EVS30 Symposium
Stuttgart, Germany, October 9 - 11, 2017

The Positive Effects of Workplace Charging on Electric Vehicle Ownership and Utilization

Daniel Boston[1], Stephanie Janczak[1], Anne-Marie Graham-Hudak[1]

[1]*Ford Motor Company, 1 American Road, Dearborn MI, dboston8@ford.com*

Executive Summary

Workplace charging plays an important role in charging infrastructure as it is the second most likely location to charge after the home [1]. Public infrastructure such as workplace charging can have a profound impact on PEV utilization by consumers and it expands the range of adoption, given it has the potential to effectively double the electric distance traveled for some drivers.

Based on experience from over 200 workplace stations installed to date at Ford's North American facilities, usage and survey data was collected from over 300 employees who utilize the campus network to better understand how access to workplace charging stations impacts plug-in vehicle adoption and utilization. This paper analyzes the impact of workplace charging, including the electric miles driven before and after workplace charging installation, home vs workplace charging rates, workplace charging policy preferences, and an analysis of workplace charging best practices based on Ford's experiences and other workplace charging projects.

Data results demonstrate that workplace charging is a key influencer in the purchasing decision and subsequent utilization of an electric vehicle. Employees who have access to workplace charging and drive plug-in hybrid electric vehicles exhibit a reduction in gasoline consumption and a positive impact on overall electric distance travelled. Regular users of Ford's workplace charging network accumulate approximately 3300 additional EV miles annually, and 25% of employees surveys stated they would not have acquired their plug-in electric vehicle without workplace charging. This demonstrates the increased utilization of workplace charging and its impact on sales of plug-in vehicles. We recommend that governments, utilities and businesses work together to promote workplace charging.

1 Background

Electrification of vehicles is a global trend that continues to accelerate as new models are introduced and improvements are made in battery range, efficiency, and costs. Customers are moving to plug-in electric vehicles (PEVs) as more models enter the mainstream automotive market. To accompany these new vehicles, charging infrastructure is being installed at home and in public. Studies such as the EV Project from Idaho National Laboratory demonstrate that home charging accounts for the majority of PEV charging [1] and

public charging has a positive impact on plug-in vehicle utilization. This paper will focus on existing workplace charging networks and what learnings have been realized from them. Next it will examine the Ford workplace charging network in Southeast Michigan and analyze the driver behavior before and after the network was installed. Lastly the paper will examine survey responses from these Ford employees and compare their responses to those of other workplace charging users to identify expected patterns or note any novel behavior. Finally, this paper will draw conclusions on the lessons learned, how this translates to recommended practices for future workplace charging installations, and the benefit for Governments and Utilities to support workplace charging initiatives to increase EV adoption and utilization.

2 Prior Workplace Charging Networks and Learnings

2.1 EV Project

The EV Project found that those with access to workplace charging had higher levels of electric miles travelled, for both BEV and PHEV owners. [2] This can be seen in the figure below with increases in electric vehicle miles travelled (eVMT) of over 2000 miles between those with access to workplace charging and those without.

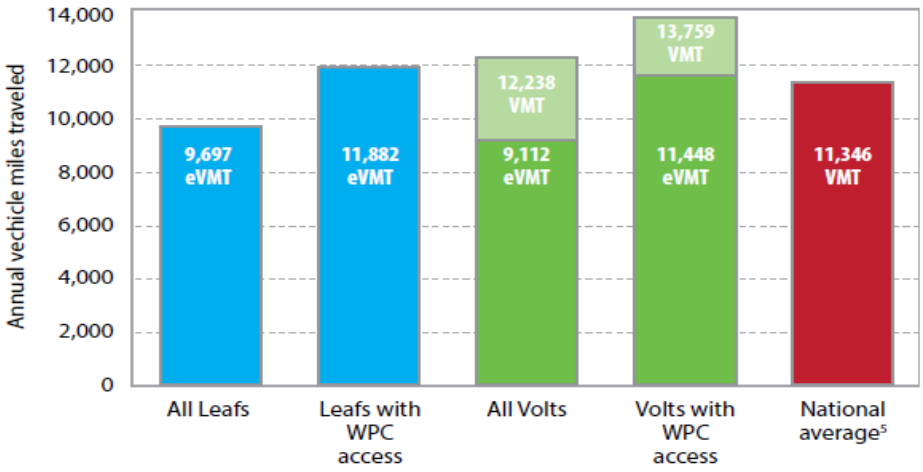

Figure 1Workplace Charging Impact on eVMT, reprinted from [2] Idaho National Laboratory, "Plugged In: How Americans Charge Their Electric Vehicles," Idaho National Laboratory, Idaho Falls, 2015.

This increase in eVMT occurred for both plug-in hybrids and for full battery electric vehicles. They also found that half of the vehicles charged at home exclusively, and only 20% of the vehicles performed 75% of the electric charging away from home. For vehicles which did have access to workplace charging, 98% of their charging during work days was either at home or work. And for all charging events, Volt drivers charged 57% of the time at home, 39% at work, and 4% at another location. Leaf drivers charged 65% of the time at home, 32% of the time at work, and only 3% at another location *[2]*. This shows that if a driver has access to workplace charging it will form a considerable percentage of their total charging, resulting in the increased electric miles travelled seen above in Figure 1.

2.2 Southern California Edison (SCE) Workplace Experiment

Southern California Edison (SCE) conducted its own workplace charging experiment through which they installed 80 level 2 (240V, 30A) chargers that could be controlled to operate as level 1 chargers at 9 buildings across the SCE service area for their employees to use [3]. The employees could opt in to a demand response program where their charge would be curtailed for a duration of time to avoid paying a premium fee during the DR event. In addition, the base level 1 and level 2 hourly charging fees were changed each month to test

consumer charging behavior relative to price. SCE found that there are a number of factors that impact a user's willingness to charge, including limitation of chargers available, costs, and workplace charger use policies, such as restrictions on how long a vehicle may remain parked.

SCE found that the commute distance is directly correlated to the likelihood that a driver will use workplace charging, and that station availability is one of the most important factors in workplace charging network satisfaction. Further, SCE found:

> "Fee based charging and other space management controls encourage space turnover and optimize charging station usage (p. 61). In order to optimize PEV charging in the workplace, the infrastructure design should consider real estate available, current charging needs, estimated PEV adoption growth, costs, site-specific factors, appropriate pricing, space management options, and average PEV requirements" (p. 103).

Following a 2016 Employee Survey for a commute distance of over 40 miles, SCE also noted that the "probability of an employee buying an EV in the next 2 years, directly correlates to a commute distance provided more employee accessible charging stations were available at their work location" (p. 26).

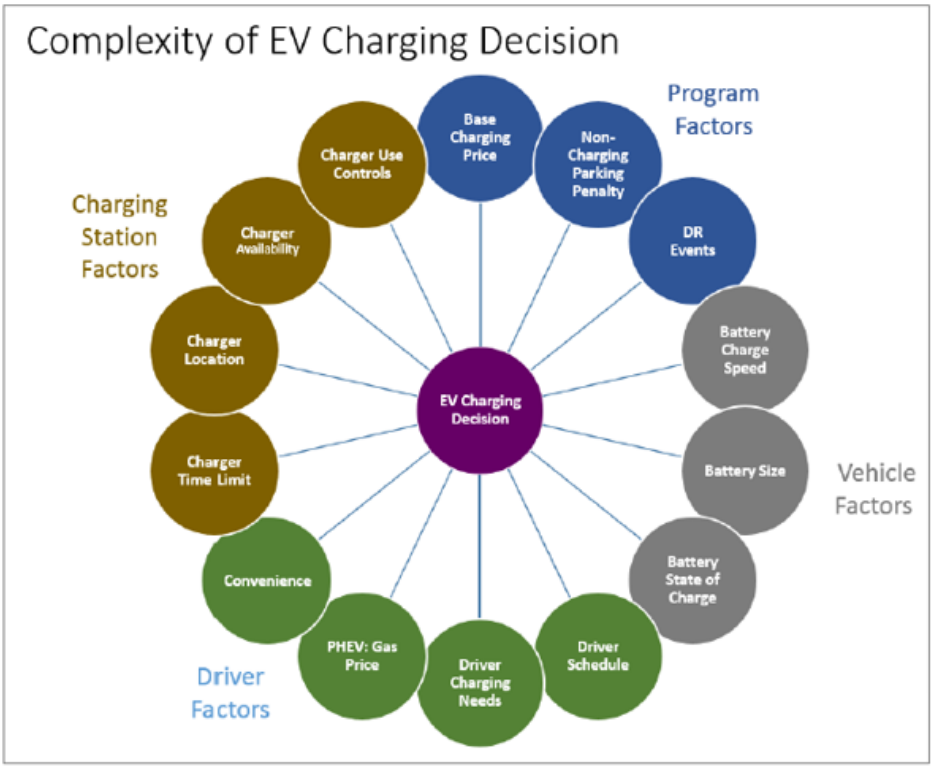

Figure 2 EV Charging Decision Factors reproduced from [3] Southern California Edison, "Southern California Edison Plug-In Electric Vehicle (PEV) Workplace Charging Pilot," Southern California Edison, Rosemead, 2015.

3 Charging Results and Utilization

3.1 Ford Employee Network

The Ford employee charge network includes over 200 networked level 2 charging stations across 40 locations throughout the United States and Canada, with the majority located in Southeast Michigan. Most of the network was installed by October 2014, with incremental additions occurring since then. Over 1,700 employees have registered to use the network as of March 2017.

The stations are only available to employees who have registered through Ford and access the stations with a GE RFID card, the GE Connect app or the PlugShare app. , The network can only be used for their personal

vehicle and not test vehicles that they may also use on campus. The network is currently only open to Ford branded plug-in vehicles, such as the C-MAX Energi, the Ford Fusion Energi, or the Focus Electric. Employees are allowed to charge for 4 hours free daily and then they must move their vehicle. If they don't move their vehicle they will be charged $1 per hour for every hour after their 4 hour allotment. This time was set because 4 hours is enough time to fully charge any of the Ford branded plug-ins. Other rules of the network include not allowing internal combustion engine (ICE) vehicles to park in designated EV spots, not allowing EV vehicles to park in spots without plugging in, and not allowing employees to unplug any vehicle except their own.

3.2 Data Collection

Data was collected through three different data sources. One was MyFord Mobile (MFM), which is Ford's app available for plug-in vehicle customers. It offers valuable features such as being able to locate your vehicle, lock or unlock the vehicle, find public charging stations, precondition your vehicle or set a charging schedule for when your electricity rates are cheapest (value charging). Once a driver has activated MyFord Mobile, data is collected via an onboard modem, which transmits charging and trip data at key on and key off, as well as at the beginning and end of charge events. Data is only analyzed in aggregate per our terms and conditions.

Another data source comes from the electric vehicle service equipment (EVSE) directly. Since the stations are networked, we are able to obtain valuable information from the station, such as energy distributed, time of charge events and station utilization. This data was cross-referenced with MyFord Mobile data when available to understand how employees charged their vehicles before and after the workplace network was installed. MFM data for this analysis was collected between January 2014 and January 2016 from vehicles operated in Southeast Michigan. It included 273 employee vehicles as well as 1,550 vehicles from the area which were not employees. The non-employee Michigan drivers were utilized as a control group in order to understand how non-employees in the area utilized their vehicles and properly calculate the impact that the addition of the workplace charging network had on our employees' vehicle utilization behavior. (minimizing the possible impact of weather and other driving conditions)

Our third data source came from survey data in which we asked our employees how they were utilizing their plug-in vehicles, their satisfaction with the vehicles, how they were using the workplace network and what changes or preferences they had with the fee schedule or rules of the workplace charging network. Two surveys were conducted, one in 2015 and one in 2017, with questions added in 2017, in order to understand how responses may have changed over time.

In November 2016 an attractive plug-in vehicle lease was offered to managers at Ford resulting in over 1500 new PEV drivers on the Ford campus. This offers a unique perspective as it influenced a large number of employees to adopt a plug-in vehicle when they may not have otherwise. This offers an unbiased opinion on the vehicle and the workplace charging network as early adopters are sometimes more forgiving of struggles with new technology or processes, where a more mainstream individual may not be. Being able to analyze the impact of this population separately proves valuable.

3.3 MFM and EVSE Network Data Results

As stated above we analyzed the MFM data by cross-referencing it with the charging network EVSE data. This allowed us to match employee charging events which took place at work and understand what percentage of their charging was at work or elsewhere. We also analyzed the control group, which consisted of drivers from Southeast Michigan who were not employees at Ford, in order to understand how our employee vehicle utilization differed from the control group before and after the network was installed. First we looked at the average weekly electric and total miles driven for both groups, which can be seen below in Figure 3.

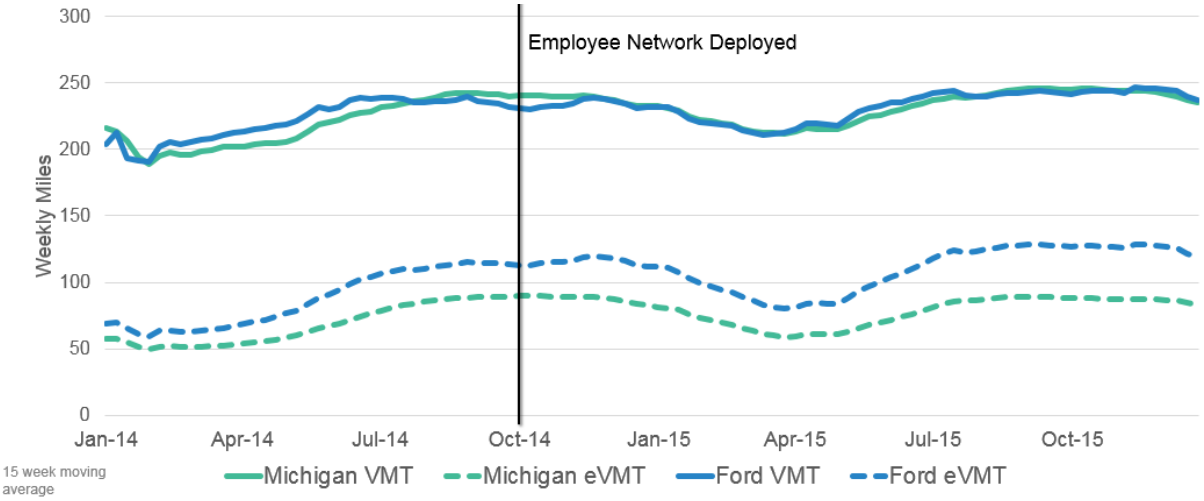

Figure 3PHEV VMT and eVMT / Week

Here it can be seen that the VMT for the Michigan drivers and the Ford drivers are seasonal yet overlap over the two year time period. This indicates that the weekly driving patterns between PHEV drivers in Michigan and Ford employees closely correlate. The chart shown is based on a 15 week moving average which pushes the seasonal effects further out such that the typical trough in eVMT and VMT is seen in February.

Table 1 PHEV VMT & eVMT Before and After Workplace Charging Installation

	VMT Before	VMT After	VMT % Improvement	eVMT Before	eVMT After	eVMT % Improvement
MI	219.0	229.2	4.67%	68.5	75.3	9.88%
Ford	222.6	230.5	3.55%	88.3	106.0	20.11%

There is a visible gap between the eVMT of Michigan drivers and Ford employees that has existed since before the workplace charging network has been installed. After the network was installed, this gap widened 42%. Table 1 indicates the VMT and eVMT increases before and after the workplace charging installation, designated as the week of October 12, 2014. The values were normalized to only include the equivalent seasonal weeks. The VMT increases slightly while the eVMT % for both groups improves considerably. If Michigan drivers are considered as representative of the trends occurring in Southeast Michigan, then 9.88% improvement is associated with other trends such as increased public charging locations, favorable temperature for EV range, increased plug-in opportunities, etc. However, for the Ford specific group the remainder 10.23% could be attributed to the workplace charging network.

If we apply these normalized trends to EV and gasoline miles achieved annually, Ford employees accumulated 4,589 EV miles in 2014 and 5,512 EV miles in 2015, compared to Michigan drivers who accumulated 3,564 EV miles in 2014 and 3,917 EV miles in 2015. Ford employees drive an additional 473 EV miles annually per vehicle which can be attributed to the workplace charging network.

However, the average Ford employee does not necessarily utilize the workplace charging network regularly. What we've found out is that the usage of the network grew over time. The transition of this workplace utilization can be found in Table 2, which displays the frequency with which employees charge a certain number of times per week.

Table 2 Distribution of Drivers and Prevalence to Charge at Work

Month	0 charges	1 charge	2 charges	3 charges	4 charges	5 charges	5+ charges
09-01-14	1	0	0	0	0	0	0
10-01-14	95.96%	1.01%	1.01%	0.84%	0.51%	0.34%	0.34%
11-01-14	77.73%	3.74%	2.73%	3.12%	4.40%	4.14%	4.14%
12-01-14	72.76%	4.99%	4.63%	4.61%	4.73%	4.14%	4.14%
01-01-15	77.94%	5.24%	3.98%	3.58%	2.17%	3.40%	3.70%
02-01-15	64.75%	4.55%	3.97%	6.23%	7.77%	6.22%	6.52%
03-01-15	62.99%	5.83%	4.09%	6.81%	8.03%	5.82%	6.43%
04-01-15	61.30%	7.55%	6.15%	6.38%	7.03%	5.58%	6.02%
05-01-15	56.62%	7.20%	5.22%	6.79%	8.13%	7.85%	8.18%
06-01-15	55.94%	7.34%	7.66%	6.52%	11.18%	5.55%	5.81%
07-01-15	55.52%	8.17%	5.79%	9.39%	8.41%	6.16%	6.56%
08-01-15	49.52%	8.47%	6.79%	10.12%	9.51%	7.58%	8.02%
09-01-15	46.99%	6.15%	8.31%	10.29%	11.78%	7.91%	8.56%
10-01-15	46.43%	7.35%	8.30%	9.68%	11.33%	8.14%	8.75%
11-01-15	46.38%	6.69%	7.62%	8.59%	11.14%	9.34%	10.23%
12-01-15	49.26%	7.77%	9.71%	11.81%	9.19%	5.89%	6.38%
01-01-16	58.55%	6.97%	5.88%	7.01%	7.39%	6.79%	7.41%
02-01-16	42.69%	9.29%	10.36%	10.88%	13.04%	6.13%	7.61%
03-01-16	47.29%	10.27%	8.49%	10.12%	11.09%	5.96%	6.78%
04-01-16	46.31%	9.48%	7.74%	11.93%	12.49%	5.69%	6.35%
05-01-16	44.98%	11.33%	7.21%	10.62%	12.64%	6.13%	7.08%
06-01-16	44.68%	8.48%	9.01%	10.64%	13.40%	6.44%	7.36%
07-01-16	50.15%	7.21%	8.13%	8.50%	10.40%	7.35%	8.26%
08-01-16	43.09%	9.20%	6.92%	8.49%	13.31%	9.13%	9.85%
09-01-16	46.63%	7.00%	11.95%	8.86%	10.92%	6.95%	7.69%
10-01-16	50.68%	5.42%	8.85%	11.23%	12.88%	5.09%	5.84%
11-01-16	52.46%	10.98%	9.82%	8.90%	8.59%	4.26%	4.99%
12-01-16	71.86%	8.49%	6.18%	7.46%	3.37%	1.32%	1.32%

Table 2 indicates that it took nearly a year for most employees to utilize the workplace network. Charging four times per week had the highest occurrence rate for those who charge at work. We wanted to understand the behavior of each of these drivers and how the occurrence rate of charging at work impacts the weekly EV miles achieved.

Table 3 EV Miles Per Week by Work Charges

	EV Miles Per Week							
Month	Michigan	0 Chrg	1 Chrg	2 Chrgs	3 Chrgs	4 Chrgs	5 Chrgs	5+ Chrgs
January-14	89.3	118.6						
February-14	78.0	97.5						
March-14	68.6	80.2						
April-14	66.0	75.8						
May-14	72.8	84.6						
June-14	83.8	101.2						
July-14	94.9	113.1						
August-14	100.4	117.1						
September-14	102.4	118.0						
October-14	102.4	116.0	132.7	152.6	181.5	190.1	213.9	212.8
November-14	101.4	117.1	137.9	150.7	180.4	183.8	202.9	216.1
December-14	96.7	111.0	135.1	144.9	168.3	177.2	187.6	198.2
January-15	90.3	102.3	124.4	130.9	155.2	165.6	177.7	191.6
February-15	80.8	89.5	103.5	120.2	131.0	149.2	159.5	170.2
March-15	71.4	77.3	85.8	105.3	112.5	128.8	135.4	140.5
April-15	70.7	77.0	82.7	101.6	106.7	120.3	132.7	135.2
May-15	76.5	84.5	87.8	101.2	112.0	127.9	140.5	143.0
June-15	87.0	98.8	98.9	106.6	123.9	143.4	160.8	164.6
July-15	97.0	110.7	107.3	113.0	137.3	159.9	178.1	183.7
August-15	101.3	114.2	112.1	114.4	143.4	170.1	189.4	194.4
September-15	102.2	114.7	111.8	117.0	148.9	173.5	193.2	200.6
October-15	101.4	111.6	111.7	117.8	147.5	173.6	195.2	203.6
November-15	100.5	108.9	111.2	118.5	142.8	171.5	198.0	206.4
December-15	97.4	103.7	105.9	118.5	136.5	167.8	191.9	199.3

Figure 4 below indicates how each population described in Table 2 achieves different weekly EV miles. There is a clear trend that as employees utilize the charging stations at work, their weekly EV miles increase. Regular users who charge at least 3 times per week can achieve nearly 3300 more EV miles per year. The remaining data can be viewed in each month in Table 3.

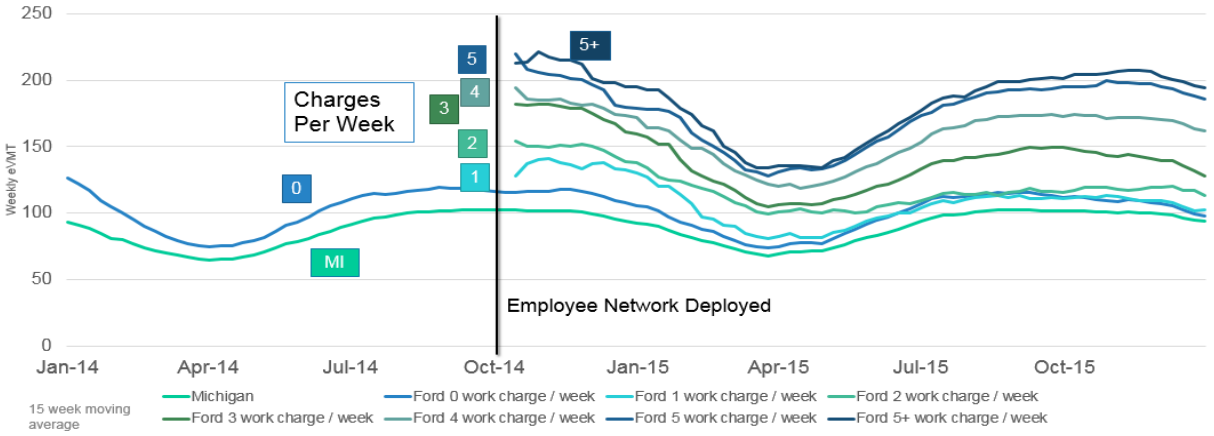

Figure 4 Weekly eVMT & Workplace Charger Usage

One interesting trend is as employees become accustomed to using the workplace charging network, the populations of employees who don't charge at work, those who charge once per week and those who charge twice per week overlap. These people are replacing their regular charging at home with workplace charging, so their workplace charges remain regular, but their EV miles achieved suffer a decline. A similar decline can be seen for those that charge 3 times per week from the beginning of the workplace network to the Fall of 2015, however they are still distinctive from those who do not charge at all at work.

The EV Project found that eVMT increases when there is access to workplace charging and we expected to find similar improvements in our own data. We did in fact find that as workplace charging utilization increased there was a positive correlation to increased electric vehicle miles travelled. Below is a chart indicating the eVMT %, or percentage of electric miles travelled over total miles travelled for our PHEV users.

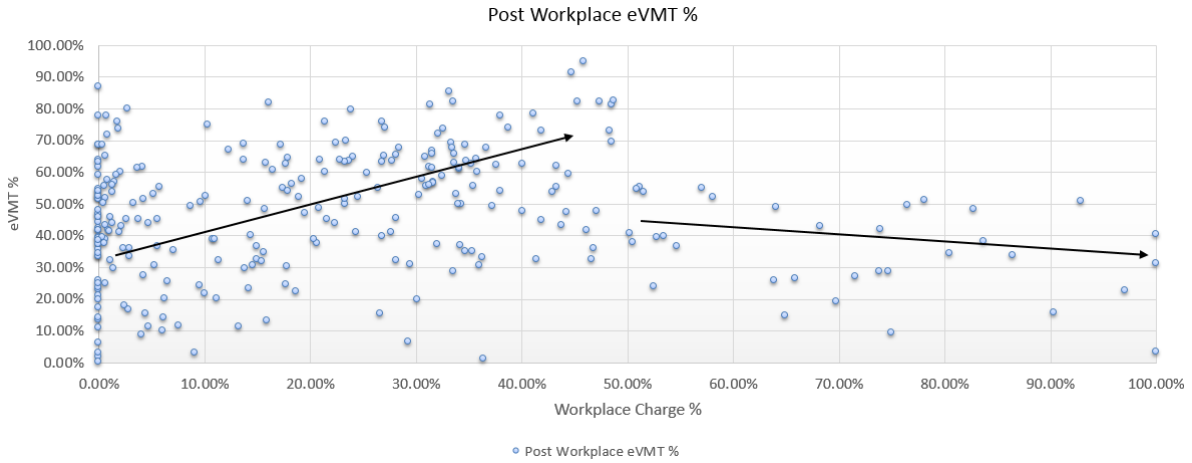

Figure 5 eVMT % vs Workplace Charge %

There is a unique relationship between eVMT % and workplace charger usage as a percentage of total charge usage. As drivers utilize the workplace charging more, they achieve higher eVMT % values. In other words, more of their driving is done electrically. However this has a limit, and those who utilize workplace charging the majority of the time, or over 50% of all of their charges, experience a flat trend in eVMT %. These are mostly people who rarely charge at home or elsewhere and so their eVMT % is capped by what they can achieve by relying on workplace charging alone.

4 Survey Response Data

Digging beyond what the vehicle data tells us can offer a more complete picture of how employees utilize workplace charging and their motivation to charge in general. Employee surveys were utilized which give us insights in to employee preference to move their vehicle, which payment and fee systems they are most comfortable with, and their indication of how the workplace charging network influenced their decision to purchase a plugin vehicle.

4.1 Survey Response Results

One of the objectives of the survey was to understand employee satisfaction with the current workplace charging network and areas for improvement. As stated previously we conducted two surveys, one in December 2015 and another in April 2017. The survey questions were largely similar, with some additional questions in 2017 around network policy preferences. In 2015 there were 191 PHEV and 18 BEV respondents while in 2017 there were 781 PHEV and 21 BEV respondents. One of the advantages of the 2017 survey was increased respondents due to the inclusion of management lease participants. As discussed earlier, there was an attractive lease offered to managers at Ford in November 2016 for a Ford Fusion Energi or a C-MAX Energi plug-in hybrid vehicle and over 1000 participants took advantage of the opportunity and signed up for the workplace charging network. This accounts for approximately 58% of all users of the network as of

March 2017. Understanding how these employees felt about the network in conjunction with employees who had personally purchased their vehicles was of particular interest.

One of the questions asked was their workplace charging preferences from least important to most important for a variety of options to gain insights into the relative importance of various workplace charging aspects, such as parking close to the office, taking a shuttle from a central location, or charging for free. Our current policy allows employees to charge for free for four hours and our employees value that. The second most important feature was having charging close to the office. Parking at a central location and taking a shuttle, even if it meant free charging without having to move the vehicle was considered very unsatisfactory. One interesting observation is that different subsets of our employees have different priorities. For example, BEV owners were more likely to find that charging further away from the office is acceptable, and employees who work in regional marketing offices specifically had no issue with moving their vehicle after a set period of time because they travel away from their office almost every day. Other responses on the effectiveness of different fee structures can be seen in Figure 6 and 7 below.

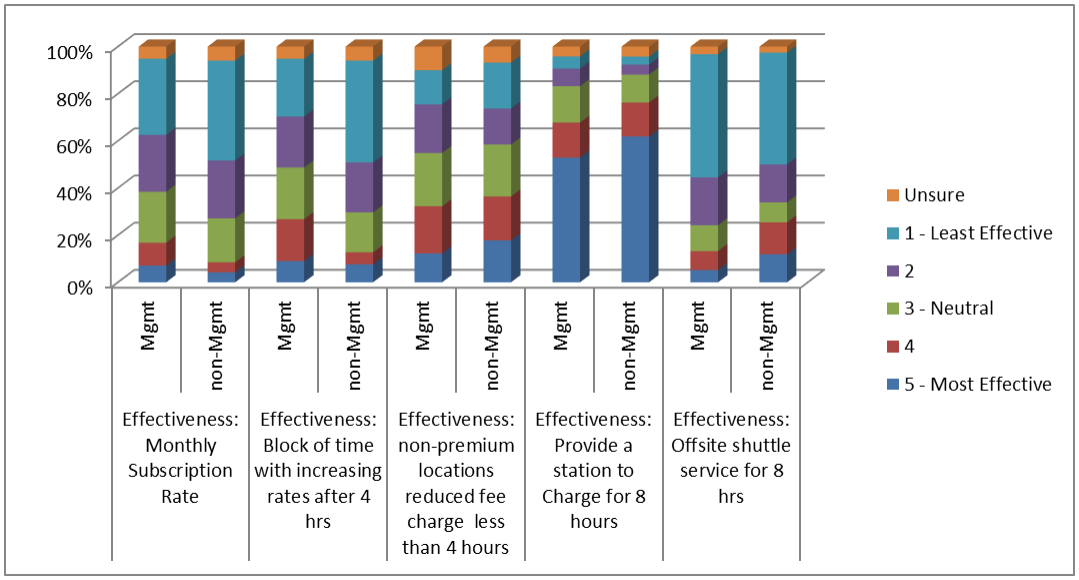

Figure 6 Fee Structure Options Part 1

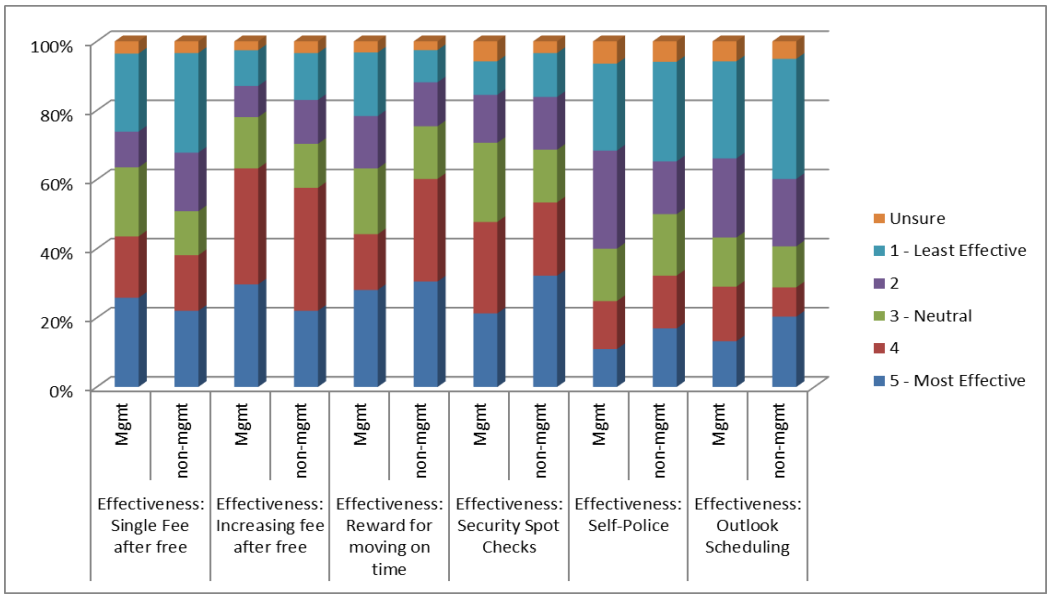

Figure 7Fee Structure Options Part 2

We also asked how influential the workplace charging network was in deciding to purchase or lease a plug-in vehicle. We found that over 25% of employees said they would not have purchased the vehicle at all if there hadn't been workplace charging. This 25% of employees is substantial as it indicates that workplace charging installations can translate into plug-in vehicle sales. Not only that, but some employees indicated they could not charge at any other location except for the workplace, and so workplace charging is not just an amenity but it is the reason they are able to travel electrically. 15% of employees stated the workplace charging had no impact at all on their purchase, a subset of these are likely to be employees who purchased their vehicle before the workplace charging was installed.

4.2 Ford Workplace Charging Adaptations

Taking what we learned from our MyFord Mobile data, our charging network data, and our employee surveys we were able to conclude that some changes to the Ford network would benefit our employees. One of the objectives of this study was to discover ways we could enable more electric driving and increase employee satisfaction with driving a plug-in and charging it at work.

Ford's campus in Southeast Michigan is undergoing a major transformation. Because of this renovation, tens of thousands of employees will be relocated to a more centralized engineering and development campus. With this transformation many of our buildings will be rebuilt and parking garages will satisfy the majority of campus parking.

One of the issues identified was that throughout 2017, the demand for chargers far outpaced the supply. This was to be expected after adding 1000 plug-ins through the management lease program, however we wanted to lay the groundwork so that our future campus has the flexibility to better match charger supply with demand. Ford is expanding our workplace charging to allow for 5% of spaces in the parking structures to be electrified , with the ability to double that capacity easily once demand requires it. This will provide Ford the option to install over 1000 chargers on our campus within the next 5 years. Additional changes to the network are summarized below:

1. >1000 new level 2 16A chargers allowing for an increase in station installations
2. Open access charging, for visitors and employees of any plug-in vehicle model
3. Complimentary charging
4. No requirement to move vehicle during the day
5. Station utilization indirectly obtained through building energy management system
6. Stations capable of being updated for communications if required

These changes are expected to address most of the opportunities our employees found with the present network. By making it open and not requiring registration an employee can very easily charge a vehicle, as well as visitors or suppliers who come to our campus. Removing charging fees and the requirement to move their vehicles improves satisfaction so the employee does not have their day interrupted by having to move their vehicle. This was seen as an inconvenience for employees who are in a meeting and cannot get their vehicle, or during inclement weather, when moving their vehicle may not be most convenient.

5 Conclusions

Several studies such as the EV Project and SCE's workplace charging network have been insightful in describing the benefits of workplace charging. The EV Project found that PHEVs and BEVs with access to workplace charging were able to achieve increased EV miles, 23% higher EV miles for BEVs and 26% higher EV miles for PHEVs. The Department of Energy stated that employees are six times more likely to purchase a plug-in vehicle if their workplace offers charging. We have found through our data collection that we achieve increased EV miles for those with workplace charging in comparison to those without access. Additionally our survey results have shown that 92% of employees are likely to recommend an EV to someone else, despite the very affordable cost of the management lease program influencing many to initially adopt the vehicle simply due to being the most economical option.

We've found that the more you utilize a workplace network the greater the increase in electric miles travelled per week. This results in 3300 more EV miles per year than for those who do not utilize the network, which

is a substantial 74% increase in EV miles. Clearly the participation rate and utilization of a network has a huge impact on the results achieved. This is important because future workplace networks can reduce barriers to utilization so as to improve the impact of their workplace networks.

In Figure 5 it was noted that those who rely on over 50% of their charging at work saw a flat trend in eVMT% compared to the positive trend found in those drivers below 50% of their charges coming from the workplace. This flat trend is indicative of one of the benefits of workplace charging for these drivers. The distribution of drivers with workplace charging > 50% compare well with the populations who charge at work less. In other words, they are still achieving eVMT % values in line with the rest of the population, albeit somewhat lower. This could be representative of PHEV drivers who cannot charge at home, due to perhaps a multi-unit dwelling or no dedicated parking at home. With workplace charging, these individuals can achieve eVMT% similar to the general population. In fact the eVMT % values achieved are similar to those drivers of the general population who do not have access to workplace charging. This intuitively makes sense, drivers who have only one reliable location for charging in essence achieve similar eVMT%, which is somewhat lower to those who have reliable access to multiple locations such as home and work.

Workplace charging offers an opportunity to cost effectively increase the electric miles travelled for all drivers, regardless of vehicle type, as well as reach out to those who live in non-single family homes, which is typically a majority in urban areas where plug-in vehicles are desired the most. And as seen in the survey data, not only will these drivers achieve more miles and enable those in multi-unit dwellings to drive a PEV, but it has the potential to impact sales, as 25% of those surveyed would not have purchased a plug-in vehicle without workplace charging available. Additionally, 92% of those surveyed would recommend a PEV, meaning those potential sales can in turn generate new interest in plug-in vehicles through word of mouth marketing.

It is for these reasons that we recommend that governments, utilities, and businesses work together to promote workplace charging. Governments and municipalities are looking for new ways to increase plug-in vehicle adoption to meet their emissions goals with maximum effectiveness. Additionally efforts to do so must be data driven and sustainable. Utilities benefit from the sale of electric vehicles through increased grid utilization with an opportunity for efficient load leveling by balancing charge times. Balancing charge times optimally at workplaces would ensure that peak demand from plugging in at work could be distributed throughout the off-peak morning and early afternoon hours, and this shifts charging away from the peak times which can be found after work hours.

To recap, workplace charging supports both governments and utilities objectives through the following:

- Increasing eVMT for both BEVs and PHEVs
- Decreasing gasoline consumption and emissions
- Improving and offering opportunity for load balancing through workplace charging scheduling
- Cost effective way to enable electrification for urban drivers and those in multi-unit dwellings
- Key influencer in the decision to purchase a plug-in vehicle, with proven incentive to increase plug-in vehicle adoption

With the data presented in this paper the benefits of workplace charging can be more widely understood by key stakeholders and the execution of effective workplace charging programs can be adopted more quickly, resulting in a sustainable acceleration of plugin vehicle adoption.

References

[1] Idaho National Laboratory, "Plug-in Electric Vehicle and Infrastructure Analysis," U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Idaho Falls, 2015.

[2] Idaho National Laboratory, "Plugged In: How Americans Charge Their Electric Vehicles," Idaho National Laboratory, Idaho Falls, 2015.

[3] Southern California Edison, "Southern California Edison Plug-In Electric Vehicle (PEV) Workplace Charging Pilot," Southern California Edison, Rosemead, 2015.

[4] Office of Highway Policy Information, Federal Highway Administration, "Highway Statistics 2013-Table VM-1," January 2015. [Online]. Available: https://www.fhwa.dot.gov/policyinformation/statistics/2013/vm1.cfm.

Authors

Danny Boston started working full-time at Ford Motor Company in August 2014. During that time he has worked on home/vehicle energy modeling in support of the MyEnergi Lifestyle integration project, and data analysis using electric vehicle customer utilization data from the MyFord Mobile app for policy and vehicle design development. Danny received his MS in Mechanical Engineering from Georgia Tech and his BS in Mechanical Engineering from the University of South Florida.

Anne Marie Graham-Hudak has worked at Ford Motor Company for 9 years, and in the automotive industry for 23 years as a Lead Design and Development Engineer, Program Manager, Business Planner and Subject Matter Expert. She has worked in infotainment, navigation, connectivity, autonomy and electrical vehicles and infrastructure. Anne Marie received her BS in Electrical Engineering from Boston University and is currently an MBA candidate at Lawrence Technological University.

Stephanie Janczak is Manager, Sustainability & Vehicle Environmental Matters - Global EVSE Technology and Deployment at Ford Motor Company. Her focus is to develop and implement new technologies, business models and partnerships to support and ensure the success of Ford's Global Electrified Vehicle plans including Residential Programs, Public and Employee Station Installations and Data Analytics. Stephanie holds a Bachelor's Degree in Mechanical/Biomedical Engineering from Carnegie Mellon University and Master's Degree in Business Administration from University of Michigan.