total Costs Installation + EVSE
$659	$437	$266	$1,362	$1,061	$2,423

Table 4 – Non-networked Residential Installations (41 ports installed)

Premises Wiring Reimbursement	Customer's Cost	Utility Hardware & Installation Cost	Total Installation Cost	EVSE Cost	Total Costs Installation + EVSE
$603	$205	$491	$1,299	$551	$1,814

Networked EVSE in residential locations have the potential to provide net system benefits with remote demand response capability. However, they also require greater upfront and ongoing operations and maintenance costs, as well as customer inconvenience, compared to non-networked EVSE. The Company intends to continue modeling costs and benefits for both types of EVSE as more operational data is gathered, as well as exploring innovative ways to improve products and services for customers that maximize net system benefits.

One in six residential installations (17%) require a service panel upgrade, which substantially increases installation costs by as much as 200%.

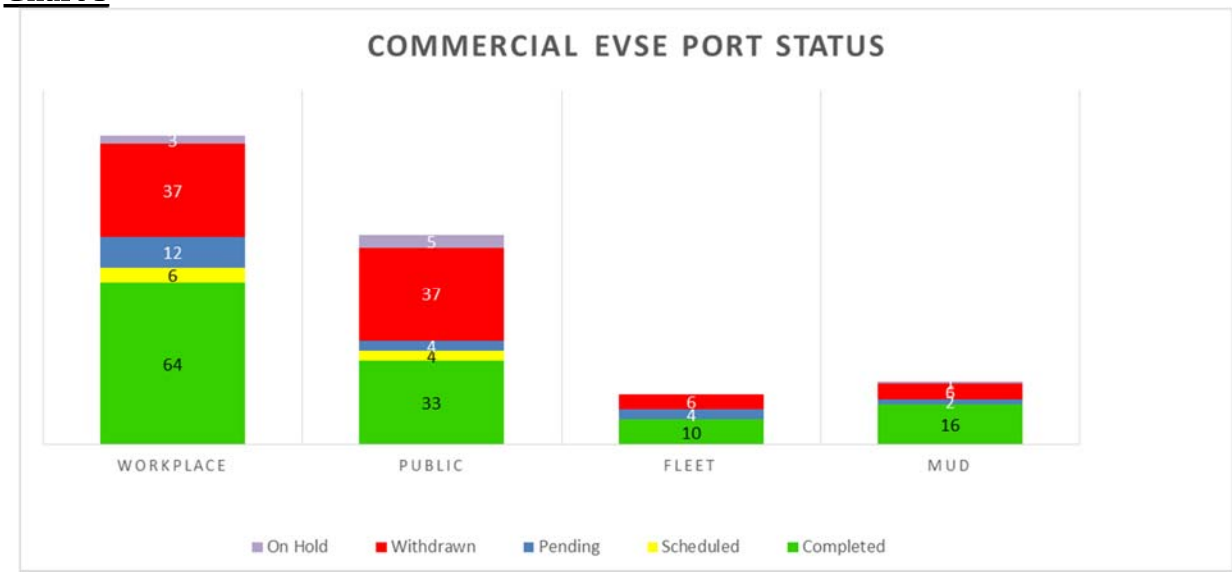
Length of conduit, the need for a subpanel, and the number of wall and floor penetrations also cause increased costs, however less substantially than the need for a service panel upgrade. Outdoor earth trenching occurs occasionally and adds costs, but concrete trench work is rare for residential installations. To date, no transformers or secondary wire from the transformer to the residential customer have required replacement as a result of an EVSE installation.

Commercial AC Level 2 Charging EVSE

EVSE from five different manufacturers have been utilized to date for commercial AC Level 2 installations. These EVSE have demonstrated varying degrees of cost, reliability, and user satisfaction over time. Similar to residential EVSE installations, this experience has reinforced the importance of utilizing open communications protocols such as the OCPP 1.6 industry standard, to avoid reliance on proprietary systems and encourage competition in the marketplace.

The following chart shows the status of commercial applications and installations by category.

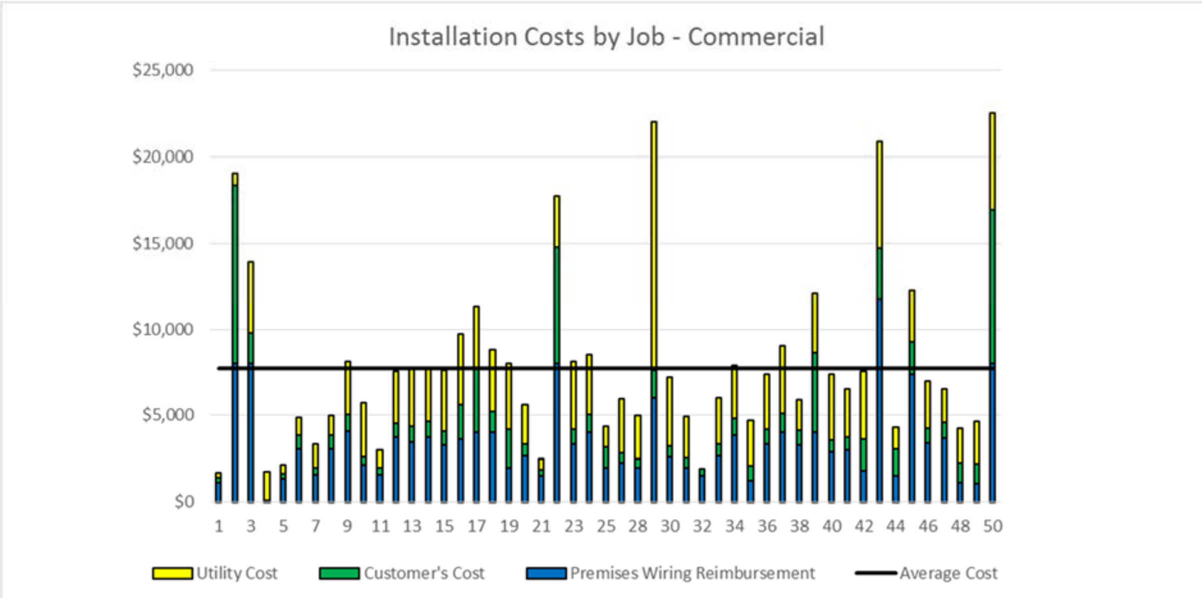
Chart 3



Typically, significant outreach and consulting work is required to inform and assist commercial customers to install an AC Level 2 EVSE on their property, particularly for more public locations. Some of the concerns include the perceived projected cost of electricity, liability risks, and potentially adverse impacts on parking areas with limited capacity. Efforts will continue to be made in terms of outreach and providing helpful information to customers, in order to make informed decisions that mutually benefit the customer and the program.

Costs for commercial installations continue to meet expectations, with an understanding that larger variations in cost are expected depending on site conditions, compared to residential installations. A greater number of withdrawals occur for commercial installations compared to residential, for a variety of reasons. This includes a larger customer cost share for premises wiring, as well as other common concerns previously mentioned. The cost components of commercial installations documented to date are shown below. The majority of these EVSE locations are used as workplace charging for employees.

Chart 4



Lower costs correspond to simpler installations avoiding service upgrades and trench work, lower cost EVSE, and/or a smaller number of port connections. Conversely, higher costs are associated with multiple installed EVSE ports, required upgrades to transformers, supply panels, and/or trench work, especially concrete and asphalt trenching. Average cost breakdowns for commercial EVSE sites are listed in the table below. These costs compare favorably with other pilot programs and studies as detailed in previous reports. Note that similar to residential installations, networked EVSE in commercial locations add substantially to upfront costs compared to non-networked EVSE. Ongoing maintenance and operations costs are also higher for networked EVSE, which will be analyzed and reported as more operational data is gathered.

Table 5 – Networked Installation Costs (49 job sites, 110 ports installed)

Premises Wiring Reimburse-ment	Customer Cost	Utility Hardware & Install Cost	Total Install Cost	EVSE Cost	Total Cost EVSE + Installation	Avg. # Ports	Total Cost per Port
$3,516	$1,616	$2,904	$8,036	$5,238	$13,273	2.2	$5,913

Table 6 – Non-networked Installation Costs (9 job sites, 16 ports installed)

Premises Wiring Reimburse-ment	Customer Cost	Utility Hardware & Install Cost	Total Install Cost	EVSE Cost	Total Cost EVSE + Installation	Avg. # Ports	Total Cost per Port
$1,679	$1,428	$2,756	$5,864	$1,943	$7,807	1.8	$4,391

Wall mounted EVSE typically require no trench work and reduce the length of both above-ground and underground conduit, while pedestal mounted EVSE typically require trench work and relatively longer conduit lengths.

In order to minimize costs, where practical, the Company will continue to encourage wall mounted EVSE to minimize trenching and conduit lengths by locating the EVSE as close as possible to the nearest power source. Other factors such as desired location, accessibility, communication signal strength, and safety concerns also are of high importance when consulting with commercial customers on EVSE siting and configuration determinations.

DC Fast Charger (DCFC) EVSE

Standardized DCFC site design has an operational 50kW DCFC with both CCS and CHAdeMO connectors, and a dual-port AC Level 2 EVSE as a backup. The installations include adequate property easements and/or site agreements for future expansion, with transformer capacity and conduit installed to allow for low-cost expansion of an additional 150kW DCFC, and where practicable downstream units supplied by the 150kW DCFC.

The first DCFC station in Rosalia, Washington was commissioned for public use on January 18, 2017. Another five DCFC stations have been installed since that time, utilizing EVSE from two different manufacturers. Site acquisition is in process for the final site in the Spokane University-District.

Remote monitoring and customer feedback have consistently demonstrated very satisfactory status and availability of all DCFC in the network. Total labor, material and overhead costs have averaged $126,928 for the six DCFC sites, installed to date. Average costs have decreased since the last report due to a number of sites requiring less trenching, concrete work and utility upgrades. More information on the DCFC sites as well as public AC Level 2 is posted online at www.plugshare.com, including customer feedback. Overall, utilization is low but continues to grow over time. Charging session characteristics are as indicated in the table below:

Table 7

No. of Charging Sessions	386
Avg. Charging Time	28.2 minutes
Avg. Power Delivery	30.3 kW
Avg. Consumption	13.8 kWh

The following table shows the number of charging sessions by month for each of the DCFC stations commissioned. Kendall Yards, Liberty Lake and Wandermere sites have relatively higher utilization rates, most likely due to their location in urban areas of Spokane along major travel corridors.

Table 8

Month	Rosalia	Kendall Yards	Pullman	Liberty Lake	Wander-mere	West Plains
Commissioned	01/18/2017	09/14/2017	12/15/2017	01/12/2018	9/14/2018	09/18/2018
Jan-Dec 2017	63	36	0	-	-	-
Jan-18	2	5	1	0	-	-
Feb-18	5	7	3	3	-	-
Mar-18	6	11	10	10	-	-
Apr-18	2	4	8	3	-	-
May-18	4	9	4	1	-	-
Jun-18	2	10	5	2	-	-
Jul-18	7	14	4	24	-	-
Aug-18	2	20	2	19	-	-
Sep-18	7	25	14	20	8	4
Total	**100**	**141**	**51**	**82**	**8**	**4**

In its proposal to extend the pilot program, the Company requested to change the rate structure for its DCFC stations from a time based rate ($0.30 per minute), to an energy based rate ($0.35 per kWh). Details about why the Company proposed this change and analysis on the rate of $0.35 per kWh can be found in the Company's filing made on December 14, 2017, in Docket UE-160082. As more data is gathered, the Company will assess projections for the amount of overall fixed and variable costs recovered through DCFC user payments.

Customer Surveys

Web based customer surveys are carried out post-installation and semi-annually thereafter for both residential and commercial customers. These surveys began on July 21, 2016 and will continue through the course of the pilot program. Given the number of responses to date, the margin of error at the 95% statistical confidence level is 6% for residential customers, and 29% for commercial customers. Completion rates as of October 15, 2018 are as follows:

Table 9

Customer	Post-installation	Semi-Annual
Residential	58% (92 of 158)	56% (252 of 454)
Commercial	19% (10 of 53)	30% (30 of 99)

Customer satisfaction remains high, with 94% of residential respondents and 90% of commercial respondents indicating they were satisfied or very satisfied with the program. A very high satisfaction rate of 98% was reported for their EV. Suggestions for program improvement centered on minimizing the frequency of troubleshooting requests when network connectivity issues arise. Additional comments included the need for more public and workplace charging, as well as informing and educating the public about EVs and EVSE locations. When contacted by phone, 11 of 21 commercial customers indicated they would be interested in installing more stations at the same or different facility locations. Multiple respondents also indicated that they would like to see more charging locations in the Spokane Valley and DC fast chargers in the downtown Spokane area.

Chart 5

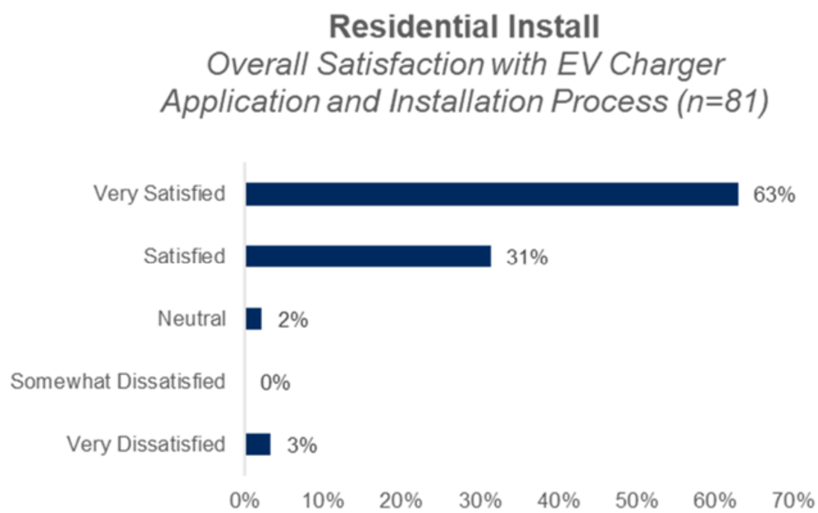


Chart 6

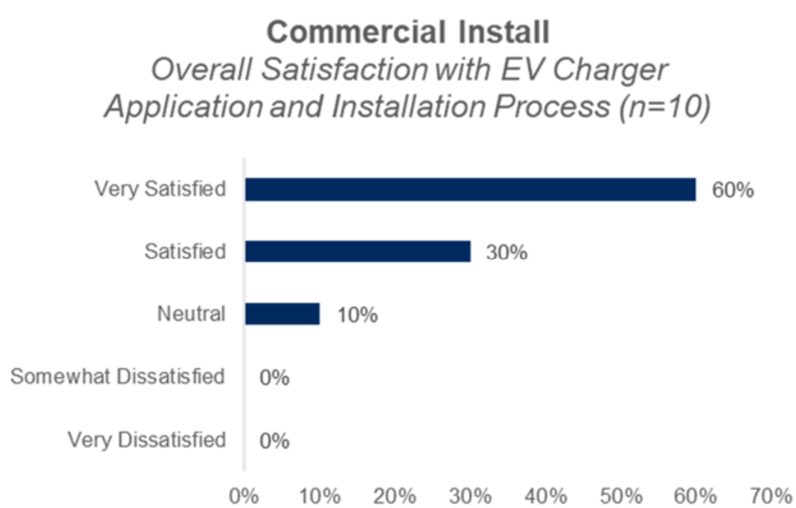


Chart 7

The Nissan Leaf continues to be the most represented vehicle in the program at 33% of the total. Larger battery vehicles like the Chevy Bolt and Tesla EVs are increasing their share of the total, currently at 19% combined. A majority of participants in the program operate EVs introduced after program launch in June, 2016.

Chart 8

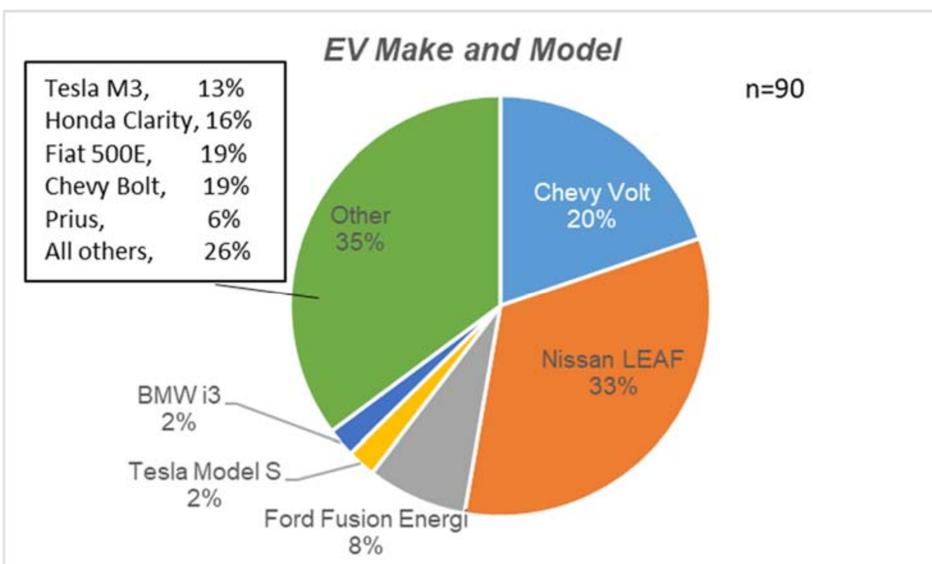
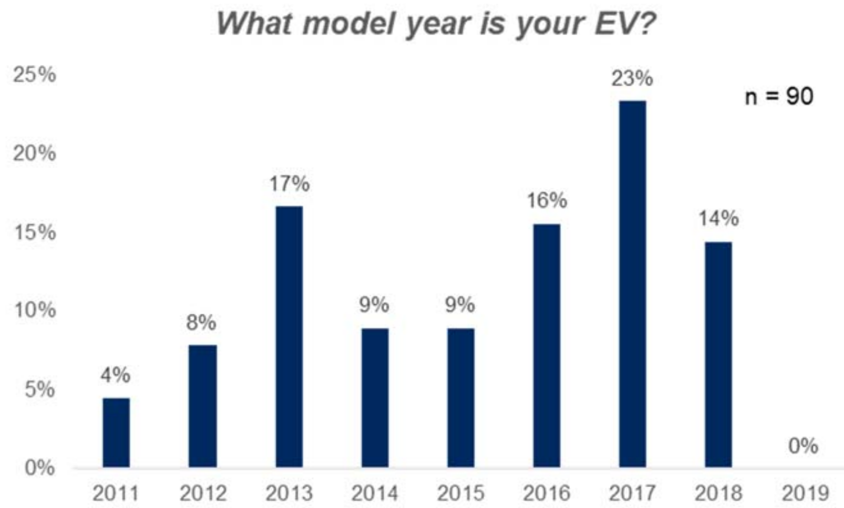
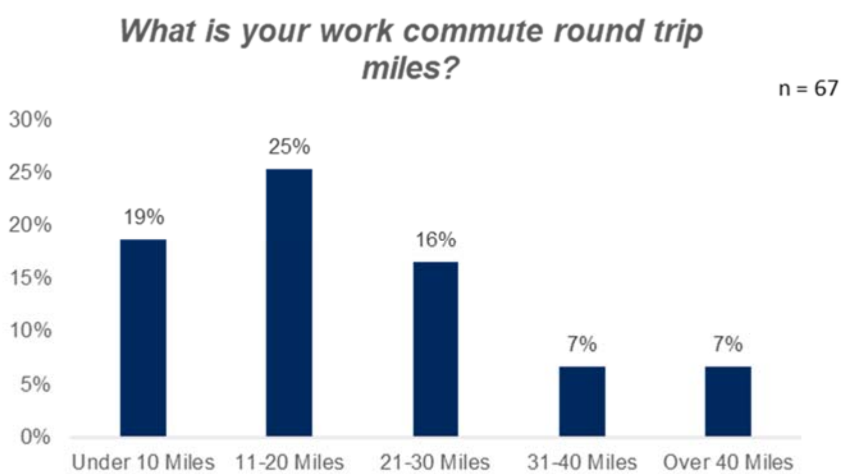


Chart 9



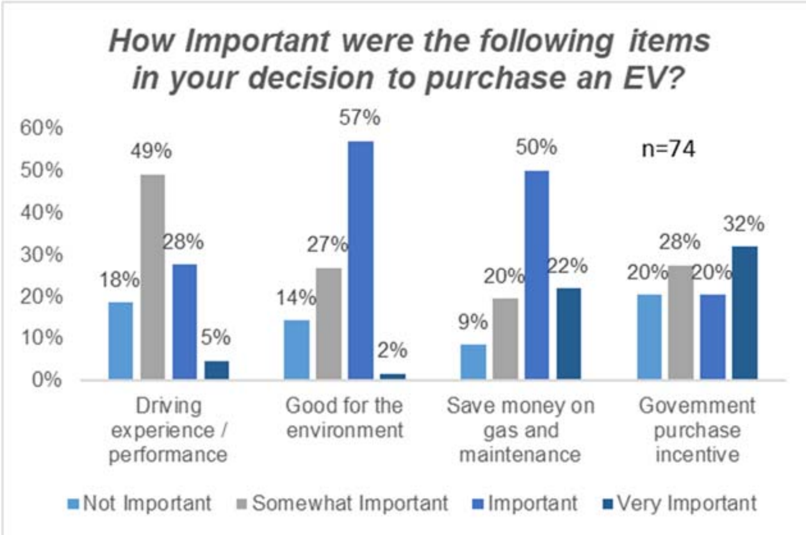
When drivers were surveyed about their commuting habits, 60% said their round trip commute was under 30 miles, while 26% had no commute. Of the 74% commuting, 72% of those said they had no workplace charging.

Chart 10



Important factors in the decision to purchase an EV are shown in the chart below. Notably, 72% of respondents stated that "saving money on gas and maintenance" was very important or important, compared to 59% that stated the same for "good for the environment."

Chart 11



Customers indicate a moderate to high level of importance for both AC Level 2 and DCFC public charging availability, and simultaneously a low level of satisfaction for both types of charging availability as shown in the four charts below. This indicates that a need for more public AC Level 2 and DC fast charging persists.

Chart 12

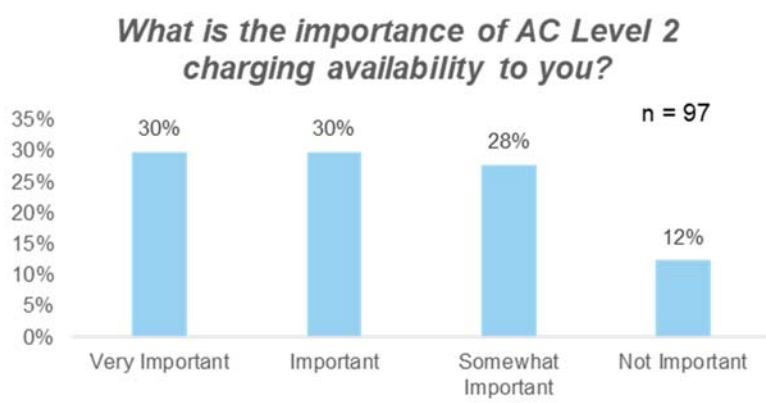


Chart 13

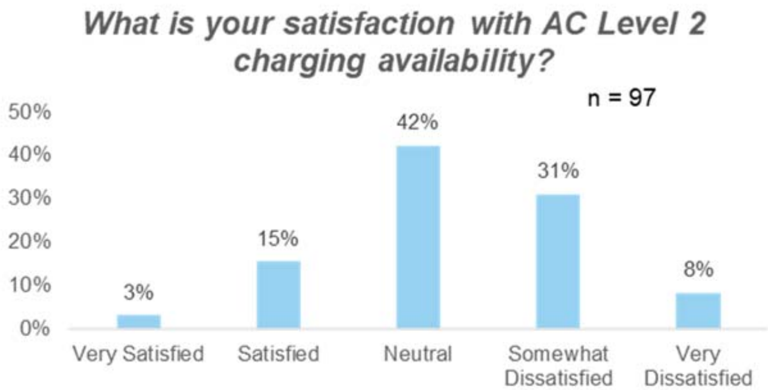


Chart 14

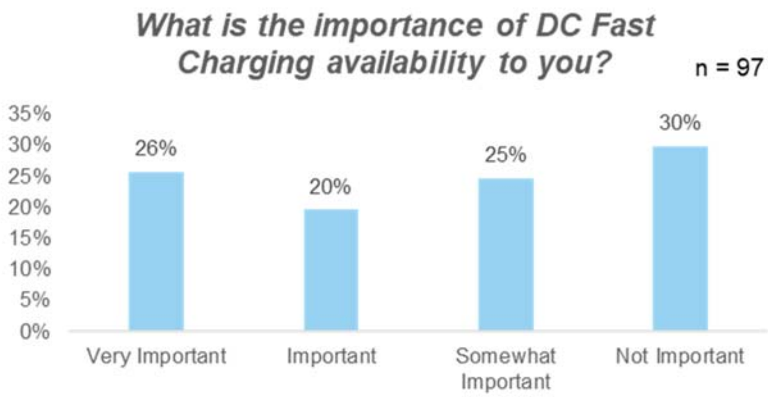
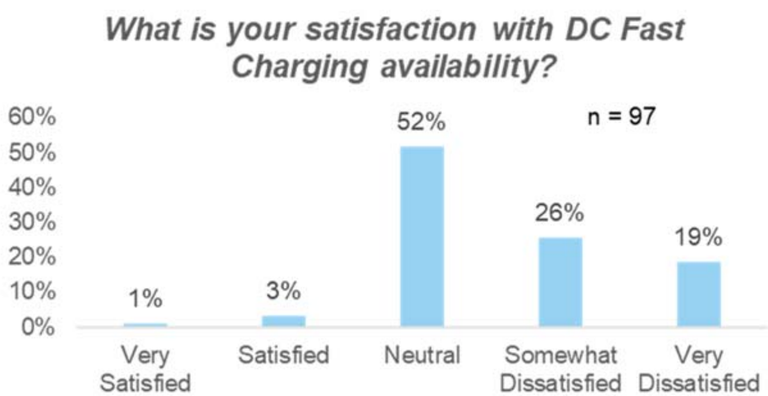


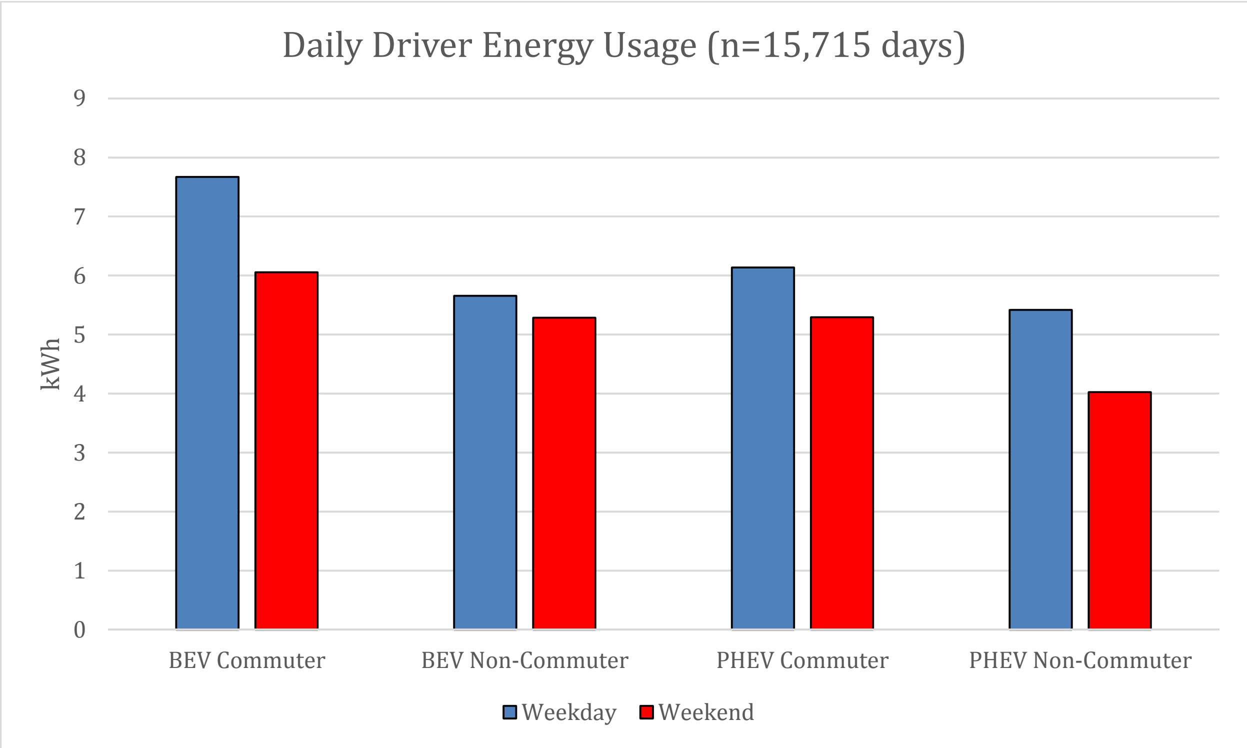
Chart 15



Data Analysis

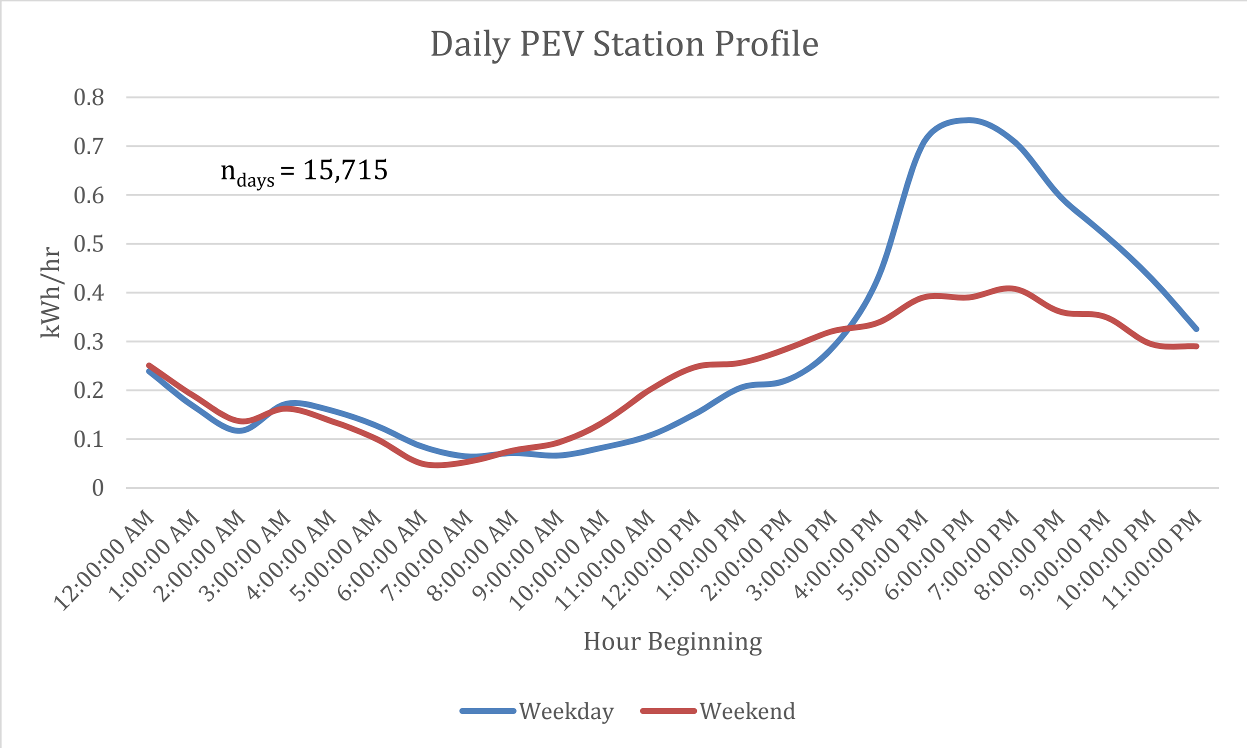
Average weekday energy demand is highest for BEV commuters at over 7.7 kWh, followed by PHEV commuters and BEV non-commuters at 6.1 kWh and 5.7 kWh, respectively. PHEV non-commuters have a slightly lower average weekday demand at 5.4 kWh. Daily energy demand in all categories is lower on the weekend compared to the weekdays as seen in the chart below.

Chart 16



Average residential PEV station load shape remained similar to results of previous analyses with a peak demand of 0.75 kW occurring at 6 pm on weekdays. Weekends continued to have a flatter load profile with a smaller afternoon peak. Daily energy usage was 6.8 and 5.5 kWh on weekdays and weekends respectively.

Chart 17



As in previous updates, BEV commuters have the highest peak weekday demand of 0.96 kW, occurring at 6 pm. With BEV commuters, weekend demand is lower and steadily increases throughout the day, peaking at 0.42 kW at 6 pm. Other profiles have lower weekend peaks and flatter afternoon demand. Notably, PHEV non-commuters have sharp increases in both weekday and weekend power demand occurring earlier in the afternoon than other groups. PHEV commuter weekday power demand is also the lowest peak demand of the different driver types, at 0.41 kW. Within each category, the weekday and weekend load profiles tend to be similar during off-peak hours, and then diverge during peak times in the afternoons and evenings. Note that these load profiles are aggregated over many dispersed, individual charging sessions. Each individual charging session typically draws power at 3.3 or 6.6 kW for the bulk of EVs currently used by customers, mostly dependent on the rectifier capacity in each vehicle. BEVs generally have higher capacity rectifiers compared to PHEVs, which mostly explains the higher peaks of BEVs.

The profiles below are useful for system-wide capacity planning for electric vehicle loads, especially when demonstrating the potential for peak shaving in the afternoon and evening using EVSE-controlled demand response technology.

Chart 18

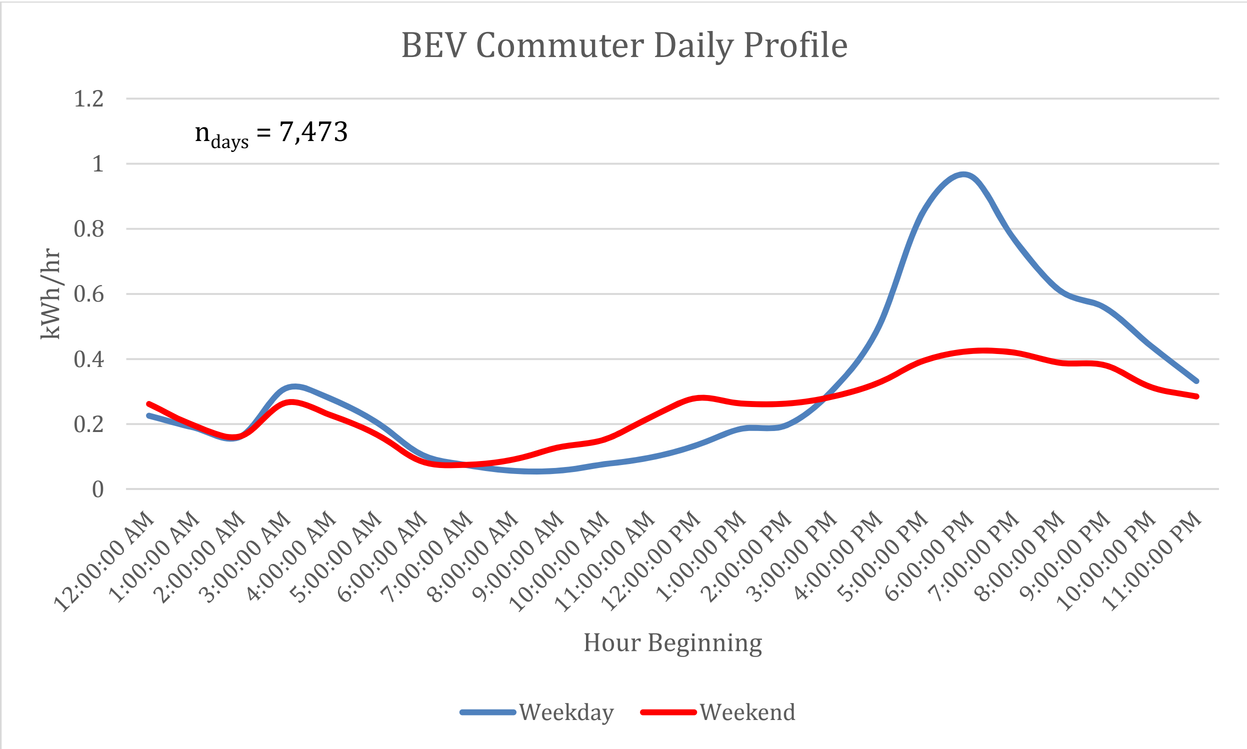


Chart 19

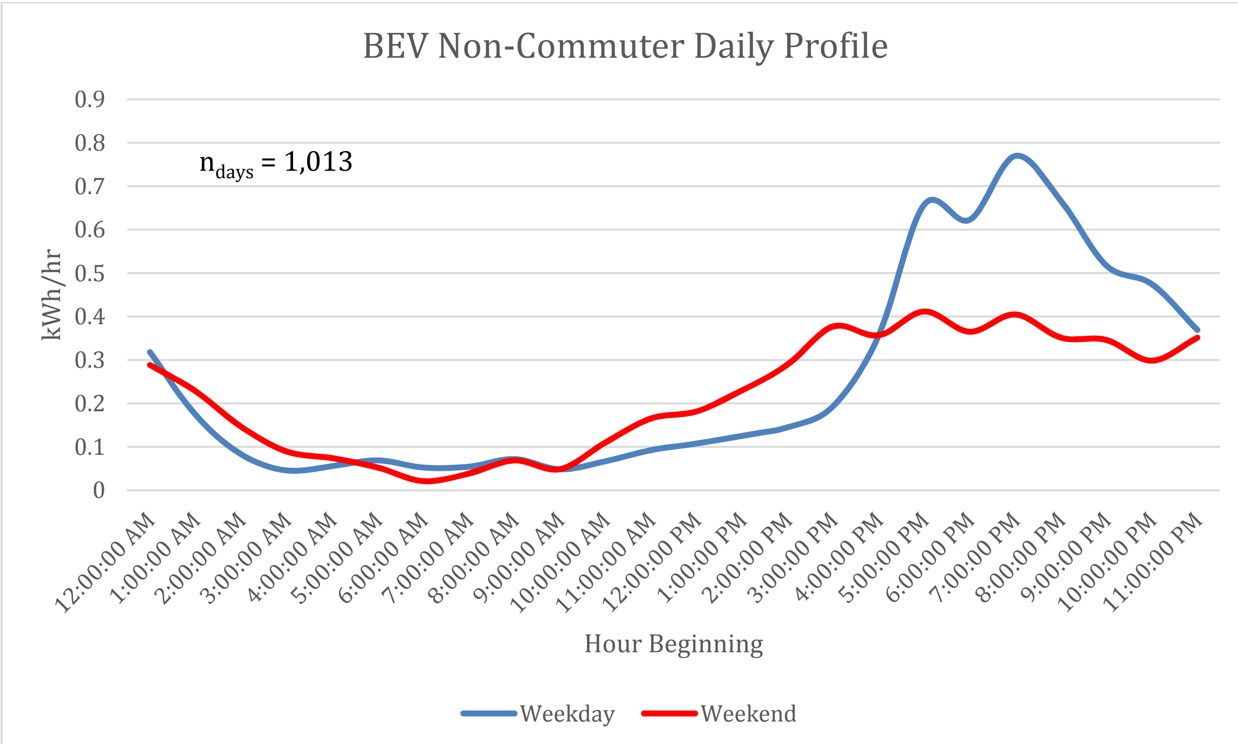


Chart 20

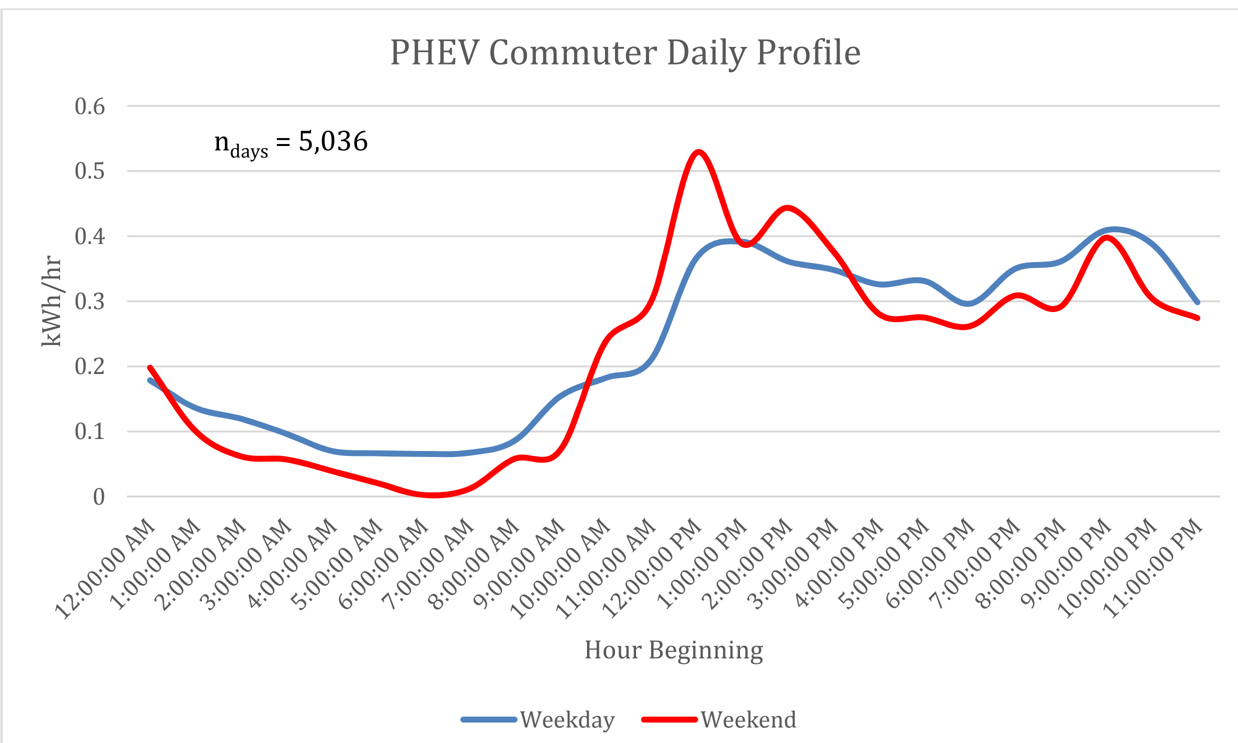
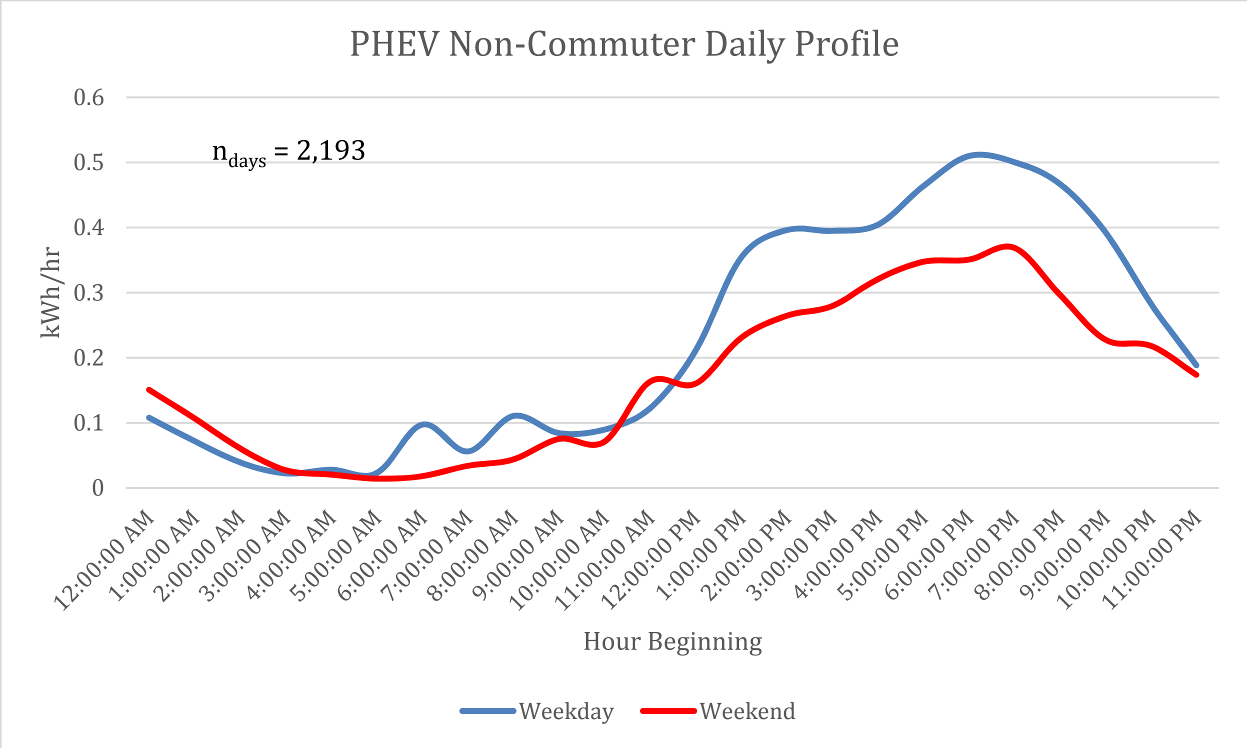


Chart 21

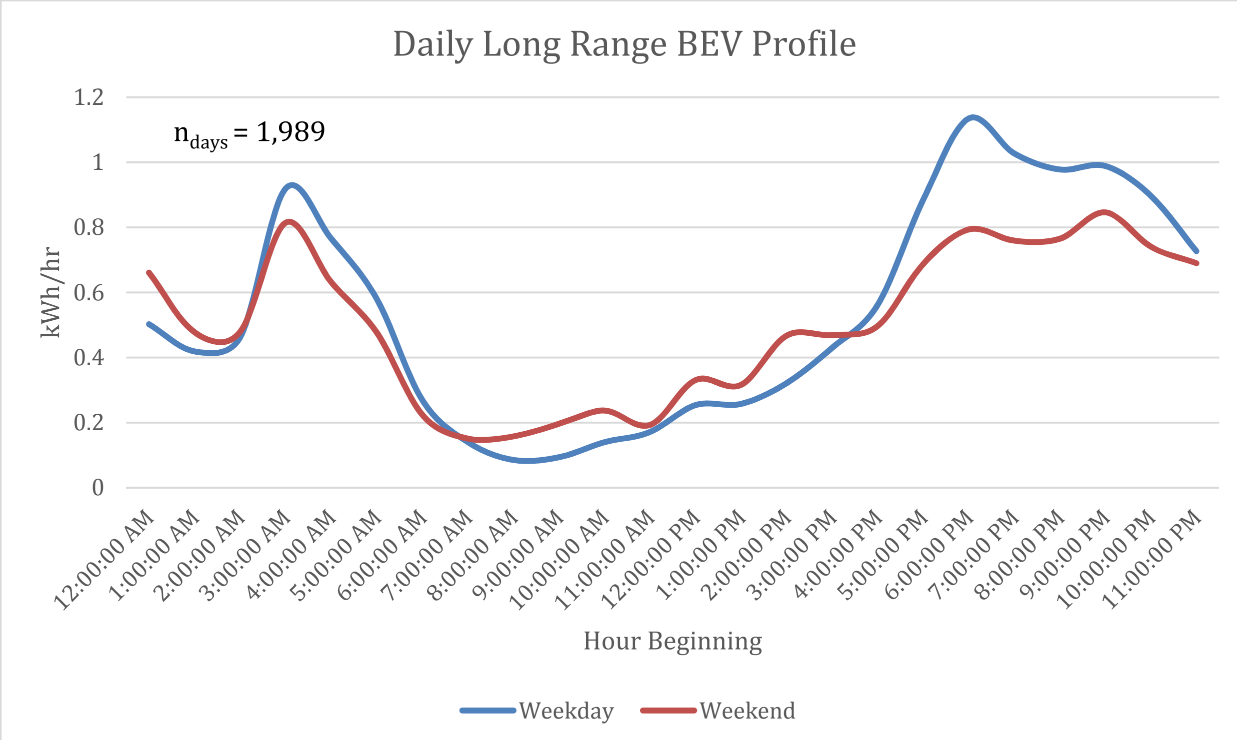


Long range BEVs (LRBEV) include vehicles with battery capacities greater than 60 kWh, enabling driving range greater than 200 miles between charging sessions. To date, 28 residential customers with these vehicles are enrolled in the program, 15 of which have networked EVSEs providing charging data. Residential LRBEV continued to demonstrate significantly greater energy consumption on average than the typical residential PEV station in the program. Average weekday and weekend energy usage was 13.0 and 12.1 kWh – an increase in energy usage of 92% and 120% over typical residential PEV energy usage for weekdays and weekends, respectively. Additionally, the peak residential energy demand of 1.1 kW was 51% greater than the average PEV peak of 0.75 kW. This is all occurring for EVSE in the program with a maximum output of 6.6kW at home. It is possible that peak loads per vehicle may increase as more advanced technology and cost reductions for LRBEVs are realized in the industry and become more widely adopted. For example, Tesla EVs come equipped with a standard 10kW rectifier and an optional 20kW rectifier, compared to 3.3kW and 6.6kW more common with the other EV types. However, this is somewhat mitigated by the higher costs of installing large capacity circuits in most customer homes (often requiring a supply panel upgrade), and the fact that most individuals drive less than 40 miles per day such that 6.6kW charging at home meets the needs of the bulk of electric vehicle customers into the foreseeable future.

An early morning peak of 0.92 kW was caused by a small number of customers that always set their vehicle start charge times to between 2 and 3 am, visibly effecting the average load profile in the small dataset of 15 customers. This demonstrates the effect a Time of Use ("TOU") rate could play by creating a new demand spike when a large number of customers initiate charging at the same time. By utilizing demand response events, dynamic load management may provide for a greater level of control over the time period and magnitude of EV charging, resulting in desired load shapes that maximize system benefits while still providing high customer satisfaction.

Avista continues to see a growing number of LRBEVs among its customer base. This is driven by a larger number of relatively affordable LRBEVs coming to market such as the Chevy Bolt and more recently the Tesla Model 3. With increased range, drivers have increased confidence to extend their routes beyond what's practical for EVs with smaller battery packs, and consequently consume more electricity. The higher energy demands of these vehicles present opportunities to install workplace charging to flatten out the LRBEV profiles throughout the day, develop key public charging infrastructure, and use effective demand response to curtail load at peak demand times in areas of clustering.

Chart 22



<u>Public Station Profiles</u>

Public charging makes up a smaller but critical component of EV charging that provides a convenient place to refuel, as well as public visibility. The following charts are profiles of different public charging locations within the program that are broadly broken down into urban, suburban and rural designations.

Peaks in power demand generally coincide with peak traffic to these locations. For example in the chart below at the suburban grocery location, power demand sharply peaks to 0.72 kW at 3 pm and tapers down through 7 pm. These profiles are good examples of validating expected assumptions about public charging at specific locations. As EV adoption increases, incorporating documented charging demand profiles into upstream distribution infrastructure planning can help ensure a reliable and effective system while minimizing infrastructure upgrades. Additionally this data can be used to produce appropriate fee structures as demand for public stations increases in high traffic locations.

Chart 23

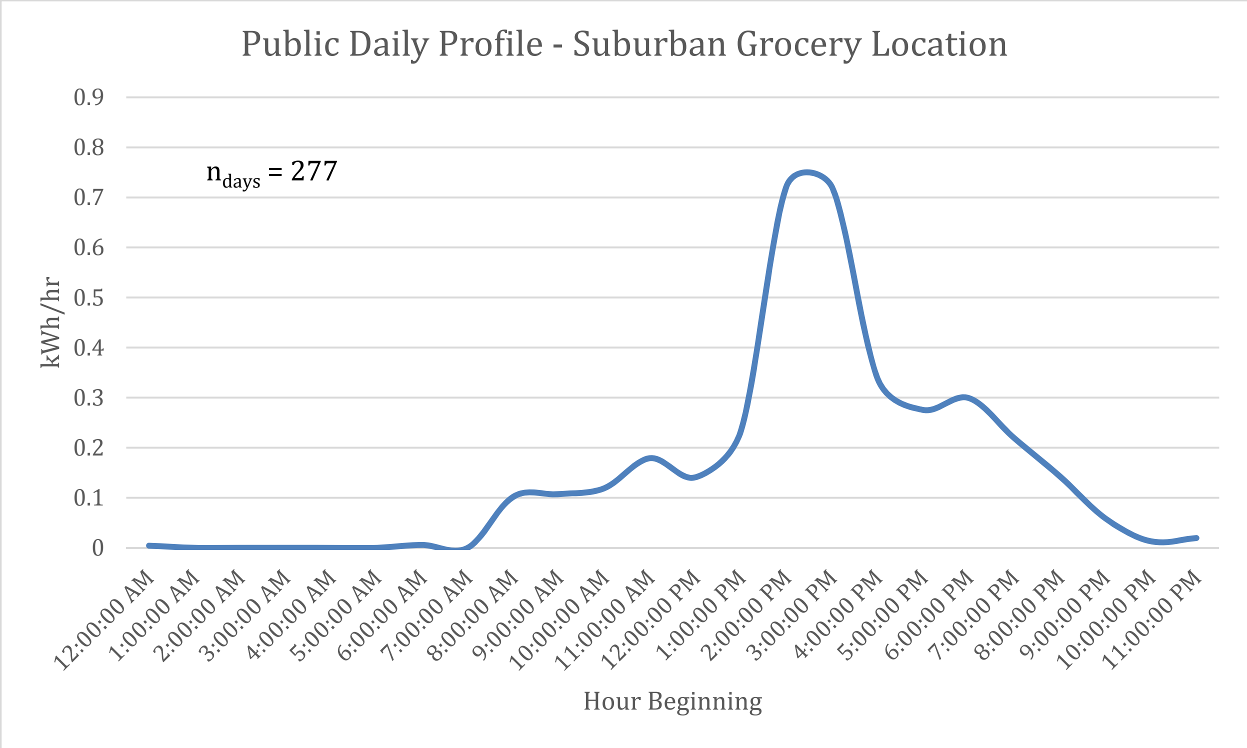


Chart 24

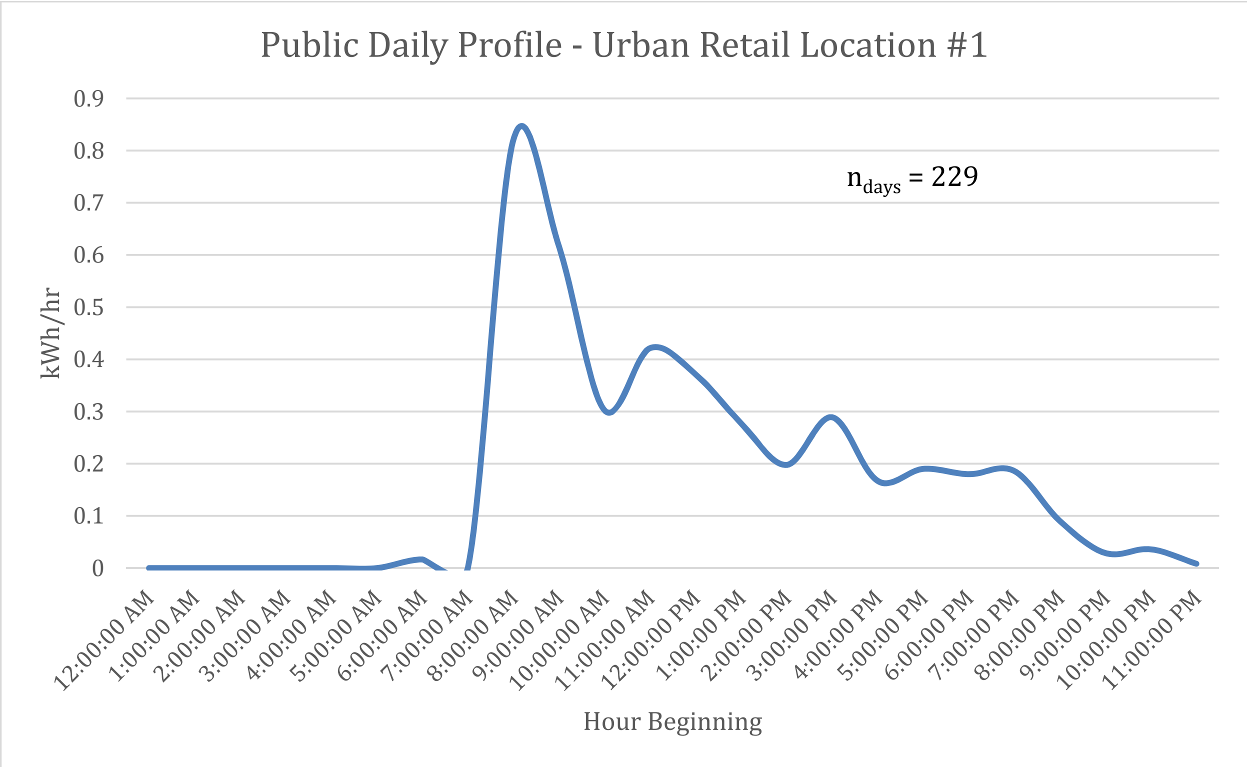


Chart 25

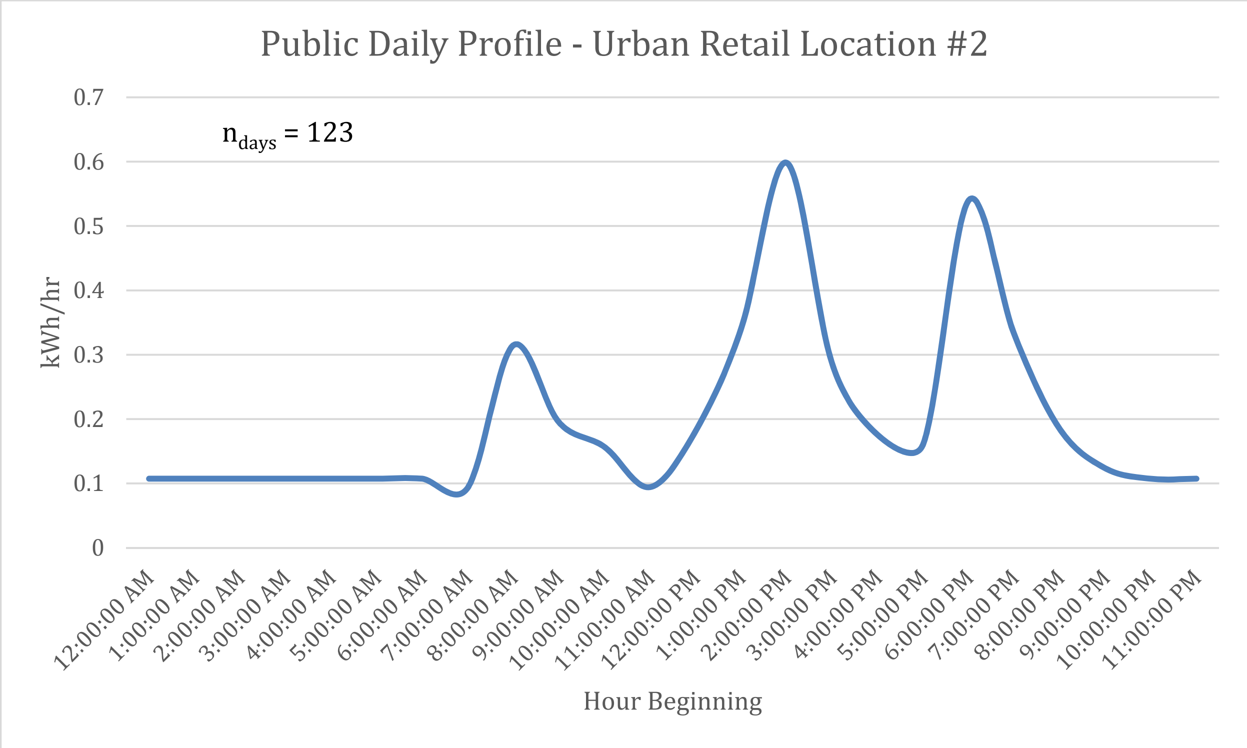


Chart 26

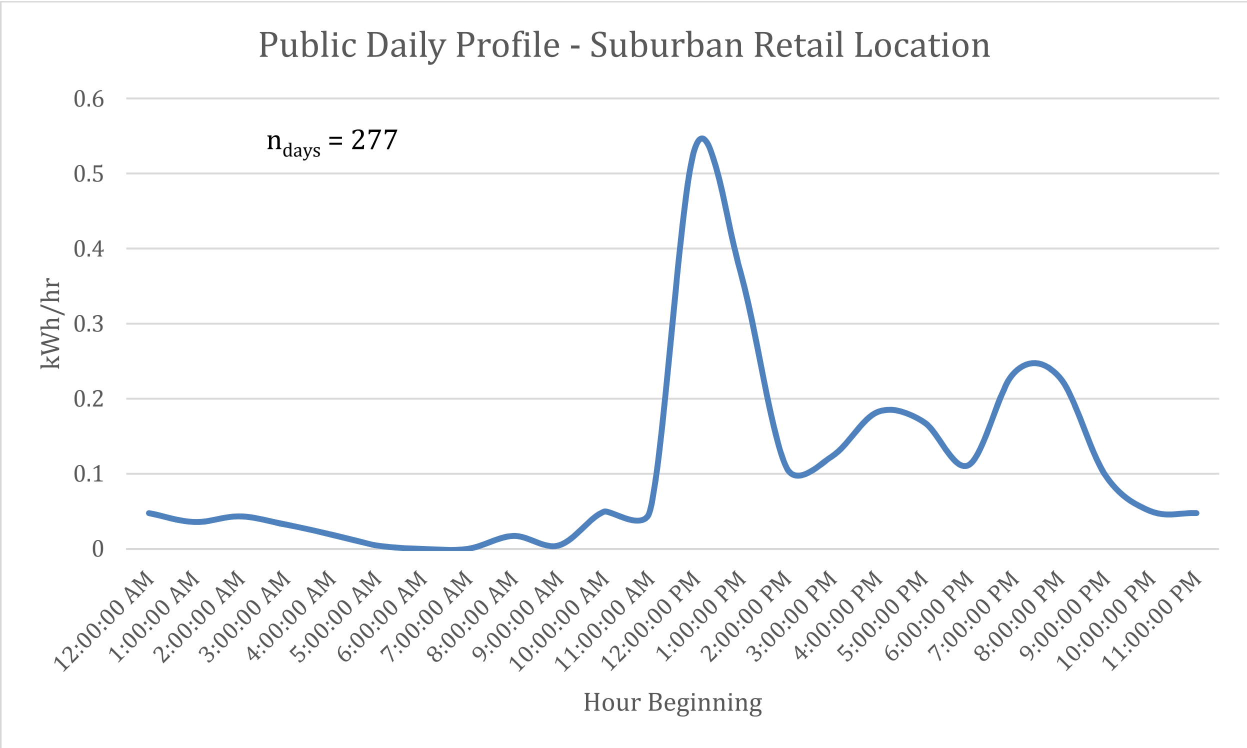


Chart 27

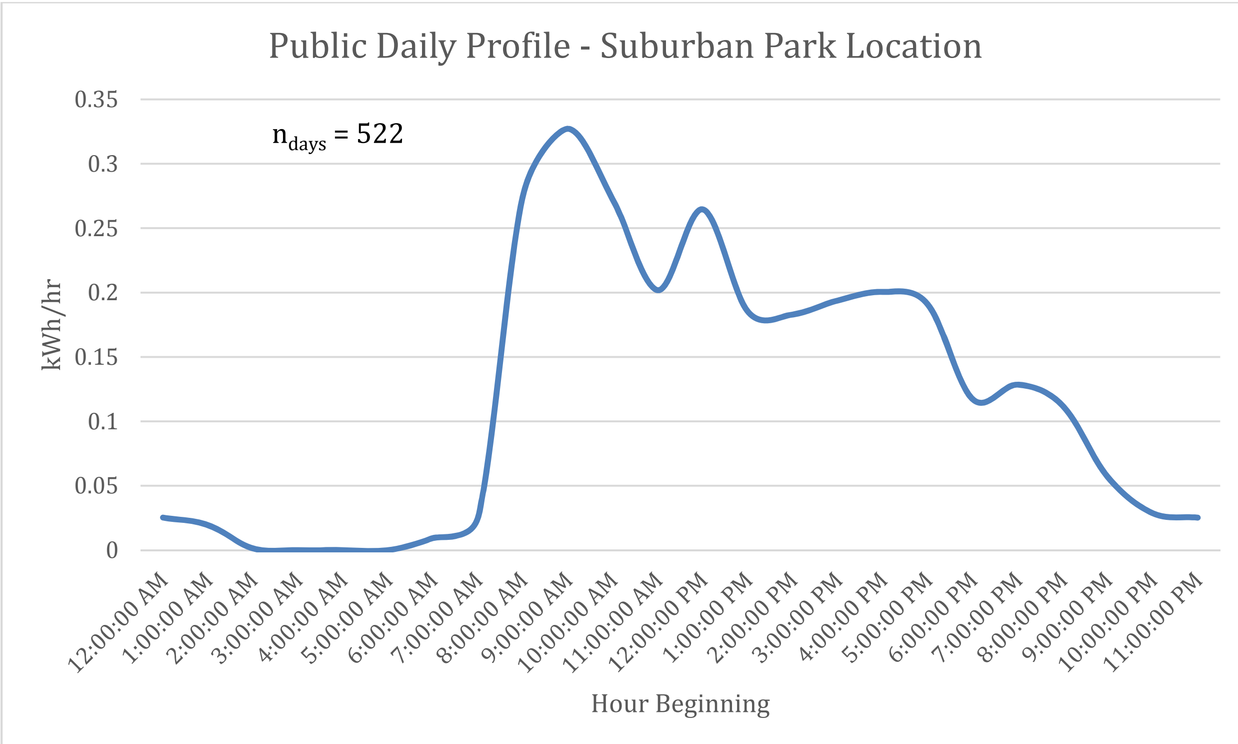


Chart 28

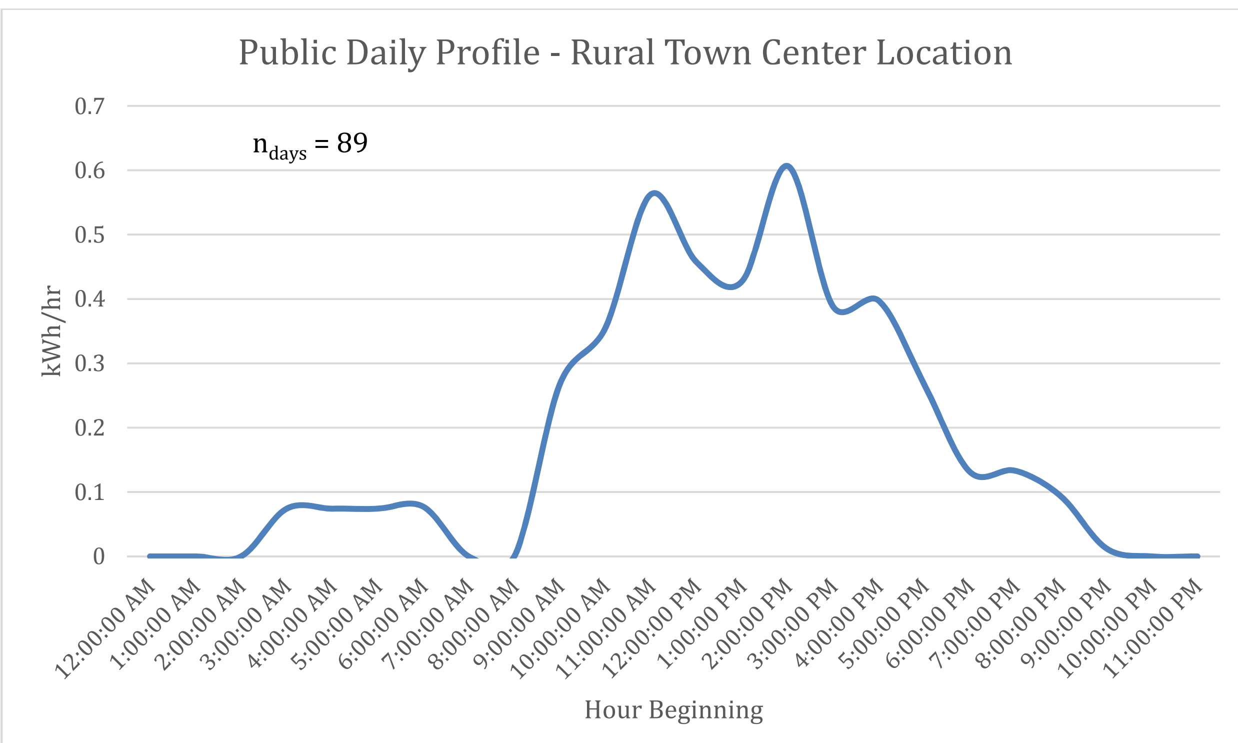


Chart 29

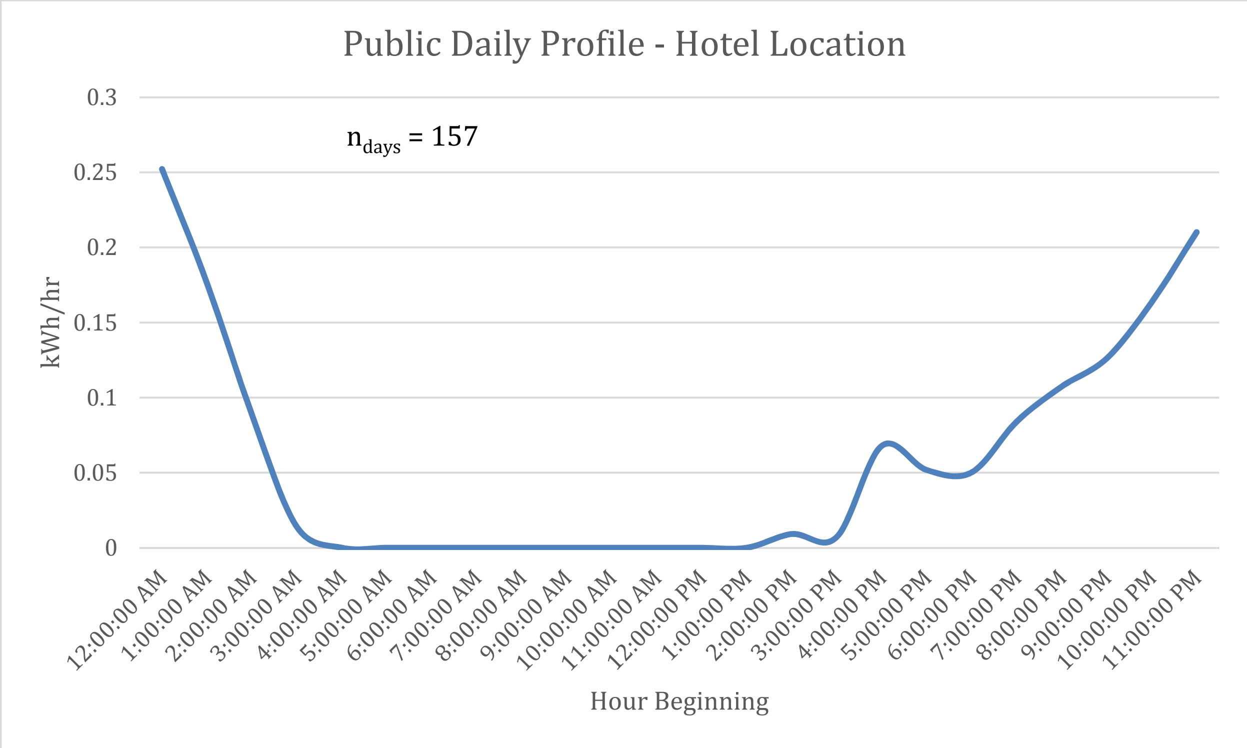
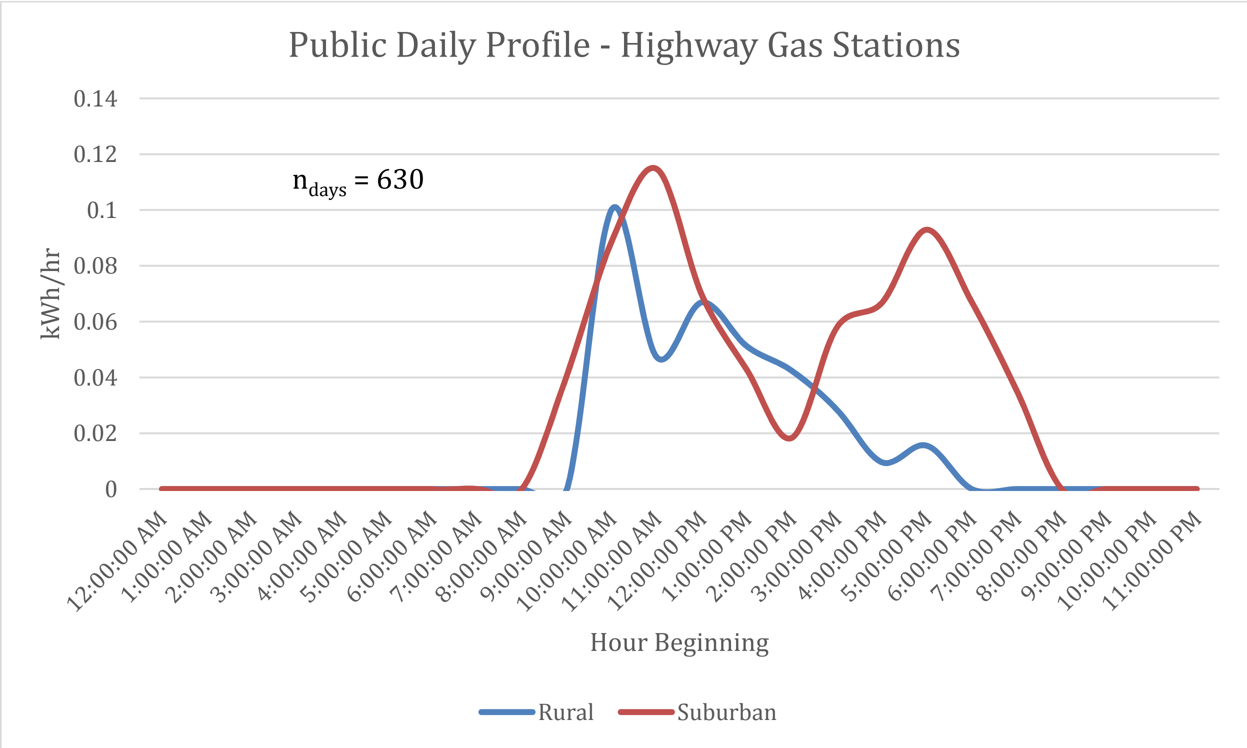


Chart 30



Workplace Charging

Various workplace profiles are shown in the following charts. Demand generally peaks at the beginning of each work shift and tapers off as vehicles are charged. For example in the chart below for a College location, power demand peaks for a brief period at 5.8 kW at 9 am and sharply drops to 1.5 kW by 11 am, suggesting that demand response events would be ideal for curtailing this demand spike, fully charging the battery at a lower rate over a longer period of time.

Chart 31

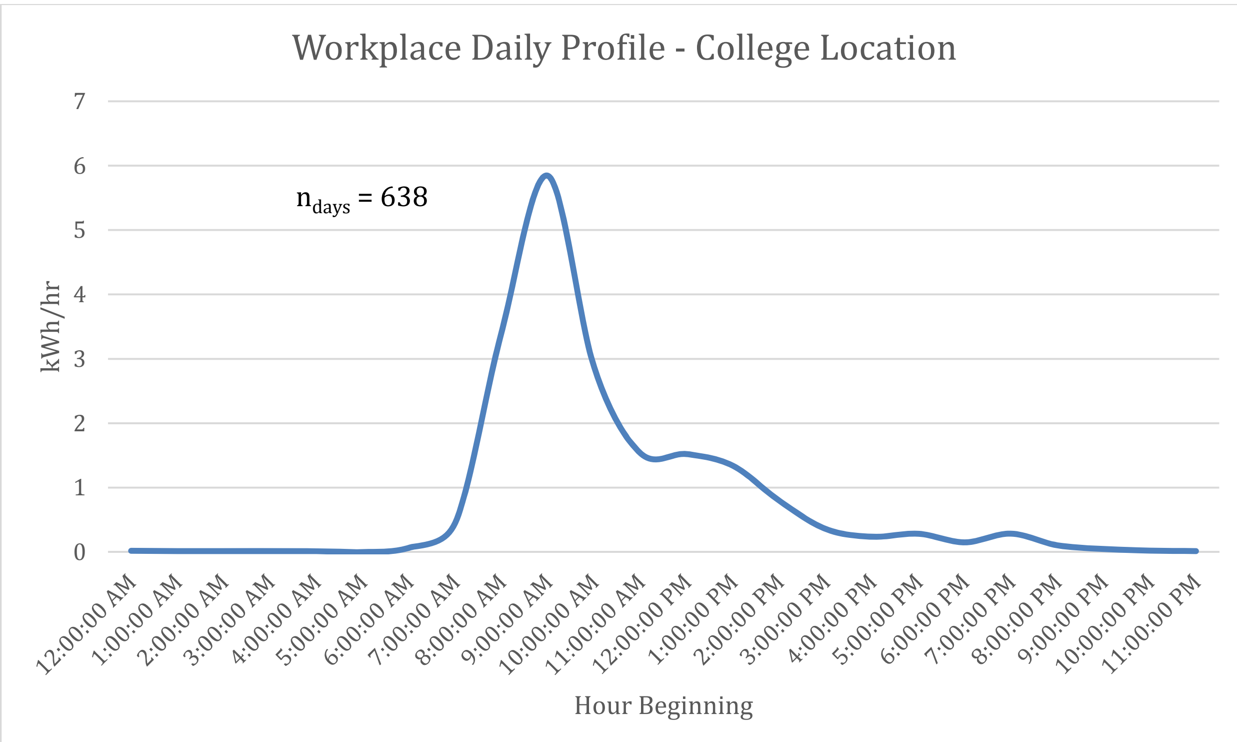


Chart 32

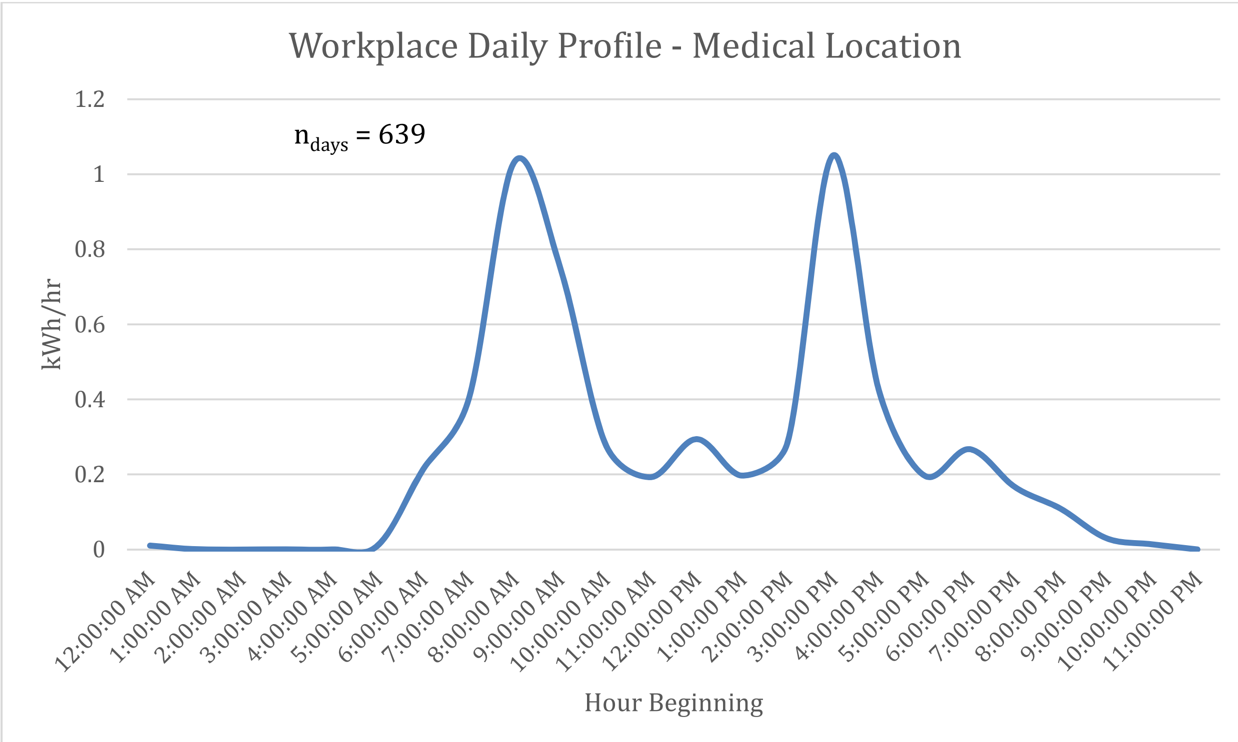
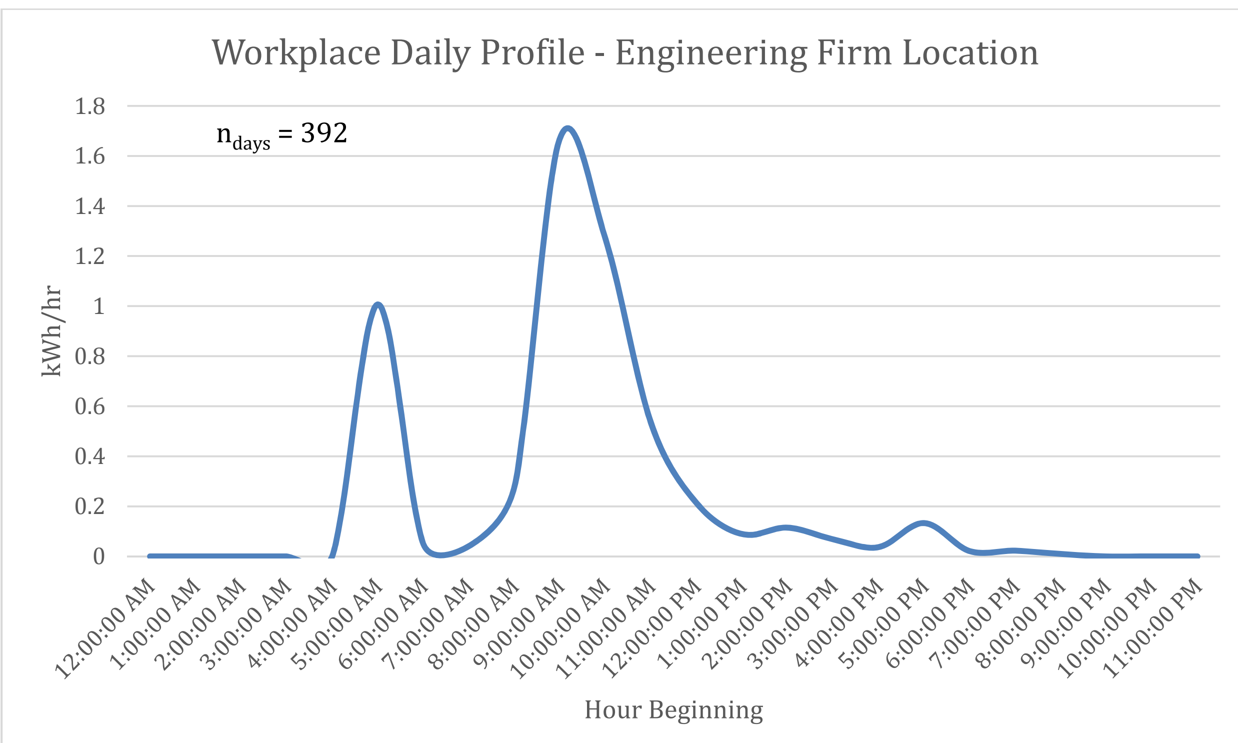
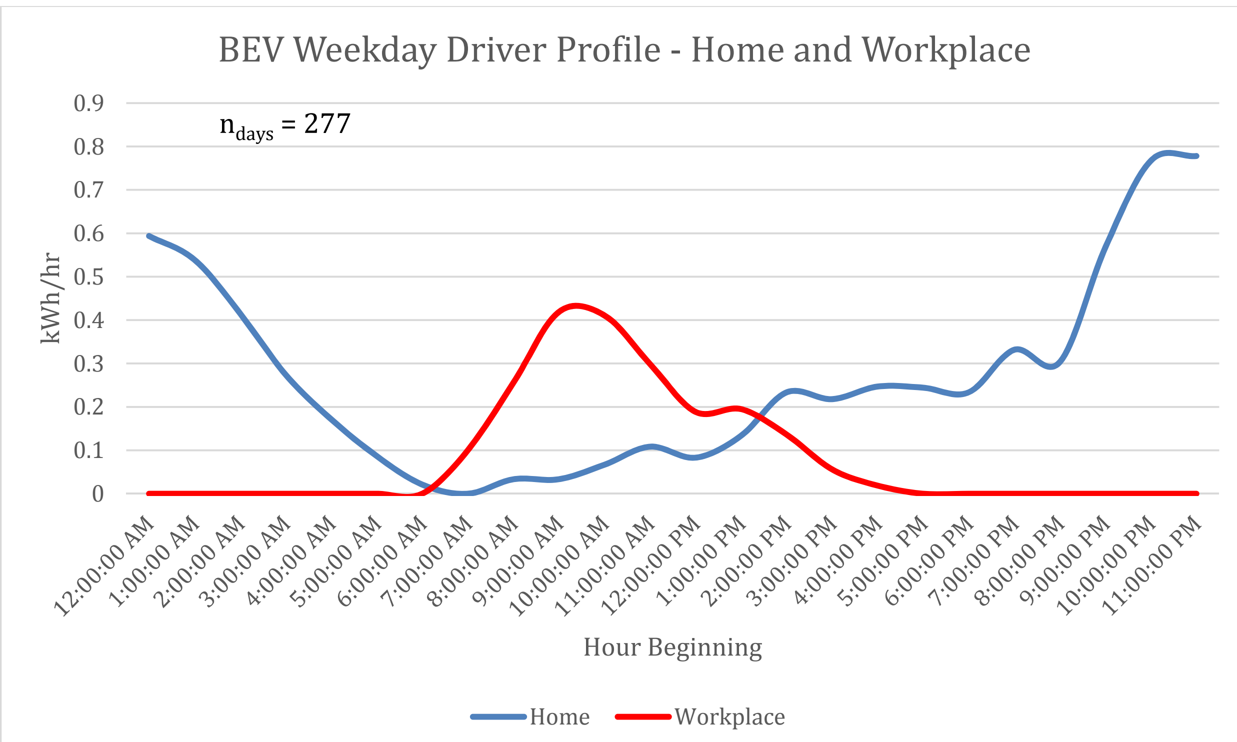


Chart 33



The chart below shows load profiles where both workplace and home charging are available. In this case, energy consumption at work represented 30% of the total daily energy usage, and peak charging at home during system peaks in the evening was reduced by 60% compared to the average PEV load profile – without the need to initiate demand response events. This demonstrates that workplace charging may be a very cost effective way to reduce peak loads, in addition to providing a number of other significant benefits such as encouraging greater adoption through visibility, convenience, and charging availability for employees that do not have charging availability at home, as is often the case for multi-unit dwellings such as apartment complexes.

Chart 34



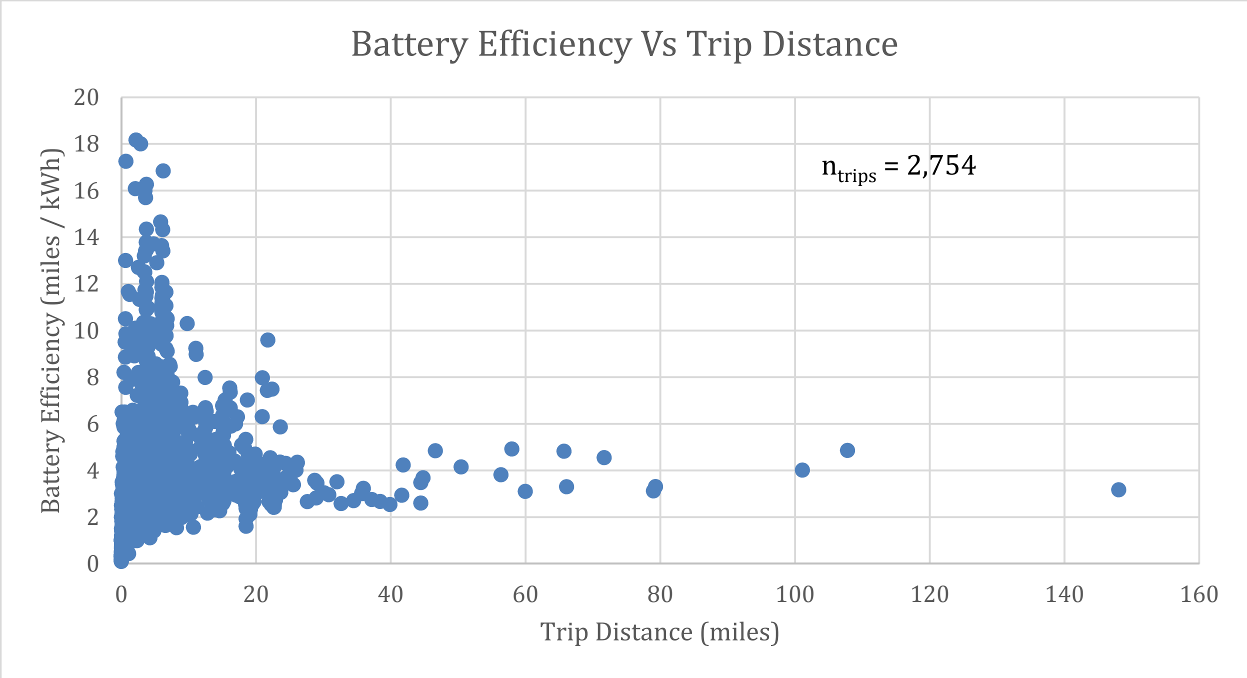
Telematics Data and Analysis

To better understand driver behaviors and validate Greenlots' EVSE data, several customers participating in Avista's EVSE program agreed to installation of Fleetcarma telematics devices in their EVs. The telematics device captures charging data as well as battery state of charge, battery efficiency, trip distance and speed, as well as energy losses from rectification and auxiliary loads.

Of the 471 sessions compared between the Greenlots and Fleetcarma data sources, the average difference in power consumption was 1.5%, with the largest percent difference at 4.64%. Although these differences are relatively small, it is unknown what accounts for them, warranting further investigation. However, the small differences justify confidence in the data accuracy of both sources. Further work and comparison between the data sets will help reveal to what degree the Greenlots data may be under reporting the total energy consumption of individual EVs, which may then be used to adjust load profiles and system impact models. For example, a participant that charges at home using an EVSE that is networked, while charging at work using an EVSE that is not networked, will show data indicating an incomplete total consumption profile from only the home charging sessions. Similarly, some public charging may occur at a few of the EVSE in the area outside of the Greenlots network, which is captured by the Fleetcarma telematics data set but not by the Greenlots network dataset.

Avista also analyzed battery efficiency in BEVs using the telematics devices, with data from 2,754 trips collected. Trip lengths ranged from less than one mile to over 148 miles in this dataset. As shown in the chart below, at shorter trip distances there is a wide range of battery efficiency. This could be due to a combination of regenerative braking, more variability in motor speed, and auxiliary components operating at non-steady states. As trip length increases and vehicle functions become less variable, battery efficiency converges between 3 and 4 miles per kWh. When filtering trip distances over 25 miles (657 data points), the average efficiency is 3.5 miles per kWh with a standard deviation of 0.7

Chart 35



Ambient temperature also has a major effect on battery efficiency. The table below shows battery efficiency versus temperature roughly corresponding with winter, spring/fall, and summer temperatures. As temperature increases, average trip efficiency increases from 3.15 miles per kWh during winter temperatures to 4.83 miles per kWh during summer temperatures.

Table 10

Outdoor Temperature		
Temperature Range (°F)	**Average Efficiency (miles / kWh)**	**Trip Count**
less than 45	3.15	1100
Between 45 and 65	3.81	765
greater than 65	4.83	889

Please note that the efficiencies above represent power consumed from the battery, downstream of the rectifier. An additional 12% to 17% of energy is consumed by the EV from rectifier losses.

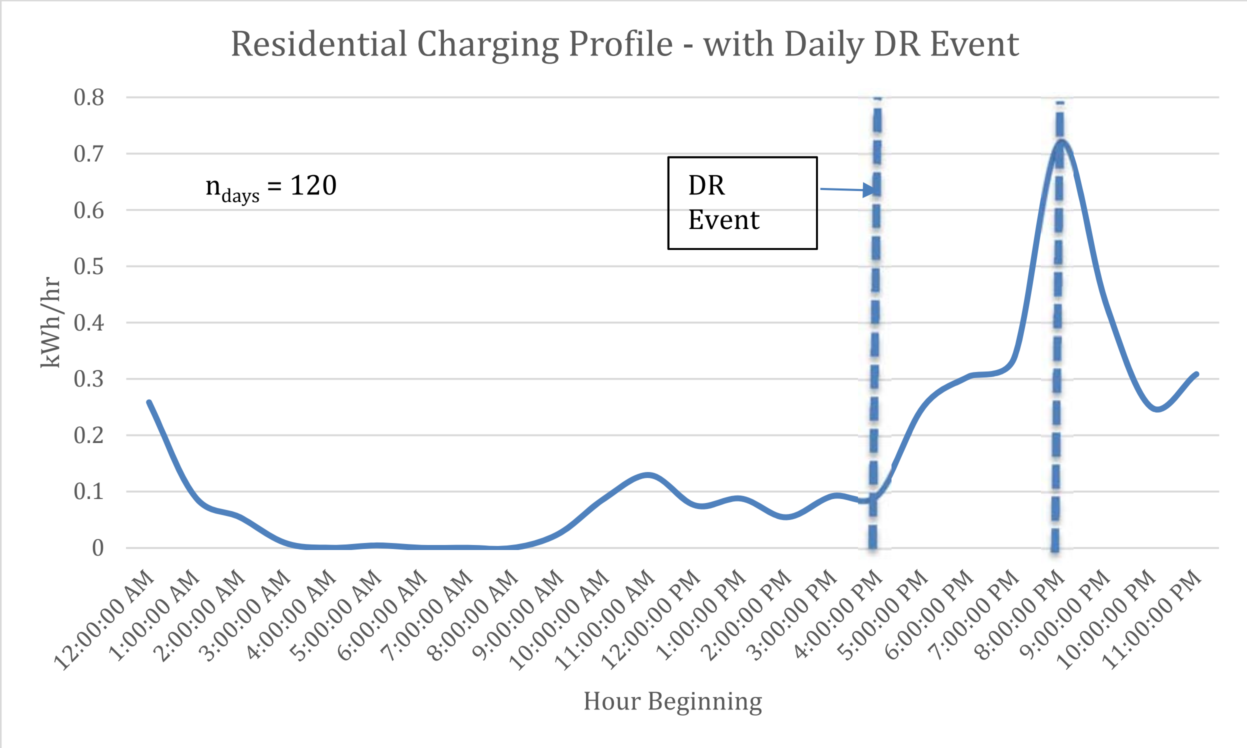
Demand Response (Load Management)

A key goal of the pilot is to test EV charging with demand response (DR), using several types of EVSE from different manufacturers. The desired approach to meet that goal is to test a standards-based implementation utilizing OCPP that is scalable beyond the pilot program.

After some delays due to technical issues, the Company has initiated DR in residential locations. From July 14th to October 20th, 586 DR events were dispatched to residential charging stations, with 82.5% of the events successfully received by targeted charging stations (a charging station that does not have connectivity at the time the event is pushed does not receive the event). Daily events to curtail the charge rate by 75% were scheduled between 4 pm and 8 pm, curtailing the power output from the maximum of 6.6 kW to a curtailed output at 1.7 kW. Items of particular interest include the behavior of charging when there was a loss of internet connectivity before or during the demand response event, the likelihood and need of users opting-out of demand response events, and any differences in behavior for demand response in residential vs public and workplace settings. For example, preliminary data shows 79% of residential users opt-in to daily Demand Response events between the hours of 4-8pm. However, this may be influenced by how the program is set up where users must set their DR preferences ahead of time on the mobile phone application. Monitoring on this metric will continue as DR is extended to more participants and when opting-out "on the fly", while charging is enabled.

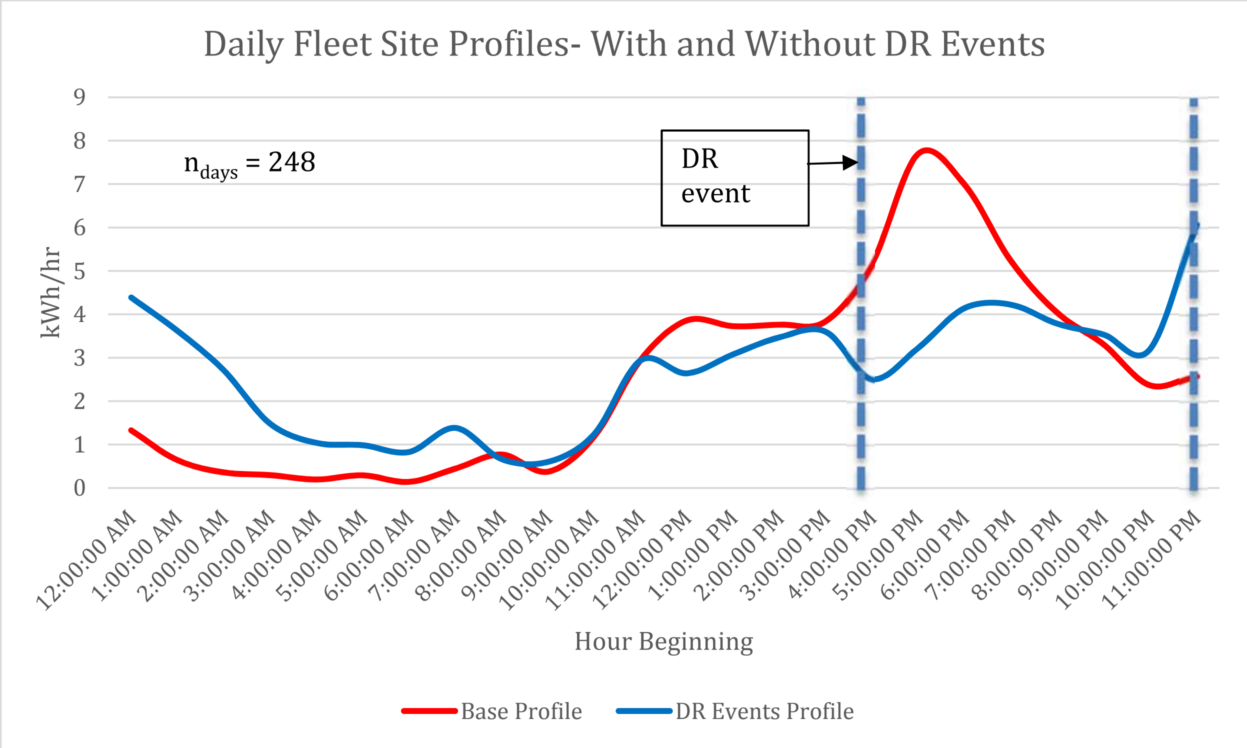
The profile below shows preliminary results over the course of a month of DR events for the initial test pool of participants. During the DR event window, the average daily peak charge rate per individual EVSE is 0.34 kW. When compared with the average PEV profile peak rate of 0.75 kW, this shows a reduction in peak load of 55% during high demand hours. While this is a small sample size, the initial results are promising and the Company has been gradually increasing the residential DR participant pool. Special consideration has been given to ensuring participants' driving habits are not negatively impacted by these DR events. Communication with the test group has been frequent, with no indication of negative impacts from DR events.

Chart 36



Avista has also conducted successful demand response events at select fleet and workplace locations utilizing EVSE from a different manufacturer. The location depicted in the chart below included a fleet of four long range BEVs utilized primarily during normal weekday business hours. The fleet vehicles typically left the facility in the morning with a full battery pack and returned near midday to initiate charging, and/or returned from an afternoon trip and initiated charging in the late afternoon. The data includes 145 charging sessions over two months. In the following charts, the base case month with no charging curtailment is compared to the month with daily DR events occurring between and 4 pm to 11 pm, where the charge rate was curtailed to 25% of the station max – 1.7 kW. In these cases, EVSE performance and communications were excellent, with a 100% DR event success rate.

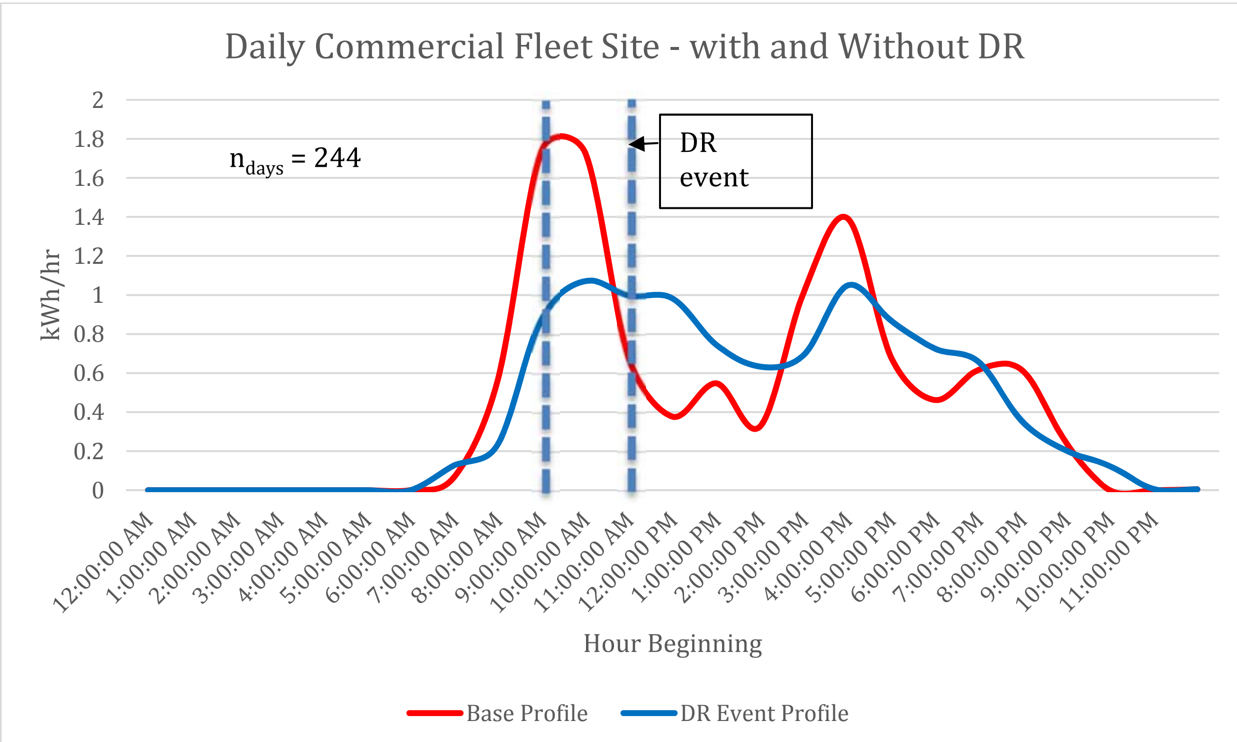
Chart 37



During this peak system demand period the DR event profile demonstrated a significant difference from the base profile, with a 45% reduction in peak demand from 7.7kW to 4.2 kW. The success of this fleet DR program demonstrates the mutual opportunity for both utilities and organizations electrifying their fleets. Utilities can provide DR capable EVSE infrastructure that allows the site host to reduce their demand charges, while reducing the load on upstream utility assets and thereby providing benefits to the grid.

The chart below depicts a workplace charging location with a base case profile and a second profile where DR events curtail demand during system peak hours. Each is the average daily site profile over the course of two separate months. DR events were scheduled in the second month between 9 am and 11 am which can coincide with some winter peak morning hours. As a result of the events, average peak demand dropped to 1.2 kW from 1.7 kW – a decrease of roughly 30%. The load profile maintained a flatter overall shape throughout the daytime hours. Similar to fleet results, this workplace DR program demonstrates the benefit to the utility, business, ratepayers and EV drivers by reducing and smoothing out peak demand with utility provided EVSE, while providing drivers with a full charge when they return to their vehicles.

Chart 38



Community Programs

The Company held a meeting on December 4, 2017, with attending representatives from 15 agencies serving low-income customers and community groups. Discussions included basic information about electric vehicles and charging, as well as ideas and opportunities to serve disadvantaged individuals and communities. Six proposals were received and competitively evaluated based on estimated benefit and cost criteria, with the top two proposals selected for implementation. In both cases, the Company provided the agency with an EV and an EVSE for agency staff to operate for the benefit of customers, including transport to critical medical services, job skills training, shuttle services for overnight shelter, and food deliveries. Each agency secured insurance and accepted responsibility for maintenance and operational costs for the EVs. Initial results are provided in the tables below, demonstrating significant cost reductions and expansion of services.

Table 11 – Transportation Cost Improvements (Spokane Regional Health District)

	Prior to utilizing electric transportation	After utilizing electric transportation (July 15 – Sep 15, 2018)
# trips per month	25	30
Transportation cost per passenger-mile	$1.04	$0.41
Total transportation cost per month	$627	$259

Table 12 – Transportation Cost Improvements (Transitions)

	Prior to utilizing electric transportation	After utilizing electric transportation (July 15 – Sep 15, 2018)
# trips per month	15	32
Transportation cost per passenger-mile	$13.35	$0.13
Total transportation cost per month	$400	$156

The Company will continue to meet with area stakeholders several times each year to review results and explore new ideas for community program initiatives, with the intent to expand programs beyond the pilot.

Revenues and Expenditures

Expenditures through October 22, 2018 totaled $2,730,942. A more detailed breakdown is provided in Attachment A.

Revenues to date are as follows, based on data from the Greenlots network:

Table No. 13

Type	No. of Charging Sessions	kWh Consumed	Avg. kWh Consumed per Session	Rate	Revenue
Residential AC Level 2	29,298	216,267	7.4	$0.09134/kWh	$19,754
Commercial AC Level 2	9,503	86,747	9.1	$0.1162/kWh	$10,080
DC Fast Charging	386	5,467	14.0	$0.35/kWh (previously $0.30/min)	$2,324
Total	39,187	308,481	-	-	$32,158

Please direct any questions regarding this report to Rendall Farley at 509-495-2823, rendall.farley@avistacorp.com, or Karen Schuh at 509-495-2293, karen.schuh@avistacorp.com.

Sincerely,

/s/Linda Gervais

Sr. Manager, Regulatory Policy
Avista Utilities

Attachment A
Avista EVSE Pilot Program Expenditures through October 22, 2018

Expenditures include all costs for both completed EVSE installations and installations in progress, as well as program administrative costs.

Expenditure Category / Type		CAP	OPER	Total
Residential Level 2 EVSE	**Design & Installation**	$182,166	-	**$182,166**
	Hardware	$216,653	-	**$216,653**
	Maintenance & Repairs	-	$4,951	**$4,951**
	Premises Wiring Reimbursements	-	$107,158	**$107,158**
	Total	**$398,819**	**$112,109**	**$510,928**
Workplace-Fleet-MUD Level 2 EVSE	**Design & Installation**	$209,312	-	**$209,312**
	Hardware	$337,202	-	**$337,202**
	Maintenance & Repairs	-	$905	**$905**
	Premises Wiring Reimbursements	-	$111,391	**$111,391**
	Total	**$546,513**	**$112,295**	**$658,809**
Public Level 2 EVSE	**Design & Installation**	$211,521	-	**$211,521**
	Hardware	$294,293	-	**$294,293**
	Maintenance & Repairs	-	$164	**$164**
	Premises Wiring Reimbursements	-	$53,850	**$53,850**
	Total	**$505,813**	**$54,014**	**$559,827**
DC Fast Charging Stations	**Design & Installation**	$306,700	-	**$306,700**
	Hardware	$304,865	-	**$304,865**
	Maintenance & Repairs	-	$764	**$764**
	Meter Billing	-	$10,608	**$10,608**
	Total	**$611,565**	**$11,372**	**$622,937**
Other Project Expenses	**Community Programs**	-	$60,433	**$60,433**
	Communications	-	$28,614	**$28,614**
	EVSE Network & Data Management	$182,298	-	**$182,298**
	Misc General Expenses/Incentives	-	$19,337	**$19,337**
	Project Management/A&G Salaries	-	$87,761	**$87,761**
	Total	**$182,298**	**$196,144**	**$378,442**
Total		**$2,245,009**	**$485,934**	**$2,730,942**