TEXAS RIVER CITIES PLUG-IN ELECTRIC VEHICLE INITIATIVE
REGIONAL PLAN AND FINAL REPORT

TEXAS RIVER CITIES

Plug-In Electric Vehicle Initiative

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TEXAS RIVER CITIES PLUG-IN ELECTRIC VEHICLE INITIATIVE

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- Gables Apartments
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- General Motors (GM)/Chevrolet
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- Greater Austin-San Antonio Corridor Council
- GRIDbot
- Gulf States Toyota
- Hubbell Wiring Device-Kellems
- ICF International
- Liberty PlugIns, Inc.
- Mission Verde Alliance
- New Braunfels Chamber of Commerce
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1.1 Executive Summary

1.1.1 Introduction

Electric utilities achieve a higher level of service through improvements in operational reliability, better energy information and energy management tools for customers, and integration of renewable energy resources. Intelligent integration of plug-in electric vehicles (PEVs) with the electric system supports several of these service goals, enables reductions in carbon emissions, and provides a cost-effective and stable transportation fuel alternative.

To fully achieve these benefits, barriers must be removed that inhibit the purchase of PEVs and the installation of electric vehicle supply equipment (EVSE). For this reason, Austin Energy, a City of Austin municipally-owned electric utility and thought-leader in PEV infrastructure, formed the Texas River Cities Plug-in Electric Vehicle Initiative (TRC) to promote PEVs in the Central Texas region, including the greater Austin and San Antonio communities. The Department of Energy provided initial funding for TRC through Funding Opportunity Announcement FOA-0000451.

The scope of TRC is to provide a regional/community-based infrastructure readiness plan, providing a series of templates and tools that can be adopted by and adapted to any region or community in the country. Contributors to this report include electric utilities, PEV manufacturers, dealerships, charging manufacturers and installers, community groups, local, state and federal government officials, academic and research institutions, and other industry participants.

1.1.2 Purpose

The purpose of this project was to identify, assess, and summarize key stakeholders’ ongoing activities and future needs critical to successful PEV adoption. This resulting report details an action plan addressing infrastructure needs and policy changes to support the adoption of PEVs. It includes needs analysis, best practices, and stakeholder tools to develop the PEV market in the TRC region.

The Texas River Cities Plug-in Electric Vehicle Regional Plan and Final Report is composed of:

- Section 2 Needs Analysis, Typology, and Best Practice Guide
- Section 3 EVSE Codes, Ordinances, and Permitting Toolkit
- Section 4 Workplace and Multifamily Housing Issue Identification
- Section 5 New Utility Business Models with Third-Party PEV Infrastructures
- Section 6 EVSE Technology Interoperability Roadmap

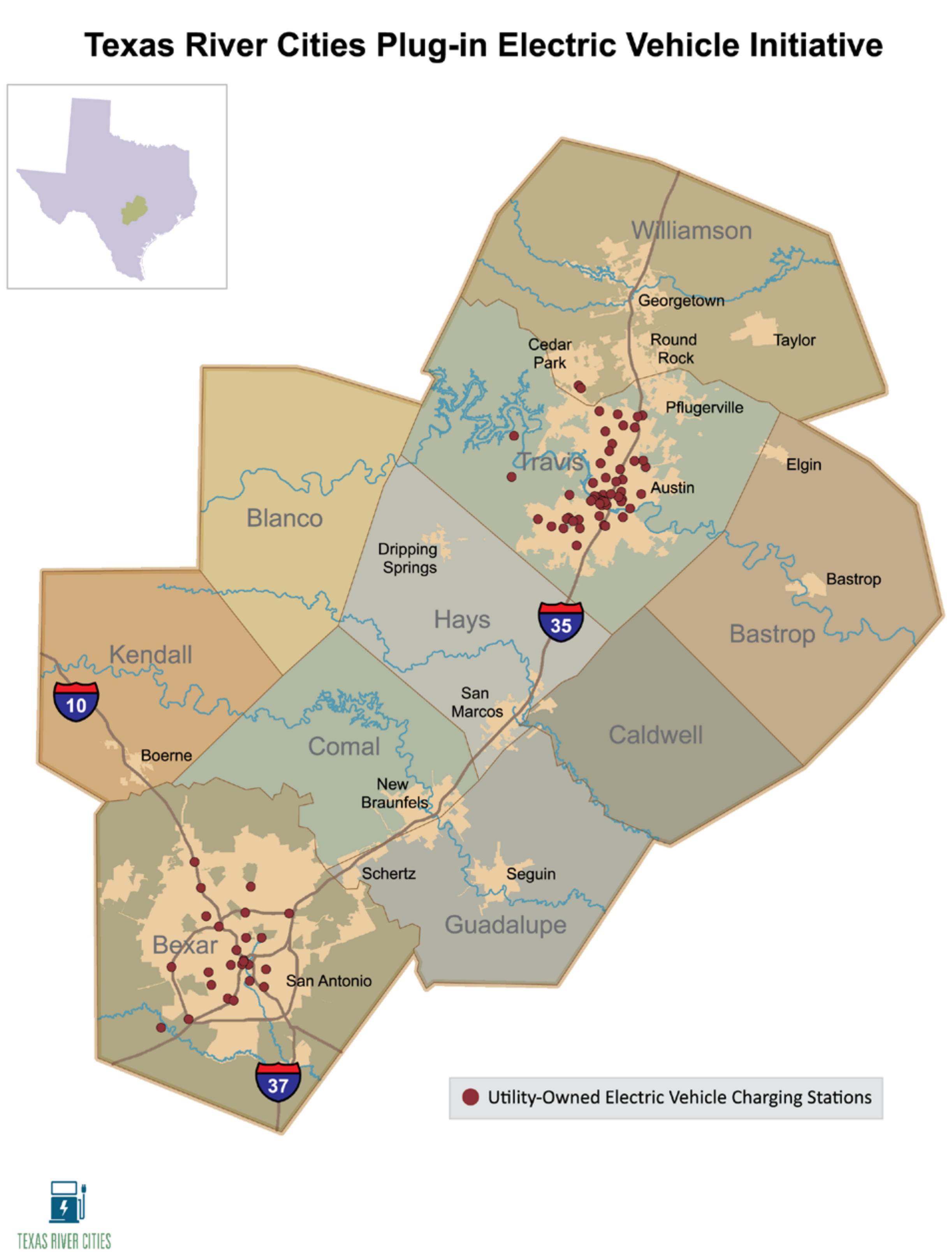
- Section 7 Communications Plan
- Section 8 Projection of PEV Market Penetration for the TRC Region
- Section 9 Creation, Administration, Growth of Texas River Cities Initiative
- Section 10 Market Research Surveys and Results

1.1.3 Stakeholder Engagement Process

Austin Energy held an initial meeting to gauge interest in TRC from stakeholders in the fall of 2011. By the spring of 2012, the TRC project team had reached out to nearly 200 potential stakeholders and those interested in the PEV market throughout the TRC region. The TRC region covers an area of Central Texas from Austin to San Antonio, including the following counties: Bexar, Comal, Hays, Travis, Williamson, Bastrop, Caldwell, Guadalupe, Kendall, and Blanco. The TRC region (see Figure 1-1), which includes nearly four million people, is primarily served by public power providers.

A series of four formal stakeholder workshops were held between March and August 2012 to solicit stakeholder input. A total of 69 individuals representing 51 companies volunteered time and effort to assist in the process. Additional stakeholder input and comments were solicited between the stakeholder meetings via conference calls and email communications. TRC collected data from six surveys incorporating over 1,000 PEV industry stakeholders and experts.

Figure 1-1. Texas River Cities Region



1.2 Key Themes and Recommendations

Throughout the course of the project several themes repeatedly emerged from the stakeholders and research. As a result, the analysis and recommendations incorporated in this report address the following:

1. **PEVs are viable in Central Texas now and are fun to drive.** As supported by the PEV owners survey conducted during the planning process, PEV drivers are not sacrificing trip mileage to drive the majority of their miles in electric mode. The PEV owners survey confirms that owners enjoy driving PEVs and appreciate the vehicles' quiet, rapid acceleration. Every major automaker has announced plans to offer a PEV by the end of 2013. As more models come onto the market, consumers will have more choices and price points to meet their demand. The automakers have targeted Texas, California, New York, Florida, and other select regions for initial vehicle launches. TRC partners expect increased adoption as vehicle availability becomes more uniform.
2. **PEVs will become price competitive.** A recent McKinsey study[1] forecasted declining battery costs combined with a $3.50 or more per gallon of gasoline price will make PEVs a more economical choice in years ahead. Price parity with conventional vehicles – the single biggest determinant of future market adoption – and/or attractive lease options will help increase market share, particularly if gas prices continue their upward trend.
3. **Charging infrastructure needs to be seamless and easy to use.** Stakeholders identified a clear need for a convenient network of charging infrastructure throughout the TRC region. Utilities have made initial investments in publicly accessible infrastructure via support from DOE. Absent additional federal incentive programs, future EVSE installations need to be market-driven, particularly in the areas of charging at workplaces and multifamily properties. Public/private partnerships between utilities, property managers and infrastructure providers are essential. Furthermore, EVSE should have a common payment system as a convenience to PEV owners throughout the TRC region.
4. **Utilities need to monitor EVSE demands and potential impact on the grid as PEV adoption increases and faster charging technologies become available.** At this time, partner electric utilities report no major grid impacts due to PEV adoption. Off-peak capacity is more than adequate to support the emerging PEV market. However, charge management programs and policies will become crucial as the Electric Reliability Council of Texas (ERCOT) market does not have the reserve capacity to support future widespread on-peak charging. As for potential grid issues, utilities will monitor the installation and usage of EVSE, and the impacts on distribution grid operations. New Fast-Charge technologies may also cause localized grid impacts; therefore, utilities will want to monitor the evolving EVSE technology landscape closely.

[1] Hensley, Russell, *et al*, "Battery technology charges ahead," McKinsey Quarterly, July 2012. http://www.mckinseyquarterly.com/Battery_technology_charges_ahead_2997.

TRC stakeholders support the following key recommendations:

1. **TRC stakeholders recommend establishment of the TRC initiative as a formal entity. The entity will review the plan outlined in this report, adopt plan elements, and pursue implementation of those elements and recommendations.** Continuation and implementation of the TRC objective will help facilitate widespread adoption of PEVs in the region through the adoption of interoperable equipment and complementary policies across the region.
   - This initiative will continue to be funded by DOE grant funds through the conclusion of the grant in June, 2013.
   - Funding for subsequent TRC activities has not been committed. TRC shall secure additional funding prior to adopting an organizational structure requiring funding to support its mission beyond June, 2013. (See Section 9)
2. **To build consumer confidence in PEV technologies, TRC will launch an education and outreach campaign.** The campaign objective is to reveal PEVs as fun, attractive, and a reliable option for Central Texans. It will educate primary and secondary audiences identified in the communications plan on how local communities can support PEVs. The campaign will also promote the regional economic benefits of PEVs.
3. **TRC will support and promote PEV rebates and other incentives.** Price parity of PEVs with conventional vehicles is the single biggest factor influencing PEV adoption according to the research completed as part of this plan.[2] Until economies of scale result in lower prices, incentives are needed to accelerate adoption. TRC will work with entities across the region to influence local support and subsidization of PEVs and related infrastructure to help bridge the price parity gap. TRC will solicit federal funds as appropriate and available.
4. **TRC will work with stakeholders to develop programs and incentives targeting charging infrastructure at multifamily housing and workplaces.** Regional surveys indicate modest interest in PEVs among multifamily housing tenants.[3] Surveys additionally show that, second to home recharging, PEV owners are most likely to charge their vehicles at work. Providing education and training to apartment managers, property owners, and employers will increase the potential for EVSE installations at these sites. TRC and its partner utilities may also accelerate experience and acceptance of EVSE by implementing pilots at these locations. Developing a "PEV-Ready" real estate certification program within the TRC region may also provide the impetus for workplaces and multifamily properties to install EVSE.
5. **TRC will address challenges of charging infrastructure interoperability throughout the TRC region.** PEV owners expect readily available access to EVSE infrastructure allowing them to fuel their vehicles wherever they drive. Furthermore, they expect the charging process to be essentially the same. Currently, there are multiple EVSE providers with proprietary systems installed throughout the United States; a PEV owner may have to be a member of multiple systems to charge his/her PEV across the region. This issue must be

[2] University of Texas at San Antonio, "Driving the Future, An Adoption Model for Electric Vehicles in San Antonio," September 2012; Austin Energy Market Research, "PEV Owners Survey," August 2012, and "Business Model Survey," August 2012. See Sections 8 and 10 of this report for more information on these studies.
[3] Quarter 1 2012, Austin Energy Market Research Product Development Survey Results.

resolved to ensure the growth and regional economic benefits of PEVs. Therefore the TRC will:

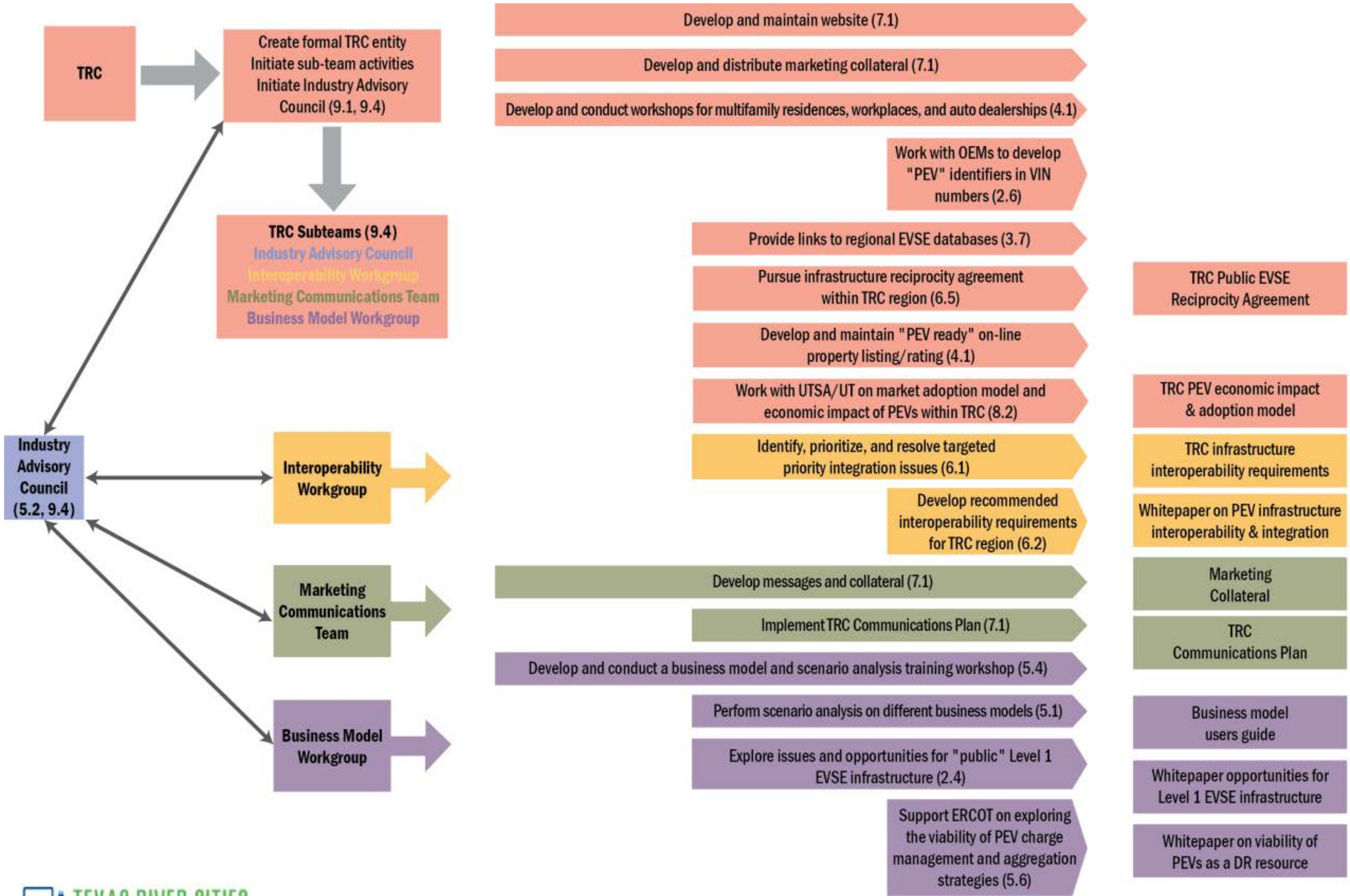
- **Pursue development and execution of a regional PEV charging infrastructure reciprocity agreement between participating utilities.** Interoperability is a key issue that must be addressed by industry and government action to lower fueling costs and make charging customer friendly.
- **Develop general functional and technical requirements for EVSE equipment and applications.** These requirements will allow for interoperability of devices, systems, and applications that will be installed in the TRC region.

A summary of all recommendations developed in this report can be found in Appendix A.

1.3 Next Steps

TRC stakeholders, upon completion and delivery of this report, will meet to vote on creating a formal TRC entity. As the entity formation process proceeds, Austin Energy, as the grant recipient, will hold the implementation kick-off meeting. The purpose of this meeting is to begin implementation activities. Figure 1-2 provides the roadmap of activities generated from the recommendations developed in the plan.

Figure 1-2. Recommendations Roadmap



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Note: The numbers in parentheses represent the plan recommendation that supports this activity. For example 9.3 is Section 9, Recommendation 3. See Appendix A for a summary list of all recommendations.

2.1 Overview

This Needs Analysis, Typology, and Best Practice Guide is a collection of information and experiences from individuals, companies, and technology vendors that have been operating in the plug-in electric vehicle (PEV)/electric vehicle supply equipment (EVSE) industry. It provides a spectrum of insights, from PEV ownership issues to EVSE installation and operation best practices and lessons learned.

This information has been distilled into a series of guidelines and tools for individuals and organizations to use to implement EVSE infrastructure in the TRC region. Key findings from this report include the following:

1. Many PEV owners are already operating throughout the TRC region and gaining valuable experiences that should be channeled into developing new processes, products, and services for the EVSE industry. A limited amount of EVSE is deployed in the TRC region and a majority of PEV owners are utilizing public and workplace EVSE as well as charging at home.
2. A growing number of EVSE vendors are available in the market today. Products, services, and applications information collected from these vendors will be used by TRC to develop technical and functional specifications that will be a key component of an ultimate TRC Implementation Plan. Furthermore, the plethora of new technologies, systems, and applications will present significant interoperability and integration challenges. Section 6: EVSE Technology Interoperability Roadmap discusses interoperability and integration in greater detail, and includes comprehensive documentation and prioritization of the integration points. In short, EVSE technology decisions will need to incorporate integration considerations, which reinforce the need for developing the specifications at the beginning of the implementation process.
3. Two key lessons learned from companies who were the first to install EVSE are 1) develop goals, objectives, and usage specifications before selecting the technology, and 2) before finalizing the location and number of EVSE units, make sure to incorporate all electric upgrade costs to avoid significant cost increases over the original budget.
4. There is value in providing energy monitoring tools to customers – as well as to the utilities serving them – to help them understand the true costs of PEV ownership and fueling.

2.2 Recommendations

Recommendation 1

A designated PEV charging infrastructure team with a formal project manager is essential to develop and execute project plans. TRC will serve as a consulting resource to companies and local governments to assist with project planning and execution.

Recommendation 2

TRC will periodically update the included EVSE Typology Landscape document and model. Furthermore, TRC will designate an organization or TRC subteam with technical experience to take over management of the document in the future.

Recommendation 3

TRC will cross-analyze the included EVSE Typology Landscape with the market research and lessons learned to identify new products or applications development opportunities to share with the industry.

Recommendation 4

TRC will conduct market analysis on Level 1 EVSE infrastructure and investigate it in conjunction with multifamily and workplace pilots in the region, as well as business-model development, to determine if there is a market for implementation.

Recommendation 5

TRC will become a regional channel for the development and dissemination of marketing outreach and education materials for the PEV/EVSE industry in the region.

Recommendation 6

TRC will work with the PEV original equipment manufacturers (OEMs) to help identify PEV location and attributes using vehicle identification numbers (VINs) or other methods to indicate features of vehicles that might impact electric system reliability.

Recommendation 7

TRC will continue to work with Pecan Street Inc. and others to collect, analyze and disseminate data to better understand when and where PEV charging occurs and how emerging technologies and new business models can mitigate PEV charging impacts.

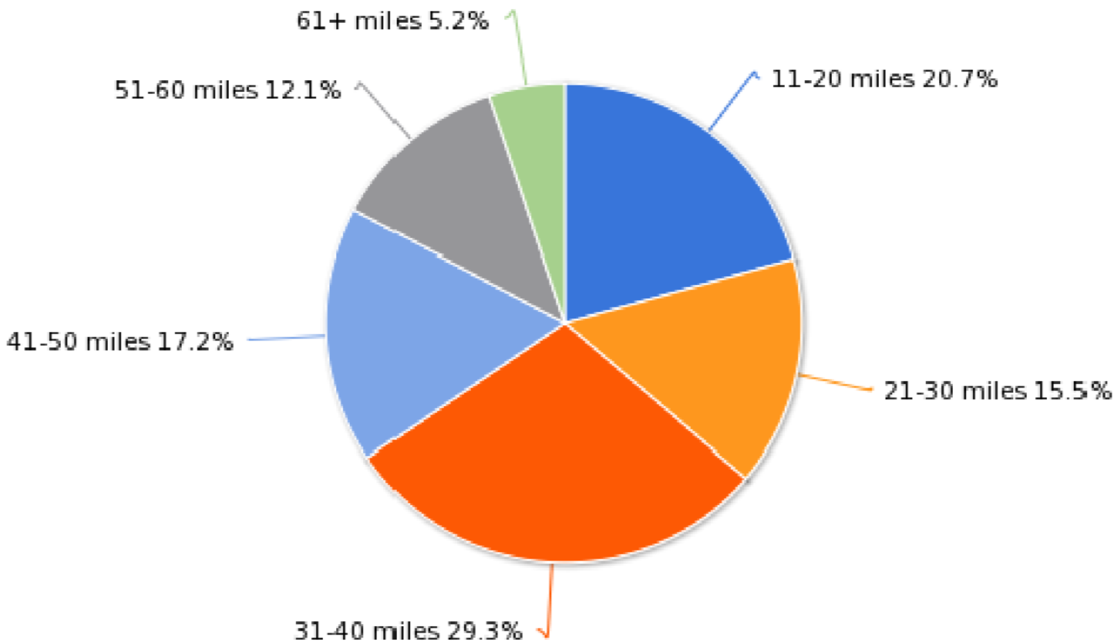
2.3 Regional Needs Analysis

As part of the TRC needs analysis, Austin Energy’s Market Research and Product Development team conducted a regional survey of PEV owners and asked questions designed to assist in the understanding of customer needs, requirements, and charging habits, and current trends of PEV ownership. The survey collected information from 62 PEV owners located throughout the TRC region.

The results were self-reported, and no energy or cost data were collected as part of the survey. Furthermore, many of the respondents had received an incentive to install Level 2 EVSE at their home. Over 93 percent (58 out of 62 respondents) had purchased their PEVs in 2011 or 2012. Twenty-seven respondents stated that the PEV was their primary car, while 30 respondents indicated they use it as a secondary vehicle. The latter respondents stated that they would consider using the PEV as their primary mode of transportation only if the vehicle gave a better range (more miles per charge). However, the respondents' definitions of adequate range varied significantly, from 120 to more than 500 miles.

Interestingly, while range was the primary factor given for those who did not use their PEV as a primary vehicle, the average miles driven per day was only 31.4, with the maximum reported at 61 miles per day. Figure 2-1 summarizes the breakdown of the distances the respondents reported driving their PEVs.

Figure 2-1. Breakdown of Regional PEV Usage Rates



Note: Average miles driven per day and percent of total.

Paramount to developing EVSE implementation strategies and recommendations is understanding how PEV owners charge their vehicles. Specifically, it is important to understand when and where charging occurs, which will help the industry develop business models and customer value propositions around EVSE operations. This is discussed in more detail in Section 5: New Utility Business Models with Third-Party PEV Infrastructures.

Surveyed PEV owners reported charging their PEV during all hours of the day. Figure 2-2 shows that the majority of the charging activity occurs between 6:00 p.m. and 6:00 a.m., which suggests that PEVs are primarily charged at owner's place of residence. Indeed, Figure 2-3 confirms this: more than 89 percent of respondents reported charging the PEV at home. This is currently higher than other studies where information on charging has been collected.[4] TRC will analyze its research with the EV Project's results to learn more about these differences, and if they impact the future value of public EVSE.

Figure 2-2. Reported PEV Charging Times

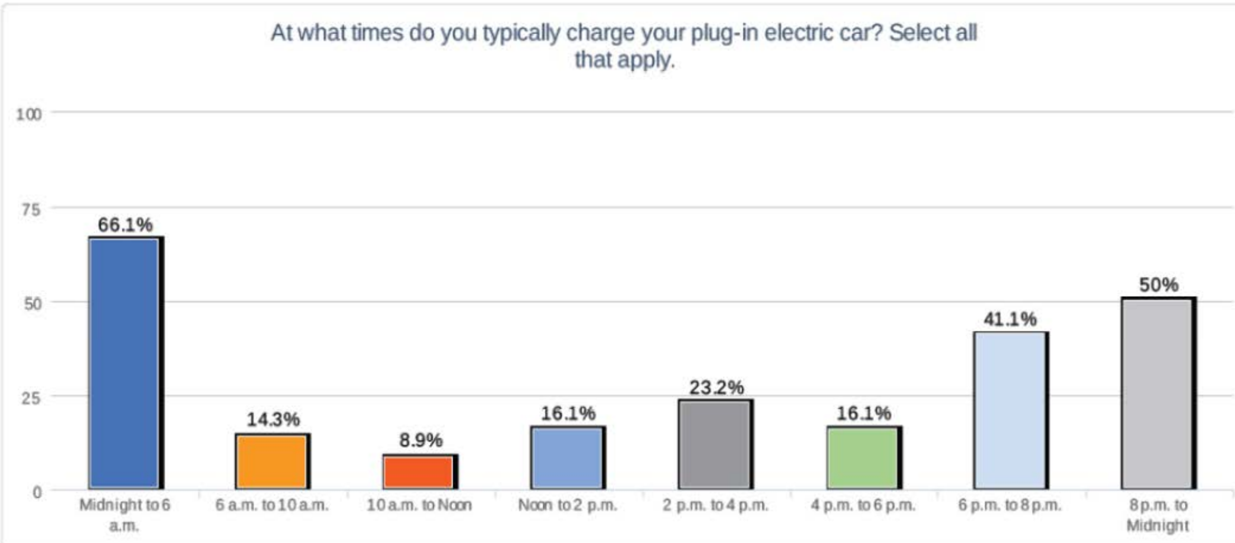
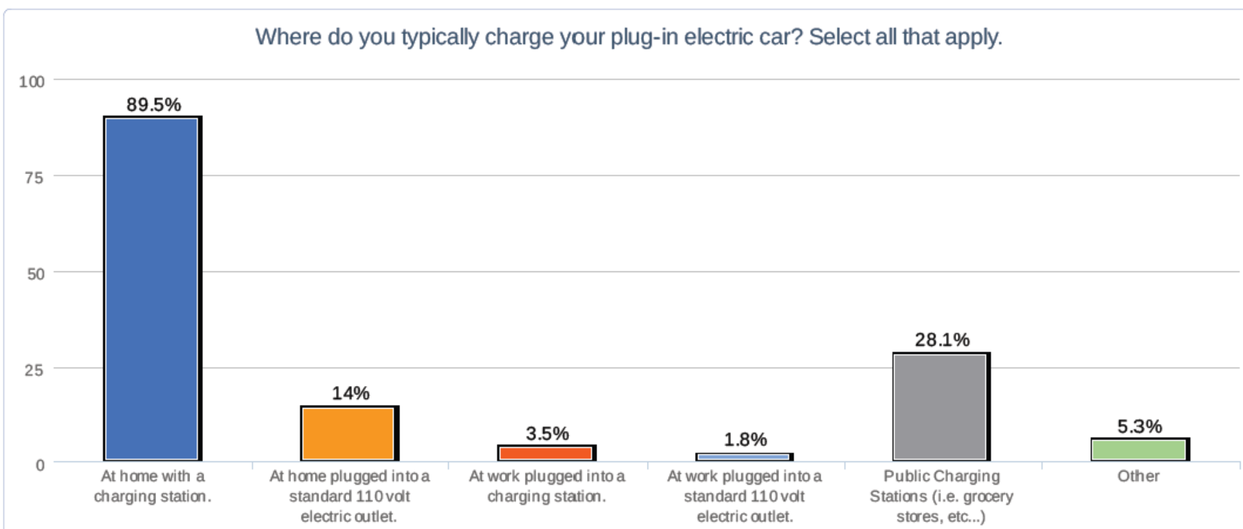


Figure 2-3. Reported PEV Charging Locations



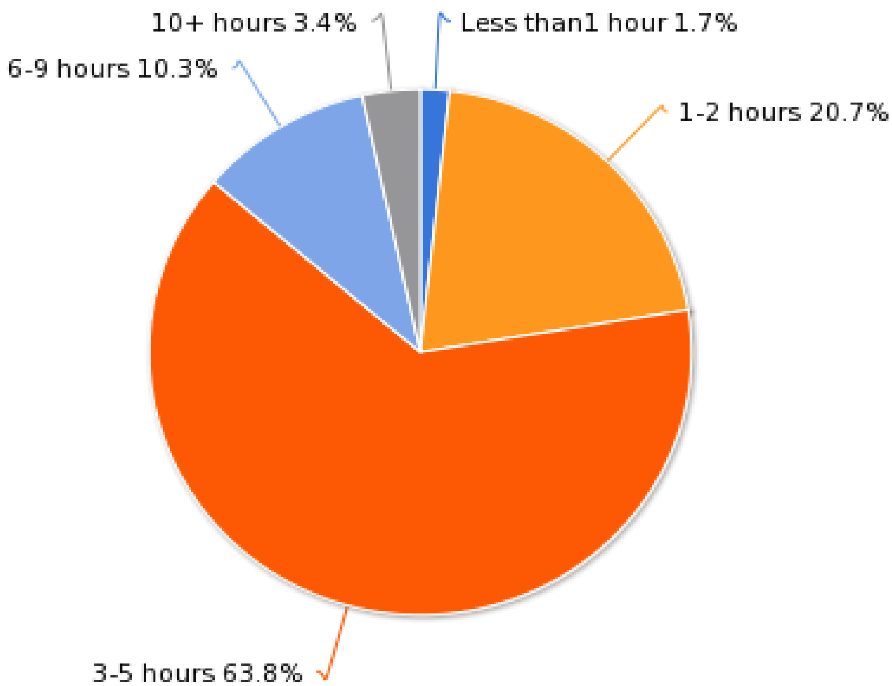
Respondents were also asked to report on how long they charged their PEVs on average each day. Figure 2-4 shows that 64 percent of the respondents only charge their PEVs 3-5 hours a day. This may reflect several important issues: the average use per day does not dictate a full charge

[4] See The EV Project, *The EV Project, Q1 2012 Report*, http://www.theevproject.com/downloads/documents/Q1%202012%20EVP%20Report.pdf.

of the battery, respondents are using a faster charging EVSE technology (such as Level 2), or they are charging several times a day for shorter periods.

With respect to types of charging, this report focuses on two major categories: a full charge, where a battery is charged from a nearly depleted state, and an opportunity charge, where the battery is charged for shorter periods to “top off” the battery.

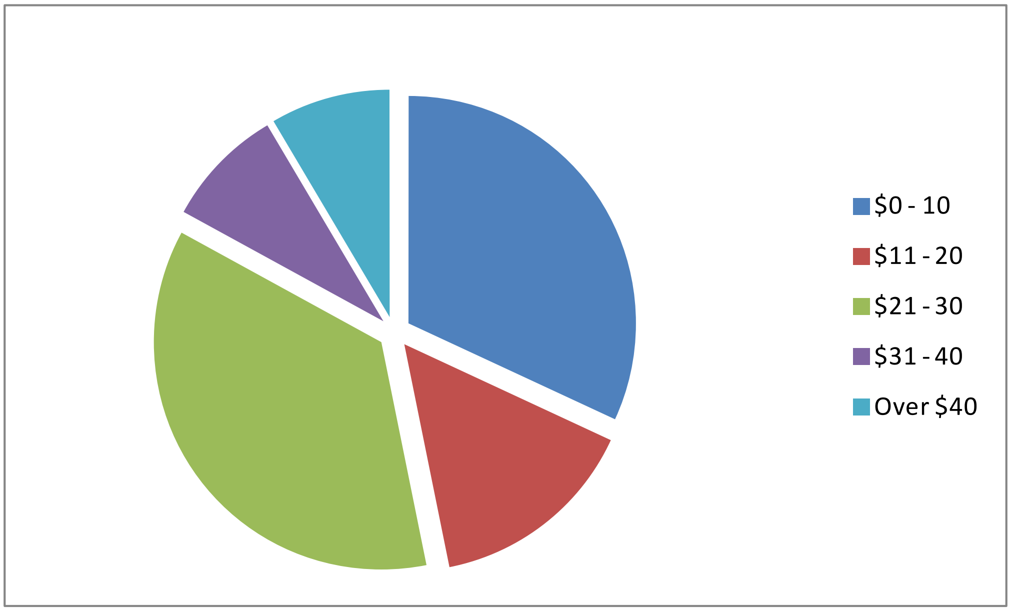
Figure 2-4. Reported Daily PEV Charging Duration



Furthermore, as illustrated in Figure 2-3, above, opportunity charging is occurring primarily at public EVSE locations and to a lesser extent at the workplace. Section 4: Workplace and Multifamily Housing Issue Identification discusses findings, barriers, challenges, and recommendations for installing EVSE in workplaces. Although public charging represented a relatively small component of the respondents’ overall charging, the majority of respondents have used public EVSE. The reluctance to use these locations regularly can be grouped into three major categories: 1) no need to use them, 2) not a convenient location, and 3) slow technology. When asked what could be done to make public charging easier, responses varied widely, with two general themes emerging: 1) provide more charging stations and 2) provide faster charging stations.

Respondents were also asked to estimate (since there is not a separate meter to monitor home charging use) how much their monthly electric bill has increased since they have purchased their PEV. According to survey results, the average bill increased by $20.20. Figure 2-5 shows the self-reported responses. Several respondents with solar-powered homes indicated that they have seen no increase in their utility electric bill. Others indicated that their bills increased by up to $50. Several factors can account for this variability, including differing driving patterns and electric rates. However, it also shows that PEVs can represent a significant new load for customers, and one that will potentially have a major impact on their electric usage. Therefore, there will be value in providing tools to customers – as well as to the utilities serving them – to help them understand the true costs of PEV ownership and fueling.

Figure 2-5. Average Reported Monthly Electric Bill Increase to Charge the PEV at Home



In conclusion, the results of the PEV owners survey show that this group is actively using the infrastructure that is available and, more importantly, is looking for ways to increase this activity. Section 10: Market Research Surveys and Results provides more information and data from the PEV owners survey.

2.4 EVSE Typology Landscape

2.4.1 Methodology

Overview

A key component of TRC was to systematically solicit, collect, and store technical product information from vendors that will assist any entity in the TRC region in selecting EVSE infrastructure. With the numerous EVSE vendors and service providers in the industry, the goal was to do some of the legwork for those companies interested in EVSE ownership. The end result of the process was the creation of a database of EVSE vendors with configurable fields that would reduce the necessary research required to purchase and install EVSE.

Process

The process started with inviting stakeholders throughout the TRC region to participate in the development of the EVSE typology template. This template included a list of EVSE capabilities and general company information that would be needed to assist in the selection of EVSE. Through multiple threads of research, a list was developed of 56 EVSE vendors that would receive the typology landscape document. The next step in the process was securing legitimate vendor contacts, sending out requests for information, tracking vendor responses, and monitoring the results.

2.4.2 Results and Conclusions

As the self-reported responses were received, they were checked for completeness and many questions or concerns were addressed with the vendor. After two months of research, data collection, and follow-up requests, the initial list of 56 vendors was whittled down to 25 companies that provided data for the typology landscape. The list of vendors is given in Figure 2-6.

The following conclusions became apparent as information was compiled and processed:

1. The EVSE industry is still in a very nascent state, and new companies and products are entering (and exiting) at a quick rate.
2. As young as the industry is, there has already been some consolidation of companies and technologies.
3. Technology, systems, and applications development is continuing at a rapid pace, suggesting that the typology landscape must be updated on a regular basis.
4. These were self-reported results from vendors. As valuable as this information is, it will need continual validation over time as the business environment changes, the market sector grows, and more industry data become available.

There will be potentially significant challenges to overcome with the integration and interoperability of different systems. To ensure that the key integration points are documented and prioritized, the technologies in this landscape need to be compared with the analysis in Section 6: EVSE Technology Interoperability Roadmap.

Figure 2-6. Initial List of EVSE Vendors Investigated for the Typology Landscape

ABB
Aerovironment, Inc.
Agero
Akerwade
Alpha Energy (Solar Charging Grid Tied Racks)
Andromeda Power
Avcon Corporation
Better Place
Blink Network
ChargeMaster
ClipperCreek, Inc.
Control Module Industries (EVSE LLC)
Coulomb Technologies, Inc.
DBT USA
Eaton
ECOtality
2Efacec
Elektromotive

Erg-go
E-Totem
EV Box
EVCharge America
Evoasis
EVoCharge
EVTEC
EyeOnPower
Fuji
General Electric
GoSmart Technologies
Green Garage Assoc (Free Juice Bar)
Greenlight AC
GRIDBot
HaloIPT (Qualcomm)
Lear
Legrand
Leviton
Liberty PlugIns

Mitsubishi
Momentum Dynamics
Nichicon
Nissan
Panasonic
Sumitomo
Optimization Technology
Park and Power
Parkpod
Pep Stations
Plug Smart
RWE
Schneider
SemaConnect
Shorepower
Siemens
SPX Service Solutions
Volta
WiTricity

2.4.3 Typology Landscape Model

TRC collected detailed EVSE capabilities from 25 different vendors. Table 2-1 summarizes some of the higher-level capabilities that would allow a TRC entity to quickly sort and filter based on their own requirements. Addendum A at the end of this section provides the detailed template information for each of these 25 vendors.

Table 2-1. EVSE Typology Summary Table

	Charge Type				Communications & Billing Options			Mounting Options			
EVSE Company	Level I Charging	Level II Charging	DC Fast-Charging	Inductive Charging	Network Communications Available	Billing/Payment Interfaces	Billing/Payment Networks	Floor/Ground	Bollard	Wall	Overhead
ABB			x		x	x	x	x			
Aerovironment, Inc.	x	x	x		x	x	x	x		x	
Andromeda Power			x		x	x	x				
ClipperCreek, Inc.	x	x			x	x	x	x		x	
Control Module Industries (EVSE LLC)	x	x			x	x	x	x		x	x
Coulomb Technologies, Inc. (Chargepoint)	x	x			x	x	x	x	x	x	
DBT USA		x			x	x		x	x	x	
Eaton	x	x	x		x	x	x	x		x	
ECOtality		x			x	x	x	x	x	x	
Erg-go		x			x	x	x	x		x	
EVCharge America	x	x			x	x	x	x		x	
EVoCharge	x	x						x		x	x
Fuji			x		x	x	x	x			
General Electric		x			x	x	x	x		x	
Green Garage Assoc (Free Juice Bar)	x	x			x	x	x	x			
Legrand		x						x		x	
Nichicon			x			x		x			
Optimization Technology	x	x			x	x	x	x			
Parkpod	x	x			x	x	x	x		x	
Pep Stations (Hubbell Wiring Device-Kellems)		x			x	x	x	x		x	
Schneider		x	x					x		x	
SemaConnect		x			x	x	x	x		x	
Shorepower	x	x			x	x	x	x		x	
Siemens	x	x			x	x	x	x	x	x	
SPX Service Solutions		x			x	x			x	x	

2.5 Best Practices and Lessons Learned Interview Results

In-depth interviews of project managers, installers, and designers across the United States were conducted to get a broader idea of the lessons learned and best practices applied to the design, installation, and operation of EVSE. The interviewees reflect a relatively comprehensive cross-section of industry stakeholders and included:

- Utilities
- State departments of transportation
- City representatives
- Large employers
- Community PEV association representatives
- Electrical contractors
- EVSE vendor representatives

The results were broken out into four major categories: reasons for installing EVSE, EVSE location and design decisions, installation experiences, and operational experiences.

2.5.1 Reasons for Installing EVSE

There are many different reasons for installing EVSE, and the decision frequently comes after an exploratory phase where costs and policy implications are investigated. A common question among organizations considering installing EVSE infrastructure is whether to wait for more demand to install charging stations or build the infrastructure to prepare for future demand.

Most respondents' primary reason for installing charging stations was the anticipation of future PEV use and/or to take advantage of free or subsidized EVSE and/or installation costs, through federal PEV or smart grid grants. For some, addressing the range anxiety their employees and customers expressed was enough of a reason to justify EV infrastructure. However, it was a business necessity for utilities – to learn what to expect and prepare for future adoption in their territory, identify system vulnerabilities or hiccups, and test smart grid technologies. Seventy-five percent of the companies interviewed received some form of incentive for installing and operating EVSE.

Additional reasons cited by the respondents for early adoption of ESVE included:

- Economics
- Internal leadership – e.g., state governor, corporate CEO, or internal PEV champion
- Environmental goals
- Education of workforce
- Royalties

2.5.2 Location and Design Decisions

No interviewed organization had a formal process in place for selecting the EVSE to be installed. However, price, attainability, smart grid features, and bidder's overall offering package were factors in decision-making.

Most decisions about installing ESVE were primarily based on cost considerations or electrical factors with a direct impact on cost. However, a few organizations providing public EVSE considered customer-focused criteria prominently as well, with the goal of highest utilization of the EVSE. The main reasons given by those interviewed for location decisions were:

- ***Cost*** – Cost is largely based on proximity to an electrical source or breaker panel. In many locations, the electric panels that would serve the EVSE are located in a building. Other cost factors to consider are the following.
  - Parking garages are preferred, as it is generally easy to run conduit just about anywhere without having to trench. However, proximity to utility power source is important.
  - Trenching through landscaping is easier and less expensive than trenching through concrete.
  - Installing in new construction is typically easier and faster than retrofitting existing buildings.
  - Pole- or wall-mounted chargers are cost effective and versatile.
  - Utility service upgrade, if required.
- ***Visibility*** **–** For hosts who installed EVSE for marketing differentiation, the need to be highly visible and yet accessible to PEV drivers was highly important. For retail establishments, this was near the entrance of the building. For parking lot owners, it was near elevators for easy access to the building.
- ***Host site willingness*** – EVSE were installed at sites hosted by companies who were advocates of PEVs. In these cases, the decision was less about location and more about having committed hosts.

2.5.3 Installation Experiences

The most basic lesson learned to date from literally every respondent is that ***there is no cookie-cutter installation process or methodology.*** Further, there is a learning curve for each organization, and each installation project has different sets of expectation and different requirements. All respondent sites required some electrical upgrades, because of the high number of variables and that each location was different. Some locations required extensive work, such as extending a pole line or trenching a cable. Others needed to change out a transformer to a larger size. Age of the facility that hosts the EVSE was a large factor, with older facilities typically requiring panel upgrades to handle the new EVSE.

Several participants recommended more due diligence on the installation bids – specifically, making sure every detail is being considered. If at all possible, have the vendors' bid responses provide the same information, to enable a side-by-side comparison. A template would be very useful in guiding potential bidders to include multiple site plan options. In addition, permitting and inspection should be proactively managed, including developing an early communication plan and strategy for local inspectors. Therefore, it is recommended that the local utility set up a program to train inspectors on EVSE technology installation and operation practices. It is also recommended that manufacturers' specification sheets be provided in advance to installers, the permitting office, and inspectors, showing Underwriters Laboratories, Inc. (UL) and National Electrical Manufacturers Association (NEMA) ratings.

2.5.4 Operational Experiences

Most EVSE installations in the United States are new, with less than two years of operational experience. In general, relatively little real-time operational monitoring of EVSE is currently happening. Respondents with few installations typically oversee their operations, and answer any questions or concerns from PEV owners. However, companies with larger installations are relying on EVSE manufacturers or service companies to provide 24/7 support.

Most organizations choose to monitor usage using the EVSE data-tracking capabilities for federal grant program requirements, air emissions reporting purposes, or for tax benefit issues. None of those surveyed were yet monitoring the EVSE on a real-time basis to understand how EVSE usage throughout the day may affect their energy bill, peak capacity constraints, or local grid operations. As more EVSE is installed, companies will likely revisit network monitoring practices. To date, there have been limited operational problems. Vandalism, damaged cords, error codes, and communication issues with Wi-Fi services were reported.

As for EVSE scheduling, most workplaces allow employees to communicate and self-regulate the process, with first-come, first-served being the most common approach. So far, there have not been many problems, given low volumes of drivers.

Other companies, facing shortages, created rules for their pilot employee participants. Those wanting to charge at the Level 2 EVSE get a half-day slot – either morning or afternoon – and those staying at work all day are asked to charge on Level 1 EVSE. Employees that come and go throughout the day as part of their jobs could use Level 2 EVSE for a faster charge. Regardless of which EVSE was used, participants still had to pay a monthly subscription fee. Half of PEV pilot participants elected to do so; the others chose to charge regularly at home, on time-of-use rates.

Finally, as companies deploy EVSE for public or company-based use, they are developing policies and procedures for the use of EVSE and the parking spots associated with it. These include:

- Customer payment policies and programs
  - $/Charge Event
  - Subscription programs
  - Time-of-use rates
- Marketing plans to attract PEV owners to use EVSE (for retail or competitive EVSE providers)
- EVSE reservation policies and plans
- Policies for removing cars that are illegally parked in an EVSE spot

- Human resource policies on the taxable or non-taxable benefits of EVSE
- EVSE monitoring and usage plan
- EVSE troubleshooting and diagnostics plan

2.6 EVSE Best Practices Guidelines

The research, analysis, and interviews above provided a significant amount of information and experiences that companies can use when investigating EVSE installation opportunities. This section provides a checklist of guidelines and insights to follow when starting the investigation into EVSE installation, ownership, and operation.

2.6.1 EVSE Business Case Justification

- Develop an overarching strategy, with specific goals and objectives for undertaking an EVSE infrastructure.
- Create business cases early in the process to ensure a clear documentation of the costs and benefits of the project. Section 5: New Utility Business Models with Third-Party PEV Infrastructures contains information on the key costs and benefits associated with EVSE, and includes templates that can be used to develop business case scenarios.
- Identify all team members, departments, and decision-makers that will be involved in the project. Involve everyone early in the process to identify and mitigate any internal obstacles – from facility standards to purchasing processes.
- Identify internal back-office issues early on and ensure management support for resolving them. Meet with company standards personnel early in the process to determine the processes and procedures required for electrical equipment installation at the facility.
- Develop electrical, technical, and business criteria for evaluating location decisions.
- Assign a project manager, program manager, designer, and purchasing officer involved in all facets of the project.
- Develop functional and technical specifications to use in the evaluation, selection, and testing of EVSE.
- Negotiate any fixed and license costs to help avoid financial surprises. This would include EVSE equipment, software license fees, network management, and EVSE installation.
- Develop a project plan to document the task and timeframes associated with different aspects of the project. Factor in additional time for internal standards review and permitting of the new technology.
- Develop an EVSE selection scorecard with specific criteria that can be used to objectively and consistently compare attributes and functionalities across the different technologies.
- Verify the EVSE vendor has a license and insurance to operate in the state where the EVSE is being installed.

- Create EVSE installation policies.
- Consult with utility and governing authorities about laws and local ordinances

2.6.2 Charging Stations Installation Check List

Property Owner Considerations:

- ☐ Level 1, Level 2, or Fast Charging
- ☐ Number of EVSE units
- ☐ Costs (e.g., installation, maintenance, network)
- ☐ Locations
- ☐ Proximity to utility service panel
- ☐ Proximity to building or residence
- ☐ Lighting and shelter
- ☐ Safety
- ☐ Signage
- ☐ Vandalism
- ☐ Ownership pros & cons
- ☐ Rebate options available
- ☐ Maintenance responsibilities
- ☐ User payment methods (if charging customers to use EVSE)
- ☐ Network management
- ☐ Long-term planning for additional EVSE to existing infrastructure
- ☐ EVSE provisioning and monitoring strategies
- ☐ Remote communication options
- ☐ Marketing and advertising plan

Contractor Considerations:

- ☐ Drawing of EVSE location
- ☐ Drawing of electric plan including new circuit
- ☐ Utility service upgrade if required
- ☐ New meter if necessary
- ☐ Load sharing options
- ☐ Trenching route (concrete cutting, trenching, and landscaping)
- ☐ Easement issues

- Proximity to utility service panel
- PEV Americans with Disabilities Act (ADA) requirements
- Standing water and flood issues
- Underground utility lines
- Building codes and zoning requirements
- Additional safety lighting requirements
- Additional utility service upgrades fees

Utility Considerations:

- Laws and regulations
- Existing service
- Transformer capacity
- Metering options
- Load sharing
- Load management
- PEV rate structure
- Grid impact/smart grid
- Load shedding
- Incentives

Permitting and Inspection Considerations:

- Certified electrician credentials
- Permit approval process
- Utility upgrade if occurred
- Building codes satisfied
- Electric codes satisfied
- PEV ADA requirements satisfied

Governing Authority Considerations:

- Public planning
- Funding/grants
- Public sitting locations
- PEV ADA requirements
- Public street signage
- Traffic patterns

- Local ordinances
- Other requirements

Public Charging Installations Process

1. Business owner researches PEV and EVSE options
2. Business owner consults with utility
3. Business owner consults with governing authority
4. Business owner consults with electric contractor
5. Contactor performs site visit
6. Contractor provides cost estimate to bushiness owner
7. Contractor signs contract
8. Contractor develops site plan
9. Contractor requests permit from city
10. Contractor requests new address from city if new meter is required
11. Contractor contacts other utilities for underground wires/pipes before digging
12. Contractor contacts local utility if utility service is required
13. Utility upgrades service if necessary
14. Contractor installs station
15. Contractor requests inspection and obtains approval
16. City inspects and approves installation
17. Contractor requests new service order for a new meter if applicable
18. Utility installs meter
19. Business owner provisions station and configures network

Home Charging Installations Process

1. PEV owner purchases Level 2 EVSE
2. PEV owner consults with utility
3. PEV owner consults with electric contractor
4. Contractor performs site visit
5. Contractor provides cost estimates to PEV owner
6. Contractor develops site plan

7. Contactor obtains permit
    a. Current service is sufficient. Proceed to step 8
    b. Current service is insufficient
        i. Contractor orders utility service upgrade
        ii. Utility installs new meter if required
8. Contractor installs station
9. Contractor requests inspection and obtains approval
10. Installation complete

Multifamily Charging Installations Process

1. PEV owner contacts landlord/homeowners association (HOA)
2. Landlord/HOA purchases EVSE
3. Landlord/HOA decides Level 1 or Level 2 EVSE
4. Landlord/HOA consults with utility
5. Landlord/HOA consults with electric contractor
6. Contractor performs site visit
7. Contactor obtains permit
    a. Current service is sufficient. Proceed to step 8
    b. Current service is insufficient
        i. Contractor orders utility service upgrade
        ii. Utility installs new meter if required
    c. Contractor considers load sharing options
8. Contractor installs stations
9. Installation complete
10. Contractor requests inspections
11. City inspects and approves installation
12. Contractor requests service order for a new meter if applicable
13. Utility installs meter
14. Landlord/HOA provisions station and configures network

Figure 2-7. EVSE Installation Process for Public Charging

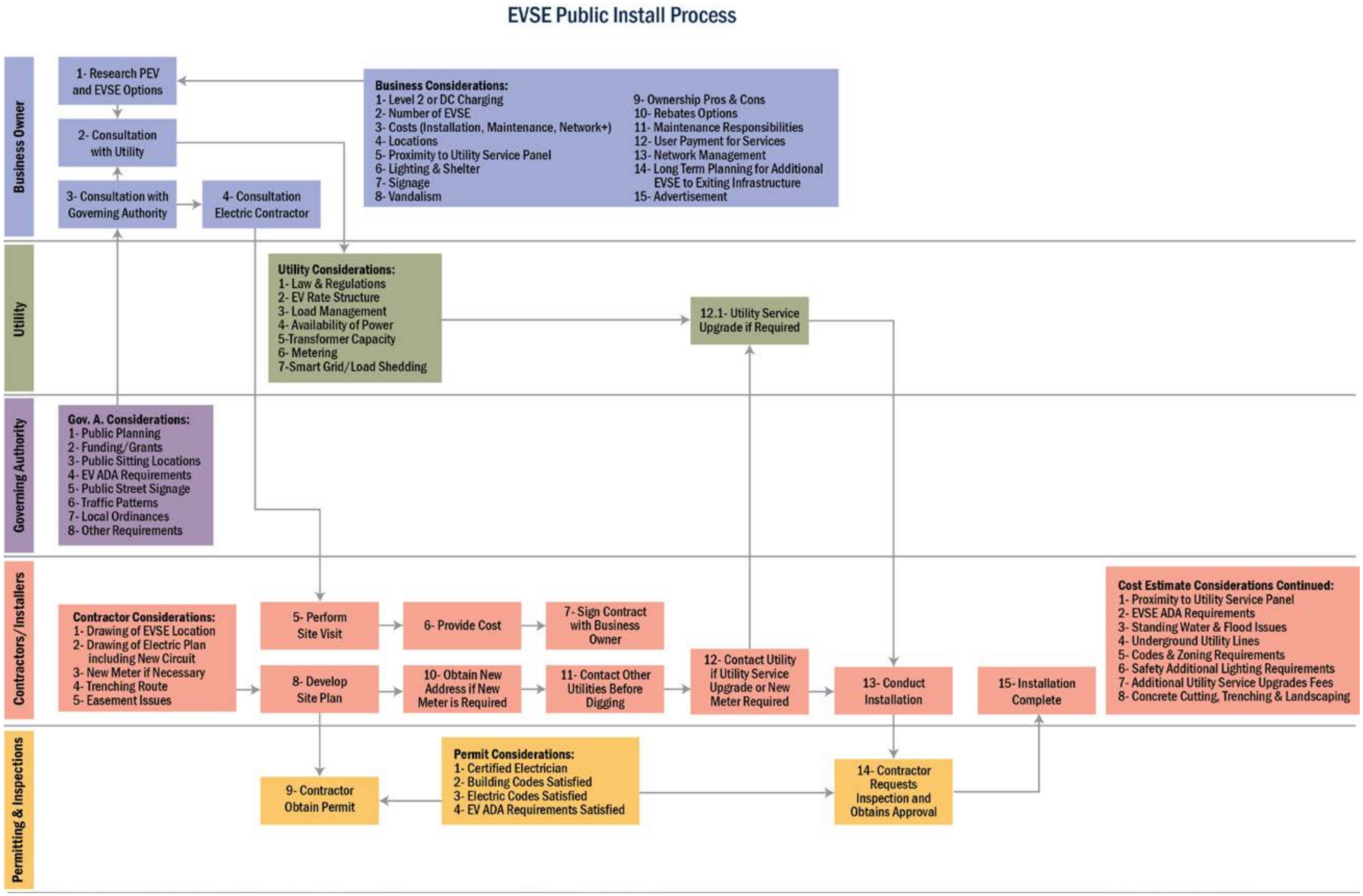


Figure 2-8. EVSE Installation Process for Residential Garage/Car Port

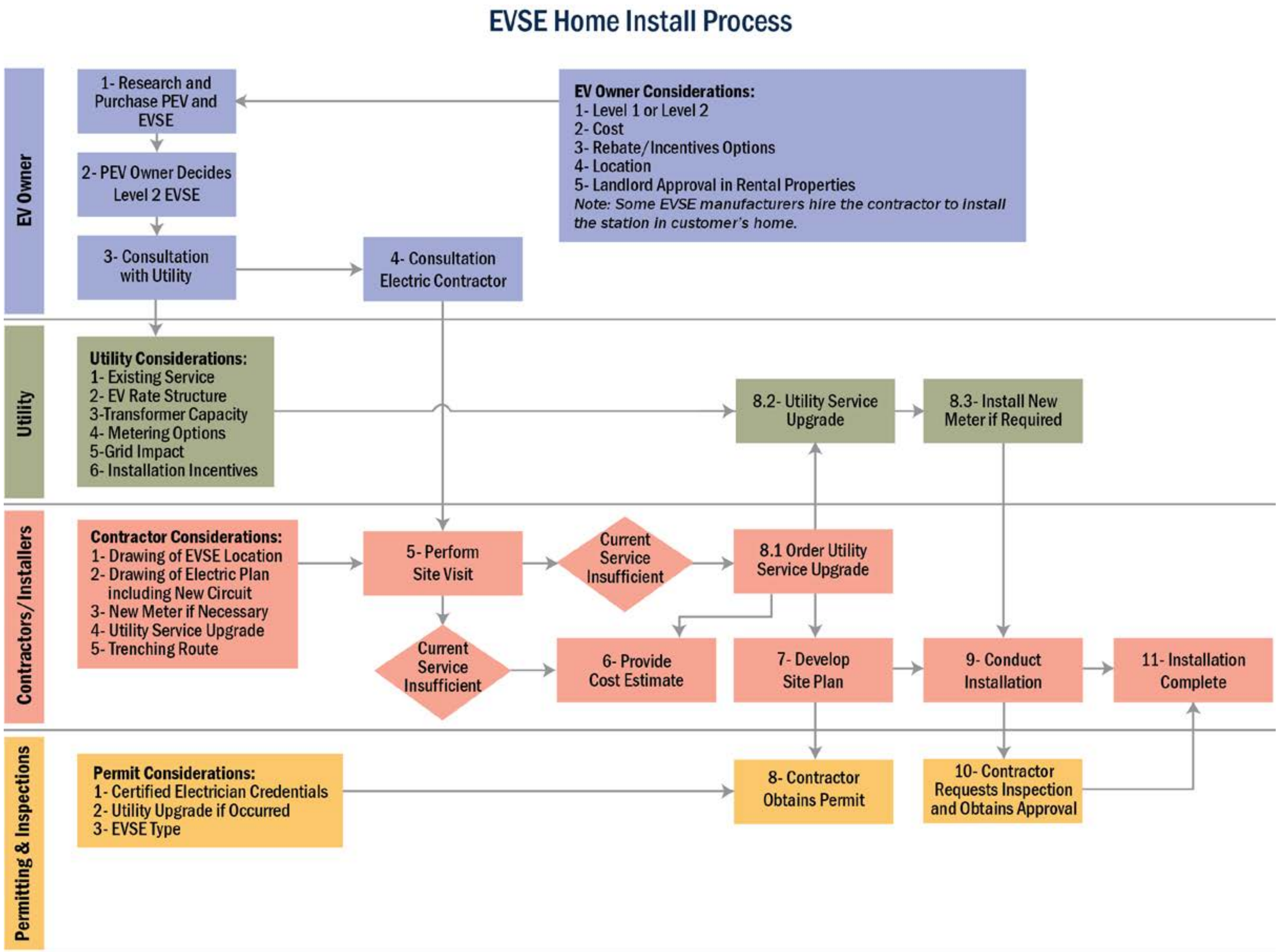
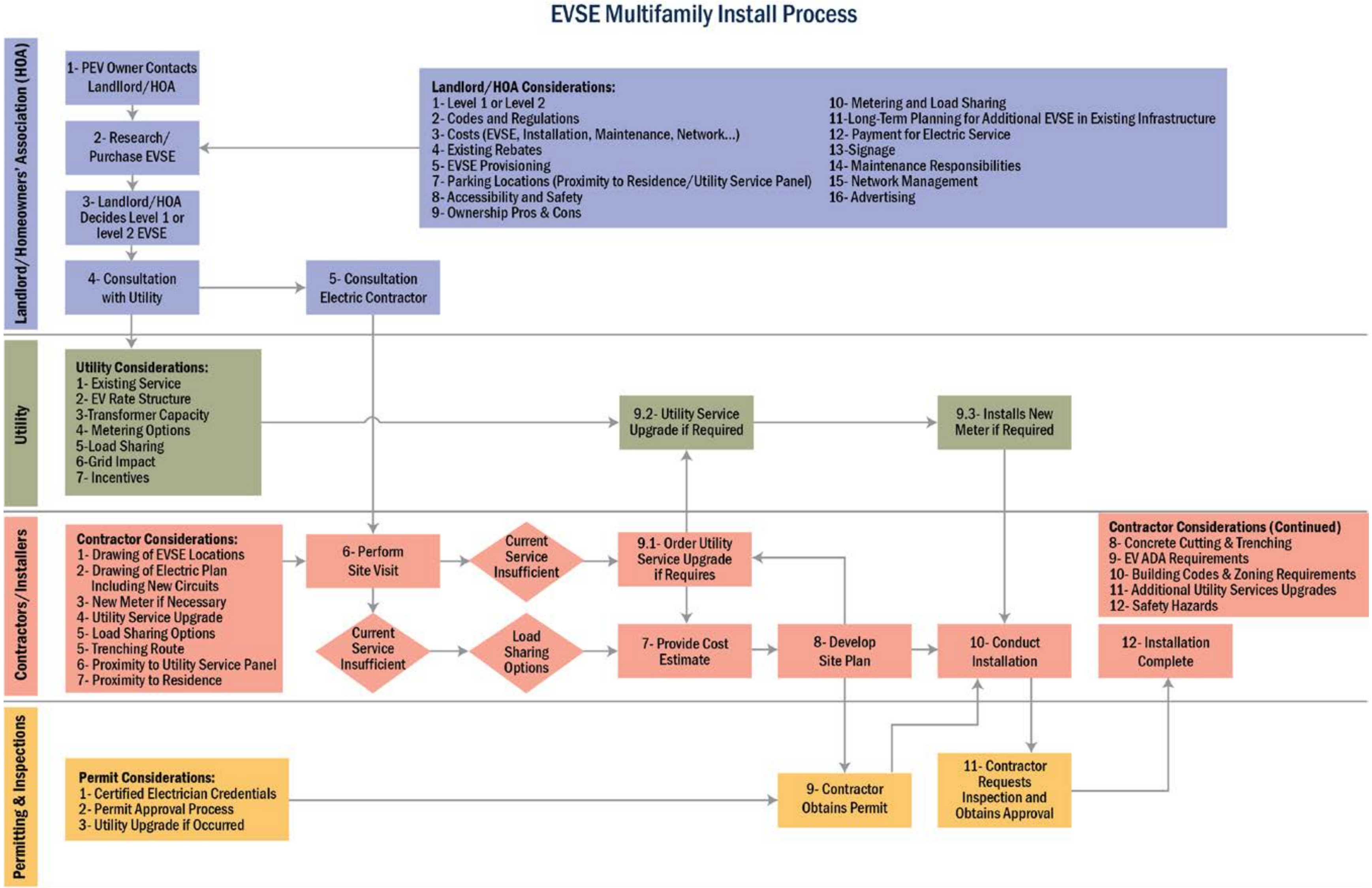


Figure 2-9. EVSE Installation Process for Multifamily



Addendum A
EVSE Typology Landscape

As mentioned in Section 2.4.1, included with the email correspondence to the 56 targeted EVSE vendors was the TRC EVSE Typology Landscape form, which is shown in Table 2-2. Table 2-3 includes a definitions page that explained each field. The remaining tables are the 25 vendor responses. These data are meant to be a starting point for an entity considering installing EVSE. Since the data within the EVSE Typology Landscape were self-described by the EVSE vendors and some fields such as networking and payment capabilities quickly change, the EVSE data provided below should be verified with the individual vendors before equipment is purchased.

Table 2-2. TRC EVSE Typology Landscape Form

EVSE Company and General Information						
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**		
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**			
EVSE Models & Specifications						
Model:						
Model Type:						
Charge Level:						
Electrical Specs:						
Portable/Hardwire						
Output Interface:						
Output Interface Lock:						
# Output Ports:						
LAN Comms:						
WAN Comms						
Payment Interfaces:						
Payment Networks:						
EVSE Management Software:						
EVSE Energy Management Software						
Mobile App Support:						
Reservation Software Support:						
Warranty:						
Mounting Options:						
Cable Length:						
Cable Management:						
Display:						

Table 2-3. TRC EVSE Typology Landscape Definitions

Field Name	Description of what is being requested from EVSE vendor
Vendor	Full name of EVSE vendor.
Headquarters	Full headquarter address of the vendor.
Phone	Contact phone number of the vendor.
URL	Website address of the vendor's homepage.
Manufactured by	Manufacturer of vendor EVSE hardware if different than vendor listed above.
Personal charger required w/ level 1 solution	If the EVSE vendor produces an EVSE level I solution will the customer charging the EV be required to provide the level I charger. (Is the solution just an outlet?)
Charging levels provided	What levels of charging stations does the EVSE vendor provide? (I, II, DC-Fast)
Safety Compliances	What safety compliances does the EVSE vendor currently meet?
Miscellaneous	EVSE vendor may list any miscellaneous items not covered anywhere else in the template.
Model	Model name of the EVSE hardware with link to specification sheet or website if possible.
Model Type	Target market of EVSE model. (Consumer, Commercial, Residential, Fleet) Multiple selections possible.
Charge level	Charging level for each EVSE model.
Electrical Specs	Electrical input specifications required for each EVSE model.
Output Interface	EVSE output interface for each EVSE model. (i.e. J1772, Nema 5-20)
Output Interface lock	For each EVSE model is the output interface locked until consumer authentication?
# Output Ports	For each EVSE model how many output interface ports are available?
LAN Comms	Are there any Local Area Network Communications available for each EVSE and if so what types of communications are available?
WAN Comms	Are there any Wide Area Network Communications available for each EVSE and if so what types of communications are available?
Payment Interfaces	What payment interface types are available for each EVSE model? (i.e. contactless credit card, RFID card)
Payment Networks	For each EVSE model what payment networks are available? (i.e. Chargepoint, NRG,)
EVSE Management Software	For each EVSE model is there any network management software available? (i.e. Network Management System)
EVSE Energy Management Software	For each EVSE model is there any energy management software available? (i.e. Demand Response)
Mobile App Support	For each EVSE model is there capability to locate, access, and/or pay via a mobile application?
Reservation Software Support	For each EVSE model is there EVSE reservation software available?
Warranty	What is the standard warranty length for each EVSE model? Are there any options to extend the standard warranties and if so please list for each model.
Mounting Options	For each EVSE model list the mounting options available.
Cable Length	For each EVSE model list the user interface cable length. (Length of cable from EVSE to EV)
Cable Management	Is there any user interface cable management solution available for each EVSE model listed? (i.e. self-retracting, manual coil)
Display	Does the EVSE model have a display and if so please provide specifications on size and type of display?

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
ABB, Inc.	New Berlin, WI	262-278-8731	Abb.com/evcharging	ABB, Inc.
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	DC Fast Charging	UL		

EVSE Models & Specifications				
Model:	Terra51			
Model Type:	Commercial/Fleet			
Charge Level:	DC Fast Charging (50kW)			
Electrical Specs:	480V, 3-phase			
Portable/Hardwire	Hardwire			
Output Interface:	CHAdeMO			
Output Interface Lock:	Yes			
# Output Ports:	1			
LAN Comms:	Yes, Ethernet			
WAN Comms	Yes, 3G Modem			
Payment Interfaces:	RFID card, remote authorization through network			
Payment Networks:	Open			
EVSE Management Software:	Yes			
EVSE Energy Management Software	Yes			
Mobile App Support:	No native support, but available through APIs			
Reservation Software Support:	No native support, but available through APIs			
Warranty:	12 months			
Mounting Options:	Floor mount			
Cable Length:	3.5 – 7m (optional)			
Cable Management:	Standard Housing			
Display:	Yes, 640x480 resolution, 16bit color screen			

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
AeroVironment, Inc	Monrovia, CA	626-357-9983	www.Evsolutions.avinc.com	AeroVironment, Inc
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1, 2 & DC Fast Charging	UL, cUL, ADA, FCC	Auto Restart, Outdoor Rated	

EVSE Models & Specifications			
Model:	EVSE-PI	EVSE-RS	EVSE-RS+
Model Type:	Residential	Residential, Fleet, Commercial	Residential, Fleet, Commercial
Charge Level:	2	2	2
Electrical Specs:	208-240VAC, Single Phase 30A	208-240VAC, Single Phase 30A	208-240VAC, Single Phase 30A
Portable/Hardwire	Plug-In	Hardwire	Hardwire
Output Interface:	J1772	J1772	J1772
Output Interface Lock:	N/A	N/A	N/A
# Output Ports:	1	1, 2, 4	1, 2, 4
LAN Comms:	N/A	N/A	N/A
WAN Comms	N/A	N/A	GPRS
Payment Interfaces:	N/A	N/A	RFID, Phone, SMS Text (Future)
Payment Networks:	N/A	N/A	NRG, West Coast Electric Highway, Electric Circuit, AV Public, TXU, IPL
EVSE Management Software:	N/A	N/A	EV Data
EVSE Energy Management Software	N/A	N/A	EV Data
Mobile App Support:	N/A	N/A	Yes
Reservation Software Support:	N/A	N/A	Yes
Warranty:	3 Years	3 Years	3 Years
Mounting Options:	Wall	Wall, Pedestal (Single, Dual, Quad)	Wall, Pedestal (Single, Dual, Quad)
Cable Length:	25 Feet	25 Feet	25 Feet
Cable Management:	Manual Coil	Manual Coil	Manual coil
Display:	LED	LED	LED

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
AeroVironment, Inc	Monrovia, CA	626-357-9983	www.Evsolutions.avinc.com	AeroVironment, Inc
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1, 2 & DC Fast Charging	UL, cUL, ADA, FCC	Auto Restart, Outdoor Rated	

EVSE Models & Specifications			
Model:	EV50-FS	EV50-PS	Nissan DCQC
Model Type:	Commercial, Fleet	Commercial, Fleet	Commercial, Fleet
Charge Level:	DC Fast Charging	DC Fast Charging	DC Fast Charging
Electrical Specs:	480VAC, 3 Phase	480VAC, 3 Phase	480VAC, 3 Phase
Portable/Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	CHAdeMO	CHAdeMO	CHAdeMO
Output Interface Lock:	N/A	Yes	N/A
# Output Ports:	1	1	1
LAN Comms:	N/A	N/A	N/A
WAN Comms	GPRS	GPRS	GPRS
Payment Interfaces:	RFID, Phone, SMS Text (Future)	RFID, Phone, SMS Text (Future)	Not yet released
Payment Networks:	NRG, West Coast Electric Highway, Electric Circuit, AV Public, TXU, IPL	NRG, West Coast Electric Highway, Electric Circuit, AV Public, TXU, IPL	Not yet released
EVSE Management Software:	EV Data	EV Data	Not yet released
EVSE Energy Management Software	EV Data	EV Data	Not yet released
Mobile App Support:	Yes	Yes	Not yet released
Reservation Software Support:	Yes	Yes	Not yet released
Warranty:	1 Year Full, 2-10 Years on key components	1 Year Full, 2-10 Years on key components	1 Year
Mounting Options:	Pad	Pad	Pad
Cable Length:	15 Feet	15 Feet	13 Feet (19.7 w/sling optional)
Cable Management:	Manual Coil	Manual Coil	Manual coil
Display:	LCD Screen	LCD Screen	LCD Screen

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Andromeda Power	PO Box 1933 Costa Mesa, CA, 92628	714-408-1905	www.AndromedaPower.com	Andromeda
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	DC Fast Charging 50 KW	UL pending	CHAdeMO tested	

EVSE Models & Specifications					
Model:	ORCA Air	ORCA Mobile	ORCA Rescue	ORCA Secure	ORCA Marina
Model Type:	Commercial	Fleet, Residential, Commercial	Commercial	Commercial	Commercial
Charge Level:	DC - Fast	DC - Fast	DC - Fast	DC - Fast	DC - Fast
Electrical Specs:	AC: 208V to 480V, 1 or 3 phase DC: 250V to 900V	AC: 208V to 480V, 1 or 3 phase DC: 250V to 900V	AC: 208V to 480V, 1 or 3 phase DC: 250V to 900V	AC: 208V to 480V, 1 or 3 phase DC: 250V to 900V	AC: 208V to 480V, 1 or 3 phase DC: 250V to 900V
Portable/Hardwire	Hardwire	Portable	Portable	Hardwire	Portable
Output Interface:	CHAdeMO	CHAdeMO	CHAdeMO	CHAdeMO	CHAdeMO
Output Interface Lock:	Optional	Optional	Optional	Optional	Optional
# Output Ports:	1	1	1	1	1
LAN Comms:	Ethernet, 3G/4G	Ethernet, 3G/4G	Ethernet, 3G/4G	Ethernet, 3G/4G	Ethernet, 3G/4G
WAN Comms	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi	Wi-Fi
Payment Interfaces:	Optional Credit Card, RF/ID	Optional Credit Card, RF/ID	Optional Credit Card, RF/ID	Optional Credit Card, RF/ID	Optional Credit Card, RF/ID
Payment Networks:	PayPal	PayPal	PayPal	PayPal	PayPal
EVSE Management Software:	ORCA Net	ORCA Net	ORCA Net	ORCA Net	ORCA Net
EVSE Energy Management Software	ORCA Controller	ORCA Controller	ORCA Controller	ORCA Controller	ORCA Controller
Mobile App Support:	Android	Android	Android	Android	Android
Reservation Software Support:	Future feature	Future feature	Future feature	Future feature	Future feature
Warranty:	1 year	1 year	1 year	1 year	1 year
Mounting Options:	Embedded	Embedded	Embedded	Embedded	Embedded
Cable Length:					
Cable Management:	Hanging	Manual coil	Manual coil	Enclosed	Enclosed
Display:	15"	15"	15"	15"	15"

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
ClipperCreek, Inc.	Auburn, CA	530-887-1674	ClipperCreek.net	ClipperCreek
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1, 2	ETL to UL 2594		

EVSE Models & Specifications					
Model:	CS-40	CS-60	CS-100	PCS-15	ACS-15
Model Type:	Commercial/Fleet	Commercial/Fleet	Commercial/Fleet	Residential	Commercial/Residential
Charge Level:	Level 2	Level 2	Level 2	Level 1	Level 1
Electrical Specs:	208 V / 240 V 30 Amps Continuous	208 V / 240 V 48 Amps Continuous	208 V / 240 V 75 Amps Continuous	208 V / 240 V 12 Amps Continuous	208 V / 240 V 16 Amps Continuous
Portable/Hardwire	Hardwire	Hardwire	Hardwire	Portable NEMA 5-15 Plug	Hardwire
Output Interface:	J1772	J1772	J1772	J1772	J1772
Output Interface Lock:	N/A	N/A	N/A	N/A	N/A
# Output Ports:	One	One	One	One	One
LAN Comms:	Wifi/ZigBee/Cell	Wifi/ZigBee/Cell	Wifi/ZigBee/Cell	N/A	N/A
WAN Comms	SilverSpring Networks 900 mHz	SilverSpring Networks 900 mHz	SilverSpring Networks 900 mHz	N/A	N/A
Payment Interfaces:	*Liberty Plug-In Credit Card	*Liberty Plug-In Credit Card	*Liberty Plug-In, Credit Card	N/A	N/A
Payment Networks:	Liberty Plug-In	Liberty Plug-In	Liberty Plug-In	N/A	N/A
EVSE Management Software:	N/A	N/A	N/A	N/A	N/A
EVSE Energy Management Software	N/A	N/A	N/A	?	?
Mobile App Support:	ParkNow, MobileNow w/Liberty Plug-In	ParkNow, MobileNow w/Liberty Plug-In	ParkNow, MobileNow w/Liberty Plug-In	N/A	N/A
Reservation Software Support:	N/A	N/A	N/A	N/A	N/A
Warranty:	1 Year Factory	1 Year Factory	1 Year Factory	1 Year Factory	1 Year Factory
Mounting Options:	Wall or Pedestal	Wall or Pedestal	Wall or Pedestal	Wall	Wall
Cable Length:	25’	25’	25’	15’ Typ.	15’ Typ.
Cable Management:	Cable retraction	Cable retraction	Cable retraction	Incorporated Hanger	Incorporated Hanger
Display:	LCD w/Credit Card, two indicator lights	LCD w/Credit Card, two indicator lights	LCD w/Credit Card, two indicator lights	Four Indicator Lights	Four Indicator Lights

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
ClipperCreek, Inc.	Auburn, CA	530-887-1674	ClipperCreek.net	ClipperCreek
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1, 2	ETL to UL 2594		

EVSE Models & Specifications					
Model:	LCS-15	LCS-20	LCS-25		
Model Type:	Commercial/Residential	Commercial/Residential	Commercial/Residential		
Charge Level:	Level 2	Level 2	Level 2		
Electrical Specs:	208 V / 240 V 12 Amps Continuous	208 V / 240 V 16 Amps Continuous	208 V / 240 V 20 Amps Continuous		
Portable/Hardwire	Hardwire	Hardwire	Hardwire		
Output Interface:	J1772	J1772	J1772		
Output Interface Lock:					
# Output Ports:	One	One	One		
LAN Comms:	N/A	N/A	N/A		
WAN Comms	N/A	N/A	N/A		
Payment Interfaces:	N/A	N/A	N/A		
Payment Networks:	N/A	N/A	N/A		
EVSE Management Software:	N/A	N/A	N/A		
EVSE Energy Management Software	N/A	N/A	N/A		
Mobile App Support:	N/A	N/A	N/A		
Reservation Software Support:	N/A	N/A	N/A		
Warranty:	1 Year Factory	1 Year Factory	1 Year Factory		
Mounting Options:	Wall	Wall	Wall		
Cable Length:	15' Typ.	15' Typ.	15' Typ.		
Cable Management:	Cable retraction	Cable retraction	Cable retraction		
Display:	Four Indicator Lights	Four Indicator Lights	Four Indicator Lights		

* Liberty Plug-In Available, Credit Card Version Available Q3 2012

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
EVSE LLC	Enfield, CT	800-722-6654	www.controlmod.com	Control Module Inc.
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1, 2	ANSI, NFPA, UL, ADA, OSHA		

EVSE Models & Specifications					
Model:	Dual Curb Side (3722-102)	EVSE Marquee	Overhead Garage Charger	Valet Charger	Motorized Wallmount (3722-105)
Model Type:	Commercial/Fleet	Commercial	Commercial/Residential/ Fleet	Residential/Commercial	Commercial/Fleet
Charge Level:	Level 2	Level 2	Level 2	Level 2	Level 2
Electrical Specs:	208 V / 240 V 24 or 30 Amps	208 V / 240 V 30 Amps	208 V / 240 V 30 Amps	208 V / 240 V 30 Amps	208 V / 240 V 24 or 30 Amps
Portable/Hardwire	Hardwire	Hardwire	Hardwire	Portable	Hardwire
Output Interface:	J1772	J1772	J1772	J1772	J1772
Output Interface Lock:	Yes	Yes	Yes	Yes	Yes
# Output Ports:	Two	One	One	One	One
LAN Comms:	Cellular/Ethernet/Wi-Fi	Cellular/Ethernet/Zigbee/ Wi-Fi	Cellular/Ethernet/Zigbee/ Wi-Fi	Cellular/Ethernet/Wi-Fi	Cellular/Wi-Fi/Ethernet
WAN Comms	Cellular/Ethernet	Cellular/Ethernet	Cellular/Ethernet	Cellular/Ethernet	Cellular/Ethernet
Payment Interfaces:	Credit Card, RFID Card, Contactless Credit Card	Credit Card, RFID Card, Contactless Credit Card	Credit Card, RFID Card, Contactless Credit Card	Credit Card, RFID Card, Contactless Credit Card	Credit Card, RFID Card, Contactless Credit Card
Payment Networks:	USA Networks	USA Networks	USA Networks	USA Networks	USA Networks
EVSE Management Software:	Gateway Software, Sky Networks	Gateway Software, Sky Networks	Gateway Software, Sky Networks	Gateway Software, Sky Networks	Gateway Software, Sky Networks
EVSE Energy Management Software	Yes	Yes	Yes	Yes	Yes
Mobile App Support:	DOE Site, Sky Networks	DOE Site, Sky Networks	DOE Site, Sky Networks	DOE Site, Sky Networks	DOE Site, Sky Networks
Reservation Software Support:	Yes	Yes	Yes	Yes	Yes
Warranty:	1 Year Factory	1 Year Factory	1 Year Factory	1 Year Factory	1 Year Factory
Mounting Options:	Ceiling, Wall, Pedestal, Surface	Pedestal, Surface	Ceiling	Wall, Pedestal	Ceiling, Wall, Pedestal, Surface
Cable Length:	Configurable	Configurable	Configurable	Configurable	Configurable
Cable Management:	Patented Cable Mgmt.	Patented Cable Mgmt.	Patented Cable Mgmt.	Patented Cable Mgmt.	Patented Cable Mgmt.
Display:	Yes	Yes	Yes	Yes	Yes

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Coulomb Technologies	Campbell, CA	408 841 4500	www.chargepoint.com	Coulomb Technologies
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
Yes	Level 1, 2	UL, IEC, ADA		

EVSE Models & Specifications					
Model:	CT2021	CT2000	CT2100	CT500	CT2500
Model Type:	Dual Port Commercial	Single Port Commercial	Dual Port Commercial	Single Port Residential / Fleet	Single Port European Model
Charge Level:	Level 2	Level 2	Level 1 & Level 2	Level 2	Level 2
Electrical Specs:	208/240 VAC/ 30 A	208/240 VAC/ 30 A	208/240 VAC/ 30 A	208/240 VAC/ 30 A	208/240 VAC/ 30 A
Portable/Hardwire	Hardwire	Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	J1772	J1772	NEMA socket and J1772	J1772	Mode 3 Type 2 Connector
Output Interface Lock:	Yes	Yes	Yes	Yes	Yes
# Output Ports:	Two	One	One	One	One
LAN Comms:	802.15.4	802.15.4	802.15.4	802.15.4	802.15.4
WAN Comms	GPRS or CDMA	GPRS or CDMA	GPRS or CDMA	GPRS or CDMA	GPRS or CDMA
Payment Interfaces:	ChargePoint RFID Card or Credit Cards	ChargePoint RFID Card or Credit Cards	ChargePoint RFID Card or Credit Cards	ChargePoint RFID Card or Credit Cards	ChargePoint RFID Card or Credit Cards
Payment Networks:	ChargePoint or Visa, Mastercard, Discover, AmEx	ChargePoint or Visa, Mastercard, Discover, AmEx	ChargePoint or Visa, Mastercard, Discover, AmEx	ChargePoint or Visa, Mastercard, Discover, AmEx	ChargePoint or Visa, Mastercard, Discover, AmEx
EVSE Management Software:	ChargePoint Service Plans	ChargePoint Service Plans	ChargePoint Service Plans	ChargePoint Service Plans	ChargePoint Service Plans
EVSE Energy Management Software	ChargePoint Service Plans	ChargePoint Service Plans	ChargePoint Service Plans	ChargePoint Service Plans	ChargePoint Service Plans
Mobile App Support:	iPhone, Android, Blackberry	iPhone, Android, Blackberry	iPhone, Android, Blackberry	iPhone, Android, Blackberry	iPhone, Android, Blackberry
Reservation Software Support:	ChargePoint Service Plan	ChargePoint Service Plan	ChargePoint Service Plan	ChargePoint Service Plan	ChargePoint Service Plan
Warranty:	Standard (1 Year) or Extended (5 years)	Standard (1 Year) or Extended (5 years)	Standard (1 Year) or Extended (5 years)	Standard (1 Year) or Extended (5 years)	Standard (1 Year) or Extended (5 years)
Mounting Options:	Pedestal or Wall	Pedestal, Wall or Pole	Pedestal, Wall or Pole	Wall	Pedestal, Wall or Pole
Cable Length:	18 feet	18 feet	18 feet	18 feet	No Cord Required
Cable Management:	Retractable Option (CT2025)	No	No	No	N/A
Display:	VFD (2 lines)	VFD (2 lines)	VFD (2 lines)	No	VFD (2 lines)

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
DBT USA Inc.	Chicago, IL	773-466-0400	www.dbtus.com	DBT CEV
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level II	UL certified by Q4 2012	N/A	

EVSE Models & Specifications					
Model:	GNS				
Model Type:	Commercial/fleet				
Charge Level:	Level II				
Electrical Specs:	240V/16-30A				
Portable/Hardwire	Hardwire				
Output Interface:	SAE J1772				
Output Interface Lock:	N/A				
# Output Ports:	2				
LAN Comms:	Yes (optional)				
WAN Comms	GPRS				
Payment Interfaces:	Contactless/RFID/ swipe card				
Payment Networks:	N/A (Future)				
EVSE Management Software:	N/A (Future)				
EVSE Energy Management Software	N/A				
Mobile App Support:	N/A (Future)				
Reservation Software Support:	N/A (Future)				
Warranty:	2 years				
Mounting Options:	Pole/wall-mounted				
Cable Length:	20ft				
Cable Management:	Coiled cable				
Display:	3''LCD screen 256 colors 320x240				

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Eaton Corp.	Eaton Electric Moon Township, PA. 15108	210.268.9453	www.eaton.com/plugin	Eaton Corp.
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
Yes	Level 1, 2 & DC Fast	UL, NEC, SAE, FCC CHAdeMO		

EVSE Models & Specifications			
Model:	Eaton Commercial Level 1 / Level 2 EVSE	Eaton DC Quick Charger	
Model Type:	Commercial, Fleet	Commercial, Fleet	
Charge Level:	1 & 2	DC-Fast	
Electrical Specs:	Level 1=120VAC,20A; Level 2=208-240VAC, 30A, 48A, 70A	208VAC 3 Phase-3 Wire, 200A	
Portable/Hardwire	Hardwire	Hardwire	
Output Interface:	Level 1=NEMA 5-20, Level 2=SAE J1772	CHAdeMO	
Output Interface Lock:	No	No	
# Output Ports:	Level 1=1, Level 2=1	1	
LAN Comms:	Modbus RTU; Network Manager (Ethernet)	Future (Ethernet)	
WAN Comms	Network Manager (Wi-Fi, Cellular GSM); ChargePoint (Cellular GSM or CDMA)	Future (Wi-Fi, Cellular)	
Payment Interfaces:	Swipe Credit Card, Contactless Credit Card, ChargePoint RFID card	Future (Swipe Credit Card Reader, ChargePoint Contactless Credit Card and RFID)	
Payment Networks:	ChargePoint, USA Technologies	Future (ChargePoint, USA Technologies)	
EVSE Management Software:	Eaton Network Manager, ChargePoint	Future(ChargePoint)	
EVSE Energy Management Software	ChargePoint	Future(ChargePoint)	
Mobile App Support:	ChargePoint	Future(ChargePoint)	
Reservation Software Support:	ChargePoint	Future(ChargePoint)	
Warranty:	1 Year Standard (Extended Warranty Available up to 3 Years)	1 Year Standard (Extended Warranty Available up to 3 Years)	
Mounting Options:	Wall, Pedestal	Free Standing Floor Mounted	
Cable Length:	18ft Standard (9 to 23ft available)	15ft	
Cable Management:	Manual Coil	Manual Coil	
Display:	2x16 Vacuum Fluorescent Display	5.7” Touchscreen User Interface	

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Electric Transportation and Engineering Corporation – dba Ecotality North America	San Francisco, CA	214-551-4014 (Texas HQ)	www.blinknetwork.com www.ECOtality.com	ECOtality North America
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	UL, ULc to 2594, NEC article 625		

EVSE Models & Specifications			
Model:	WE-30Kice	PE30ice	DCFC
Model Type:	Commercial Wall Mount	Commercial Pedestal	Commercial Direct Current Fast Charger
Charge Level:	L2	L2	DCFC
Electrical Specs:	208 VAC to 240 VAC 30A max with 40A circuit	208 VAC to 240 VAC 30A max with 40A circuit	INPUT: 208/380/400/480/575 VAC 3-phase, 60 kW Max OUTPUT: 200 VDC – 450 VDC, 200A max, 60 kW Max
Portable/Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	SAE J1772	SAE J1772	Yazaki CHAdeMO and TBD
Output Interface Lock:	Yes	Yes	Yes
# Output Ports:	One	One	Two
LAN Comms:	Ethernet, Wi-Fi, Cellular	Ethernet, Wi-Fi, Cellular	Ethernet, Wi-Fi, Cellular
WAN Comms	Ethernet, Wi-Fi, Cellular	Ethernet, Wi-Fi, Cellular	Ethernet, Wi-Fi, Cellular
Payment Interfaces:	RFID Card Mobile Devices	RFID Card Mobile Devices	RFID Card Mobile Devices
Payment Networks:	Blink network	Blink network	Blink network
EVSE Management Software:	Blink network	Blink network	Blink network
EVSE Energy Management Software	Blink network (Demand Response available)	Blink network (Demand Response available)	Blink network (Demand Response available)
Mobile App Support:	Yes-Blink network	Yes-Blink network	Yes-Blink network
Reservation Software Support:	Coming soon	Coming soon	Coming soon
Warranty:	2 year warranty standard, Extended warranty $125 per year up to 5 years max	2 year warranty standard, Extended warranty $125 per year up to 5 years max	2 year warranty standard
Mounting Options:	Wall or post	anchored	anchored
Cable Length:	18 feet	18 feet	12 feet
Cable Management:	Manual coil	Manual coil	Top Hang Cable
Display:	7” touch screen color display	7” touch screen color display	7” touch screen color display and 42” LCD media display

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Evergo LLC.	Rocky Ridge, MD	301-271-4649	www.evergocharge.com	Evergo, LLC.
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	ETL		

EVSE Models & Specifications			
Model:	ERG2		
Model Type:	Kiosk (Commercial or Fleet)		
Charge Level:	II		
Electrical Specs:	208/240 40Amp		
Portable/Hardwire	Hardwire		
Output Interface:	J1772		
Output Interface Lock:	N/A		
# Output Ports:	2		
LAN Comms:	Ethernet		
WAN Comms	3G Cellular		
Payment Interfaces:	Magnetic Stripe Credit Card and RFID		
Payment Networks:	Evergo Charge Network		
EVSE Management Software:	Evergo Charge Network		
EVSE Energy Management Software	Evergo Charge Network		
Mobile App Support:	N/A		
Reservation Software Support:	N/A		
Warranty:	1 yr.		
Mounting Options:	Wall, Pole, Kiosk		
Cable Length:	20’		
Cable Management:	Retractable Reel		
Display:	6” LCD		

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
EV-Charge America	9030 W. Sahara Dr, Ste 125 Las Vegas, NV 89117	859-305-6117 Charlie Payne	www.ev-chargeamerica.com	EV-Charge America
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1 & 2	UL, ULc to 2594, NEC article 625		

EVSE Models & Specifications			
Model:	2101-1	2101-2	2201-1-1
Model Type:	Commercial	Commercial	Commercial
Charge Level:	2	2	1 & 2
Electrical Specs:	208/240V 40 A	208/240V 40 A	208/240V 40 A and 120V 20A
Portable/Hardwire	Hardwire/Portable Option	Hardwire/Portable Option	Hardwire/Portable Option
Output Interface:	J1772	J1772s	J1772 and NEMA 20 Outlet
Output Interface Lock:	Yes	Yes	Yes
# Output Ports:	1	2	1, 2, 3, or 4
LAN Comms:	Yes – Ethernet, Cellular, WiFi	Yes – Ethernet, Cellular, WiFi	Yes – Ethernet, Cellular, WiFi
WAN Comms	Yes – Ethernet, Cellular, WiFi	Yes – Ethernet, Cellular, WiFi	Yes – Ethernet, Cellular, WiFi
Payment Interfaces:	RFID, Magnetic Credit Card, Contactless Credit Card, Smart Phone	RFID, Magnetic Credit Card, Contactless Credit Card, Smart Phone	RFID, Magnetic Credit Card, Contactless Credit Card, Smart Phone
Payment Networks:	VISA, EVCA, PAYPAL	VISA, EVCA, PAYPAL	VISA, EVCA, PAYPAL
EVSE Management Software:	EVCA & GridPoint	EVCA & GridPoint	EVCA & GridPoint
EVSE Energy Management Software	EVCA & GridPoint	EVCA & GridPoint	EVCA & GridPoint
Mobile App Support:	Yes	Yes	Yes
Reservation Software Support:	Yes	Yes	Yes
Warranty:	2 Years Parts & Labor Std. 5 Years Optional	2 Years Parts & Labor Std. 5 Years Optional	2 Years Parts & Labor Std. 5 Years Optional
Mounting Options:	Ground	Ground	Ground
Cable Length:	20 feet Standard	20 feet Standard	20 feet Standard
Cable Management:	Cable Caddy Standard, Self-retracting Reel Optional	Cable Caddy Standard, Self-retracting, Self-retracting Reel Optional	Cable Caddy Standard, Self-retracting Reel Optional
Display:	LCD or VFD	LCD or VFD	LCD or VFD

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
EV-Charge America	9030 W. Sahara Dr, Ste 125 Las Vegas, NV 89117	859-305-6117 Charlie Payne	www.ev-chargeamerica.com	EV-Charge America
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 1 & 2	UL, ULc to 2594, NEC article 625		

EVSE Models & Specifications			
Model:	2102/3	2104/2105	
Model Type:	Commercial	Residential	
Charge Level:	1 and/or 2	1 and 2	
Electrical Specs:	208/240V 40 A and/or 120V 20A	208/240V 40 A and 120V 20A	
Portable/Hardwire	Stationary / Hardwire Portable Option	Portable & Both plug in and hardwire options	
Output Interface:	J1772 and Optional NEMA 20 Outlet	J1772	
Output Interface Lock:	Yes	Yes	
# Output Ports:	1, or 2	1	
LAN Comms:	Yes – Ethernet, Cellular, WiFi	Yes – Ethernet, Cellular, WiFi	
WAN Comms	Yes – Ethernet, Cellular, WiFi	Yes – Ethernet, Cellular, WiFi	
Payment Interfaces:	RFID, Magnetic Credit Card, Contactless Credit Card, Smart Phone	RFID	
Payment Networks:	VISA, EVCA, PAYPAL	No	
EVSE Management Software:	EVCA & GridPoint	EVCA	
EVSE Energy Management Software	EVCA & GridPoint	EVCA	
Mobile App Support:	Yes	Yes	
Reservation Software Support:	Yes	No	
Warranty:	2 Years Parts & Labor Standard 5 Years Optional	2 Years Parts & Labor Standard 5 Years Optional	
Mounting Options:	Pole, Wall	Wall, Floor	
Cable Length:	20 feet Standard	20 feet Standard	
Cable Management:	Cable Caddy Standard	Cable Caddy Standard	
Display:	LCD or VFD	LCD or VFD	

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
EVoCharge	Phoenix, AZ	(800)930-9450	www.evocharge.com	EVoCharge
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
No	Level 1, 2	UL 2594, US NEC 623		

EVSE Models & Specifications				
Model:	EVoReeL1	EVoReeL2	Industrial EVoReeL1	Industrial EVoReeL2
Model Type:	Residential, Commercial, Private	Residential, Commercial, Private	Industrial, Residential	Industrial, Residential
Charge Level:	AC Level 1; 16A max output	AC Level 2; 30A max output	AC Level 1; 16A max output	AC Level 2; 30A max output
Electrical Specs:	110-120 VAC 50-60Hz	208-240 VAC 50-60Hz	110-120 VAC 50-60Hz	208-240 VAC 50-60Hz
Portable/Hardwire	Stationary; Plug-in or Hardwire	Stationary; Plug-in or Hardwire	Stationary; Plug-in or Hardwire	Stationary; Plug-in or Hardwire
Output Interface:	SAE J1772	SAE J1772	SAE J1772	SAE J1772
Output Interface Lock:	Optional	Optional	Optional	Optional
# Output Ports:	Single	Single	Single	Single
LAN Comms:	Optional Wi-Fi 10/100 Ethernet	Optional Wi-Fi 10/100 Ethernet	Optional Wi-Fi 10/100 Ethernet	Optional Wi-Fi 10/100 Ethernet
WAN Comms	Optional Wi-Fi 10/100 Ethernet	Optional Wi-Fi 10/100 Ethernet	Optional Wi-Fi 10/100 Ethernet	Optional Wi-Fi 10/100 Ethernet
Payment Interfaces:	RFID	RFID	N/A	N/A
Payment Networks:	--	--	N/A	N/A
EVSE Management Software:	Capable	Capable	N/A	N/A
EVSE Energy Management Software	Capable	Capable	N/A	N/A
Mobile App Support:	Capable	Capable	N/A	N/A
Reservation Software Support:	Capable	Capable	N/A	N/A
Warranty:	One-Year Limited	One-Year Limited	One-Year Limited	One-Year Limited
Mounting Options:	Wall, Pedestal, Ceiling	Wall, Pedestal, Ceiling	Wall, Pedestal, Ceiling	Wall, Pedestal, Ceiling
Cable Length:	9.14m (30.0ft)	9.14m (30.0ft)	9.14m (30.0ft)	9.14m (30.0ft)
Cable Management:	Self-Retracting Reel	Self-Retracting Reel	Self-Retracting Reel	Self-Retracting Reel
Display:	Optional Touchscreen	Optional Touchscreen	Optional Handheld Touchscreen	Optional Handheld Touchscreen

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Fuji Electric Corp. of America	50 Northfield Ave, Edison, NJ 08837	201-490-3914	www.americas.fujielectric.com/	Fuji Electric Corp. of America
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	DC-Fast	UL, CHAdeMO	SAE Combo unit will be released with release and adoption of standard	

EVSE Models & Specifications			
Model:	FRCM25CUS		
Model Type:	Commercial, Fleet		
Charge Level:	DC-Fast		
Electrical Specs:	3 Phase 208V AC		
Portable/Hardwire	Hardwire		
Output Interface:	CHAdeMO		
Output Interface Lock:	Key lock		
# Output Ports:	1		
LAN Comms:	Zigbee		
WAN Comms	Cellular		
Payment Interfaces:	Contactless Credit Card, RFID Card, Standalone		
Payment Networks:	ChargePoint		
EVSE Management Software:	ChargePoint		
EVSE Energy Management Software	ChargePoint		
Mobile App Support:	ChargePoint		
Reservation Software Support:	ChargePoint		
Warranty:	1 Year		
Mounting Options:	Floor		
Cable Length:	15’		
Cable Management:	Manual Coil		
Display:	4.5” x 3.4” LCD		

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
GE Energy	Atlanta, GA	(800)930-9450	www.GE-Energy.com	General Electric
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	UL, cUL, NEC, SAE, ETL, CETL		

EVSE Models & Specifications					
Model:	WattStation	WattStation Wall Mount	DuraStation	DuraStation	DuraStation
Model Type:	Commercial	Residential	Commercial/Fleet	Commercial/Fleet	Commercial/Fleet
Charge Level:	2	2	2	2	2
Electrical Specs:	208-240VAC @30A	208-240VAC @30A	208-240VAC @30A	208-240VAC @30A	208-240VAC @30A
Portable/Hardwire	Hardwire	Portable/Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	SAE J1772	SAE J1772	SAE J1772	SAE J1772	SAE J1772
Output Interface Lock:	No	No	No	No	No
# Output Ports:	1	1	1	1	1
LAN Comms:	Ethernet	N/A	Ethernet	Ethernet	Ethernet
WAN Comms	Wi-Fi/3G	N/A	N/A	N/A	N/A
Payment Interfaces:	RFID/ QR Code	N/A	N/A	N/A	N/A
Payment Networks:	Paypal	N/A	N/A	N/A	N/A
EVSE Management Software:	GEwattstation.com/connect	N/A	RFID Access Control	RFID Access Control	RFID Access Control
EVSE Energy Management Software	GEwattstation.com/connect	N/A	RFID Access Control	RFID Access Control	RFID Access Control
Mobile App Support:	WattStation Connect App	N/A	N/A	N/A	N/A
Reservation Software Support:	N/A	N/A	N/A	N/A	N/A
Warranty:	3 Year	3 Year	3 Year	3 Year	3 Year
Mounting Options:	Pedestal	Wall Mount	Pedestal	Pedestal	Wall/Pole
Cable Length:	15’6”	16’	20’	20’	20’
Cable Management:	Enclosed-Retractable	Around Unit	Cord Holder – Manual	Cord Holder – Manual	Cord Holder – Manual
Display:	LED	LED	VFD	VFD	VFD

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Garage Juice Bar, LLC	750 Main Street, Suite 150 Hartford, CT 06103	860-308-2054	www.freejuicebar.com	BTC Power, Inc
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
No	Level 1, 2	ETL, UL 2202, UL2231, UL 50 Nema 3		

EVSE Models & Specifications			
Model:	2F2C		
Model Type:	Commercial		
Charge Level:	1 & 2		
Electrical Specs:	Input Voltage: 208/240 VAC (+/- 10%), single phase Input Current: 32 Amps Max., Frequency: 50/60 Hz Breaker Size: 50 Amps, Output Voltage: 240 VAC Output Power: 7.2kW		
Portable/Hardwire	Hardwire		
Output Interface:	J1772		
Output Interface Lock:	N/A		
# Output Ports:	Single or Dual port		
LAN Comms:	Ethernet, Wi-Fi, Zigbee		
WAN Comms	Ethernet, Wi-Fi, Cellular		
Payment Interfaces:	Credit Card, Debit Card, Coulomb/Chargepoint Card, Proprietary Card		
Payment Networks:	Coulomb/Chargepoint Network, Proprietary Card		
EVSE Management Software:	System status as well as real time energy usage		
EVSE Energy Management Software	Energy management and usage information is available on line		
Mobile App Support:	Juice Bar application which shows the current status and system availability		
Reservation Software Support:	Enabled via Payment Network		
Warranty:	3 years		
Mounting Options:	Pedestal		
Cable Length:	22’		
Cable Management:	a) Manual cord loop b) Retractable cord assembly		
Display:	6.5 inch color display		

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Legrand	West Hartford, CT	315-468-8097	www.legrand.us	Lear Corp
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	ETL, NEMA 3R, NEC		

EVSE Models & Specifications			
Model:	L2EVSE16	L2EVSE16P1	L2EVSE16P2
Model Type:	Residential	Commercial	Commercial
Charge Level:	2	2	2
Electrical Specs:	208/240V 16A	208/240V 16A	208/240V 16A (2 circuits)
Portable/Hardwire	Hardwired	Hardwired	Hardwired
Output Interface:	SAE J1772	SAE J1772	SAE J1772
Output Interface Lock:	No	No	No
# Output Ports:	1	1	2
LAN Comms:	No	No	No
WAN Comms	No	No	No
Payment Interfaces:	No	No	No
Payment Networks:	No	No	No
EVSE Management Software:	No	No	No
EVSE Energy Management Software	No	No	No
Mobile App Support:	No	No	No
Reservation Software Support:	No	No	No
Warranty:	1 year	1 year	1 year
Mounting Options:	Wall mount	Pedestal mount	Pedestal mount
Cable Length:	24’	24’	24’
Cable Management:	Coiled cord	Coiled cord	Coiled cord
Display:	LED indicators	LED indicators	LED indicators

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Nichicon Corporation	Kyoto Japan	81-75-241-5319	www.nichicon.com	Nichicon
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	DC Fast Charging	PSE (ETL is planned)		

EVSE Models & Specifications				
Model:	NQC-A502	NQC-A302	NQC-A202	NQC-A102
Model Type:	Commercial, Fleet	Commercial, Fleet	Commercial, Residential, Fleet	Commercial, Residential, Fleet
Charge Level:	50KW	30KW	20KW	10KW
Electrical Specs:	170VAC to 230VAC	170VAC to 230VAC	170VAC to 230VAC	170VAC to 230VAC
Portable/Hardwire	Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	CHAdeMO	CHAdeMO	CHAdeMO	CHAdeMO
Output Interface Lock:	Yes	Yes	Yes	Yes
# Output Ports:	1	1	1	1
LAN Comms:	No	No	No	No
WAN Comms	No	No	No	No
Payment Interfaces:	Option	Option	Option	Option
Payment Networks:	None yet- in discussion with Chargepoint	None yet- in discussion with Chargepoint	None yet- in discussion with Chargepoint	None yet- in discussion with Chargepoint
EVSE Management Software:	No	No	No	No
EVSE Energy Management Software	In the option, Maximum output can be changed.	In the option, Maximum output can be changed.	In the option, Maximum output can be changed.	In the option, Maximum output can be changed.
Mobile App Support:	No	No	No	No
Reservation Software Support:	In discussion with Chargepoint	In discussion with Chargepoint	In discussion with Chargepoint	In discussion with Chargepoint
Warranty:	One year	One year	One year	One year
Mounting Options:	Floor/Slab Mount	Floor/Slab Mount	Floor/Slab Mount	Floor/Slab Mount
Cable Length:	4.5m	4.5m	4.5m	2m
Cable Management:	Manual	Manual	Manual	Manual
Display:	5.7 Inch Wide	5.7 Inch Wide	5.7 Inch Wide	5.7 Inch Wide

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
OpConnect, LLC	Portland OR	503-477-5742	www.opconnect.com	OpConnect, LLC.
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
Yes	1 & 2	ETL listed UL2231-1 / UL2231-2 & UL SUB 2594		

EVSE Models & Specifications			
Model:	C-J4000		
Model Type:	Commercial		
Charge Level:	1 & 2		
Electrical Specs:	240 VAC 60 Hz 80 amp 4 wire circuit		
Portable/Hardwire	Hardwire		
Output Interface:	NEMA 5-20 L2- J1772 connector		
Output Interface Lock:	Proximity switch lock on J1772		
# Output Ports:	4		
LAN Comms:	Ethernet (RJ-45), WiFi, Radio (Proprietary Mesh)		
WAN Comms	GSM modem		
Payment Interfaces:	Credit/Debit Card, OpConnect Network Card, Wright Fleet Card, Magnetic Cards (ID or Loyalty Cards)		
Payment Networks:	OpConnect		
EVSE Management Software:	Linux-based proprietary		
EVSE Energy Management Software	Linux-based proprietary		
Mobile App Support:	OpConnect iPhone App		
Reservation Software Support:	Pending		
Warranty:	1 year and Optional extended warranty		
Mounting Options:	Pedestal		
Cable Length:	20 ft.		
Cable Management:	Manual		
Display:	8.4” Touchscreen		

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
ParkPod LLC	San Francisco, CA	800-272-7838	www.parkpod.com	ParkPod GMbH
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
Yes	1 & 2	NEMA 3R, CE Cert, US NRTL Cert		

EVSE Models & Specifications			
Model:	PP37-4 DSC	PP46 SWC	
Model Type:	Commercial, Fleet	Commercial, Fleet	
Charge Level:	1 & 2	1	
Electrical Specs:	208 to 240V AC, max 32A	208 to 240V AC, max 32A	
Portable/Hardwire	Hardwire	Hardwire	
Output Interface:	J1772 & NEMA 5	J1772	
Output Interface Lock:	Yes	Yes	
# Output Ports:	2 Level 2, 2 Level 1	1	
LAN Comms:	Ethernet, Wi-Fi, Zigbee, 802.11.x, Cellular	Ethernet, Wi-Fi, Zigbee, 802.11.x, Cellular	
WAN Comms	Ethernet, Wi-Fi, Zigbee, 802.11.x, Cellular	Ethernet, Wi-Fi, Zigbee, 802.11.x, Cellular	
Payment Interfaces:	RFID	RFID	
Payment Networks:	Proprietary	Proprietary	
EVSE Management Software:	Proprietary	Proprietary	
EVSE Energy Management Software	Proprietary	Proprietary	
Mobile App Support:	Proprietary	Proprietary	
Reservation Software Support:	Proprietary	Proprietary	
Warranty:	1 year with option to renew	1 year with option to renew	
Mounting Options:	Floor	Floor, Wall	
Cable Length:	10ft	10ft	
Cable Management:	Manual	Manual	
Display:	No	No	

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Hubbell Wiring Device-Kellems	39209 Six Mile Rd. Suite 111, Livonia, MI 48152	888-760-0140	www.pepstations.com	Hubbell Wiring Device-Kellems
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	UL 2594, UL 2231, UL 1998, NFPA 70, NEC Article 625	Concrete pedestal eliminates the need for bollards and meets ADA compliance requirements. Stainless steel component housing with dual Level 2 charge ports with J1772 connectors	

EVSE Models & Specifications		
Model:	PS2000	
Model Type:	Commercial	
Charge Level:	Level 2, 7.2kW	
Electrical Specs:	208/240V AC, 30A	
Portable/Hardwire	Hardwire	
Output Interface:	J1772	
Output Interface Lock:	No	
# Output Ports:	2	
LAN Comms:	Ethernet or Cellular	
WAN Comms	Ethernet or Cellular	
Payment Interfaces:	Magnetic stripe reader for credit cards or access cards; unrestricted access	
Payment Networks:	PEPAdvantage, open system compatible with universal payment gateways for magnetic stripe credit cards	
EVSE Management Software:	PEPAdvantage offers online station management and provides monthly usage reporting	
EVSE Energy Management Software	Modbus Protocol	
Mobile App Support:	Future	
Reservation Software Support:	Future	
Warranty:	1-year warranty, opt. 3-year warranty available	
Mounting Options:	Pedestal or wall	
Cable Length:	18’	
Cable Management:	Manual Coiled	
Display:	8” color LCD screen, sunlight readable/fingerprint resistant, 800X600 pixels	

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Schneider Electric	1415 South Roselle Rd. Palatine, IL 60067	888-778-2733	www.schneider-electric.com	Schneider Electric
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2, DC Fast Charging	UL, NEC, SAE	NEMA 3R enclosure	

EVSE Models & Specifications				
Model:	EV2430WS	EV230WSR	EV230PSR	EV230PDR
Model Type:	Indoor Residential	Commercial Outdoor Wall-Mount (also have EV230WSRR with RFID)	Commerical Outdoor Pedestal Single (also have EV230PSRR with RFID)	Commercial Outdoor Pedestal Dual (also have EV230PDRR with RFID)
Charge Level:	2	2	2	2
Electrical Specs:	208/240VAC 30A	208/240VAC 30A	208/240VAC 30A	208/240VAC 30A
Portable/Hardwire	Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	SAE J1772	SAE J1772	SAE J1772	SAE J1772
Output Interface Lock:	N/A	N/A	N/A	N/A
# Output Ports:	1	1	1	2
LAN Comms:	N/A	N/A	N/A	N/A
WAN Comms	N/A	N/A	N/A	N/A
Payment Interfaces:	N/A	N/A	N/A	N/A
Payment Networks:	N/A	N/A	N/A	N/A
EVSE Management Software:	N/A	N/A	N/A	N/A
EVSE Energy Management Software	N/A	N/A	N/A	N/A
Mobile App Support:	N/A	N/A	N/A	N/A
Reservation Software Support:	N/A	N/A	N/A	N/A
Warranty:	18 - 24 months	18 - 24 months	18 - 24 months	18 - 24 months
Mounting Options:	Wall	Wall	Pedestal	Pedestal
Cable Length:	18ft	18ft	18ft	18ft
Cable Management:	Dock and cord hanger	Dock and cord hanger	Dock and cord hanger	Dock and cord hanger
Display:	N/A	N/A	N/A	N/A

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Schneider Electric	1415 South Roselle Rd. Palatine, IL 60067	888-778-2733	www.schneider-electric.com	Schneider Electric
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2, DC Fast Charging	UL, NEC, SAE	NEMA 3R enclosure	

EVSE Models & Specifications			
Model:	EVF20850DTR	EVF24050DTR	
Model Type:	Fleet DC Quick RFID 208 volt (also have EVF20850DTB Credit Card Version)	Fleet DC Quick RFID 240 volt (also have EVF24050DTB Credit Card Version)	
Charge Level:	DC Fast Charging	DC Fast Charging	
Electrical Specs:	208 Vac 3-phase 160A	240Vac 3-phase 140A	
Portable/Hardwire	Hardwire	Hardwire	
Output Interface:	CHAdeMO	CHAdeMo	
Output Interface Lock:	N/A	N/A	
# Output Ports:	1- 500Vdc Max 125 A Max	1- 500Vdc Max 125 A Max	
LAN Comms:	N/A	N/A	
WAN Comms	N/A	N/A	
Payment Interfaces:	Credit Card	Credit Card	
Payment Networks:	N/A	N/A	
EVSE Management Software:	N/A	N/A	
EVSE Energy Management Software	N/A	N/A	
Mobile App Support:	N/A	N/A	
Reservation Software Support:	N/A	N/A	
Warranty:	18 - 24 months	18 - 24 months	
Mounting Options:	Pedestal	Pedestal	
Cable Length:	18ft	18ft	
Cable Management:	Dock and cord hanger	Dock and cord hanger	
Display:	LCD screen	LCD screen	

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
SemaConnect	4961 Telsa Drive Suite A Bowie, MD 20715	410-562-8490	www.semaconnect.com	SemaConnect
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	CCID Trip Threshhold 5mA, CCID5 per UL2231-2 / UL 2231-1, -2 and UL2594 certified NEC Article 625 Compliant		

EVSE Models & Specifications			
Model:	Chargepro		
Model Type:	Commercial		
Charge Level:	Level 2 (30A, 7.2kW@240VAC)		
Electrical Specs:	208/240v,center grounded,60Hz supply 3-wire; Phase A, Phase B, ground (no neutral)		
Portable/Hardwire	Hardwire		
Output Interface:	SAE J1772 EV Connector		
Output Interface Lock:	N/A		
# Output Ports:	2		
LAN Comms:	2.4GHz 802.15.4 dynamic mesh network		
WAN Comms	Commercial CDMA or GPRS cellular network		
Payment Interfaces:	Smart Card/Credit Card		
Payment Networks:	SemaCharge		
EVSE Management Software:	SemaCharge		
EVSE Energy Management Software	SemaCharge		
Mobile App Support:	Yes		
Reservation Software Support:	In Development		
Warranty:	1 year		
Mounting Options:	Wall, Pedestal, Dual Pedestal		
Cable Length:	18 feet		
Cable Management:	Manual Coil		
Display:	LCD screen		

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Shorepower Technologies	Portland, OR	503-892-7345	www.shorepower.com	Shorepower Technologies
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
Yes	Level 1, 2	NRTL	ePump	

EVSE Models & Specifications				
Model:	M2100 Tower	M2100 Cube	S2100 Tower	S2100 Cube
Model Type:	Commercial	Commercial, Residential	Commercial	Commercial, Residential
Charge Level:	1 & 2	1 & 2	1 & 2	1 & 2
Electrical Specs:	Level 1: 208-240v 2-pole 40 Amp Level 2: 208-240v 2-pole, up to 100 Amp	Level 1: 208-240v 2-pole 40 Amp Level 2: 208-240v 2-pole, up to 100 Amp	Level 1: 208-240v 2-pole 40 Amp Level 2: 208-240v 2-pole, up to 100 Amp	Level 1: 208-240v 2-pole 40 Amp Level 2: 208-240v 2-pole, up to 100 Amp
Portable/Hardwire	Hardwire	Hardwire	Hardwire	Hardwire
Output Interface:	Level 1: NEMA 5-15 GFCI receptacles Level 2: SAE J1772	Level 1: NEMA 5-15 GFCI receptacles Level 2: SAE J1772	Level 1: NEMA 5-15 GFCI receptacles Level 2: SAE J1772	Level 1: NEMA 5-15 GFCI receptacles Level 2: SAE J1772
Output Interface Lock:	Yes, Optional	Yes, Optional	No	No
# Output Ports:	2	2	2	2
LAN Comms:	Wired: RJ45 Wireless: Bridge	Wired: RJ45 Wireless: Bridge	Wired: RJ45 (daisychain to M-Series)	Wired: RJ45 (daisychain to M-Series)
WAN Comms	Yes, proprietary network	Yes, proprietary network	No	No
Payment Interfaces:	Card Reader, RFID	Card Reader, RFID	None	None
Payment Networks:	Shorepowerconnect.com	Shorepowerconnect.com	None	None
EVSE Management Software:	Shorepowerconnect.com	Shorepowerconnect.com	None	None
EVSE Energy Management Software	None	None	None	None
Mobile App Support:	Web browser	Web browser	None	None
Reservation Software Support:	None	None	None	None
Warranty:	1 Year Hardware	1 Year Hardware	1 Year Hardware	1 Year Hardware
Mounting Options:	Base plate - street	Wall or pole	Base plate - street	Wall or pole
Cable Length:	18‘ - 23’	18‘ - 23’	18‘ - 23’	18‘ - 23’
Cable Management:	Manual coil	Manual coil	Manual coil	Manual coil
Display:	12” LCD touchscreen	12” LCD touchscreen	None	None

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
Siemens	300 New Jersey Ave., Suite 1000, Washington, D.C. 20001	1 (800) 347-6659	www.usa.siemens.com/evi	VersiCharge – Siemens Community line – Coulomb Technologies, Inc.
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
L1 port on Multi-level is a Nema 5-20 receptacle (Yes)	L2 & L2/L1 combo	UL listed		

EVSE Models & Specifications					
Model:	Community Level II	Community Multi-level	Community Dual Level II	Community Dual Level II CM	VersiCharge
Model Type:	Commercial	Commercial	Commercial	Commercial	Residential/Fleet
Charge Level:	2	1 & 2	2	2	2
Electrical Specs:	208/240 VAC, 30 A	L2: 208/240 VAC, 30 A L1: 120 VAC, 16 A	208/240 VAC, 30 A per port	208/240 VAC, 30 A per port	208/240 VAC, 30 A
Portable/Hardwire	Hardware	Hardwire	Hardwire	Hardwire	Hardwire/Portable
Output Interface:	J1772	J1772/Nema 5-20R	J1772	J1772	J1772
Output Interface Lock:	Locked	Locked for both L2 & L1	Locked	Locked	Unlocked
# Output Ports:	1	2	2	2	1
LAN Comms:	N/A	N/A	N/A	N/A	N/A
WAN Comms	Cellular	Cellular	Cellular	Cellular	N/A
Payment Interfaces:	Contactless credit card and RFID	Contactless credit card and RFID	Contactless credit card and RFID	Contactless credit card and RFID	N/A
Payment Networks:	ChargePoint	ChargePoint	ChargePoint	ChargePoint	N/A
EVSE Management Software:	ChargePoint	ChargePoint	ChargePoint	ChargePoint	N/A
EVSE Energy Management Software	Demand response via ChargePoint	Demand response via ChargePoint	Demand response via ChargePoint	Demand response via ChargePoint	N/A
Mobile App Support:	iPhone, Android, Blackberry	iPhone, Android, Blackberry	iPhone, Android, Blackberry	iPhone, Android, Blackberry	N/A
Reservation Software Support:	Available via ChargePoint	Available via ChargePoint	Available via ChargePoint	Available via ChargePoint	N/A
Warranty:	12 month standard; 3 & 5 yr. extended	12 month standard; 3 & 5 yr. extended	12 month standard; 3 & 5 yr. extended	12 month standard; 3 & 5 yr. extended	12 month standard
Mounting Options:	Bollard, wall & pole	Bollard, wall & pole	Bollard	Bollard	Wall
Cable Length:	23 feet	23 feet	18 feet	18 feet	20 feet
Cable Management:	Manual coil	Manual coil	Manual coil	Self retracting	Manual coil
Display:	Vacuum fluorescent	Vacuum fluorescent	Vacuum fluorescent	Vacuum fluorescent	N/A

EVSE Company and General Information				
Vendor:	**Headquarters:**	**Phone:**	**URL:**	**Manufactured by:**
SPX	28635 Mound Rd. Warren, MI 48092	877-805-EVSE (3873)	www.evse.spx.com	SPX
Personal Charger required w/ Level I?	**Charge Levels Available:**	**Safety Compliances:**	**Miscellaneous:**	
N/A	Level 2	UL, SAE, FCC, NEC		

EVSE Models & Specifications			
Model:	Power Xpress Level 2 EVSE (EL-50600)	Power Xpress Level 2 EV Bollard (EL-50650)	
Model Type:	Residential, Commercial, Fleet	Commercial, Fleet	
Charge Level:	Level 2	Level 2	
Electrical Specs:	95VAC-264VAC, 24A	95VAC-264VAC, 30A (Adjustable to 12A, 16A, 24A)	
Portable/Hardwire	Plug-In or Hardwire	Hardwire	
Output Interface:	SAE J1772	SAE J1772	
Output Interface Lock:	N/A	N/A	
# Output Ports:	1	1	
LAN Comms:	UART Port	UART Port	
WAN Comms	UART Port	UART Port	
Payment Interfaces:	UART Port	UART Port	
Payment Networks:	N/A	N/A	
EVSE Management Software:	N/A	N/A	
EVSE Energy Management Software	N/A	N/A	
Mobile App Support:	N/A	N/A	
Reservation Software Support:	N/A	N/A	
Warranty:	1 Year, 3 Year w/ SPX installation	1 Year, 3 Year w/ SPX installation	
Mounting Options:	Wall	Bollard	
Cable Length:	18 Feet	23 Feet	
Cable Management:	Manual Coil	Manual Coil	
Display:	N/A	N/A	

Addendum B
EVSE Typology Landscape Vendor Letter for Participation

Subject: ***Electric Vehicle Supply Equipment Vendor Landscape - conducted by Utility***

"Dear Electric Vehicle Supply Equipment (EVSE) Vendor,

My name is "requestor" from "Company" and we are working on behalf of the "requesting entity," a group of communities and stakeholders in "State" planning for the use of plug in electrical vehicles throughout "State." We are inviting you to participate in an "'EVSE Typology Landscape'" that will be part of an "electric vehicle readiness plan" focused on the unique needs of the "Area" region that stretches from "city" to "city." The finished document will be used as a foundation for an interoperability roadmap being developed, as well as a reference document for potential buyers of EVSE infrastructure. Your input and feedback will be critical to the ultimate success of this initiative, and we hope your organization will be able to participate. More importantly, your information will be available to all utilities and companies interested in installing EVSE at their facilities or within their service territories.

With your participation in the EVSE Typology Landscape activity we will be able to include your company's information into our final report to be delivered to the stakeholders. Attached is a document that will assist in your completion of the EVSE Typology Landscape activity. On the first page is a template document with the fields we are to include in this landscaping process. The second page is a list of definitions for each field that has been called out in the template document. If you could please take the time to fill out the EVSE Typology Landscape document and return to "requestor@xxxxxx.com" we will be sure to include it in the final report.

CONTACT/RSVP

We strongly encourage your participation and request that you RSVP to "Requestor" at "requestor@xxxxxx.com" so that we have adequate contact information for your organization going forward for this landscaping activity. If you could please RSVP back to me with the correct contact information for the individual or individuals for this request by Month XX, 20XX, I will be sure to include them further in the project. Once I have the correct contact names for this activity we will request the EVSE Typology Template to be filled out and submitted no later than Month XX, 20XX.

The work being done under this grant covers a wide array of topics all focused on facilitating the deployment of EV charging infrastructure. For your participation in this project, we will send you a copy of the final regional plan for EV infrastructure readiness.

Your experience, input and participation will be critical to the ultimate success of this initiative, and we sincerely hope to hear from you soon. If you have any questions please don't hesitate to contact me. (requestor@xxxxxx.com)

Thank you for participating!"

3.1 Overview

The Texas River Cities Plug-In Electric Vehicle Initiative (TRC) has developed a customizable "toolkit" of electric vehicle supply equipment (EVSE) codes, ordinances, and permitting development in preparation for plug-in electric vehicles (PEVs) and the electric infrastructure necessary to support them.

The toolkit contains a basic starter set of ordinance language. Cities, counties, and local governments in the United States may take and modify it to create their own "Electric Vehicle Supply Equipment Ordinance." Some cities or counties may not require ordinances, but those that do can take the ordinance starter kit and customize it as required locally fitting their particular needs. An ordinance for EVSE may be needed for several reasons.

- If there is demand from customers, businesses, or local residents asking for plug-in electric vehicle (PEV) charging stations
- For safety reasons
- If existing electrical permitting processes do not account for EVSE installations
- To reduce confusion by standardizing charging station signs and parking space markings
- To promote local marketing and economic development

Electric vehicles have been selling in growing quantities and are now on the road in increasing numbers. Therefore communities should be prepared to ensure the safety of the community and to provide guidance to those who may be thinking about installing electric vehicle charging stations. It is better to start the ordinance process sooner rather than later, although each community needs to decide when it is appropriate for their own jurisdiction.

The toolkit includes the following sections along with helpful comments that explain concepts, provide examples, and guide the user throughout the document.

Ordinance Toolkit Table of Contents

Key Findings

During development of the ordinance tool kit, the following key findings were uncovered:

1. Across the regions, municipal ordinances and zoning laws are approached in widely different ways. Some areas don't have ordinances, while other areas have local codes. In some areas ordinances are controlled by cities, and in other areas, by counties. Some areas have zoning and in other areas zoning may not apply. Each region interested in EVSE guidelines can take this ordinance template, modify it and apply it as applicable in the local area.
2. Federal standards pertaining to EVSE signage and parking space accessibility (Americans with Disability Act) have not yet been finalized. So interim signage and temporary technical specifications have been created by some states and municipalities to use until the official designs are released.
3. Electric vehicle and charging standards are changing rapidly. Charging level specifications reflect newer AC and DC charging technologies. Definitions of various electric vehicle categories are changing as new electric models are announced, especially in the plug-in hybrid area. The need to keep this document up to date is important for consistency.
4. There is a wide variety of PEV charging station signs in the TRC region and inconsistency in the implementation of parking spaces markings. The need for consistent charging station standards is apparent to help prevent confusion, and ensure safety.

This documentation was developed based upon previous ordinance work from Illinois, Washington, and Michigan and subsequently revised by the TRC over a five-month period in 2012 to reflect current industry information and EVSE language. Over time it will require refreshing from TRC or an appropriate entity to remain a useful tool for the PEV industry.

3.2 Recommendations

Recommendation 1

Local governments across the TRC region may use this toolkit to update codes or create customized local ordinances as applicable to prepare for PEVs and the electric infrastructure necessary to support them.

Recommendation 2

Local entities with an interest in creating standard PEV ordinances should find a local champion to lead the initiative.

Recommendation 3

The Plan ordinance toolkit will be maintained and updated by TRC to ensure the toolkit is up to date with changing electric vehicle definitions, regulations, standards, and technologies. Such tools will be made available through a web site and be supported by TRC outreach.

Recommendation 4

TRC will incorporate interim EVSE signage into the Plan toolkit until federal signage standards are adopted and approved.

Recommendation 5

TRC will recommend that interim EVSE parking-space markings consistent with the Texas Department of Licensing and Regulation (TDLR) will be incorporated across the TRC region until formal federal accessibility guidelines are adopted.

Recommendation 6

Publicly available EVSE will be inspected periodically by the operating entity to ensure proper operation. EVSE specifications, coordinates, and addresses will be verified to ensure they are entered accurately in mapping databases to help PEV owners locate the charging stations.

Recommendation 7

TRC will provide links on its website to regional EVSE databases that will allow PEV owners to access it on a real-time basis to view geographic and operational information on all public EVSE.

3.3 Example Permitting-Installation-Inspection Process Flow

For related information refer to Section 2: Needs Analysis, Typology, and Best Practices Guide, for example process flows to install EVSE at houses, multifamily dwellings, and businesses.

3.4 Customizable Toolbox of Codes, Ordinances, and Permits

Please refer to the Electric Vehicle Supply Equipment Ordinance Toolkit document, below.

ELECTRIC VEHICLE SUPPLY EQUIPMENT
ORDINANCE TOOLKIT

SPONSORED BYTHE
TEXAS RIVER CITIES PLUG-IN ELECTRIC VEHICLE INITIATIVE
October 2012

TEXAS RIVER CITIES
Plug-In Electric Vehicle Initiative

Acknowledgments

The Texas River Cities Plug-In Electric Vehicle Initiative (TRC) would like to acknowledge the following professionals for their contributions and support in developing this Code, Ordinance, and Permitting Development Toolkit and for their participation in numerous meetings and teleconferences. This toolkit, as part of the overall regional plug-in electric vehicle (PEV) development plan, was developed based on their collective input, following a consensus process, and does not necessarily reflect the views of the organizations listed.	This document was developed for the Texas River Cities Plug-In Electric Vehicle Initiative through funding provided by a Clean Cities grant under contract DE-EE0005585 issued by the U.S. Department of Energy (DOE) to Austin Energy in 2011.

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The City of Austin, Office of Sustainability	Zachary Baumer
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Special acknowledgment and appreciation are given to Michael Donohue, member of the Kane County, Illinois, Board and Heidi Files, Senior Executive Planner for Kane County, for their leadership in shaping the initial Kane County Electric Vehicle Ordinance, upon which this toolkit was based. That ordinance, developed in 2011 and accepted by the Kane County, Illinois, Board in February 2012, was itself based upon plug-in electric vehicle (PEV) ordinances previously developed in Auburn Hills, Michigan, and Puget Sound, Washington.

How to Use This Electric Vehicle Supply Equipment Ordinance Toolkit

This document contains a basic starter set of electric vehicle supply equipment (EVSE, or charging station) codes, ordinances, and permits that local governments may use for the purpose of modifying or creating an Electric Vehicle Supply Equipment Ordinance. Some cities or counties may not require ordinances, but those that do can take this ordinance starter kit and customize it to fit their particular needs.

Here are some quick guidelines to determine if ordinances are necessary:

Q: WHEN are electric vehicle ordinances necessary?

A: An ordinance for EVSE may be needed in one or more of the following situations

- Demand from customers or local residents asking for plug-in electric vehicle (PEV) charging stations
- Insufficient electrical permitting processes that do not account for PEV charging station installations
- An interest in providing incentives to install EVSE to increase demand
- A need to streamline EVSE permitting and installation processes to reduce processing time and increase consistency
- A need for consistent signs or parking space markings for electric vehicles compliant with the Americans with Disabilities Act (ADA) or interim designations
- A desire to prepare for electrical infrastructure necessary for electric vehicles

Q: WHY should EVSE (charging station) ordinances be put in place?

A: For the following reasons

- Safety – so electrical inspections can be done to protect the public
- Standardization – to reduce complexity, cost, and confusion by using consistent guidelines
- Reliability – to protect the electrical grid and keep the local utility involved and informed
- Strategy – to promote marketing and economic development

Q: WHO should be involved?

A: A local champion is usually required to lead the effort. This may be a board member or community leader who steps forward determined that there is sufficient need to develop an ordinance for PEVs. Local officials may be asking if the community is ready for PEVs. Local grass roots organizations, such as an electric auto association, may also lead the initiative to instill an ordinance for PEVs.

Potential Audiences

- Applicable city or county management, sustainability, and/or environmental offices
- Public safety officials: fire, emergency medical services (EMS), police
- Power utilities
- Public works, planning, code, and/or transportation departments

- Local government officials, planning commission members, and building code officials
- Local utility contact in charge of PEV planning
- Representative of a local PEV auto association or PEV owners club
- Vehicle manufacturing representatives and dealers
- Employees of EVSE- or PEV-related services
- Electrical contractors with experience installing charging stations
- Electrical inspectors
- Transportation planners
- Private single- and multifamily builders, and real estate developers
- Others interested in helping promote the rollout of PEVs

Q: WHEN should an area begin developing electric vehicle ordinances and guidelines?

A: It is better to start the ordinance process sooner rather than later, although each community needs to decide when it is appropriate for their own jurisdiction. Communities want to be prepared to ensure the safety of the community and to provide guidance to community members who may be thinking about installing electric vehicle charging stations.

One indication that electric vehicle ordinances may be needed is the appearance of electric vehicle charging stations with different types and styles of signs. Here are a variety of electric vehicle signs observed in one region of Texas – demonstrating the need for standardization at the state or federal level.

Finally, as you review the ordinance information below, note the following opportunities to include customization language for your region:

- Information between the brackets < > represents information that should be modified to reflect the specific circumstances of the locality or region developing the ordinances.
- This document contains blue comments that help explain terminology or provide links to helpful information. They may be removed for your final ordinance or left in for educational purposes.

Comments or feedback on this document may be directed to: info@texasrivercities.com

ORDINANCE NO.___

DATE

ORDINANCE NO.___

AN ORDINANCE CREATING A NEW APPENDIX < x > OF THE <Location> CODE, ELECTRIC VEHICLE INFRASTRUCTURE ORDINANCE

TABLE OF CONTENTS

Appendix <number>. Electric Vehicle Infrastructure

Article I.
Development/Zoning Regulations and Guide

1.1. Definitions

Comment: Ordinances should have a set of common definitions to provide a consistent base understanding of electric vehicles, hybrids, and their variations. Please note that the Society of Automotive Engineers (SAE) is working to update its Hybrid Electric Vehicle (HEV) and Electric Vehicle (EV) Terminology definitions in a new standards document, J1715, at http://standards.sae.org/j1715_200802/. Many definitions here are based on the preliminary SAE work.

1.1.1 AC: Alternating current (electricity).

1.1.2. Battery: An energy storage system consisting of a cell or cells onboard an electric vehicle used for storing and furnishing electrical energy for the purpose of propelling the vehicle.

1.1.3. Battery Electric Vehicle (BEV): An electric vehicle that operates exclusively on electrical energy stored in an on-board energy storage system ("battery") designed to be recharged from an external, off-vehicle source of electric energy.

1.1.4. Charging Level: The standardized indicators of electrical force, or voltage, at which an electric vehicle's battery is recharged. Typical Society of Automotive Engineers (SAE) electric vehicle charging levels and specifications are:

A. Level 1 – AC slow battery charging. Voltage is 120 volts AC, limited to16 amps on a 20-amp circuit breaker.

B. Level 2 – AC medium battery charging. Voltage is between 208 and 240 volts AC, limited to 32 amps on a 40-amp circuit breaker, up to a limit of 80 amps on a 100-amp circuit breaker.

C. Level 3 – AC

Comment: Level 3 technology was targeted for high-voltage AC battery charging with voltages higher than 240 volts, but the category is currently undefined by SAE. More commonly this level has been referred to by owners and vendors as DC Fast Charge or DC Quick Charge, which the SAE now defines separately below as DC Level 2 See International Association of Electrical Inspectors (IAEI) Magazine article on DC Chargers http://www.iaei.org/magazine/2012/01/have-any-electric-vehicle-ev-level-3-dc-fast-chargers-been-ul-certified-listed/.

D. DC Charging - voltages greater than 240 volts DC.

1. Level 1 – DC limit is 80 amps, at up to 450 volts DC
2. Level 2 – DC limit is 200 amps, at up to 450 volts DC
3. Level 3 – DC limit is 400 amps, at up to 600 volts DC

1.1.5. Charging Station: Equipment that has as its primary purpose the transfer of electric energy by conductive or inductive means to a battery or other energy storage device located onboard an electric vehicle. Also known as electric vehicle supply equipment (EVSE). Types of charging stations include:

A. **Accessible Charging Station:** A charging station incorporated into or immediately adjacent to a handicapped parking space as a “handicapped parking space” or an “accessible parking space” as defined by the <STATE> Vehicle Code.

B. **Fast-Charge Station:** (formerly referred to as “Level 3” now DC Level 2) Please refer to Section 1.1.4. Charging Level.

C. **Private Charging Station:** A charging station that is (1) privately owned and has restricted access (e.g., single-family home, executive parking, designated employee parking) or (2) publicly owned and restricted (e.g., fleet parking with no access to the general public).

D. **Public Charging Station:** A charging station that is (1) publicly owned and publicly available (e.g., park & ride, public parking lots, on-street parking) or (2) privately owned and publicly available (e.g., shopping center parking, non-reserved parking in multifamily parking lots).

1.1.6. Charging Station Equipment: The conductors, including ungrounded and grounded, and the electric vehicle connectors, attachment plugs, and all other fittings, devices, power outlets, charging stations, or apparatus installed specifically for the purpose of delivering electrical energy from the charging station to the electric vehicle.

1.1.7. Charging Station Space: A dedicated, marked space that identifies the use thereof as exclusively for the charging of electric vehicles.

1.1.8. DC: Direct current (electricity).

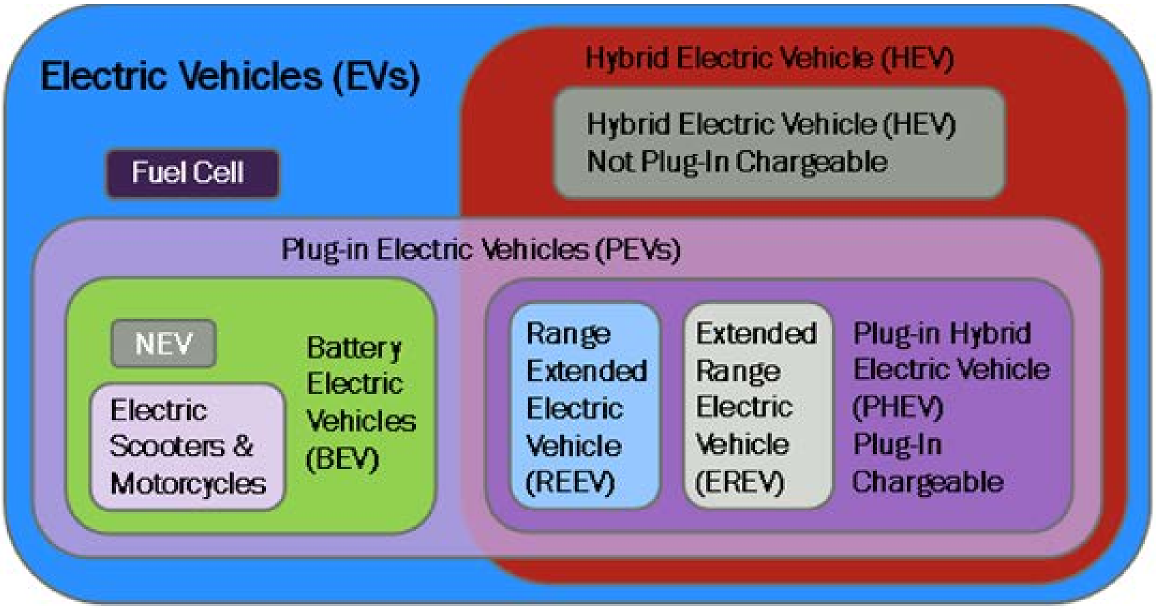
1.1.9. Electric Scooter and/or Motorcycle: A two- or three-wheel electric vehicle that operates exclusively on electrical energy stored in the vehicle’s energy storage system (battery).

1.1.10. Electric Vehicle (EV): A vehicle powered in whole or in part by electricity. Includes a battery electric vehicle (BEV), a plug-in hybrid electric vehicle (PHEV), a neighborhood electric vehicle (NEV), and electric scooters or motorcycles, among others.

Figure 1-1. Example Electric Vehicle Charging Station

Electric vehicle charging stations, Howson Library, Austin, Texas

Figure 1-2. Select Types of Electric Vehicles



Comment: Figure 1-2 is for educational purposes and shows how different kinds of electric and hybrid electric vehicle *categories compare with one another; it is based on preliminary SAE J1715 documentation.*

1.1.11. Extended-Range Electric Vehicle (EREV): A type of plug-in hybrid electric vehicle (PHEV) that runs primarily on electrical energy stored in batteries. It has at least one electric motor and a secondary power source, usually an internal combustion engine (ICE). In some modes of operation or after batteries are drawn down, the ICE engages, turning an on-board generator to power the motor. In other modes, the ICE engages to assist the electric motor(s) by connecting directly to the power train to help propel the vehicle.

Comment: EREV is a term Chevrolet uses to describe the Volt, which runs in electric mode at all times in four different drive modes using one or both of its two electric motors. The Volt's ICE drives a generator to charge the battery when the battery is low or during hard acceleration. In its high-speed mode, the Volt runs off of both electric motors and closes a clutch allowing engine power to go directly to the wheels, as well. It is this unique combination of drive modes that makes the Volt a little different than other range-extended electric vehicles (REEVs), which typically use the ICE to just power the on-board generator. For a detailed explanation of the Volt's four driving modes, refer to: *http://media.gm.com/content/Pages/news/us/en/2010/Oct/1011_volt/_jcr_content/rightpar/sectioncontainer_1/par/download/file.res/Chevrolet%20Volt%20Electric%20Drive%20Unit%20operating%20mode.doc.*

1.1.12. Hybrid Electric Vehicle (HEV): A vehicle with two or more propulsion systems, both of which provide power, either together or independently. HEVs typically include an electric motor and an internal combustion engine (ICE).

Comment: In practice, hybrid vehicles typically require both energy sources to provide full vehicle capability. The engine is usually the larger of the two propulsion sources, being sized to provide most of the power during high-power vehicle events. The electric motor is typically the smaller of the two propulsion sources and sized to maximize the amount of energy that can be captured during braking and for limited low-speed electric vehicle operation.

1.1.13. Neighborhood Electric Vehicle (NEV): Categorized as a type of low-speed vehicle, the NEV is an electric vehicle with four wheels that conforms to federal regulations under Title 49 CFR Part 571.500, which can, from a stand–still, attain a speed of 20 miles per hour (mph) within one mile, but cannot exceed a speed of more than 25 mph and is limited to streets with a speed limit of 35 mph or less.

Comment: For updates on NEVs see http://www.iihs.org/laws/lowspeedvehicles.aspx. As of May 2012, four states (Connecticut, Mississippi, Montana, and Pennsylvania) did not have statutes allowing the use of low-speed vehicles on their public roads. Many states allow their departments of transportation or local jurisdictions to restrict their use (for instance as of July 2012, San Antonio, Texas, did not allow the use of NEVs).

In Texas, the NEV is defined as a type of BEV that operates at a maximum speed of 35 mph and has a maximum weighted load of 3,000 pounds. NEVs in Texas cannot operate on roadways with posted speed limits above 45 mph, but can cross them. Unlike golf carts, which are also a form of BEV, NEVs have a valid 17-digit vehicle identification number (VIN), must be titled and registered, and must have the following safety equipment: seat belts, lights, windshield, turn signals, parking brake, reflectors, turn signals, and brake lights.

For more on Texas NEVs see http://www.txdmv.gov/vehicles/drivers/golf_carts.htm.

1.1.14. Plug-In Electric Vehicle (PEV): An electric vehicle with an energy storage system (battery) that is designed to be recharged from an off-vehicle source of electricity; includes both battery electric vehicles (BEV) and plug-in hybrid electric vehicles (PHEV).

1.1.15. Non-Electric Vehicle: A vehicle that does not meet the definition of electric vehicle as provided herein.

1.1.16. Plug-In Hybrid Electric Vehicle (PHEV): A hybrid electric vehicle with an energy storage system (battery) that is designed to be recharged from an external, off-vehicle source of electric energy.

1.1.17. Range-Extended Electric Vehicle (REEV): Also referred to as a series hybrid vehicle, the REEV is a plug-in hybrid electric vehicle (PHEV) that runs primarily on electrical energy stored in batteries. It has least one electric motor and a secondary power source, usually an internal combustion engine (ICE). After the batteries are drawn down, it operates in range-extended mode using the ICE to turn an on-board generator, allowing the electric motor(s) to continue to propel the vehicle.

1.1.18. Vehicle: Has the same meaning as provided in <your STATE Vehicle Code 625> <Reference>

1.2. Permitted Locations

Comment: The following section may or may not be applicable, or can be reworded depending upon the use of zoning in the community.

1.2.1. Level 1 and Level 2 charging stations are permitted in <every zoning district> when accessory to the primary permitted use <of said district>. Charging stations located at single-family, multiple-family, and mobile home park dwellings for use only by residents shall be designated as private-use only. Installation of Level 2 charging stations shall be subject to building permit approval.

1.2.2. Level 3 charging stations are permitted in <zoning locations> when accessory to the primary permitted use. Installation thereof shall be subject to building permit approval.

1.2.3. If the primary use of a parcel is the retail charging of electric vehicle batteries, then the use shall be considered <describe for zoning purposes>. Installation of charging stations shall be subject to Special Land Use approval and located in <zoning locations>.

1.3. Station Requirements and Design Criteria

1.3.1. General Charging Station Requirements for Multifamily Residential, Non-Residential Development, and Public Rights-of-Way

A. Charging Station Space Requirements

1. **Minimum requirements:** A charging station space may be included in the calculation for minimum parking spaces that are required pursuant to other county and state regulations.

2. **Number:** No minimum number of charging station spaces is required.

   Comment: See also Section 1.4: Quantity and Location

B. Charging Station Space Location and Design Criteria

1. Where provided, spaces for charging station purposes are required to include the following:

   a. **Signage:** Each charging station space shall be posted with signage indicating the charging station space is only for use by electric vehicles for charging purposes. Days and hours of operations shall be included if time limits or tow-away provisions are to be enforced.

   b. **Maintenance:** Charging station equipment shall be maintained in all respects. A phone number or other contact information shall be provided on the charging station equipment for reporting purposes when the equipment is not functioning or other equipment problems are encountered.

   c. **Accessibility:** Where charging station equipment is provided within a pedestrian circulation area, such as a sidewalk or other accessible route to a building entrance, the charging station equipment shall be located so as not to interfere with accessibility requirements of the <State> Accessibility Code or other applicable accessibility standards.

   Comment: in Texas, please refer to Texas Department of Licensing and Regulation, "Electric Vehicle Charging Stations" at http://www.tdlr.state.tx.us/ab/info/TM11-01.pdf. The Texas Department of Licensing and Regulation has issued technical clarifications until formal federal accessibility guidelines addressing electric vehicle charging stations become available and are adopted. These guidelines pertain to electric charging stations provided in new or existing parking lots, parking garages, or other locations containing parking spaces.

   d. **Lighting:** Where charging station equipment is installed, adequate site lighting shall be provided in accordance with <Location> ordinances and regulations.

   e. **Charging Station Equipment:** Charging station outlets and connector devices shall be no less than 36 inches and no more than 48 inches from the ground or pavement surface where mounted, and shall contain a retraction device and/or a place to hang permanent cords and connectors a sufficient and safe distance above the ground or pavement surface. Equipment mounted on pedestals, lighting posts, bollards, or other devices shall be designated and located as to not impede pedestrian travel or create trip hazards on sidewalks.

f. **Charging Station Equipment Protection:** Adequate charging station equipment protection shall be used, unless the manufacturer of the EVSE specifically indicates it is unnecessary. This may include concrete-filled steel bollards, or non-mountable curbing in lieu of bollards if the charging station is set back a minimum of <24><36> inches from the face of the curb.

Comment: 36 inches may be specified for further protection from vehicles or snow accumulation, as appropriate in certain locations. Some charging stations claim to be sturdy enough not to need concrete-filled bollards, but most charging stations will require some form of protection to help prevent vehicles impacts.

g. **Usage Fees:** In accordance with federal, state, and local regulations, an owner of a charging station <is><is not> prohibited from collecting a fee for the use of a charging station. <Fees shall be prominently displayed on the charging station.>

Comment: Most areas allow fees to be charged, but some state or local laws may prohibit certain owners from collecting fees for the resale of electricity. Please check state and local regulations and adjust statement accordingly. For example, as of August 2012, in Austin Texas, which is a home-rule municipality, the utility is the only entity that can charge for electricity, including electricity distributed from public EVSE. The EVSE owner pays the cost to install the EVSE and maintains ownership of the device, but transfers the EVSE billing and maintenance functions related to the sale of electricity to the utility.

2. Those providing charging station spaces should consider the following:

a. **Notification:** Information on the charging station, identifying voltage and amperage levels, and time of use, fees, or safety information.

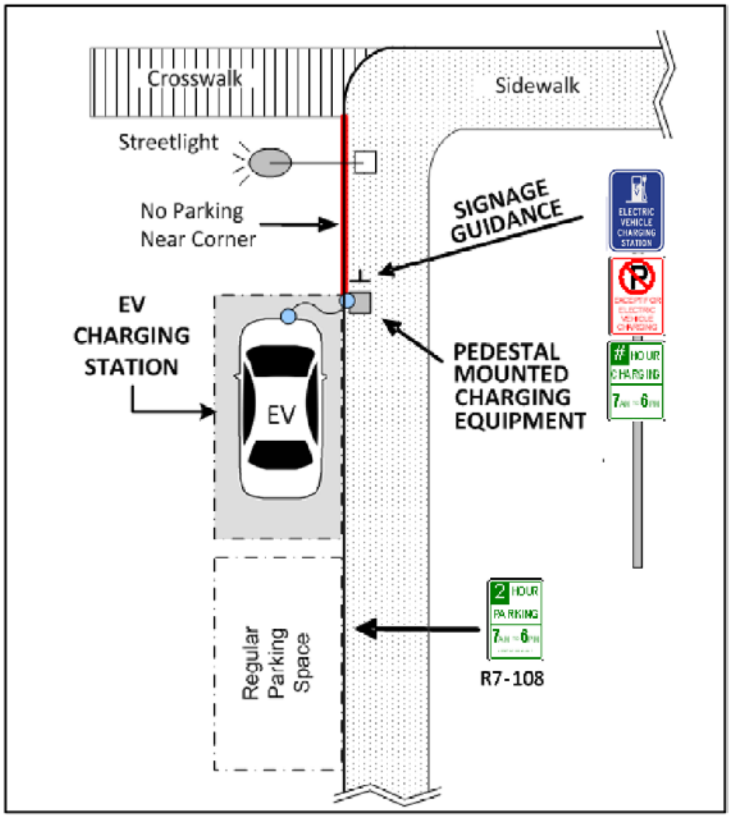
b. **Signage:** Installation of directional signs at appropriate decision points to effectively guide motorists to the charging station space(s).

c. **Location:** (Specific to On-Street Parking) Placement of a single charging station is preferred at the beginning or end stall on a block face.

C. **Data Collection:** To allow for maintenance and notification, the <Location> shall require the owners of public charging stations to provide information on the charging station's geographic location, date of installation, equipment type and model, and owner contact information.

Figure 1-3 shows an example of an on-street electric vehicle charging station.

Figure 1-3. Electric Vehicle Charging Station — On Street



On-street charging near end of block.

Comment: On-street charging stations should first be installed at either end of a row of regular on-street parking spaces. Subsequent charging stations should be installed in the space next to the existing charging stations. Several factors that suggest an end-stall as the preferred location include proximity to electrical service, adjacency to existing no-parking zone, better accessibility for all users, higher lighting levels, and less clearance and obstruction issues with existing parking spaces. The charging station equipment should be installed in a well-lit area, on a hard surface, and near the front of the designated space, have adequate clearance (36") from the face of curb, and leave a barrier-free sidewalk clearance (36"). Signage shall be at or near the charging station. All regulatory signs shall comply with visibility, legibility, size, shape, color, and reflectivity requirements contained within the Federal Highway Administration (FHWA) Manual on Uniform Traffic Control Devices (MUTCD), http://mutcd.fhwa.dot.gov/. It is also recommended the charging station be located in an area with sufficient drainage, and not in an area subject to "ponding" or accumulation of pools of water.

1.4. Quantity and Location

1.4.1. Residential: In order to proactively plan for and accommodate the anticipated growth in market demand for electric vehicles, it is <strongly encouraged, but not required><mandatory> that all new one-family and multiple-family homes with garages be constructed to include <roughed-in> conduit, panel space, and electrical capacity to install a 220- to 240-volt, 40-amp outlet on a dedicated circuit in close proximity to designated vehicle parking, to accommodate the potential future hardwire installation of a Level 2 charging station.

Comment: Modify the above statement for your particular community. At a minimum, roughing-in the conduit and basic panel space helps avoid much higher costs to add a charging station later.

In 2010, Hawaii passed Senate Bill 2231 stating that one cannot prevent the installation of an electric vehicle charging station on or near the parking stall of any multifamily residence or townhouse. See http://www.capitol.hawaii.gov/session2010/Bills/SB2231_cd1_.pdf.

1.4.2. Non-Residential: In order to proactively plan for and accommodate the anticipated future growth in market demand for electric vehicles, it is <strongly encouraged, but not required><mandatory> that all new and expanded non-residential development parking areas be constructed to include <roughed-in> conduit, panel space, and electrical capacity to accommodate the future hardwire installation of Level 2 charging stations in close proximity to designated vehicle parking.

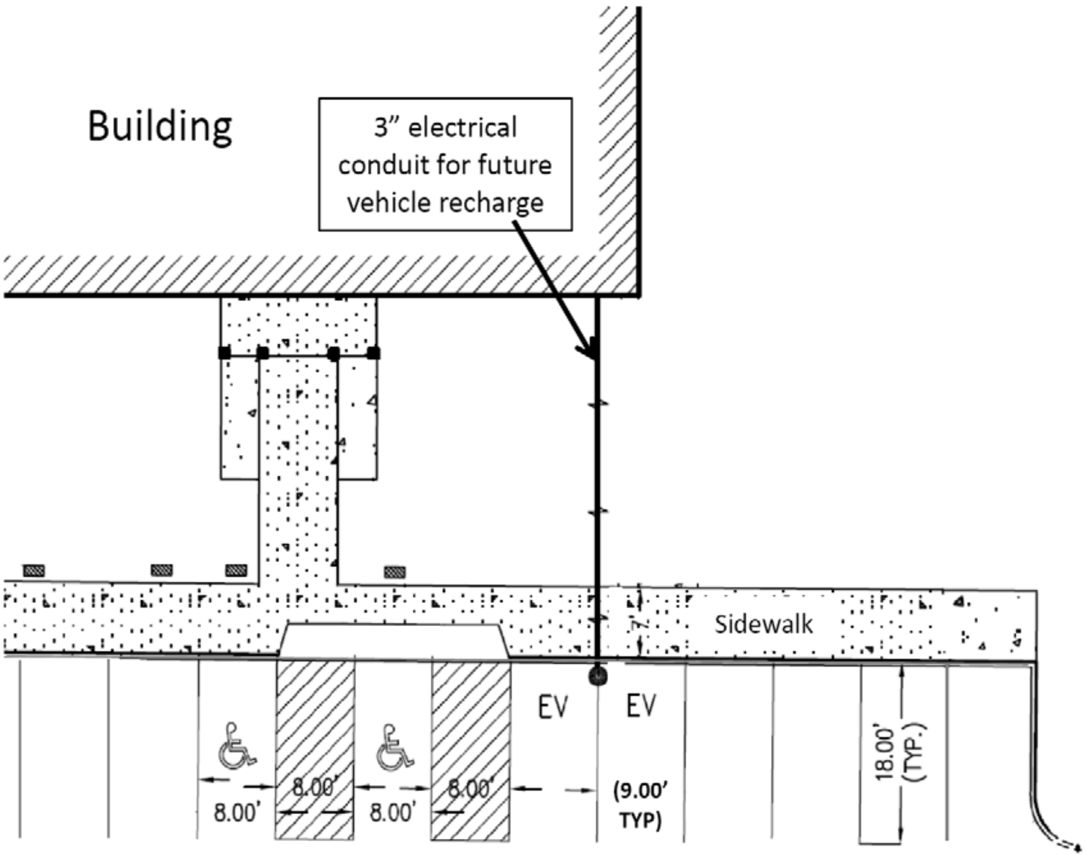
It is <recommended but not required><mandatory> that a typical parking lot that installs EVSE provide 20% (or one fifth) as accessible parking spaces.

Comment: Laying basic conduit from parking areas to the circuit panels during construction is a low-cost method that avoids high-cost trenching or cutting of concrete when adding charging stations later.

Quantities: As of March 15, 2012, the U.S. Department of Justice had not issued formal accessibility guidelines addressing electric vehicle charging stations. The Texas Department of Licensing and Regulation issued technical clarifications until such time as federal standards become available and are adopted. If electric charging stations are provided in a parking lot or garage, 20 percent but not less than one shall meet the accessibility standards specified. See interim guidance provided by Texas: http://www.license.state.tx.us/ab/info/TM2012-01.pdf.

Figure 1-4 shows an example of a site plan that includes a rough-in for electric vehicle charging stations.

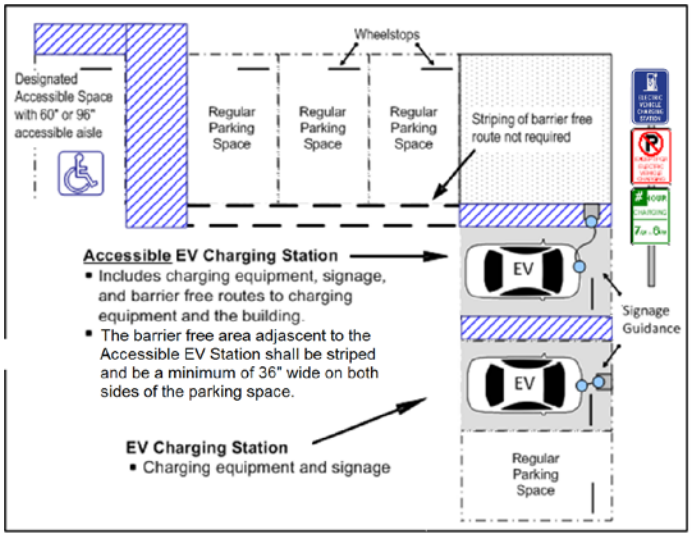
Figure 1-4. Example Site Plan – “Rough-In” of Electric Vehicle Charging Stations



1.4.3. Accessible Charging Stations: It is <strongly encouraged, but not required,><mandatory> that a minimum of one accessible charging station be provided anywhere charging stations are installed. Accessible charging stations shall be located in close proximity to the building or facility entrance and shall be connected to a barrier-free accessible route of travel to and from the building or facility. It is not necessary to designate the accessible charging station exclusively for the use of disabled persons.

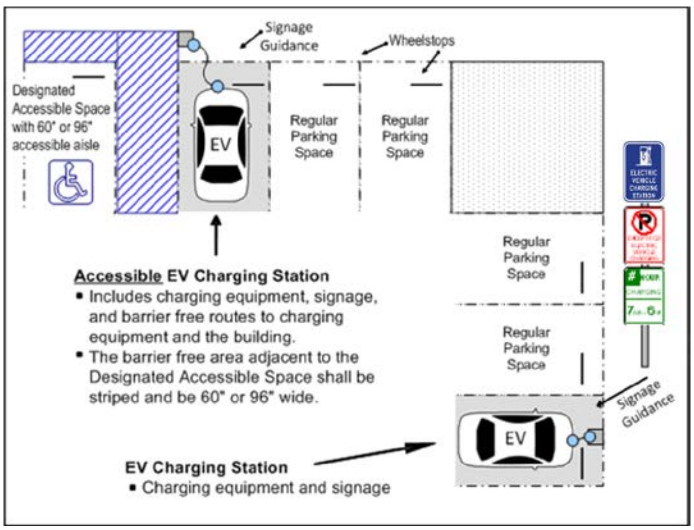
Figures 1-5 and 1-6 show two options for providing accessible electric vehicle charging stations.

Figure 1-5. Off-Street Accessible Charging Station Example - Option 1



Austin, Texas, City Hall parking garage with accessible parking spaces.

Figure 1-6. Off-Street Accessible Charging Station Example - Option 2



Fashion Island Shopping Mall, Newport Beach, CA. Photo by LightMoves.

Comment: The illustrations and photos above show two options for providing accessible charging stations. Option 1 is a likely scenario for installation in existing parking lots. An accessible charging station may be installed more cost-effectively by using an existing, wider, end parking stall or by restriping. Where feasible, a wider (60") clear area around the equipment is preferable. Additionally, since the accessible charging station is away from prime parking areas near the building, it is more likely the space will be available for those needing a charge, including persons with disabilities. Option 2 provides a location that has a shorter travel distance for persons with disabilities and can be easily installed in a new parking lot. This option may allow the installer to provide a wider, more fully compliant aisle.

While other options are likely, depending on the specific layout of the new or reconfigured parking area, at a minimum, an accessible charging station must be located within accessible reach of the barrier-free access aisle and the electric vehicle and connect to a barrier-free route of travel. However, because the charging station *facility is not a parking facility, the accessible charging station does not need to be located immediately adjacent to the building entrances or reserved exclusively for the use of disabled persons.*

1.5. Signage

1.5.1. Directional – Off-Street Parking Lot or Parking Garage Charging Stations: The following signs shall be used to designate electric vehicle charging equipment in a parking facility.

Comment: The two EV signs in Figure 1-7 below are the interim approved symbols per the FHWA as of April 20, 2012. See "Lessons Learned – The EV Project EVSE Signage Prepared for the US Department of Energy Award #DE-EE0002194" Section 5-1 on page 9, *http://www.theevproject.com/downloads/documents/Signage%20Initial%20Issue%204-20-2012.pdf.*

It is recommended that these interim signs be adopted, with the expectation that they will ultimately be approved at the federal level and become the uniform standard nationally.

As of May 2012, there appears to be no official federal guidelines for other signs that are needed for electric vehicles. See article *http://www.nytimes.com/2012/05/06/automobiles/pointing-the-way-to-where-ev-drivers-can-plug-in.html.*

Figure 1-7. Recommended Directional Off-Street Electric Vehicle Charging Signs

12" x 6"

The directional sign for an on-site parking lot or parking garage should be used in the parking facility with a directional arrow at all decision points.

Comment: These signs are compliant with the FHWA MUTCD.

1.5.2. Off-Street Charging Station Space Signage: The following signs shall be used to designate off-street electric vehicle parking. The use of time limits is optional.

Figure 1-8. Recommended Combination of Off-Street Electric Vehicle Charging Signs

12” x 18”

12” x 18”

Comment: Combination of signs identifying the space as a charging station space, prohibiting non-EVs, and imposing a charging time limit. These signs are compliant with the MUTCD.

1.5.3. Directional Signage – Highways and Freeways: The following signs shall be used to designate direction of travel to reach electric vehicle charging stations.

Figure 1-9. Recommended Directional Highway Electric Vehicle Charging Signs

30” x 12”

The directional sign (MUTCD D9-11b) for highways and freeways should be installed at a suitable distance in advance of the turn-off point or intersecting highway. If used at an intersection or turn-off point, it shall be accompanied by a directional arrow. The symbol on the sign above may be supplemented with the sign below (MUTCD D9-11bP) to help early PEV drivers avoid confusion with liquid fueling stations.

Comment: *These signs are compliant with the MUTCD.*

Figure 1-10: Proposed Electric Vehicle Charging Station Signs

30” x 24”

Comment: Dimensions. As mentioned previously, it is anticipated that a federal standard for electric vehicle signs is forthcoming, but these are the interim recommended signs. See dimensions for interim electric vehicle signs at http://mutcd.fhwa.dot.gov/resources/interim_approval/ia13/ia13evcaltd911bimg.pdf.

The long-term objective of these electric vehicle signs is to have a consistent symbol from the federal highways, to state highways, to local streets, and finally at the charging station. Use of one federal symbol is the simplest way to accomplish this end. Recognizing that the experimentation process may result in revisions, the current interim approved federal signs shown above should be utilized by local governments and installers until federal signs are approved. One potential revision that may be proposed from Washington State is that the sign include information on the charging level (i.e., AC Level 1 or Level 2, or DC Level 1, Level 2, or Level 3).

1.5.4. Directional Signage for Local Streets: The following signs shall be used to designate and direct traffic to electric vehicle charging stations on local streets.

Figure 1-11. Recommended Local Street Directional Signs

24” x 24”

24” x 9”

The directional sign for local streets should be installed at a suitable distance in advance of the intersection or charging station facility. If used at an intersection or parking lot entrance, it should be accompanied by a directional arrow. The symbol on the sign above may be supplemented with the sign below (MUTCD D9-11bP) to help early PEV drivers avoid confusion with liquid fueling stations.

Comment: These signs are compliant with the MUTCD.

Figure 1-12. Optional Supplemental Charging Station Sign

24” x 18”

1.5.5. On-Street Parking Space with Charging Station: The following signs shall be used to designate on-street electric vehicle charging stations. The use of time limits is optional.

Figure 1-13. Recommended Sign Combination for an On-Street Parking Space with Charging Station

12” x 12”

12” x 18”

12” x 18”

Comment: This is a combination sign identifying the space as a charging station space with charging time limits, prohibiting non-EVs. Time limits allow the charging equipment to be available for more than one use during the day. For example, a jurisdiction may want to utilize time limits in areas where the on-street charging station spaces would turn over consistent with whatever time limits might otherwise be posted on a block (e.g., two-hour time limits). The design of the time limit charging sign is modeled after the existing R7-108 sign in the federal MUTCD. If time limits are used, suggested enforcement regulations are provided in Section 2.2. Electric Vehicle Charging Station Regulations. If the jurisdictions wish to allow dual use of the space (i.e., the spaces is for electric vehicles only during a certain period of time, but then allow all vehicles to park after specified hours), the time limits would need to be added to the red/black/white sign rather than the green sign. These signs are compliant with the MUTCD.

1.6. Battery Recycling and Handling Provisions

Comment: At the time of this publication, no federal laws or regulations were regulating PEV batteries except less-used lead-acid batteries and regulations pertaining to the air shipment of lithium and lithium batteries. Additional educational information on lithium batteries is also provided in Addendum A.4.

1.6.1. Battery Handling and Storage: EV batteries shall be properly managed in accordance with any local, state, and federal laws. Dismantling a battery is extremely dangerous and should always be done by the manufacturer. In the event that the battery needs to be removed, dismantling guides are available from the manufacturer.

Comment: In rare instances if a lithium battery is pierced, depending upon the design, specific chemical composition, cold temperatures, and other factors, crystallization of the electrolyte may occur over time, causing a short, possibly resulting in a fire. If the hole is small, that reaction could take days or weeks to occur. The important point is that after an electric vehicle has been involved in an accident or the battery has sustained damage in some other way, or when the electric vehicle is being stored or dismantled, its battery systems must first be properly de-energized according to manufacturer specifications. Such battery de-energizing can be done by following the manufacturer's instructions, which typically consist of stabilizing the car in a safe place, and turning on various features to drain the battery. In all cases, please refer to specific instructions from the manufacturer.

1.6.2. Solutions for End of Battery Life: End-of-life information for most PEV models is available from the End of Life Vehicle Solutions Corporation at http://www.elvsolutions.org/battery_home.html. The site includes information on processes and batteries for the disposal of many makes and models of electric vehicles. It is recommended that batteries be taken to the car dealership for removal if ever necessary. If a dealership is not available, the manufacturer's telephone number listed in the owner's manual should be able to offer guidance on disposal.

Comment: Included in the end-of-life vehicle solutions documentation at the URL above are links to specific end-of-life information from each of the various EV manufacturers.

1.6.3. Air Shipment: Follow the guidelines governing the air shipment of lithium and lithium batteries. Refer to the International Air Transportation Association (IATA) guidance document, "Transport of Lithium Metal and Lithium Ion Batteries: Revised for the 2012 Regulations," at: http://www.iata.org/whatwedo/cargo/dangerous_goods/Documents/Guidance-Document-on-the-Transport-of-Li-Batt-2012-V1.1.pdf.

1.6.4. Other Battery Technologies: Documentation for handling of lead-acid and other battery types, which still may be used in some older PHEVs, is described in the Mercury-Containing and Rechargeable Battery Management Act, PUBLIC LAW 104–142—MAY 13, 1996, http://www.epa.gov/osw/laws-regs/state/policy/p1104.pdf.

2.1. Laws and Permits, Listing, Codes, and Inspections

2.1.1. Federal and State Laws:

Comment: Specific information on federal and state laws pertaining to electric vehicles may be found at the DOE Alternative Fuels Data Center, "Federal and State Laws and Incentives," http://www.afdc.energy.gov/afdc/laws/.

2.1.2. Permits: A permit for the installation of a charging system is required from the authority having jurisdiction. DOE's Alternative Fuels Data Center provides an example permit that may be used as a template for charging equipment installation and modified for use in the local jurisdiction at http://www.afdc.energy.gov/afdc/pdfs/EV_charging_template.pdf.

2.1.3. Jurisdiction: Each jurisdiction should consider adding to and/or modifying the permit to include additional information such as:

A. Date utility is notified of work completed

B. Installation information sent to tax assessor

C. Indoor/outdoor location

D. Modification to existing service required

E. Public or private

F. Charging station level

G. Permit details to be shared with the following authorities: <local utility, etc.>

H. Other items as determined by the jurisdiction

2.1.4. EVSE "Listing" or "Recognition": EVSE should be "listed" or "recognized" and installed according to the Occupational Health and Safety Administration (OHSA) by nationally recognized testing laboratories (NRTLs). Such listings are required by the National Fire Protection Association's NFPA 70, also referred to as the National Electrical Code® (NEC®) Code 625, Electric Vehicle Charging System Equipment, at http://www.nfpa.org/assets/files/pdf/a625-675.pdf.

Comment: Please refer to the Addendum below for additional information on testing laboratories, "Listing," or "Recognition," and information on testing standards for EVSE.

2.1.5. Codes: EVSE installations shall comply with applicable building codes and energy requirements according to the applicable state laws.

Comment: A good reference for building code, energy, and accessibility requirements in all 50 states, major cities, and some counties is offered by Reed Construction Data's® Building Code Reference Library, which can be found at http://www.reedconstructiondata.com/building-codes/.

2.2. Electric Vehicle Charging Station Regulations

2.2.1. Charging Station Spaces — General:

A. Charging station spaces are reserved for use by electric vehicles only.

B. Electric vehicles may park in any parking space otherwise designated for parking, subject to the restrictions that would apply to any other vehicle generally.

2.2.2. Prohibitions: Pursuant to <Reference>, when a sign authorized under <Reference> provides notice of a designated charging station space, no person shall park or stand a non-electric vehicle therein <or park an electric vehicle that is not charging>. Any vehicle parked or standing in a charging station space that is not <an EV><charging> is subject to fine and/or impoundment of the offending vehicle.

2.2.3. Notice of Electric Vehicle Charging Station: Upon adoption of an ordinance by <Location> establishing a charging station space(s), the <Location> Engineer shall cause appropriate signs and markings to be placed in and around the designated charging station space(s), indicating prominently thereon the parking regulations. The signs shall define time limits and hours of operation, as applicable, and shall state that the parking space is reserved for the charging of electric vehicles only.

2.2.4. Violations and Penalties: Violations of any provision of this chapter shall be punishable as an ordinance violation. Punishment shall be by a fine not to exceed the fine prescribed in accordance with <Reference> of the <Location> Code. Each hour such violation continues shall constitute a separate offense and shall be punishable as such.

<2.2.5. Texas Vehicle Towing and Booting: The vehicle towing and booting occupations code for Texas is provided under Title 14, Regulation of Motor Vehicles and Transportation, Chapter 2308, as administered by the Texas Department of Licensing and Regulation, effective September 1, 2009, except where noted, and specifically subchapter G, Signs Prohibiting Unauthorized Vehicles and Designating Restricted Areas, available at http://www.tdlr.state.tx.us/towing/towinglaw.htm#tsubg.>

The information in Addendum A is offered to the reader as additional educational material and may or may not be included in an ordinance as appropriate.

A.1 Nationally Recognized Testing Laboratories (NRTLs)

Nationally recognized testing laboratories (NRTLs) provide safety certification and develop standards and test procedures mainly dealing with product safety for electric appliances and devices that plug into an outlet on the inside of a house.

Below is a list of NRTLs used for testing equipment like EVSE. Refer to the Department of Labor for updated information on NRTLs: http://www.osha.gov/dts/otpca/nrtl/index.html.

- CSA Canadian Standards Association
- CCL Communication Certification Laboratory, Inc.
- CSL Curtis-Straus, LLC
- FM FM Approvals LLC
- ITSNA Intertek Testing Services NA, Inc.
- MET MET Laboratories
- NSF NSF International
- NTS National Technical Systems, Inc.
- SGSUS SGS U.S. Testing Company, Inc. (formerly UST-CA)
- SWRI Southwest Research Institute
- TUVAM TUV SUD America, Inc.
- TUV TUV Reinland of North America
- UL Underwriters Laboratories, Inc.
- WL Wyle Laboratories, Inc.

In order to be covered by a listing service, charging station products must have been tested by an NRTL and will display a “Mark” along with the word “Listed” plus a control number and product name. That mark on a product provides evidence it has been “Listed” as required by the NEC®.

A.2 National Electrical Code® (NEC®)

A. Article 625 of the NEC® covers the installation of electric vehicle charging stations. The NEC® is also referred to as the National Fire Protection Agency 70 (NFPA 70), a U.S. standard for the safe installation of electrical wiring and equipment. It is a stand-alone document that does not have binding authority, meaning it must be legally adopted by a jurisdiction and can be altered as necessary. It is not a U.S. law, but it has been adopted in all 50 states and is the commonly used electrical code. The following describes some of the sections related to EVSE:

1. Section 625.5 requires "Listing" of all electrical materials, devices, fittings, and associated equipment.
2. Section 625.18 requires EVSE to include an interlock to de-energize an electric vehicle connector and its cable when the connector is detached from an EV.
3. Section 625.19 requires that the EVSE have a method to automatically de-energize the cable conductors and electric vehicle connectors when exposed to stress that could result in cable rupture or separation of a cable from the electrical connector and potentially expose live parts.
4. Section 625.22 requires the EVSE have a "listed" system to protect users from electric shock.

For more information please refer to http://www.nfpa.org/assets/files/pdf/a625-675.pdf.

A.3 Listing, Recognition, or Equivalent

All EVSE to be installed require "listing" or "recognition" by an NRTL since they are electrical devices that plug into an outlet on the inside of a house.

Two good references on the subject are "EVSE Update" by John Halliwell, Electric Power Research Institute (EPRI), available at the following site:
http://mydocs.epri.com/Docs/PublicMeetingMaterials/1009/4FNWWJ9XQWB/407584_E234984_Halliwell_EVSE_Update.pdf and "Electric Vehicle Supply Equipment (EVSE) Certification" by Intertek, available at http://www.intertek.com/uploadedFiles/Intertek/Divisions/Commercial_and_Electrical/Media/PDF/Battery/Electric-Vehicle-Supply-Equipment-EVSE-Certification.pdf.

A description of testing is offered in UL's "Electrical Connections," November 2010, at
http://ul.com/global/documents/corporate/aboutul/publications/newsletters/electricalconnections/November10.pdf
.

Many EVSE have the Underwriters Laboratories (UL) listing, but EVSE do not require specific listing by UL. They are one of many nationally recognized testing laboratories that are able to test EVSE.

Sources of information on UL's electric vehicle standards include
http://www.ul.com/global/eng/pages/offerings/industries/powerandcontrols/electricvehicle/evstandards/.
Also see the article in the International Association of Electrical Inspectors (IAEI NEWS, January-February 2012, page 98, http://digital.ipcprintservices.com/publication/?i=93653) on certification of Level 3 chargers.

A.4 Batteries

Lithium-ion Battery: Batteries in electric vehicles differ from batteries used with ICE vehicles. ICE vehicles typically require a 12-volt battery to provide cranking power to start the engine, as well as to provide power for the accessories like lights, horn, sound systems, ignition, and the like. The ICE battery is recharged by an alternator when the engine is running. The larger, more powerful battery in an electric vehicle or PHEV powers the vehicle itself. Most electric vehicles and PHEVs also have a separate battery to power the accessories. Many battery chemistries are undergoing research and development but lithium-ion batteries are currently the most common battery technology for electric vehicles and PHEVs and will be the main focus of this section.

Batteries used in electric vehicles and PHEVs discharge energy during vehicle use and are primarily recharged by connecting to an off-board electrical source, and in some cases are able to sustain a charge using an on-board ICE-driven generator. Because an electric motor powered by a battery pack is up to three times as energy efficient as an ICE, an electric vehicle can travel much farther than a conventional gas-powered car on an equivalent amount of energy. Lithium-ion batteries also provide the benefit of multiple reuse options and high recyclability.

Battery Chemical Composition: In contrast to lead-acid batteries used to power the accessories, lithium-ion batteries do not contain lead, mercury, cadmium, heavy metals, or federally defined toxic materials. However, large quantities of the batteries may contain potentially dangerous materials so they are regulated under the Standards for Universal Waste Management (40 CFR PART 273). Please refer to http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?type=simple&c=ecfr&cc=ecfr&idno=40&region=DIV1&q1=273&rgn=Part+Number.

Battery Recycling: The parts, chemicals, and components of lithium-ion batteries are highly recyclable. Given the toxicity of lead-acid batteries, state law tightly regulates their recycling and disposal. These laws and regulations do not apply to lithium-ion batteries. Once a lithium-ion battery reaches its ultimate end of life, it can be processed at an experienced battery recycler's commercial facility by being shredded and separated into its recyclable components. Metals and other compounds can be sold and the lithium may either be recycled back to battery manufacturers or disposed of as a nonhazardous material. Efforts are underway by industry groups and the federal government to develop increased capabilities for recycling lithium from electric vehicle batteries.

See http://www.toxco.com/ and http://www.call2recycle.org/ for example resources for lithium battery recycling.

Battery Re-use: When an electric vehicle battery reaches the end of life in its primary application, it may be possible to use it for a time in other purposes. These include standby power and utility load leveling where battery performance is not as demanding as a vehicle application. Opportunities for the reuse of lithium-ion batteries after the end of their normal vehicle life are expected to be widely established in the future. Automobile manufacturers can determine when a battery is no longer able to carry a sufficient charge to be used in the vehicle. It is anticipated that lithium-ion batteries will still retain 70-80% of their residual capacity at that point and could be reused for other energy storage purposes. Additionally, the electric vehicle industry is looking to reduce the cost of electric vehicles by giving the lithium-ion batteries a second life through re-use, resale, re-fabrication, and recycling.

Section 4
WORKPLACE AND MULTIFAMILY HOUSING ISSUE IDENTIFICATION

4.1 Overview

This section describes barriers facing companies and multifamily communities related to EVSE installation and operation, and offer a series of recommendations to overcome those barriers. Due to the limited EVSE installation activity among employers and multifamily housing in the TRC region, three surveys were developed to collect information and opinions from these groups. The surveys focused on anticipated activities and lessons that may come with future involvement. This section focuses on insights from the following three surveys:

- Multifamily (apartment, townhouse, duplex) property owners
- Multifamily residents
- Workplaces

Multifamily and workplace environments face many of the same challenges. The challenges for owners, residents, and employees are similar, and tend to overlap:

- Demand for charging from residents, owners, and employees is currently low
- Educational material on PEVs and EVSE is lacking
- Facilities cannot easily install EVSE due to physical, electrical, metering, and equipment constraints
- Reaching consensus as to who pays for the hardware, installation and operation costs
- High cost of installation, hardware, increased load and network management costs hinders sales of EVSE
- Restrictions or perceived restrictions due to covenants, laws, or regulations hamper sales of EVSE

Key Findings

During the implementation and analysis of survey responses, the following key findings were uncovered:

1. **Education**. Homeowners, renters, and employees need to better understand PEVs and the benefits they provide. Half of residents indicated they would not recognize a PEV on the street. A quarter of multifamily property owners said they needed more information on EVSE, and more than a third of them said there were no benefits to installing EVSE. More than 40 percent of multifamily property owners did not know where to get information on purchasing and installing EVSE.

2. **Equipment Incentives**. According to the surveys, half of multifamily property owners and 70 percent of large employers indicated they would purchase EVSE if at least half of the cost of equipment and installation were rebated. Currently, financial incentives need to cover at least half the cost of EVSE equipment and installation to further spur adoption of PEVs.
3. **Services Rebates**. In Texas, some utilities offer business incentive programs that rebate EVSE network-management fees, maintenance-contract fees, and incremental kilowatt-hour (kWh) costs. Similar rebates may also be provided to multifamily property owners.
4. **Economics**. Many employees who drive a PEV would like low-cost or free electric charging at work to limit their out-of-pocket fuel expenditures. Charging at work would reduce the need for them to have charging stations at their homes, apartments, or condominiums. Those who do not have access to charging at home may consider a PEV if they knew they could charge at work or at other public place.
5. **Sustainability**. For businesses that have already installed charging stations, five of nine say they installed them to support corporate sustainability and environmental goals.
6. **Charges**. Half of the businesses with charging stations charge employees for their use and half provide the service for free.
7. **Is Workplace charging a free benefit or is it taxable?** The IRS provided two pieces of information that will help a company's legal and human resources departments determine a corporate policy on the matter. First, taxpayers can exclude from gross income any fringe benefit that qualifies as a *de minimis* fringe benefit which is generally so small that accounting for it is unreasonable or administratively impracticable. Second, in the IRS Employer's Tax Guide to Fringe Benefits for use in 2012, employers can generally exclude the value of transportation benefits provided to an employee during 2012 from the employee's wages up to $240 per month for qualified parking.
8. **Public charging expectations differ from private charging expectations**. Consumers want free or low-cost charging, but vendors need to offset infrastructure costs to remain viable. EVSE placed at customer premises that pay a commercial rate may be subject to costly incremental electricity charges, such as demand charges. Both objectives may be difficult in the current environment and at this stage in PEV life cycle.
9. **Dealership Information**. The PEV owner survey highlighted that many car dealerships lack PEV sales or technical experience, and online sources and dealerships often provide conflicting information. This points to the need for developing dealer training and education programs. It also indicates the need to develop alternative methods for potential PEV owners to secure information on PEVs and EVSE.
10. **Electrical Infrastructure**. Many communities, especially older ones, have insufficient electrical feeds to support EVSE without significant upgrades to main panels, service entrance size, and transformers.
11. **Parking limitations.** Parking limitations may prevent EVSE installation. For example, parking spaces may not be conveniently located near the electrical panel, and trenching through concrete may be necessary to reach the desired space, which is costly.
12. **PEV purchases**. One in five multifamily property residents surveyed are likely to consider a plug-in electric car when shopping for their next vehicle.

13. **Hard to convince**. Those who are not likely to consider a PEV are hard to sway in their beliefs. Many are concerned about the distance they can travel between charges and the high cost of the vehicle.
14. **Requesting charging stations**. While most do not own or do not plan on owning a PEV, about half say that if they did, they would ask for charging stations within their community.

4.2 Recommendations

Recommendations for the Workplace

Recommendation 1

TRC will develop education and outreach programs for business owners to understand the benefits and challenges associated with the installation and operation of EVSE units.

Recommendation 2

TRC will develop education and outreach programs for employees to understand the benefits and issues with charging their PEVs at the workplace.

Recommendation 3

TRC will encourage local governing bodies to draft or amend codes providing standards for the installation of EVSE for new construction and major renovations for businesses, parking lots, and public parking garages. At a minimum, regulations should include requirements that conduit be roughed-in and breaker-panel space allocated to accommodate future installation of EVSE electrical connections.

Recommendation 4

TRC will assist interested employers with surveying their employees to understand current and future needs for charging infrastructure. The results will be used for planning infrastructure development, site surveys, future electrical work, parking needs, sustainability policies, marketing, and corporate benefit policies.

Recommendation 5

To spur PEV adoption, utilities in the TRC region should consider incentives or rebates to businesses that install EVSE at workplace parking areas and office parking garages.

Recommendation 6

TRC will assist employers in the evaluation of Level 1 charging. This provides PEV owners with low-speed charging over many hours, and it offers a lower-cost method for businesses to gauge initial demand for PEV charging at their facilities.

Recommendation 7

Employers should consider providing charging at the workplace to encourage PEV use.

Recommendation 8

TRC will support utilities in the region conducting pilot(s) of PEV infrastructure programs for the workplace through the creation of marketing collateral and programs.

Recommendations for Multifamily Housing

Recommendation 1

TRC will develop a “PEV Ready” online property listing available to potential multifamily tenants and apartment-listing entities. This property listing will also include education and outreach programs on PEVs to help multifamily property owners understand the benefits and challenges associated with the installation and operation of EVSE units. This will include a step-by-step guide on purchasing and installing EVSE.

Recommendation 2

TRC will develop education and outreach programs to help multifamily residents understand the benefits and issues with charging PEVs at multifamily and public EVSE locations.

Recommendation 3

TRC will encourage local governing bodies to draft or amend codes providing standards for the installation of EVSE units for new construction and major renovations for multifamily housing and parking. At a minimum, regulations should include requirements for conduit to be roughed-in and breaker-panel space allocated to accommodate the future installation of EVSE electrical connections.

Recommendation 4

TRC will encourage and work with utilities in the region to provide incentives to multifamily property owners for the purchase and installation of charging stations.

Recommendation 5

TRC will assist interested property owners with surveying their residents to understand the current and future needs for charging infrastructure. The results will be used for planning infrastructure development, site surveys, future electrical work, parking needs, sustainability policies, marketing, and amenities.

Recommendation 6

TRC will assist multifamily property owners in the evaluation of Level 1 charging at multifamily parking areas. This provides PEV owners with low-speed charging over many hours, and it offers a lower-cost method for property owners to gauge initial demand for PEV charging at their facilities.

Recommendation 7

TRC will support utilities in the region conducting pilots of PEV infrastructure for multifamily housing through the creation of marketing collateral and programs.

4.3 Workplace Issues with EVSE

Employers in the TRC region are just starting to install electric charging stations, based either on corporate sustainability requirements or on requests from employees and customers.

Many employees who drive a PEV would like low-cost or free electric charging at work to limit their out-of-pocket fuel expenditures. However, barriers to adoption of EVSE in the workplace exist that need to be addressed. The main reason TRC implemented workplace surveys was to determine how to encourage EVSE installation through identification and removal of barriers. The average number of employees per company surveyed was 257, and the number of companies that have installed EVSE was nine. For more detailed information please refer to Section 10 for survey details.

4.3.1 Barriers and Challenges - Workplace

The analysis of the data collected indicates the following barriers to installing workplace EVSE in the TRC region:

- Low demand for PEVs in the region
- Lack of education on the costs and benefits of PEVs and EVSE infrastructure
- Identifying appropriate locations for workplace EVSE
- Insufficient electrical service to parking areas or garages
- Selecting a billing approach and process
- High cost to install EVSE (e.g., electrical work, digging trenches, cutting through concrete) and associated management networks
- Opposition toward employer-provided, free charging from employees who do not own a PEV
- Indecision on providing EVSE due to lack of understanding on taxability.
- Disconnect between employees desire for “free” charging at work and need to pay for infrastructure
- State and local laws regarding provision of electric service. For example, workplace properties, like multifamily and retail properties, are barred from cost recovery of the installation and purchase of charging equipment through pricing plans that may constitute a violation of Texas State Law, Public Utility Regulatory Act (Sec. 39.105. LIMITATION ON SALE OF ELECTRICITY). All options continue to restrict parties other than the municipally owned utility to sell electric service within the service territory.

4.3.2 Addressing Barriers and Challenges - Workplace

Companies can take many steps to help encourage PEV use, address the barriers and challenges associated with installing workplace EVSE, and build up the infrastructure to support PEVs by undertaking the following:

- Educate themselves on the subject of PEVs and EVSE
- Work with TRC for help addressing these challenges through information, education, and training.
- Poll employees to determine current and future needs for workplace charging stations
- Taxability of charging at the workplace (see Section 4.3.3: Non-Taxable Benefit?)
- Develop appropriate company policies and strategies for EVSE usage
- Track usage over time and poll employees periodically to determine if EVSE services meet needs and if such benefits help make the employer more competitive
- Encourage informal EVSE sharing if employee demand for charging is more than the infrastructure can support
- Use this report in planning EVSE installations
- Complete a site survey to plan the best locations for EVSE
  - Determine shortest distances between sources of power and parking spaces
  - Consider ADA requirements for parking spaces (see Section 3: EVSE Codes, Ordinances, and Permitting Toolkit)
  - Minimize concrete cuts to reduce cost
  - Avoid low lying spots where water accumulates
  - Select appropriate charging station, billing method, and network options

4.3.3 Non-Taxable Benefit?

An issue raised during survey interviews was whether company-provided workplace PEV charging represented a taxable benefit to the employee or if it was a non-taxable fringe benefit. Questions addressed the benefit of free electricity, levels of EVSE, costs for installation (hardware, software, and network), and ongoing network and maintenance costs. The companies discussed the taxability issues internally and reached a variety of conclusions, summarized below:

- **Non-taxable public chargers – users pay a usage fee**
  One utility decided on a policy that avoided the taxation concern altogether by installing charging stations on the street so they would be available to the public or available to employees. All PEV chargers would pay the standard charging fee.
- **Taxable private chargers – employees pay a low monthly fee**
  One organization determined that charging stations represented a value of $10 per month, which it billed to employees participating in its PEV pilot program. Management considered

it a benefit similar to coffee, worth less than $1 per day, but charged employees a low monthly fee.

- **Non-taxable private chargers – free for employees**
  Other businesses decided to install EVSE and offer free charging to employees – at least free for now. They considered it a fringe benefit like coffee or an employee fitness center, which is non-taxable income.

Which is the Right Approach?

Two resources identified during the research and stakeholder involvement help to clarify the IRS position on the matter of taxability.

IRS *de Minimis* Definition

First, an IRS letter (Number 2012-0008, dated December 2011[5]) was written in response to a congressional representative's inquiry on behalf of a constituent, asking about the tax treatment of using an employer's electrical outlet to charge an electric car at work. An excerpt from the letter states:

> "Taxpayers can exclude from gross income any fringe benefit that qualifies as a de minimis fringe benefit (section 132(a)(4) of the Code). A de minimis fringe benefit is any property or service whose value is (after taking into account the frequency with which the employer provides similar fringes to his or her employees) so small that accounting for it is unreasonable or administratively impracticable."

The IRS provides the examples shown in Table 4-1:

Table 4-1. IRS de Minimis Fringe Benefit Examples

IRS Examples of *de Minimis* Fringe Benefits (Non-Taxable)	IRS Examples of Benefits that are not *de Minimis* Fringe Benefits (Taxable)
■ Occasional theater or sporting event tickets	■ Season tickets to sporting or theatrical events
■ Coffee, soft drinks	■ Membership in a private country club
■ Doughnuts	■ Use of employer-owned or leased facilities (e.g., an apartment, hunting lodge, boat) for a weekend
■ Local telephone calls	

Monthly Exclusion for Qualified Parking

Second, the IRS provides the following general guidelines in its *Employer's Tax Guide to Fringe Benefits* for use in 2012:[6]

> You can generally exclude the value of transportation benefits that you provide to an employee during 2012 from the employee's wages up to the following limits.
>
> - $125 per month for combined commuter highway vehicle transportation and transit passes

[5] http://www.irs.gov/pub/irs-wd/12-0008.pdf
[6] http://www.irs.gov/pub/irs-pdf/p15b.pdf

    - $240 per month for qualified parking

Absent specific IRS decisions on workplace charging, many companies are basing taxability decisions on two points:

- The IRS *de minimis* definition
- $240 per month exclusion from wages for qualified parking

If the EVSE charging benefit costs less than $240, many companies interpret the benefit as non-taxable.

(Note: This is not to be construed as legal advice, and each company must make its own decisions.)

4.3.4 Incentives and Programs to Encourage Workplace Charging

Incentives and programs employers can use to encourage workplace charging include:

- Provide premium parking spaces equipped with EVSE that employees can rent on a monthly basis
- Provide free or low-cost charging stations
- Install Level 1 charging equipment as a lower-cost way to provide charging for employees
- Sponsor a local PEV organization or a “PEV ride and drive” event to generate interest

Level 1 Charging

The simplest way to charge at the workplace is through a standard 120-volt outlet. Level 1 provides an average of three or four miles per hour of charging. Over the course of an eight-hour day it can top off a battery and improve PEV owners’ range comfort. Level 1 charging gives employers a fairly easy-to-employ charging option with less expense than Level 2 charging.

The benefits of Level 1 charging include:

- Infrastructure is less costly than Level 2
- Lower load requirements (kW) to charge a PEV less adversely affects the workplace and the utility during peak times. Cars parking for the day still receive a substantial charge
- May be easier to install than Level 2, which may require electrical upgrades

Several vendors produce EVSE with a J-1772 plug and a standard National Electrical Manufacturers Association (NEMA) 5-20 120-volt outlet combination for low-speed charging. Please refer to the EVSE typology in Section 2: Needs Analysis, Typology, and Best Practice Guide, for a list of specific vendors. These units have lock options for the Level 1 receptacle to prevent theft, and they communicate through communication networks for billing, status, and/or remote management. At least one vendor provides an unmanaged (non-networked) four-receptacle 120-volt station that can be linked with additional units to provide up to 16 slow-charge receptacles. This capability may interest businesses or multifamily housing complexes just beginning to offer PEV charging on a limited budget.

Each company must determine which level of charging (Level 1 or Level 2) meets its requirements, based on costs, charging duration, and other factors described in more detail in Section 2: Needs Analysis, Typology, and Best Practice Guide.

4.4 Multifamily Property Issues

Surveys included 250 telephone interviews with apartment complex managers or managers of other multifamily communities in Austin, San Antonio, San Marcos, New Braunfels, and Georgetown, Texas. Interviews were conducted in summer 2012, a majority (88%) of which were with apartment residents. Table 4-2 shows the distribution of survey participants.

Table 4-2. Multifamily Property Buildings by Type

	Total Sample
Apartment	**88%**
Townhouse/duplex	**12%**
Condo	**6%**
Homes/single-family housing	**3%**
Low-income housing	**1%**
Average number of units managed:	***246***
Base:	**250**

4.4.1 Barriers and Challenges – Multifamily Properties

The surveys provided excellent insight into some of the many challenges facing the electric vehicle industry, which include the following:

- High up-front costs for PEVs and lack of consumer education slow the rate of PEV adoption.
- There are issues of EVSE ownership in multifamily dwellings since the resident does not own the parking space where the EVSE would be installed.
- Some complexes have infrastructure issues, such as electrical system or parking limitations, which prevent installation of EVSE.
- There are questions as to who pays for installation costs and who pays for ongoing costs, such as billing and maintenance.
- Property owners have a hard time justifying the installation of charging infrastructure without rebates or other incentives.
- Public charging expectations differ from private charging expectations. Consumers want free or low-cost charging, but vendors need to offset infrastructure costs to remain viable. Both may be difficult in the current environment and at this stage in PEV life cycle.
- Car dealerships lack PEV sales or technical experience, and online sources and dealerships often provide conflicting information
- Lack of education on the benefits of PEVs (and their higher cost) is dampening PEV sales and the related need for EVSE.

- Many communities, especially older ones, have insufficient electrical feeds to support EVSE without significant upgrades to main panels, service entrance size, and transformers.
- Parking limitations may prevent EVSE installation. For example, parking spaces may not be conveniently located near the electrical panel, and costly trenching through concrete may be necessary to reach the desired space.
- EVSE and installation costs are significant. Rebates of around 50 percent on average would motivate multifamily housing owners to install EVSE.
- State and local laws regarding provision of electric service. For example, multifamily properties, like workplaces and retail properties, are barred from cost recovery of the installation and purchase of charging equipment through pricing plans that may constitute a violation of Texas State Law, Public Utility Regulatory Act (Sec. 39.105. LIMITATION ON SALE OF ELECTRICITY). All options continue to restrict parties other than the municipally owned utility to sell electric service within the service territory

4.4.2 Addressing Barriers and Challenges – Multifamily Properties

To address the barriers and challenges associated with EVSE adoption at multifamily properties, owners should:

- Educate themselves on the subject of PEVs and EVSE
- Poll residents to determine the current and future needs for charging stations
- Complete a site survey to plan the best EVSE locations
- Determine the shortest distances between sources of power and parking spaces
- Consider the Americans with Disabilities Act (ADA) requirements for parking spaces
- Minimize concrete cuts to reduce cost
- Avoid low lying areas where water accumulates
- Select appropriate charging station, billing method, and network options
- Develop technical designs for EVSE installation based on site-survey results and potential future demand
- Use this report to plan installations appropriately
- Track usage over time and poll residents periodically to determine if EVSE services meet their needs and determine if the services benefit the property by helping it become more attractive in the market.

Property owners can take advantage of the many forms of education regarding PEVs and EVSE, including Internet searches, vendor-provided in-depth courses, conferences, interest or user groups, and online local utility education.

Cities and counties can provide education for contractors and inspectors by addressing building codes, electrical codes, and city ordinances related to uniform standards, signage, parking, and fees for charging. Refer to Section 3: EVSE Codes, Ordinances, and Permitting Development for suggestions on drafting or amending codes, ordinances, and permitting. Streamlining EVSE installation permitting and inspection processes will help smooth installations.

4.5 Pilot Programs to Increase Interest in EVSE

As mentioned above, there are barriers to the successful implementation of EVSE at workplaces and multifamily properties due to lack of knowledge and experience installing and operating EVSE. Public power utilities operating in the region – in partnership with TRC – can help overcome these barriers by sponsoring and managing a select number of EVSE pilots. The pilots can target those employers and multifamily properties who want to proactively provide information and services to employees and residents. While TRC would not specifically implement the pilots, it can develop marketing, communication, and training programs to facilitate the installation and operation of the EVSE. Furthermore, TRC can collect results from the pilots underway in the region and develop analysis and insights that can be used across the TRC region and share findings with other entities interested in implementing EVSE.

Below are materials developed by TRC for implementing a pilot program for workplaces and multifamily properties.

4.5.1 Workplace Pilot Program

Below are outlines and considerations for implementing a pilot program for workplace and multifamily properties by utilities.

1. Local utility develops workplace pilot program incorporating educational material and incentive plans
    a. Utility utilizes educational materials on planning for PEVs prepared by TRC
        i. Overall offering and service description
        ii. Information on PEVs and EVSE – FAQs
        iii. Web site links for information – utility and TRC
        iv. HR/tax implications related to charging benefits at the workplace
            1. Taxpayers may exclude *de minimis* fringe benefits
            2. Employer’s Tax Guide to Fringe Benefits 2012 states employers may exclude value of transportation benefits up to $240 per month for qualified parking.
        v. Flowchart(s) for installation process
            1. Workplace, retailers, parking areas
            2. Checklist
    b. Utility develops incentive plan for EVSE installations to businesses
        i. Workplace eligibility requirements
            1. Network capable of Level 2 (240 V) EVSE
            2. Properties must be utility account holders
            3. Approved contractors for installations
        ii. Rebates for EVSE installation
        iii. Terms, conditions, process, dates, deadlines, restrictions, contacts

c. Property owner promotional program considerations
    i. Designate "premium" parking spaces with electric vehicle charging for a low monthly cost – paid for by PEV owner
    ii. Offer "premium" parking spaces, some with electric vehicle charging, for a low monthly cost – paid for by any employee who wants convenient parking
    iii. Offer free charging
    iv. Offer electric vehicle charging nearby on public accessible streets with standard pay-as-you-go rate plans
d. Utility sends pilot announcement/information to large businesses, retailers, parking lots, and garages to determine interest
e. Business owner monitors "inquiries" for EVSE prior to installation of EVSE
f. Pilot plan initiated: EVSE installed
g. After EVSE is installed, business owner monitors EVSE responses / inquiries
h. Compare interest levels before and after

2. Utility monitors and manages usage of the EVSE
3. Perform analysis on usage; prepare report for workplace pilot sponsor

4.5.2 Multifamily Pilot Program

1. Local utility develops multifamily (MF) pilot program for utility, incorporating educational material and incentive plans
    a. Utility utilizes educational materials on planning for PEVs prepared by TRC
        i. Overall offering and service description
        ii. Information on PEVs and EVSE – FAQs
        iii. Web site links for information – AE and TRC
        iv. Flowchart for installation process
            1. MF properties
            2. Checklist
    b. Utility develops incentive plan for EVSE installations for MF properties
        i. MF property eligibility requirements
            1. Network capable of Level 2 (240 V) EVSE
            2. Properties must be utility account holders
            3. Approved contractors for installations
        ii. Rebates for EVSE installation
        iii. Terms, conditions, process, dates, deadlines, restrictions, contacts
    c. TRC works with MLS listing agencies in area and/or on-line services to create "EV Ready" amenity in listings
    d. "EV Ready" amenity to indicate charging stations, parking availability
    e. Generates interest among PEV owners and MF owners monitor increase in inquiries
    f. Utility sends pilot announcement/information to MF owners to determine interest in the pilot and incentive program
    g. Utility selects MF property for pilot(s)
    h. MF owner monitors "inquiries" for EVSE prior to installation of EVSE
    i. Pilot plan initiated; EVSE installed

   j. After EVSE are installed, MF owner monitors EVSE responses / inquiries
   k. Compare interest levels before and after
   l. Utility monitors usage of the EVSE
2. Utility monitors and manages EVSE, collects usage information
3. Perform analysis on usage; prepare report for MF property owner
4. Transfer operations and ownership to MF property owner
5. Signoff and close task

4.5.3 Example Pilot Program: Austin Energy Multifamily Rebate Incentive

The following is a draft example of a utility pilot program.

MEMORANDUM

TO:

FROM:

DATE:

SUBJECT:

DRAFT

This memo addresses guidelines for the Austin Energy Multifamily (MF) rebate incentive pilot program for plug-in electric vehicle (PEV) charging stations at eligible customer properties.

SERVICE GUIDELINES

Pursuant to Texas State Law, Public Utility Regulatory Act (Sec. 39.105. LIMITATION ON SALE OF ELECTRICITY) all options continue to restrict parties other than the municipally owned utility to sell electric service within the service territory. All electric vehicle supply equipment (EVSE) must adhere to applicable codes and related safety standards.

ELIGIBILITY

1.) To qualify for the rebate, properties must be Austin Energy customers and agree to connect the station to the Plug-in EVerywhere™ network. Charging station installations must also be conducted by a contractor approved by Austin Energy. The contractor must be an approved city vendor and have the appropriate insurance listing. As part of the program, property owners grant Austin Energy ownership rights to data collected from the charging stations.

2.) Austin Energy will provide multifamily property owners that install charging stations connected to the Plug-in EVerywhere™ network a rebate incentive of $2,500 for the cost and installation of (a) Level 2 charging station(s) meeting technical specifications in the Station Host Agreement (attachment).

3.) Property owners that install charging stations at multiple sites are eligible for rebates on up to two charging stations per site. Property owners installing stations at only one location are eligible for rebates on up to three charging stations.

ACCESS AND BILLING

1.) Austin Energy does not require each station be separately metered. Properties have the option to install the equipment on the main customer meter. Austin Energy will reimburse the electricity used by the station on a six-month basis pursuant to the billing section of the station host agreement. Reimbursement may alternatively be determined by energy usage tracked through a utility-grade meter in the charging station.

2.) Multifamily property owners have the option to purchase Plug-In EVerywhere™ one-year subscription cards on the behalf of tenants for $50.

3.) Alternatively, tenants may purchase subscription cards directly from Austin Energy at the same rate. The Plug-In EVerywhere subscription cards can access both the charging station at the multifamily property and the 110+ stations in the Plug-In EVerywhere™ network.

4.) Stations installed under this program will be limited-access stations. Only residents at participating properties will be granted Plug-In EVerywhere™ cards that can be used to access these stations.

FUTURE PROGRAM ENHANCEMENTS

Program guidelines were constructed based on recommendations and data gathered from the Texas River Cities Plug-In Electric Vehicle Initiative (TRC). Future education and outreach materials, including a property certification as “PEV ready” related to PEV charging infrastructure at multifamily properties, will be developed by Austin Energy through the TRC implementation phase.

REBATE GUIDELINES

1.) MF properties participating in the rebate program must join Austin Energy’s Plug-In EVerywhere™ network of stations.
2.) Under this program, station hosts pay for the equipment cost, installation, and ongoing network management fees associated with the Level 2 charging station(s), less rebates.

Austin Energy manages the station network and maintenance.

Section 5
NEW UTILITY BUSINESS MODELS WITH THIRD-PARTY PEV INFRASTRUCTURES

5.1 Overview

A top priority of the Texas River Cities Plug-In Electric Vehicle Initiative (TRC) is to identify a range of utility and private business models that allow for successful electric vehicle supply equipment (EVSE) industry growth in the TRC region. In order for this to occur, TRC needed a structure and methodology for running a variety of business scenarios that may arise as the industry starts to take shape. This section provides a broad overview of the issues facing companies investigating the plug-in electric vehicle (PEV)/EVSE industry. Specifically, the industry is still in the development stages, with a significant amount of funding coming from government grants and incentives to stimulate market participation. In an effort to investigate the challenges, barriers, and scenarios associated with the industry, this section covers three areas:

1. Industry-wide analysis of key business issues through the implementation of a business-model survey. Data and analysis from this survey are used in the business case scenarios.
2. Stakeholder brainstorming and development of a series of business models – for both utilities and private companies – that may be adopted to gain market share in a growing market.
3. Development of utility and private company business-model templates that will allow interested stakeholders and ecosystem participants to develop scenarios and run business cases to test different market and industry assumptions.

The results of the activities above yielded two clear insights that will pervade the industry for the foreseeable future: 1) The PEV/EVSE market will likely take at least another decade to fully develop and 2) there is a significant amount of uncertainty with respect to the products, services, and customer value propositions that will eventually become successful as and when the market develops. These insights led to several key findings:

Key Finding #1

The PEV industry likely will continue to develop over the next ten years. Research from industry experts, in the business-model survey implemented as part of this report, shows that until PEV prices approach parity with their conventional counterparts, sales will continue to grow slowly. However, escalating gas prices should help make the economics more viable for PEVs. This finding is also supported by the research and analysis presented in Section 8: Projection of PEV Market Penetration for the TRC Region, which indicates that price parity of PEVs with vehicles using traditional internal-combustion engines is the single biggest influencer of PEV adoption.

Key Finding # 2

Slow industry growth will pose challenges to development and growth of a healthy ecosystem of partners and competitors to support the industry in the short term, but will allow interested parties more time to prepare and execute well thought out business models.

Key Finding #3

PEVs represent the single largest potential opportunity for new energy sales growth for the utility industry. Therefore, utilities should proactively work with all stakeholders to develop an ecosystem that supports its growth.

Key Finding #4

The modeling tool developed for this project indicates that (unsubsidized) large-scale EVSE infrastructure owner/operator business models will have negative returns for years, especially with the higher capital cost of Fast Charge EVSE. However, there are strategic and opportunistic ways to build up EVSE infrastructure throughout TRC. Retail and workplace entities may be interested in being station hosts but not operators. Utilities may look to rate-base the infrastructure, allowing for rate recovery based on prudent investments. This would allow utilities to plan simultaneously for the implementation of EVSE and the associated distribution electrical upgrades to support it.

Key Finding #5

Although the industry is still in its early stages of development, a clear trend is emerging with respect to the separation of software and application services from equipment. Several of the original entrants into the EVSE industry originally offered consolidated packages of software and equipment. However, some have begun focusing primarily on EVSE management and monitoring software. This trend may lead to the consolidation of equipment providers to achieve economies of scale and lower equipment costs, and to the short-term proliferation of new applications as competitors look to consolidation as the quickest, least risky path to profitability.

Key Finding #6

Extensive PEV owner research is required to understand owner habits, likes, and dislikes associated with the evolution of the industry and product development. Furthermore, segmentation models must be developed to aid in exploration and development of new business models to serve the industry.

Whereas a significant amount of time and effort has been spent developing the business models and templates, analysis of these models has just begun. Therefore, the recommendations below primarily focus on continuing this analysis once the TRC organization has been formed. Developing a robust set of business scenarios will help TRC shape business and regulatory policies in the future.

5.2 Recommendations

Below are recommendations for next steps for engaging the EVSE ecosystem and developing strategies based on various business-model scenarios:

Recommendation 1

TRC will perform scenario analyses on key variables in the utility and private business models to understand what issues, policies, regulations, products, and/or technology advancements may affect the EVSE industry in the TRC region.

Recommendation 2

TRC will form an Industry Advisory Council to engage private industry participants directly in TRC implementation activities.

Recommendation 3

TRC will continue analysis of business model survey data to gain deeper insights into the key industry drivers, challenges, and barriers to overcome for the growth of PEV and EVSE industries.

Recommendation 4

TRC will conduct a business-model scenario workshop to vet the templates, and train interested TRC stakeholders on how to use the business-model templates to create and run scenarios. The workshop will result in the development of comprehensive documentation and training manuals for users, provide company business-model templates, and provide examples and demonstrations of how to develop and run scenarios.

Recommendation 5

TRC will support ERCOT efforts to explore the viability of strategies to allow aggregation of PEVs and EVSE to be bid into future market programs, such as ancillary services and emergency load curtailment.

Recommendation 6

Assist entities looking to install large public EVSE networks in pursuing federal grants and incentives as a source for PEV infrastructure funding.

Recommendation 7

Utilize the findings and tools included in this plan to assist entities looking to enter the EVSE market with developing EVSE deployment strategies, goals, and objectives.

Recommendation 8

Private companies interested in participating in the PEV industry should meet with utilities to comply with utility regulation.

5.3 Public Power Service Territory Business Models for Engaging Third-Party PEV Infrastructure Services

A top priority of TRC is to identify, document, and develop alternative business models that may be deployed within a public power footprint as PEVs gain market acceptance. The purpose of this section is to provide stakeholders a primer on the business models that address the charging needs in the TRC region and to discuss issues in adopting them. The models summarized in this document can be broken into two main categories: 1) utility models, and 2) private company models. This section provides: 1) summaries of each model, to initiate future stakeholder discussions and development; 2) an initial list of potential barriers to successful business-model development; and 3) utility and private business-model templates to allow stakeholders to run scenarios on different business models and strategies.

This section concentrates on models that enable adoption beyond what is possible with pilots or smaller-scale deployments. The models presented herein are designed to capitalize on the more significant investments utilities and their partners would need to make to meet PEV demand after this initial period of public sector investment. Models must be able to produce cash flow in order to cover expanding, upgrading, maintaining, and operating the charging infrastructure, customer service, and other aspects of providing PEV charging services.

Market for PEVs in TRC

The focus of this section is to identify business models that may be deployed within TRC. In conjunction with this activity, Section 8: Projection of PEV Market Penetration for the TRC Region discusses different market penetration models that can be used to forecast PEVs within TRC. The business models developed in this section use forecast-based census data and business-model survey results. Table 5-1 provides the 2010 census count for each county that makes up the TRC footprint.

Table 5-1. Population of Counties in the TRC Footprint[7]

County	Population
Bastrop	74,171
Bexar	1,714,773
Blanco	10,497
Caldwell	38,066
Comal	108,472
Guadalupe	131,533
Hays	157,107
Kendall	33,410
Travis	1,024,226
Williamson	422,679
Total	3,714,934

The TRC PEV projection is derived from applying the ratio of the TRC area population in 2010 to the total U.S. population from the 2010 Census (308,745,538). This ratio = 3,714,934 / 308,745,538 = 1.2%. (Note: As part of the business models developed, the user has the ability to adjust this ratio based on his or her opinion as to how PEVs may grow in TRC relative to the rest of the United States.) As part of the business-model survey, participants were asked for PEV forecasts for the years 2015, 2020, and 2025. Taken were the mean values of 147 responses; the highlighted numbers shown in Table 5-2 are the results for 2015 and 2020. The other numbers were calculated based on a steady growth rate between the two fixed numbers.

[7] Source: http://quickfacts.census.gov

Table 5-2. TRC PEV Market Forecast

PEV Market Forecast	2012	2013	2014	2015	2016	2017	2018	2019	2020
Total U.S PEV Population	50,000	151,632	253,264	354,896	572,843	790,790	1,008,737	1,226,684	1,444,631
Texas River Cities Region PEV Population	600	1,820	3,039	4,259	6,874	9,489	12,105	14,720	17,336

5.3.1 Inventory/Summary of Business Models Identified by the Stakeholders

Through brainstorming and development activities over several stakeholder meetings and conference calls, the Business Model Subteam created a list of 12 different business models to explore as part of this project. Table 5-3 lists and briefly describes them, and Tables 5-4 through 5-15 provide summaries of each business model.

Table 5-3. Business-Model Summary

Business Model Name	Category	Summary Comments
Basic Sell-Electricity EVSE Service	Utility	This is for the utility interested in the minimalist approach to the PEV market. The utility will sell electricity to new users/uses; however, it does not have smart-grid infrastructure in place to manage/monitor EVSE or offer specialty rates and services.
Enhanced Sell-Electricity EVSE Services	Utility	This model represents a proactive and innovative approach to sell electricity and services without owning the EVSE infrastructure. It does require smart-grid components to offer some of the innovative services.
EVSE Owner/Operator	Utility	The utility owns and operates the EVSE and applications.
EVSE Design, Installation, and Maintenance Services	Utility	The utility leverages its core competencies and resources in electric equipment design, installation, and operation of EVSE infrastructure.
EVSE Host-Managed Services	Utility	The utility manages the software applications and systems for delivery of PEV charging services.
Green EVSE Program	Utility	This model develops applications specifically related to extracting the green benefits of PEVs and EVSE.
EVSE Turnkey Owner/Operator	Private	The company owns and operates EVSE for a variety of clients.
EVSE Services Provider	Private	The company offers an application services platform to operate EVSE owned by other clients/companies.
EVSE Subscription Services	Private	The company offers tiered levels of service from company-controlled EVSE to PEV owners.
Joint-Venture Services Offering	Private	Multiple companies combine products and services into a unique service offering.
PEV Battery-Swap Service	Private	This company owns a facility and batteries, and offers a battery-swapping service as an alternative to charging at EVSE.
PEV Mobile Charging Service	Private	This company would own EVSE tow trucks that would be able charge cars without access to EVSE.

Table 5-4. Basic Sell-Electricity EVSE Service Business Model

Business-Model Name	Basic Sell-Electricity EVSE Service
Model Category	Utility
Summary	This is the minimalist model; the utility essentially stays out of the EVSE infrastructure business.
Model Outline	■ No desire to own, operate, or manage equipment ■ PEV is essentially another appliance at a home or business ■ Identify value of selling retail versus wholesale commodity ■ Limited or no smart-grid infrastructure plans and deployment ■ Will provide basic communication and education information to customers interested in charging their PEVs
EVSE Owner	EVSE turnkey owner/operators, businesses, governments, and residential customers
EVSE Funder/Developer	Not applicable
EVSE Installer	Not applicable – although the utility may proactively develop a trade ally program to alert the installers when installations are scheduled to occur
EVSE Operator	EVSE turnkey owner/operators, EVSE service providers, businesses, governments, and the like
EVSE Site Host	Businesses, government sites, public sites (e.g., parking garages), and single-family and multifamily residences
What product is sold?	Electricity
Who is the customer?	EVSE turnkey owner/operators, businesses, governments, and residential customers
Opportunities	■ Risk-adverse revenue opportunity ■ Limited fixed or variable costs
Barriers to Entry/Success	■ Limited upside, potential adverse impacts of new load if utility cannot monitor, manage, or control load ■ Loss of potential future EVSE/smart-grid opportunities

Table 5-5. Enhanced Sell-Electricity EVSE Service Business Model

Business-Model Name	Enhanced Sell-Electricity EVSE Services
Model Category	Utility
Summary	Utility develops electric rates and/or ancillary services specifically for EVSE owners and/or operators. Note: Smart-grid infrastructure components will be required to deliver many of the services (e.g., smart meters, home energy management [HEM] systems; home-, local-, and wide-area network [HAN/LAN/WAN] communications; distribution monitoring).

Model Outline	■ Develop electric rates specifically tailored for EVSE
	■ Develop sub-metering standard/service to ensure proper metering of electricity
	■ Electricity becomes a cost component; however, rates are developed to cover marginal costs
	■ Utility can incorporate EVSE into demand response (DR)/demand-side management (DSM) programs
	■ Need to understand around TRC (and the United States) where peaking occurs and how to manage EVSE throughout the year
	  ■ Some peak in early evening
	  ■ Need to acknowledge there are differences around the country
	■ Develop energy-monitoring applications to help customers manage their own loads and costs

EVSE Owner	EVSE turnkey owner/operators, businesses, governments, and residential customers
EVSE Funder/Developer	Not applicable
EVSE Installer	Not applicable – although the utility will proactively develop a vendor ecosystem program that will incentivize members to alert the utility when installations are scheduled to occur
EVSE Operator	EVSE turnkey owner/operators, EVSE service providers, businesses, governments, and the like
EVSE Site Host	Businesses, government sites, public sites (e.g., parking garages), and single-family and multifamily residences
What product is sold?	Electricity via multiple rate options, energy monitoring, DR/DSM programs, marketing outreach, and education programs
Who is the customer?	EVSE turnkey owner/operators, businesses, governments, and residential customers
Opportunities	■ New revenue stream that can be synched with commodity costs to achieve optimal profit ■ Smart metering of EVSE allows utility to monitor usage and determine how it may be impacting the grid ■ Clear understanding on how and when EVSE are used, which will help maintain reliable grid operation ■ New revenue stream
Barriers to Entry/Success	■ If the utility has not implemented a smart-grid/meter system, incremental costs of adding a meter could be high ■ Also, would not have interval data in a timely fashion to do usage analysis ■ Legislative – will need to approve this for traditional utilities ■ Public power concern about opening market to competition ■ Regulatory – need to develop new rates for service ■ Economies of scale – business constrained to the existing utility service territory

Table 5-6. EVSE Owner/Operator Business Model

Business-Model Name	EVSE Owner/Operator
Model Category	Utility
Summary	Utility develops a full-service EVSE business.
Model Outline	■ Responsible for EVSE infrastructure in service territory ■ Earn revenues on operation of EVSE under a variety of revenue scenarios ■ Electricity becomes a cost component ■ Value comes from more than commodity
EVSE Owner	Utility
EVSE Funder/Developer	Utility
EVSE Installer	Utility or approved subcontractor
EVSE Operator	Utility
EVSE Site Host	Utility-owned sites, businesses, government sites, public sites (e.g., parking garages), and single-family and multifamily residences
What product is sold?	Electricity, EVSE monitoring, DR/DSM
Who is the customer?	PEV owners, businesses, local governments, and the like that are willing to locate an EVSE at their site for economic, marketing, environmental, or societal purposes
Opportunities	■ Control of business ■ Allows utility to incorporate business aspects into its traditional business to leverage existing standards and processes ■ Clear understanding of how and when EVSE are used, which will help maintain reliable operation of grid ■ New revenue stream
Barriers to Entry/Success	■ Significant upfront capital costs of EVSE ■ Technology risk (EVSE) ■ Market is developing slowly – potential long-term payback (if at all, as yet to be determined) ■ May not allow for enough third-party market participation or variability/choice ■ Legislative – will need to approve this for traditional utilities ■ Regulatory – need rules to approve infrastructure costs ■ Economies of scale – business constrained to the existing utility service territory ■ Site/area location selection process: Where is the correct location to install?

Table 5-7. EVSE Design, Installation, and Maintenance Services Business Model

Business-Model Name	EVSE Design, Installation, and Maintenance Services
Model Category	Utility
Summary	Utility leverages its electric infrastructure installation resources and core competency to offer design, installation, and maintenance services for EVSE providers.

Model Outline	■ Public, private, and home installations
	■ Uses existing personnel (or subcontractors) to develop electrical designs and recommendations for EVSE installations
	■ Uses existing personnel (lineman, meter technicians?) to install EVSE; alternatively, can use utility-approved contractors to install (in the same way they are used to assist with other infrastructure installations)
	■ Services include:
	  ■ Identification and selection of location
	  ■ Electrical and site design
	  ■ Electrical facilities upgrade analysis
	  ■ EVSE installation
	■ Utility also can perform a distribution grid analysis to determine if any system upgrades would be required to accommodate the new equipment and load

EVSE Owner	EVSE turnkey owner/operators, businesses, governments, and residential customers
EVSE Funder/Developer	Not applicable
EVSE Installer	Utility
EVSE Operator	EVSE turnkey owner/operators, businesses, governments, and residential customers
EVSE Site Host	EVSE turnkey owner/operators, businesses, governments, and residential customers
What product is sold?	Design, installation, and maintenance services
Who is the customer?	EVSE turnkey owner/operators, businesses, governments, and residential customers
Opportunities	■ Earn additional revenues with existing resources, assets, and contracts ■ Allows utility to install using its standards ■ No risk associated with EVSE installation and ownership ■ Advance notice of where/when EVSE will be installed
Barriers to Entry/Success	■ Limited resources (due to age, attrition at some utilities) ■ Limited revenue opportunity ■ May only be able to offer within the service territory ■ Legislative uncertainty with respect to how retail competition may affect public power companies' operation of EVSE

Table 5-8. EVSE Host-Managed Services Business Model

Business-Model Name	EVSE Host-Managed Services
Model Category	Utility
Summary	Utility operates EVSE and networks on behalf of owners, leveraging smart-grid systems and programs.
Model Outline	■ Operates EVSE, collects all fees/revenues from customers using existing billing systems ■ Identifies and remotely diagnoses any issues with EVSE, and alerts owner (or contract support personnel) if equipment requires repair ■ Incorporates EVSE into smart grid Network Management System to ensure continuous monitoring of communications network ■ Incorporates and operates EVSE under utility-sponsored DR programs ■ Reimburses EVSE/facility owner for electricity used by EVSE
EVSE Owner	EVSE owner/operators, businesses, and governments
EVSE Funder/Developer	Not applicable
EVSE Installer	Not applicable
EVSE Operator	Utility
EVSE Site Host	Businesses, government sites, public sites (e.g., parking garages), and multifamily residences
What product is sold?	Turnkey services to manage and monitor EVSE, EVSE operation analytics, and operation alerts and alarms
Who is the customer?	EVSE owner/operators, businesses, and governments
Opportunities	■ Leverages utility systems for additional revenue ■ No risk associated with EVSE installation and ownership, as companies will still own assets ■ Clear understanding of how and when EVSE are used, which will help maintain reliable grid operation ■ Ability to optimize capacity, energy, and grid operation costs through proactive EVSE management ■ Ability to monitor and control EVSE usage to meet utility needs ■ Ability to manage EVSE throughout TRC (need to investigate)
Barriers to Entry/Success	■ System integration costs could be extensive if utility has not updated systems recently ■ Risk of opening utility to competition (need to investigate) ■ Limited value today for DR megawatt savings ■ Legislative – need to determine viability of service offering as it pertains to public utilities ■ Regulatory – need approval to utilize existing systems for new services ■ Economies of scale – business may be constrained to the existing utility service territory

Table 5-9. Green EVSE Program Business Model

Business-Model Name	Green EVSE Program
Model Category	Utility
Summary	Utility offers incentives for green EVSE/PEV usage.

Model Outline	■ Develop strategy to reflect increased value of green
	  ■ Nitrogen Oxide (NOx) nonattainment areas – increasing PEVs may help with this
	■ Need to analyze value of moving from fossil fuels to PEVs
	■ Green-power pricing programs tied with EVSE
	  ■ A way to increase efficiency of renewable usage
	  ■ Sell green energy to customers at a discount (same as conventional fossil fuel)
	  ■ Ability for utility to implement DR at customer's home or when customer charges at public EVSE

EVSE Owner	EVSE turnkey owner/operators, businesses, governments, and residential customers
EVSE Funder/Developer	Not applicable
EVSE Installer	Not applicable
EVSE Operator	EVSE turnkey owner/operators, businesses, governments, and residential customers
EVSE Site Host	EVSE turnkey owner/operators, businesses, governments, and residential customers
What product is sold?	Incentives to reduce pollution
Who is the customer?	PEV owners, EVSE turnkey owner/operators, businesses, and governments
Opportunities	■ Help meet EPA standards (NOx non-attainment areas) ■ Financial benefit to utility of tying green energy to DR event management
Barriers to Entry/Success	■ Unclear definition/documentation of program benefits ■ May only be able to offer within the service territory ■ Uncertainty surrounding state and federal regulations ■ Enough benefits to spend money on model? ■ No direct financial incentive from NOx penalty avoidance and PEV use

Table 5-10. EVSE Turnkey Owner/Operator Business Model

Business-Model Name	EVSE Turnkey Owner/Operator
Model Category	Private Company
Summary	Private company installs, owns, and operates EVSE and sells fuel and services to PEV owners in the TRC footprint.
Model Outline	■ Works with companies, governments, and other stakeholders to identify installation locations ■ Manages installation, operation, and maintenance of charges ■ Develops contracts with utilities to purchase electricity
EVSE Owner	EVSE turnkey provider

EVSE Funder/Developer	EVSE turnkey provider or business investor (similar to renewable-asset investments)
EVSE Installer	Electrical contractor
EVSE Operator	EVSE turnkey provider
EVSE Site Host	Businesses, local governments, and others willing to locate EVSE at their sites for economic, marketing, environmental, or societal purposes
What product is sold?	Charging services, monthly EVSE rentals, reservation services, ancillary services, load aggregation, and aggregated load management
Who is the customer?	PEV owners, businesses, local government, wholesale markets, and independent system operators (ISOs)
Opportunities	■ Freedom to work with customers throughout TRC ■ Control over all aspects of the EVSE business value chain
Barriers to Entry/Success	■ Significant upfront costs ■ Uncertain regulation/legislation ■ Legislation significantly different for utilities throughout state; may have problems with economies of scale ■ Significant number of entrants vying for a small number of PEV charging opportunities

Table 5-11. EVSE Services Provider Business Model

Business-Model Name	EVSE Services Provider
Model Category	Private Company
Summary	This company offers a platform of applications and services to help EVSE owners and operators manage their EVSE infrastructure.

Model Outline	The platform could offer the following services:
	■ Develop marketing and incentive programs for PEV users
	■ Identify where EVSE are being overused and underused, and establish programs to optimize usage
	■ Identify locations of new EVSE
	■ Manage financial transactions between participants
	    ■ Utilities
	    ■ Operations & Maintenance (O&M) companies (local electricians)
	    ■ PEV owners
	■ Manage DR events on behalf of region or specific utility based on reliability
	The platform will consist of at least the following components:
	■ EVSE element management system
	■ EVSE network management system
	■ Central data center and data warehouse
	■ Web interface via username and password
	■ License fee for use of application

EVSE Owner	Utility, local government, private companies, EVSE providers, or the like

EVSE Funder/Developer	Not applicable – this business applies to EVSE already installed
EVSE Installer	Not applicable – this business applies to EVSE already installed
EVSE Operator	Utility, local government, businesses, EVSE providers, or the like
EVSE Site Host	Utility, local government, businesses, EVSE providers, or the like
What product is sold?	Applications to manage and monitor EVSE, EVSE operation analytics, operation alerts and alarms, advertising opportunity on EVSE screens
Who is the customer?	EVSE owners
Opportunity	■ Potentially high-value applications and analysis for EVSE owners ■ Recurring revenue from license fees ■ Freedom to work with customers throughout TRC ■ Customers will own EVSE, so no up-front capital costs
Barriers to Entry/Success	■ Success dependent on EVSE being installed by other companies ■ Application needs to interface with multiple EVSE models ■ Application may need to integrate with various utility systems. ■ Slow emergence of industry interoperability standards between EVSE technologies

Table 5-12. EVSE Subscription Services Business Model

Business-Model Name	EVSE Subscription Services
Model Category	Private Company
Summary	Company offers tiered subscription services from an EVSE network that it owns or controls through a host relationship.
Model Outline	■ Variety of monthly flat-fee options ■ Different levels of service, depending on whether user owns home-based EVSE ■ Transfers cost of charging risk from PEV owner to the company ■ Applies to home-based EVSE as well as public, multifamily, or workplace-owned EVSE
EVSE Owner	Utilities, businesses, governments, multifamily complexes, residential customers, or EVSE subscription companies
EVSE Funder/Developer	■ Utilities, businesses, governments, multifamily complexes, and residential customers for EVSE ■ Company will do this for installation and operation of EVSE
EVSE Installer	Company
EVSE Operator	Company
EVSE Site Host	Utilities, businesses, governments, multifamily complexes, and residential customers
What product is sold?	Product bundle that can include installation, energy (for home charging), and public network charging access
Who is the customer?	PEV owners
Opportunities	Innovative value proposition resonates with PEV owners
Barriers to Entry/Success	Inability to expand proprietary network

Table 5-13. Joint-Venture Services Offering Business Model

Business-Model Name	Joint-Venture Services Offering
Model Category	Private Company
Summary	The EVSE manufacturer partners with a security company to combine products into one infrastructure platform.
Model Outline	■ Leverage one box for charging, monitoring, and metering components ■ Leverage dedicated communication source for both EVSE and security services ■ Multiple value streams and applications will help cover system infrastructure costs ■ Target residential customers
EVSE Owner	EVSE or security services provider
EVSE Funder/Developer	Jointly funded by EVSE and security companies
EVSE Installer	Electrician selected by joint-venture operator
EVSE Operator	Operator of the joint business venture
EVSE Site Host	Residential homes
What product is sold?	Security services, EVSE charge services, energy monitoring, DR negawatts
Who is the customer?	Residential or multifamily homeowners where EVSE and security systems can be installed, utilities

Opportunity	■ Additional revenue streams
	■ Ability to spread costs over more revenue
	■ Market segment for both products suggests symbiotic potential
	  ■ Higher discretionary income
	  ■ Larger single-family home

Barriers to Entry/Success	■ Establishing joint ventures can be complicated ■ Upfront capital costs of designing new infrastructure ■ Developing operating and governance structure ■ Customers may already have one of the products, or may not want to purchase a bundled product ■ Only able to offer one EVSE type/manufacturer to consumer

Table 5-14. PEV Battery-Swap Service Business Model

Business -Model Name	PEV Battery-Swap Service
Model Category	Private Company
Summary	Private company owns batteries and facility to swap batteries for PEV owners.
Model Outline	■ Industry recognizes that batteries are the most expensive and riskiest component of a PEV; therefore, risk (and PEV upfront costs) is reduced by eliminating the battery as the PEV-owner's cost ■ Using an analogy (and business model) similar to that of propane tanks, customers go to a facility to swap batteries each time the PEV batteries run low on energy ■ Replacement takes 5-10 minutes, not much longer than pumping gas ■ Pays a fixed fee each time ■ Batteries are charged by company during off-peak hours ■ Inventory of batteries allows for scheduled charging to occur
EVSE Owner	Not applicable – there are no EVSE facilities involved in this model
EVSE Funder/Developer	Not applicable – however, there will need to be funding for the battery-swap facility
EVSE Installer	Not applicable
EVSE Operator	Not applicable
EVSE Site Host	Not applicable – the battery-swap facility will be where primary activities occur
What product is sold?	Battery swap and charging services
Who is the customer?	PEV owners, fleet owners
Opportunity	■ Freedom to work with customers throughout TRC ■ Customers will own EVSE, so no upfront capital costs
Barriers to Entry/Success	■ Upfront capital costs to set up station and battery inventory ■ Most PEVs are not currently designed to accommodate a fast swap; therefore, this is a niche market ■ Significant system-integration activities, depending on what systems are used as part of the package ■ Slow adoption of PEV designs to incorporate fast-swap technology ■ No American cars have interchangeable batteries at this time

Table 5-15. PEV Mobile Charging Service Business Model

Business-Model Name	PEV Mobile Charging Service
Model Category	Private Company
Summary	Private company owns trucks and on-board charging equipment to charge stranded cars or those without access to public EVSE facilities.
Model Outline	■ As the industry grows, there will be gaps where EVSE have not been installed, posing a risk for PEV drivers ■ Mobile chargers provide the opportunity to reduce the impact of lack of EVSE or of drivers running out of fuel
EVSE Owner	Not applicable

EVSE Funder/Developer	Not applicable
EVSE Installer	Not applicable
EVSE Operator - Mobile	Mobile service provider
EVSE Site Host	On vehicle
What product is sold?	Emergency charging services, subscription services (e.g., AAA)
Who is the customer?	PEV owners
Opportunities	■ Moderate up-front capital costs ■ Business can grow incrementally as more PEVs are purchased ■ Opportunity to develop partnerships with utilities and EVSE providers to provide mobile charging services as part of the their programs ■ May also align with loyalty programs (e.g., AAA) or with local towing companies
Barriers to Entry/Success	■ Niche market today ■ Total market potential may be limited with widespread EVSE deployment (less chance of someone running out of fuel) ■ Downtime to recharge mobile units ■ May just be cheaper to tow the PEV to stationary EVSE

5.4 Business-Model Templates

The original plan for developing the business-model templates was to narrow down the number of models to a manageable level (three or four), and then to develop specific templates for them. Unfortunately, this proved a difficult task, as there was a lot of sensitivity about discussing specific aspects and attributes of business models, especially when some were components of stakeholder models. This resistance led to a more productive alternative: development of two model templates that allow users the flexibility to run many different models instead of just one. Consistent with the original model-development plan, utility and private business-model templates were developed. The following sections describe these templates in detail. They are Excel®-based models and will be available for public use through the TRC website as part of this grant.

Subsequent to the filing of this report, TRC will sponsor a business-model scenario workshop where stakeholders will have the opportunity to receive training on how to use the business-model templates. The workshop will include a user’s manual, sample scenarios, and financial documentation.

5.4.1 Utility EVSE Business Model Template

General Overview of Utility EVSE Business Model Template

The utility EVSE model enables a utility to define a variety of utility EVSE business alternatives or scenarios and assess the economic feasibility of these business models by changing a variety of global assumptions on PEV battery charging characteristics and economic criteria.

Utility EVSE Business Model Template Components

The business model consists of four main tabs:

- Utility EVSE Template
- Key Parameters
- Forecast & Cash Flow
- Business Case Summary

The utility template tabs contain information used to define a variety of capital, operations, and maintenance costs and other variables, including initial startup investment, to define up to three EVSE business model alternatives or scenarios. Space is provided in the template to enable the user to add notes, supporting references, or other comments regarding assumptions for all user-defined fields. Appendix A contains reference to the Utility EVSE Business Model Template.

The Key Parameters tab contains a variety of user-defined global model variables that uniformly affect all EVSE business-model alternatives or scenarios defined in the Utility EVSE Template tab. Global model variables in the Key Parameters tab focus on two areas. First, all variables on the left-hand portion of the tab are user-defined variables to model assumptions about the regional PEV market, average PEV battery size, global battery-charge event characteristics, and EVSE population size. Also, user-defined variables model assumptions about what percentages of charge events are provided by conventional utility, standard non-traditional services, and subscription non-traditional services. Second, all variables on the right-hand portion of the Key Parameters tab are user-defined variables to model all cost escalation, depreciation, tax, and economic evaluation assumptions used throughout the Forecast & Cash Flow tab. All associated global utility model variables are described in Table 5-16 on the following pages.

The Forecast & Cash Flow tab provides a 20-year forecast of a utility's PEV and EVSE market or customer base, battery-charge events, and energy for conventional utility, standard non-traditional services, and subscription non-traditional services. The total U.S. PEV population and user-defined global model variables provided in the Key Parameters tab drive the EVSE and charge-event forecast for all EVSE business-model alternatives or scenarios defined in the Utility EVSE Template tab. All revenues and costs for alternatives or scenarios defined in the Utility EVSE Template tab are used to generate cash flows in the Forecast & Cash Flow tab that are modified using user-defined global cost escalation, depreciation, tax, and economic evaluation assumptions on the Key Parameters tab.

The Business Case Summary tab provides an overview of the economic evaluation developed in the Forecast & Cash Flow tab. Items provided include a table of net present value (NPV) and internal rate of return (IRR) and a graph of annual net cash flows and cumulative present value (PV) over a 20-year period.

Table 5-16. Utility EVSE Global Model Variables

Global Parameters Table – Utility EVSE Business Model Template	
Name	**Description**
Est % TRC Share of U.S. PEV Market	A variable used to estimate the size of the TRC PEV market as a percentage of the forecast U.S. PEV market. This percentage variable, which is assumed to range from 0 percent to 10 percent, is applied to each year of the annual U.S. PEV market forecast. For example, if the U.S. PEV market is 1 million vehicles for a given year then a 1-percent share of the TRC PEV market for that same year is 10,000 vehicles.
Average PEV Battery Size	A variable used to estimate the average PEV battery size for the population of all-electric and hybrid vehicles in the TRC market. This variable is assumed to range from 0 kWh to 100 kWh per vehicle.
Annual No. of Full-Charge Events / PEV	A variable used to estimate the anticipated number of annual full-charge events for the average or typical PEV in the TRC market. This variable for the average vehicle is assumed to range from 0 to 500 annual full-charge events.
Est % of Battery Charge / Full-Charge Event	A variable used to estimate the average percentage of the typical PEV battery charged during the average full-charge event. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during full-charge events.
Est % Full-Charge Event on Level 1 EVSE	A variable used to estimate the average percentage of full-charge events that occur on Level 1 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during full-charge events.
Est % Full-Charge Event on Level 2 EVSE	A variable used to estimate the average percentage of full-charge events that occur on Level 2 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during full-charge events.
Annual No. of Quick-Charge Events / PEV	A variable used to estimate the anticipated number of annual quick-charge events for the average or typical PEV in the TRC market. This variable for the average vehicle is assumed to range from 0 to 500 annual quick-charge events.
Est % of Battery Charged / Quick-Charge Event	A variable used to estimate the average percentage of the typical PEV battery charged during the average quick-charge event. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during quick-charge events.
Est % of Quick-Charge Events on Level 1	A variable used to estimate the average percentage of quick-charge events that occur on Level 1 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during quick-charge events.
Est % of Quick-Charge Events on Level 2	A variable used to estimate the average percentage of quick-charge events that occur on Level 2 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during quick-charge events.
No. of EVSE / PEV for 2012-2016	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2012-2016 period, in the utility EVSE business's PEV customer base or market.
No. of EVSE / PEV for 2017-2021	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2017-2021 period, in the utility EVSE business's PEV customer base or market.
No. of EVSE / PEV for 2022-2026	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2022-2026 period, in the utility EVSE business's PEV customer base or market.

Global Parameters Table – Utility EVSE Business Model Template	
Name	**Description**
No. of EVSE / PEV for 2027-2031	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2027-2031 period, in the utility EVSE business's PEV customer base or market.
Est % of Charge Events by Std Non-Trad Svc	A variable used to estimate the percentage of total charge events provided by standard non-traditional service. This percentage plus the Est % of Charge Events by Subscribe Non-Trad Svc (described below) cannot exceed 100 percent.
Est % of Charge Events by Subscript Non-Trad Svc	A variable used to estimate the percentage of total charge events provided by subscription full service. This percentage plus the Est % of Charge Events by Std Non-Trad Svc (described above) cannot exceed 100 percent.
Est % of Total Energy Sold to Residential Class	A variable used to estimate the percentage of total energy sold by traditional utility operations to residential-class customers. This variable may range from 0 percent to 100 percent annually.
Annual Power Cost Escalation	A variable used to estimate the annual percent escalation in wholesale power costs and retail power costs, including revenues associated with retail charging events. This variable may range from 0 percent to 10 percent annually. An accompanying check-box is provided for circumstances where annual reductions in power costs may be modeled.
Est % of Total Charge Events Avoided w/ DR	A variable used to estimate the percentage of total charge events avoided by the local utility's DR programs. This variable may range from 0 percent to 10 percent annually.
T&D Infrastructure Cost Escalation	A variable used to estimate the annual percent escalation in all transmission and distribution (T&D)-related capital costs. This variable may range from 0 percent to 10 percent annually. An accompanying check-box is provided for circumstances where annual reductions in T&D-related capital costs may be modeled.
EVSE Infrastructure Cost Escalation	A variable used to estimate the annual percent escalation in all EVSE-related capital costs. This variable may range from 0 percent to 10 percent annually. An accompanying check-box is provided for circumstances where annual reductions in EVSE-related capital costs may be modeled.
Annual O&M Expense Escalation	A variable used to estimate the annual percent escalation in all O&M-related activity with the exception of power-related costs. This variable may range from 0 percent to 10 percent annually.
SLN Depreciation Period on T&D Infrastructure	A variable used to estimate the useful life of all T&D assets, such as electric service upgrades and calculate annual straight-line (SLN) depreciation assuming no salvage value. This variable ranges from 20 years to 50 years.
SLN Depreciation Period of EVSE Infrastructure	A variable used to estimate the useful life of all EVSE-related assets and calculate annual straight-line depreciation assuming no salvage value. This variable ranges from 1 year to 20 years.
Combined Fed-State Income Tax Rate	A variable used to estimate the combined annual federal and state (if applicable) income tax rate and calculate tax benefits associated with depreciation. This variable may range from 0 percent to 50 percent annually.

Global Parameters Table – Utility EVSE Business Model Template	
Name	Description
Property Tax Rate (Net Book Value)	A variable used to estimate the local property tax rates on the depreciated net book value of T&D- and EVSE-related infrastructure. This variable may range from 0 percent to 50 percent annually.
After-Tax Weighted Avg Cost of Capital	A variable used to estimate the after-tax weighted average cost of capital, including all debt and equity, used to finance all T&D- and EVSE-related assets. This variable is used in all present-value and NPV calculations and may range from 0 percent to 25 percent annually.

5.4.2 Private EVSE Business Model Template

General Overview of Private EVSE Business Model Template

The private EVSE template enables businesses and other non-utility entities to define a variety of private EVSE business alternatives or scenarios and assess the economic feasibility of these business models by changing a variety of global assumptions on PEV battery charging characteristics and economic criteria.

Private EVSE Business Model Components

The business model consists of four main tabs:

- Private EVSE Template
- Key Parameters
- Forecast & Cash Flow
- Business Case Summary

The private EVSE template tabs contain information used to define a variety of capital, operations, and maintenance costs and other variables, including initial startup investment, to define up to three EVSE business-model alternatives or scenarios. Space is provided in the template to enable users to add notes, supporting references, or other comments regarding assumptions for all user-defined fields. Appendix A contains reference to the Private EVSE Business Model Template.

The Key Parameters tab contains a variety of user-defined global model variables that uniformly affect all EVSE business-model alternatives or scenarios defined in the Private EVSE Template tab. Global model variables in the Key Parameters tab focus on two areas. First, all variables on the left-hand portion of the tab are user-defined variables to model assumptions about the regional PEV market, the private EVSE business's customer base or share of the regional market, average PEV battery size, global battery-charge event characteristics, and EVSE population size. Also, user-defined variables model assumptions about what percentage of charge events are provided by standard and subscription full and managed services, respectively. Second, all variables on the right-hand portion of the Key Parameters tab are user-defined variables to model all cost escalation, depreciation, tax, and economic evaluation assumptions used throughout the Forecast & Cash Flow tab. All associated global private model variables are described in Table 5-17, below and on the following pages.

The Forecast & Cash Flow tab provides a 20-year forecast of a private EVSE business's PEV and EVSE market or customer base, battery-charge events, and energy for standard and subscription full and managed services, respectively. The total U.S. PEV population and user-defined global model variables provided in the Key Parameters tab drive the EVSE and charge-event forecast for all EVSE business-model alternatives or scenarios defined in the Private EVSE Template tab. All revenues and costs for alternatives or scenarios defined in the Private EVSE Template tab are used to generate cash flows in the Forecast & Cash Flow tab that are modified using user-defined global cost escalation, depreciation, tax, and economic evaluation assumptions on the Key Parameters tab.

The Business Case Summary tab provides an overview of the economic evaluation developed in the Forecast & Cash Flow tab. Items provided include a table of NPV and IRR and graph of annual net cash flows and cumulative PV over a 20-year period.

Table 5-17. Private EVSE Global Model Variables

Global Parameters Table – Private EVSE Business Model Template	
Name	**Description**
Est % TRC Share of U.S. PEV Market	A variable used to estimate the size of the TRC PEV market as a percentage of the forecast U.S. PEV market. This percentage variable, which is assumed to range from 0 percent to 10 percent, is applied to each year of the annual U.S. PEV market forecast. For example, if the U.S. PEV market is 1 million vehicles for a given year, then a 1-percent share of the TRC PEV market for that same year is 10,000 vehicles.
Est % Private Business Share of TRC Market	A variable used to estimate the size of the private EVSE business PEV customer base or market as a percentage of the TRC PEV market. This percentage variable, which is assumed to range from 0 percent to 10 percent, is applied to each year of the annual TRC PEV market forecast. For example, if the TRC PEV market is 10,000 vehicles for a given year then a 1-percent share of the private EVSE customer base or market for that same year is 100 vehicles.
Average PEV Battery Size	A variable used to estimate the average PEV battery size for the population of all-electric and hybrid electric vehicles in the TRC market. This variable is assumed to range from 0 kWh to 100 kWh per vehicle.
Annual No. of Full-Charge Events / PEV	A variable used to estimate the anticipated number of annual full-charge events for the average or typical PEV in the TRC market. This variable for the average vehicle is assumed to range from 0 to 500 annual full-charge events.
Est % of Battery Charge / Full-Charge Event	A variable used to estimate the average percentage of the typical PEV battery that is charged during the average full-charge event. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during full-charge events.
Est % Full-Charge Event on Level 1 EVSE	A variable used to estimate the average percentage of full-charge events that occur on Level 1 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during full-charge events.
Est % Full-Charge Event on Level 2 EVSE	A variable used to estimate the average percentage of full-charge events that occur on Level 2 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during full-charge events.

Global Parameters Table – Private EVSE Business Model Template	
Name	Description
Annual No. of Quick-Charge Events / PEV	A variable used to estimate the anticipated number of annual quick-charge events for the average or typical PEV in the TRC market. This variable for the average vehicle is assumed to range from 0 to 500 annual quick-charge events.
Est % of Battery Charged / Quick-Charge Event	A variable used to estimate the average percentage of the typical PEV battery that is charged during the average quick-charge event. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during quick-charge events.
Est % of Quick-Charge Events on Level 1	A variable used to estimate the average percentage of quick-charge events that occur on Level 1 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during quick-charge events.
Est % of Quick-Charge Events on Level 2	A variable used to estimate the average percentage of quick-charge events that occur on Level 2 EVSE. This variable for the average vehicle is assumed to range from 0 percent to 100 percent during quick-charge events.
No. of EVSE / PEV for 2012-2016	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2012-2016 period, in the private EVSE business's PEV customer base or market.
No. of EVSE / PEV for 2017-2021	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2017-2021 period, in the private EVSE business's PEV customer base or market.
No. of EVSE / PEV for 2022-2026	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2022-2026 period, in the private EVSE business's PEV customer base or market.
No. of EVSE / PEV for 2027-2031	A variable ratio representing the number of EVSE units per PEV used to forecast the number of EVSE units each year, over the 2027-2031 period, in the private EVSE business's PEV customer base or market.
Est % of Charge Events by Std Full Svc	A variable used to estimate the percentage of total charge events provided by standard full-service. This percentage plus the Est % of Charge Events by Subscript Full Svc plus the Est % of Charge Events by Std Managed Svc (both described below) cannot exceed 100 percent.
Est % of Charge Events by Subscript Full Svc	A variable used to estimate the percentage of total charge events provided by subscription full-service. This percentage plus the Est % of Charge Events by Std Full Svc (described above) plus the Est % of Charge Events by Std Managed Svc (described below) cannot exceed 100 percent.
Est % of Charge Events by Std Managed Svc	A variable used to estimate the percentage of total charge events provided by standard managed service. This percentage plus the Est % of Charge Events by Std Full Svc plus the Est % of Charge Events by Subscript Full Svc (both described above) cannot exceed 100 percent.
Annual Power Cost Escalation	A variable used to estimate the annual percent escalation in wholesale power costs and retail power costs including revenues associated with retail charging events. This variable may range from 0 percent to 10 percent annually. An accompanying check-box is provided for circumstances where annual reductions in power costs may be modeled.
Est % of Total Charge Events Avoided w/ DR	A variable used to estimate the percentage of total charge events avoided if private EVSE operators participate in local utility DR programs. This variable may range from 0 percent to 10 percent annually.

Global Parameters Table – Private EVSE Business Model Template	
Name	Description
EVSE Infrastructure Cost Escalation	A variable used to estimate the annual percent escalation in all EVSE-related capital costs. This variable may range from 0 percent to 10 percent annually. An accompanying check-box is provided for circumstances where annual reductions in EVSE-related capital costs may be modeled.
Annual O&M Expense Escalation	A variable used to estimate the annual percent escalation in all O&M-related activity with the exception of power-related costs. This variable may range from 0 percent to 10 percent annually.
SLN Depreciation Period on Long-Term Infrastructure	A variable used to estimate the useful life of all long-term assets, such as buildings, and calculate annual straight-line depreciation assuming no salvage value. This variable ranges from 20 years to 50 years.
SLN Depreciation Period of EVSE Infrastructure	A variable used to estimate the useful life of all EVSE-related assets and calculate annual straight-line depreciation assuming no salvage value. This variable ranges from 1 year to 20 years.
Combined Fed-State Income Tax Rate	A variable used to estimate the combined annual federal and state (if applicable) income tax rate and calculate tax benefits associated with depreciation. This variable may range from 0 percent to 50 percent annually.
Property Tax Rate (Net Book Value)	A variable used to estimate the local property tax rates on the depreciated net book value of long-term and EVSE-related infrastructure. This variable may range from 0 percent to 50 percent annually.
After-Tax Weighted Avg Cost of Capital	A variable used to estimate the after-tax weighted average cost of capital, including all debt and equity used to finance all long-term and EVSE-related assets. This variable is used in all PV and NPV calculations and may range from 0 percent to 25 percent annually.

5.5 Business-Model Case Studies

The utility and private business model templates will allow companies to create and run a variety of scenarios to help them better understand the potential benefits and challenges with entering the EVSE industry. The templates have many variables that can be quickly modified to allow for immediate analysis of incremental changes in strategy. This will give users the ability to understand the relative financial impacts of changes in business cases or scenarios.

To illustrate the capabilities of the business-model templates, six scenarios were developed and run through the templates:

- Utility Case Study #1: Sell Electricity
- Utility Case Study #2: Sell Electricity with Time-of-Use Rates
- Utility Case Study #3: EVSE Owner/Operator
- Private-Company Case Study #1: Turnkey Owner/Operator
- Private-Company Case Study #2: Managed Services Provider
- Private-Company Case Study #3: Application Services Provider

The scenario description, summary results, and insights from these six case studies follow.

5.5.1 Utility Case Study #1: Sell Electricity

Scenario Description

This is the base case utility scenario. Essentially, the utility sells electricity at its current rates to residential and commercial customers who install EVSE at their facilities, and also sells electricity at commercial rates to EVSE owners and operators. In this scenario, all incremental upgrade costs should be included in the electric rates.

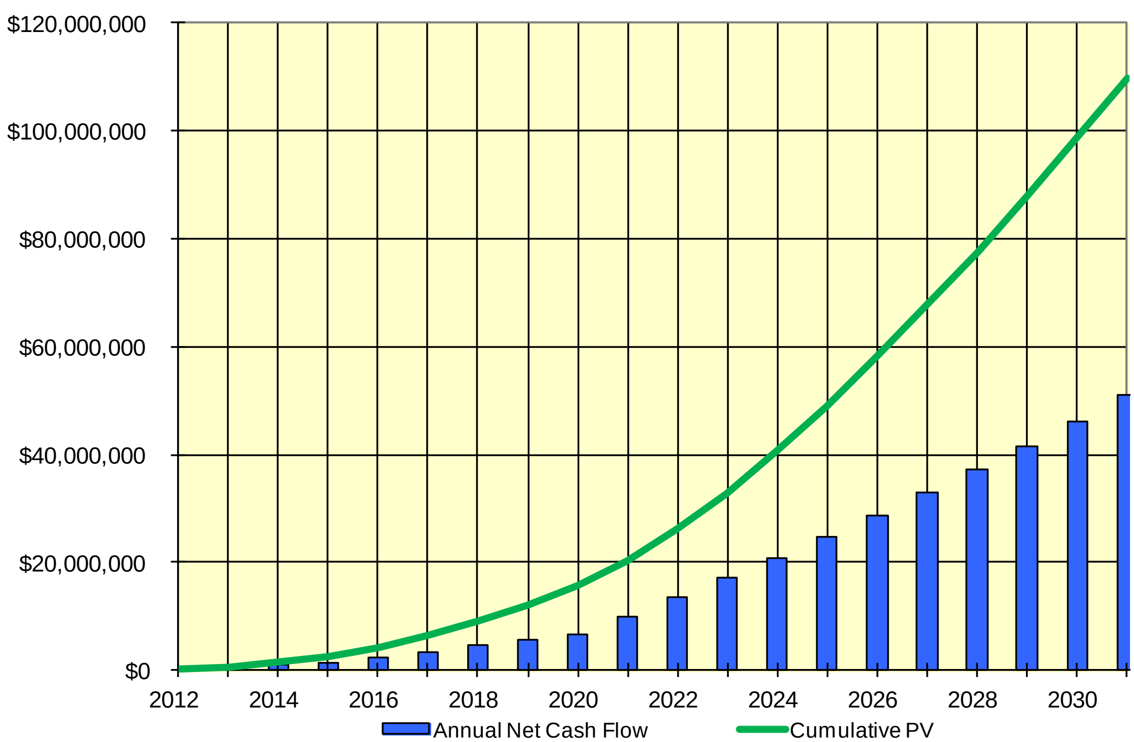
Summary Results

Table 5-18 and Figure 5-1 summarize the study results.

Table 5-18. Results of Utility Case Study #1: Sell Electricity

	5-Year	10-Year	15-Year	20-Year
Net Present Value	$4,350,291	$20,316,720	$58,051,283	$109,811,921
Internal Rate of Return	No IRR	No IRR	No IRR	No IRR

Figure 5-1. Utility Case Study #1: Sell Electricity – Cash Flow versus Cumulative PV



Insights and Implications

As expected under most regulatory environments, PEVs represent a new load for utilities. Under the regulated-return scenario, the utility will receive a negotiated rate of return on all assets installed to accommodate the new load. Understanding that this represents the biggest single opportunity for new energy sales growth, the utility should be proactive in providing information, education, and incentives for PEVs and EVSE providers to enter the service territory.

5.5.2 Utility Case Study #2: Sell Electricity with Time-Of-Use Rates

Scenario Description

This scenario assumes that time-of-use rates are introduced for residential customers, and that a weighted average commercial rate that accounts for a demand charge is also used.

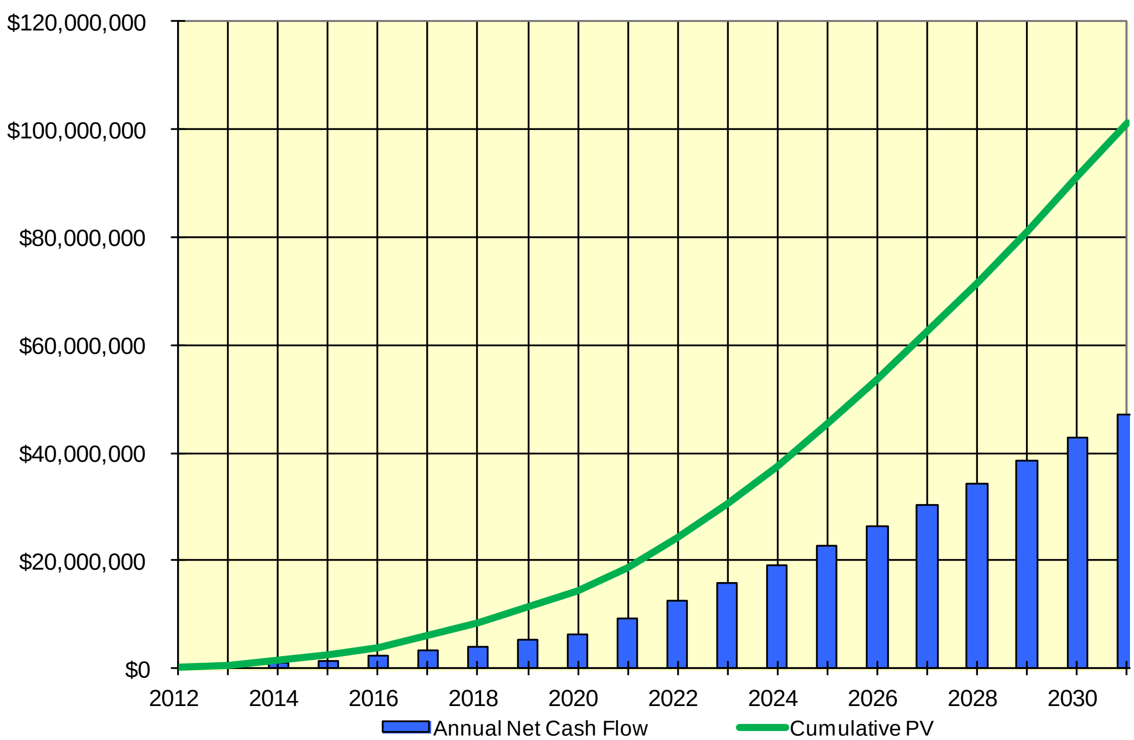
Summary Results

Table 5-19 and Figure 5-2 summarize the study results.

Table 5-19. Results of Utility Case Study #2: Sell Electricity with Time-of-Use Rates

	5-Year	10-Year	15-Year	20-Year
Net Present Value	$4,013,290	$18,742,860	$53,554,268	$101,305,202
Internal Rate of Return	No IRR	No IRR	No IRR	No IRR

Figure 5-2. Utility Case Study #2: Sell Electricity with Time-of-Use Rates – Cash Flow versus Cumulative PV



Insights and Implications

The consequences of offering innovative rates may be that customers use them, and as a result, lower their energy bills and the utility's future revenue stream. However, the successful use of these rates may also help the utility reduce its future costs, which are not modeled in this specific scenario.

5.5.3 Utility Case Study #3: EVSE Owner/Operator

Scenario Description

In this scenario, the utility invests in and operates an EVSE fleet. The fleet grows over time as more PEVs enter TRC. In all, about 10 percent of utility PEV revenues come from selling charging events from EVSE, and 5 percent comes from selling EVSE subscription services. The rest of the revenue stream comes from selling electricity at the same rates as in Scenario 1.

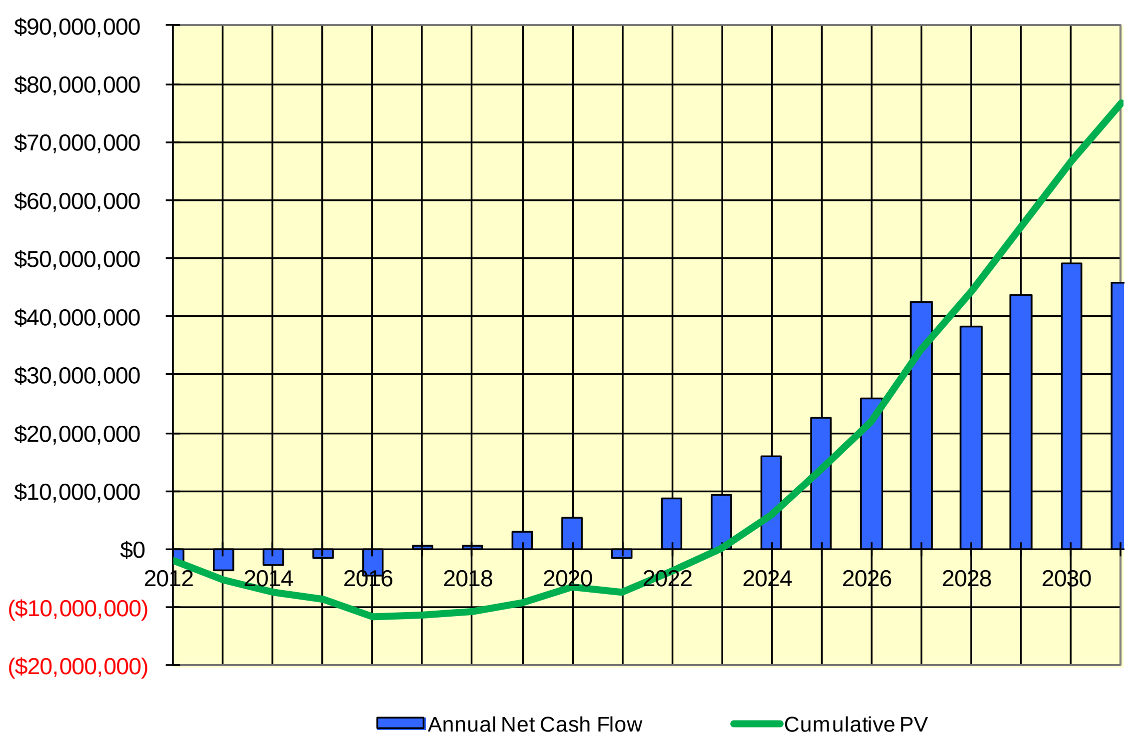
Summary Results

Table 5-20 and Figure 5-3 summarize the study results.

Table 5-20. Results of Utility Case Study #3: EVSE Owner/Operator

	5-Year	10-Year	15-Year	20-Year
Net Present Value	($11,684,980)	($7,353,549)	$21,789,415	$76,677,564
Internal Rate of Return	NA	NA	20.6%	27.4%

Figure 5-3. Utility Case Study #3: EVSE Owner/Operator – Cash Flow versus Cumulative PV



Insights and Implications

There are many business-model opportunities for utilities; however, in the United States, regulatory rules regarding utility EVSE ownership vary by state. California, for example, prohibits utilities from owning and operating EVSE assets. Other states have not ruled on this or have allowed it. The paramount and differentiating issue between a private EVSE owner and a utility will be whether EVSE is considered a utility asset, and therefore recovered in rates. In this scenario, there is no rate recovery for equipment, installation, or O&M costs.

5.5.4 Private-Company Case Study #1: Turnkey Owner/Operator

Scenario Description

This is the scenario in which a private company owns and operates EVSE. The scenario assumes the company achieves a 15-percent market share, and sells a mix of Level 1, Level 2, and Fast Charge equipment. Furthermore, 70 percent of the sales come from charge events, while 30 percent of the sales come from annual subscription services. Finally, the company pays commercial electric rates for fuel costs.

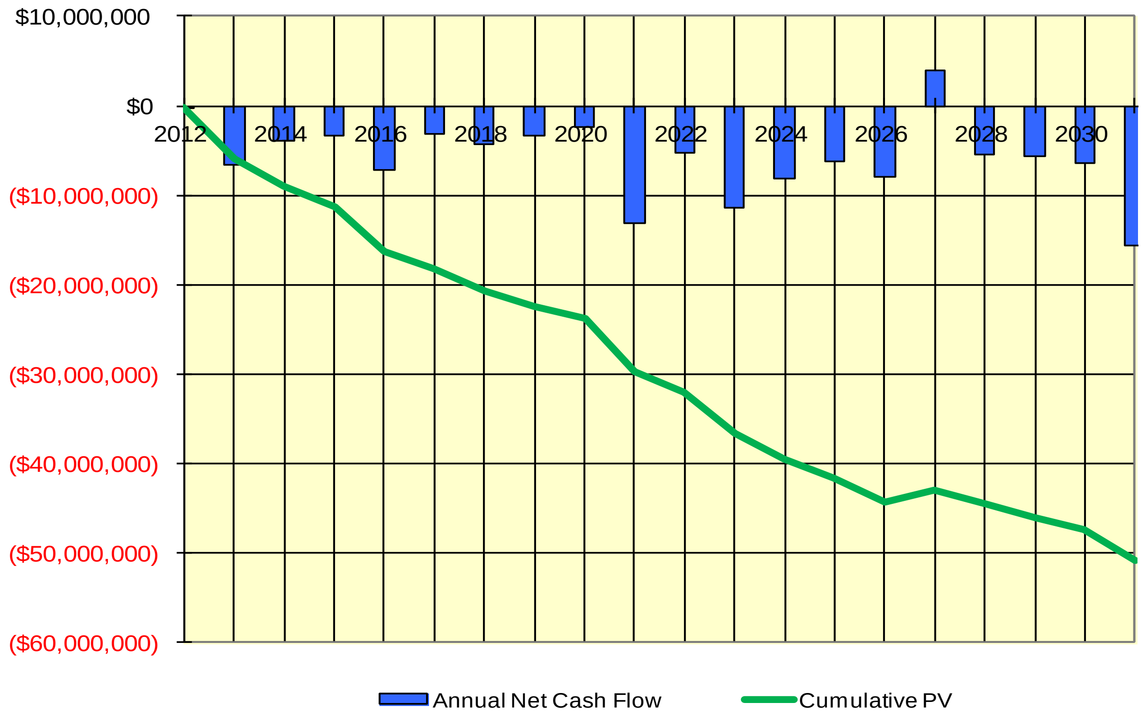
Summary Results

Table 5-21 and Figure 5-4 summarize the study results.

Table 5-21. Results of Private-Company Case Study #1: Turnkey Owner/Operator

	5-Year	10-Year	15-Year	20-Year
Net Present Value	$ (16,246,510)	$(29,789,396)	$ (44,225,107)	$ (50,807,424)
Internal Rate of Return	NA	NA	NA	NA

Figure 5-4. Private-Company Case Study #1: Turnkey Owner/Operator – Cash Flow versus Cumulative PV



Insights and Implications:

It is a common and pervasive belief that owning and operating EVSE will be a serious financial challenge within the next ten years. Based on the mix of units and charging price points, the proposition never becomes financially viable in this model. The benefit of the private business-model template is that the user can modify many different input variables in an effort to determine what mix of events, prices, costs, and the like may increase the overall business-model economics. For example, changing the mix of EVSE types can improve the economics, all other things being equal.

5.5.5 Private-Company Case Study #2: Managed Services Provider

Scenario Description

This is the scenario where a private company operates EVSE on behalf of EVSE owners. The company is responsible for the variable revenues and costs associated with selling charging events and subscription services. In turn, it pays the EVSE owner an annual lease payment per EVSE (represented as a percentage of total revenues). This specific scenario makes money until the lease payment exceeds 40 percent of total revenues. In this scenario, the lease payment is 20 percent.

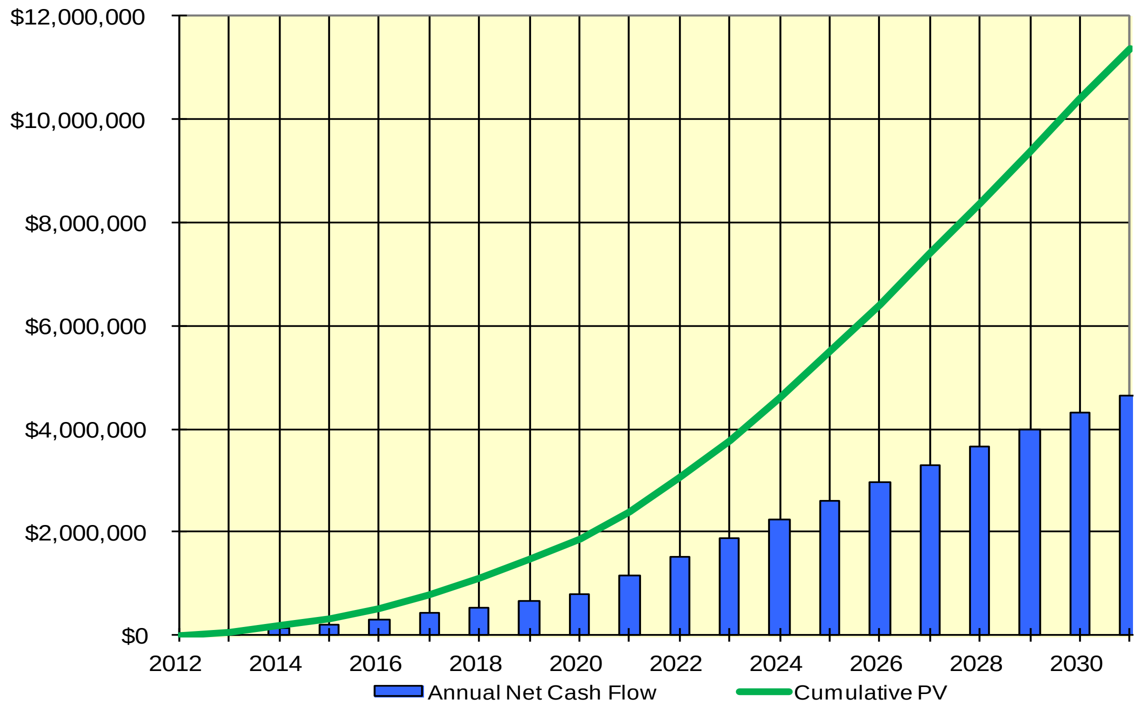
Summary Results

Table 5-22 and Figure 5-5 summarize the study results.

Table 5-22. Results of Private-Company Case Study #2: Managed Services Provider

	5-Year	10-Year	15-Year	20-Year
Net Present Value	$ 527,440	$ 2,394,320	$ 6,419,070	$ 11,368,702
Internal Rate of Return	No IRR	No IRR	No IRR	No IRR

Figure 5-5. Private-Company Case Study #2: Managed Services Provider – Cash Flow versus Cumulative PV



Insights and Implications

The business model could represent a win-win opportunity for those companies that may want to host an EVSE unit but not have the day-to-day worries of operating it. The equipment costs would represent an investment (perhaps in the case of a retail store, to attract customers), and the lease payment an annuity to cover part of the costs.

5.5.6 Private-Company Case Study #3: Application Services Provider

Scenario Description

In this scenario, a company develops and sells applications to the EVSE owner and operators. The developer spends $100,000 up front to develop an application. This application earns $200 per year per EVSE unit, and costs $100,000 per year to host and support.

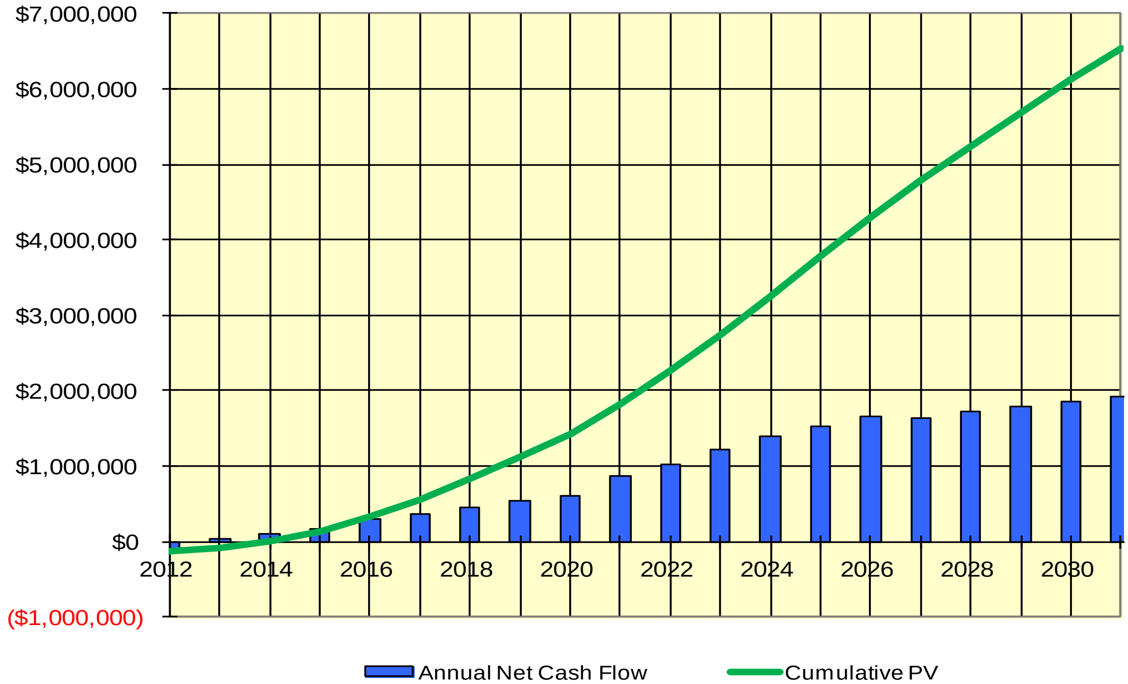
Summary Results

Table 5-23 and Figure 5-6 summarize the study results.

Table 5-23. Results of Private-Company Case Study #3: Application Services Provider

	5-Year	10-Year	15-Year	20-Year
Net Present Value	$ 332,410	$ 1,822,300	$ 4,298,927	$ 6,535,567
Internal Rate of Return	71.7%	92.9%	94.2%	94.3%

Figure 5-6. Private-Company Case Study #3: Application Services Provider – Cash Flow versus Cumulative PV



Insights and Implications

One trend underway in the emerging EVSE industry is the separation of software and services from the equipment as business opportunities. This trend is expected to accelerate as the ecosystem realizes, as business owners, it will be a challenge to develop successful business plans unless prices come down and economies of scale are achieved. Conversely, as the market develops, the demand for new applications to run on the networks will increase.

5.6 Business-Model Survey

As the PEV/EVSE industry continues to develop, there has been significant interest and uncertainty with respect to which products, services, and value propositions will resonate with customers. The majority of EVSE installations to date have been funded with government credits or incentives. The DOE-sponsored EV Project alone will spend $115 million to install EVSE in 21 major cities and metropolitan areas in nine states and the District of Columbia.[8]

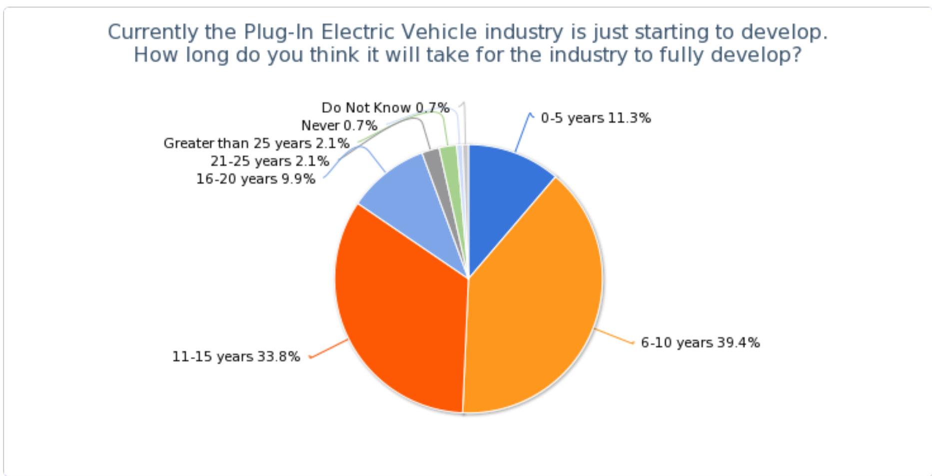
[8] For more information on the EV Project, see www.theevproject.com .

In order to help frame the business-model discussion in the TRC region, the business-model subtask team – with the assistance of the Austin Energy Market Research and Planning Department – developed and implemented an Internet-based survey. This survey was designed to gain insights into what key barriers, challenges, and uncertainties the industry faces. This information would help develop the inputs and assumptions to be used in the business-model templates. To ensure robust results, the survey was sent to 694 industry professions throughout the United States, with 147 people responding, representing a 21-percent response rate. The survey instrument and results can be found in Section 10: Market Research Surveys and Results.

From a business-planning and infrastructure perspective, three fundamental questions were asked: 1) how long will it take for the PEV/EVSE industry to fully develop; 2) how many PEVs do you forecast being on the road; and 3) what will be the mix of EVSE types in the industry when it is fully developed?

Figure 5-7 summarizes the participants' responses with respect to how long it will take the industry to develop. The average response was 9.5 years. More importantly, only 11 percent believe full development will occur over the next five years. The conclusion is that the relatively slow development will represent a challenge for companies looking to establish market share in the industry in the near term.

Figure 5-7. Business-Model Survey Results – PEV Industry Development



The answers to the PEV forecast question illustrate even more industry uncertainty. Respondents were asked provide U.S. PEV forecasts for 2015, 2020, and 2025. Table 5-24 provides a summary of these responses. Although the mean values were used in the business-model templates to develop a baseline forecast, the additional median, minimum, and maximum values reflect significant differences in opinion – from industry professionals, no less. The key insight of these forecasts is that scenario analysis needs to be performed around all businesses developed to reflect the ramifications of this industry uncertainty. The business-model templates accompanying this report will allow users to construct and run various scenarios. Section 8: Projection of PEV Market Penetration for the TRC Region provides documentation on a market-penetration model that will expand on the business-model survey research regarding what inputs and influences will drive PEV forecasts.

Table 5-24. PEV Forecasts by Select Year

	2015	2020	2025
Average	**354,896**	**1,444,631**	**4,771,471**
Median	300,000	1,000,000	2,100,000
Minimum	5,000	15,000	0
Maximum	2,000,000	10,000,000	50,000,000

Respondents were also asked to forecast what the future mix of EVSE equipment types would be once the market is fully developed. This was done under the assumption that the three main equipment types – Level 1, Level 2, and Fast Charge – would continue to be the dominant types in the future. (Section 2: Needs Analysis, Typology, and Best Practices Guide, provides a detailed list of manufacturers and equipment types.) Gaining insights into the industry's collective perception as to EVSE market share will provide insights as to what the industry believes will be the customers' future requirements(and may therefore invest in or develop). Furthermore, there are significant financial ramifications as to how the EVSE infrastructure market develops, since the fixed and operating costs of the different types vary significantly. Table 5-25 summarizes these responses.

Table 5-25. Forecasted EVSE Market Share by Type

	Level 1	Level 2	Fast Charge
Average	**30%**	**52%**	**18%**
Median	25%	55%	10%
Minimum	0%	5%	0%
Maximum	90%	90%	75%

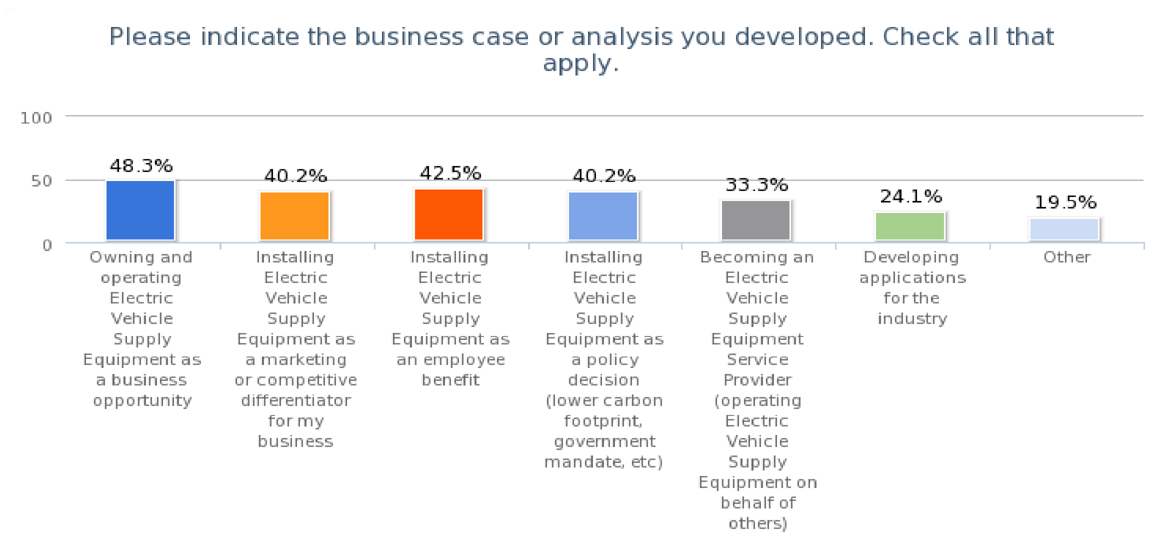
In anticipation of the PEV/EVSE industry continuing its slow development, respondents were asked to rate a list of factors that may help accelerate adoption of the market. Table 5-26 summarizes the answers. It is interesting to note that the top two responses are not directly related to the development of EVSE infrastructure. Specifically, if the EVSE industry continues to be primarily dependent on PEV sales and gasoline prices, there is limited opportunity to influence business and market economics.

Table 5-26. Factors That May Speed Up Establishment of the PEV Industry

Factor (5 stars = Most Preferred)	**Average**	**Count**
Lower Plug-In Electric Vehicle purchase prices (through innovative leases, incentives, tax rebates, etc.)	4.63	142
Increased fuel/mileage range of Plug-In Electric Vehicles	3.79	141
Broader installed network of charging infrastructure throughout United States	3.14	142
More regulatory certainty (installation ordinances, sale of electricity as fuel, Electric Vehicle Supply Equipment ownership, etc)	2.42	141
Higher gasoline prices	4.00	141
Other	4.03	38

In light of the initial stages of development and market uncertainty, respondents indicated that they have performed a variety of business cases in an effort to understand the industry and identify future opportunities. Figure 5-8 provides a summary of the business cases under development.

Figure 5-8: Business Cases Under Development



Another significant area of uncertainty, from both a revenue and system-interoperability perspective, concerns a basic industry event: paying to charge the PEV. A significant amount of time and effort has been spent developing EVSE technology and applications; however, due to regulatory and market idiosyncrasies, no universally accepted method of payment has dominated the market. This represents an opportunity for additional customer value-proposition development; it is also a major cause of uncertainty as industry competitors attempt to forecast future revenues. Respondents were asked to state *their* preferences; the results are shown in Table 5-27.

Table 5-27. Proposed Charge-Event Payment Methods

Please rate the following payment methods for paying for PEV charging (5 stars = Most		
	Average	**Count**
$ Per Unit of Fuel	3.37	129
$ Per Mile Charged	1.96	125
$ per hour of connectivity	2.95	133
Flat connectivity fee per use	2.73	131
Subscription fee (monthly, annually) for unlimited use	3.03	133
Subscription fee (monthly, for fixed number of hours or charges, then additional fees apply)	2.59	130
Other (Service Level Agreement, Mobile Speed Pass, Free)	4.00	10

In conclusion, although there is significant business and regulatory uncertainty today in the PEV/EVSE industry, a significant amount of interest remains, as attributed to the number of industry stakeholders and the continued acceleration of new product and service development. That said, all those interested in participating in this market in the long term will want to actively participate in its development, monitor its events, and continue to refine their business plans and models.

5.7 Vendor Ecosystem Ideas and Issues

For a market or industry to grow, there must be an active ecosystem working in the area. This will fundamentally occur if the participants believe there is an underlying strategic and economic justification. Tables 5-28 and 5-29 provide lists of organizations that could be considered part of the PEV/EVSE ecosystem. These lists will constantly change as new players enter and exit the ecosystem. Once TRC becomes a formal organization, it is recommended that it develop a plan of action for engaging and growing the ecosystem.

Table 5-28. TRC PEV/EVSE Ecosystem – Direct Participants

EVSE Manufacturers	EV Manufacturers	Utilities
- ABB - Aerovironment - Akerwade - Alpha Energy - Andromeda Power - Avcon Corporation - Blink Network - ChargeMaster - ClipperCreek, Inc. - Control Module Industries - Coulomb Technologies - DBT USA - Eaton - ECOtality - Efacec - Elektromotive - Erg-go - E-Totem - EV Box - Evatran/Plugless Power - EVCharge America - Evoasis - EVoCharge - EVTEC - EyeOnPower - Fuji - General Electric - General Electric - GoSmart Technologies - Green Garage Assoc - Greenlight AC - Gridbot - Lear - Legrand - Leviton - Nichicon - Optimization Technology - Park and Power - Parkpod - Pep Stations - Plug Smart - RWE - Schneider - SemaConnect - Shorepower - Siemens - SPX Service Solutions - Verdek - WiTricity	- Azure Dynamics - Bright Automotive - Chevrolet - Coda - Electric Mobile Cars - EV Autos - Fiat - Fiskers - Ford - Honda - Mitsubishi - Modec - Nissan - ProTerra - Smart - Tata - Tesla - Think - Via Motors - ZWheelz **EVSE Integrators & Service Providers** - Ace Technologies - Better Place - eVgo by NRG Energy - GridPoint - Power Tagging Technologies - Volta - Xtreme Power **EVSE Infrastructure Installers** - Hubbell Wiring Device - Local Electricians - LVI Energy **Automobile Dealerships** - Chevrolet - Gulf States Toyota - Nissan	- Austin Energy - Bluebonnet Electric Cooperative - City of Bastrop Electric Utility - CPS Energy - Georgetown Utilities - Guadalupe Valley Electric Cooperative - New Braunfels Utilities - Oncor Electric Delivery - Pedernales Electric Cooperative - San Marcos Electric Utility - Sumter Electric Cooperative - Texas Electric Cooperative Association - Texas Public Power Association - TXU Energy **Channel Partners** - Enterprise Rent-a-Car **Financial & Payment Integrators** - Credit Card Companies - Liberty Plug-Ins

Table 5-29. TRC PEV/EVSE Ecosystem – Active Influencers

Local Government - Alamo Area Council of Governments - Austin-San Antonio Corridor Council - Capital Area Council of Governments - Capital Area Metropolitan Planning - Capital Metro (Austin) - Central Texas Clean Cities - City of Austin - City of Boerne - City of Cedar Park - City of Dripping Springs - City of Elgin - City of Garden Ridge - City of Georgetown - City of Houston - City of Kyle - City of Pflugerville - City of Round Rock - City of San Antonio - City of San Marcos - City of Schertz - City of Seguin - City of Taylor - Comal County Engineers - Greater Austin Chambers of Commerce - New Braunfels Chambers of Commerce - North Central Texas Council of Governments - Travis County - Travis County Facilities Management Department - VIA (San Antonio Bus Transit)	**State Government** - Electric Reliability Council of Texas - Lower Colorado River Authority - Public Utility Commission of Texas - Texas Commission of Environmental Quality - Texas Department of Transportation **Federal Government** - Department of Energy - Department of Transportation - Environmental Protection Agency - Internal Revenue Service **Research Entities/Collaboration** - Build San Antonio Green - Center for the Commercialization of Electric Technologies - CleanTX Foundation - Clinton Climate Initiative - EDF - Electric Power Research Institute - Environment Texas - Houston Advanced Research - Mission Verde Alliance - Pecan Street - Plug-In Texas - San Antonio Clean Technology Forum - South Central Partnership for Energy - Southwest Research Institute - Southwest Research Institute - Texas Renewable Energy Industry Association - US Green Building Council	**Universities** - Southwestern University - Texas A&M - Texas State University - University of Texas - Austin - University of Texas - San Antonio **Industry Consultants** - EcoGreen Hotel - Good Company - ICF International - SAIC - Tuttle Consulting

5.8 Implications of Adhering to ERCOT Policies and Guidelines

Understanding that there may be a new major electricity-consuming source in the state, ERCOT is proactively interested in understanding the market. Today, there are no connections between ERCOT and EVSE. However, that is expected to change as EVSE and PEVs become more prevalent. Therefore, it would behoove TRC to invest the time to determine where there may be future activities between ERCOT, utilities, and EVSE operators.

This should be done on several fronts:

- Operational – ERCOT programs that may directly or indirectly effect EVSE operations
- Interoperability/integration – What devices, systems, and/or applications need to be integrated to allow ERCOT to influence EVSE activities?

ADDENDUM C
UTILITY AND PRIVATE EVSE BUSINESS MODEL TEMPLATES

Please refer to the Utility and Private EVSE Business Model Template Excel® workbooks accompanying this report.

Section 6
EVSE TECHNOLOGY INTEROPERABILITY ROADMAP

6.1 Overview

Successful and seamless integration of technologies, systems, and applications will be imperative to the success of the plug-in electric vehicle (PEV)/electric vehicle supply equipment (EVSE) industry. Historically, system integration has been a challenge for utilities and their vendors, due in large part to proprietary systems and technologies. This challenge will significantly increase because the PEV is a technology with the ability to cross jurisdictions, networks, and service territories at will. The PEV and EVSE ecosystem needs to address this challenge, as the ability to allow PEV owners to have a hassle-free driving and charging experience will accelerate the growth of the industry.

The Texas River Cities Plug-In Electric Vehicle Initiative (TRC) stakeholders went through a rigorous and structured process to identify and prioritize the key integration points between the technologies. This section describes the process used, provides documentation on the key components requiring integration, identifies and prioritizes integration points, and suggests a timeframe for development. In total, 194 integration points were documented, with 49 identified as priorities.

6.2 Recommendations

Recommendation 1

Convene a subteam to develop and execute a plan for addressing the highest priority integration/interoperability issues outlined in Section 6 – those addressable at the regional level, and identified as critical needs within the next two years.

Recommendation 2

Develop a set of general functional and technical requirements for TRC to recommend utilities within the TRC region formally adopt for use. These requirements will be the foundation for selecting technologies, systems, and applications that could be installed in the TRC area as part of the regional infrastructure interoperability plan.

Recommendation 3

Identify “integration clusters” –groups of integration points that may all be simultaneously addressed with the adoption of a specification or interoperability standard.

Recommendation 4

Periodically update the included roadmap matrices to reflect new devices, systems, and applications that would create new integration points.

Recommendation 5

TRC will facilitate the investigation of a utility PEV infrastructure reciprocity agreement across the TRC region, allowing customers of one utility's network program in the region seamless access to other utilities' networks without an additional fee associated with it.

6.3 Methodology for Identifying Integration Points

The primary focus of this subtask was to develop an interoperability roadmap that identifies where the major integration issues may occur as EVSE and systems are deployed across the TRC utility service territory. Specifically, some devices, systems, and applications will be confined to utility service territories, while others will need to operate seamlessly between them. In order to comprehensively document these integration points, an inventory was developed of devices, systems, and applications that are or will be deployed as part of the EVSE rollout.

Once the inventory was developed, the interrelationships between each of the devices, systems, and applications were determined through the development of six integration matrices:

1. Device to Device
2. System to Device
3. Application to Device
4. Application to System
5. System to System
6. Application to Application

Subtask leaders were appointed and stakeholders were offered the chance to participate on this subtask. There were 19 members of the subtask. Conference calls and meetings were held to fill out the matrices using the process described below:

1. Identify where integration points may occur between the different components.
2. Identify and prioritize the integration points that are key components to accelerated PEV adoption, require further development and documentation, and are required in the short term (less than five years). These were denoted with a "P."
3. Estimate the timeline required to complete the integration.

As the various matrices were developed and integration points identified, team members suggested that a time element be included as part of the documentation. This would help the implementation team determine where to focus its efforts as plans rolled out in the TRC region. Although it would be very difficult to pinpoint a specific year for each of the integration points, it was felt that a time range would help prioritize efforts. Experience with other technology and program activities underway in the utility industry would suggest that timeframes for these activities could be grouped as follows: 0-2 years, 2-5 years, and 5-10 years.

Table 6-1 lists the six integration matrices, the number of integration points and priority integration points identified for each. Overall, 194 integration points were identified, with 49 of these being considered priorities. The matrices document the specific areas where interoperability standards will need to be developed. They also provide additional insight and recommendations for action for the integration points identified as priorities, since these would logically be the first ones addressed by TRC when deployment activities begin.

Table 6-1. Summary of Integration Points by Matrix

Matrix	Number of Integration Points Identified	Number of Priority Integration Points
Device to Device	30	8
System to Device	36	5
Application to Device	52	17
Application to System	28	8
System to System	15	4
Application to Application	33	7
Total	194	49

6.3.1 Inventory of Devices Requiring Integration

A **device** is defined as a piece of hardware used to perform a specific set of functions for the customer or company. Table 6-2 lists the devices will require some form of integration with other devices, systems, or applications in the future. With respect to coverage, devices may be located in a specific utility territory, or they may be located throughout the entire TRC.

Table 6-2. Devices Requiring Integration with Systems or Applications

Device Name	Description	Coverage
PEV	Plug-in Electric Vehicle	TRC
Dedicated EVSE	EVSE used and/or owned by one person	Service Territory
Shared EVSE	EVSE available to multiple PEV owners	TRC
Smart Meter	Component of smart grid – records interval data	Service Territory
Home Energy Management (HEM) Gateway	Manages/monitors appliance energy use	Service Territory
Smart-Grid Communications Node	Used to manage and monitor smart-grid communications infrastructure	Service Territory
Smart Thermostat (TSAT)	Home thermostat that can be managed remotely by customer and/or utility	Service Territory
Direct Load Control (DLC) Switch	Used to turn energy-intensive appliances off and on during a demand-response event	Service Territory
Smart Phone	Mobile (cellular) phone with applications that allow customer to perform various functions, such as EVSE payment, EVSE location, and charge control	TRC
Smart Appliance	Home appliance with embedded intelligence and/or remote management capabilities	Service Territory
Home Personal Computer (PC)/Tablet	Based in customer’s home, used to monitor energy, dedicated EVSE, and PEV usage	Service Territory
Radio-Frequency Identification (RFID) Tag	Used to initiate PEV charging sessions	TRC

6.3.2 Inventory of Systems Requiring Integration

A **system** is the software foundation for the basic control and operation of a device. Table 6-3 lists systems that will require integration with other devices or applications. Note that since several of these may be legacy utility systems, integration efforts will be more complicated.

Table 6-3. Systems Requiring Integration with Devices or Applications

System Name	Description	Coverage
PEV Onboard Telematics System	Manages PEV activities in the car (e.g., OnStar®)	TRC
EVSE Management System	Remotely manages, monitors, diagnoses, and supports EVSE	TRC
Advanced Metering Infrastructure (AMI) Headend	Element management system for smart meters	Service Territory
Meter Data Management System	Central database for collection of smart-meter data	Service Territory
Smart Grid Communications Network Management System (NMS)	Remotely manages, monitors, diagnoses, and supports communication devices	Service Territory
Demand-Response Management System	Element management and control system for utility demand-response (DR) programs	Service Territory
HEM System	Monitors and manages customer appliance usage	Service Territory
Distribution Management System (DMS)	Monitors and manages utility distribution devices	Service Territory
Customer Information System (CIS)	Central system for customer billing and demographic information	Service Territory

6.3.3 Inventory of Applications Requiring Integration

Applications are software developed to perform specific actions through the control of a device or to collect and analyze information from devices, systems, or other applications. Table 6-4 shows the applications list developed by the subteam, realizing that this list will grow significantly as the market grows and customers require increased value and information.

Table 6-4. Applications Requiring Integration with Devices or Systems

Application Name	Description	Coverage
EVSE Locator	Identifies and locates charging stations	TRC
EVSE Provisioning/ Monitoring	Provides remote EVSE operations, monitoring, and troubleshooting by owner or service provider	TRC
EVSE Reservation Application	Provides customers the ability to reserve shared EVSE in advance of arrival	TRC
EVSE Payment Application	Payment process for use of EVSE	TRC
Basic EVSE Charge	Manual charge	TRC
Customer-Control EVSE Charge	Automated charging based on specific user requirements and rates	Service Territory
Utility-Control EVSE Charge	Automated charging based on specific utility operational requirements	Service Territory

Application Name	Description	Coverage
Workplace-Control Advanced EVSE Charge	Optimizes specific utility rates (e.g., demand charge limiting)	TRC
Utility Customer Portal	Allows customers to view their interval electricity usage from their smart meter	Service Territory
Customer Appliance Monitoring	Monitors customers appliance energy usage	Service Territory
Demand-Response	Event notification, execution, monitoring, and verification of a utility-sponsored (and customer-accepted) load-control event	Service Territory
Voltage Monitoring	Systematic monitoring of secondary distribution voltages	Service Territory
Transformer Load Monitoring	Systematic monitoring of transformer loading	Service Territory
Integrated Volt/Var Management	Management of capacitor banks and other equipment to achieve utility operational goals	Service Territory

6.3.4 Integration Matrices

Tables 6-5 through 6-10 are the matrices developed to identify the integration points between devices, systems, and applications. The numbers in the cells below are the integration-point identification numbers. The numbers in red with a P were determined by the subteam to be priority integration points. These will be the ones to investigate first as part of the implementation plan.

Table 6-5. Device to Device

Device	Device											
	PEV	Dedicated EVSE	Shared EVSE	Smart Meter	HEM Gateway	Smart-Grid Communications Node	Smart TSAT	DLC Switch	Smart Phone	Smart Appliance	Home PC/Tablet	RFID Tag
PEVs		1P	2P		3P				4		5	6
Dedicated EVSE	1P			7P	8P	9			10		11	
Shared EVSE	2P			12P		13			14P			15P
Smart Meter		7P	12P		16	17	18	19		20	21	
HEM Gateway	3P	8P		16		22	23	24	25	26	27	
Smart-Grid Communications Node		9	13	17	22			28				
Smart TSAT				18	23				29		30	
DLC Switch				19	24	28						
Smart Phone	4	10	14P		25		29					
Smart Appliance				20	26							
Home PC/Tablet	5	11		21	27		30					
RFID Tag	6		15P									

Red/P = Priority

Table 6-6. System to Device

System	Device											
	PEV	Dedicated EVSE	Shared EVSE	Smart Meter	HEM Gateway	Smart-Grid Communications Node	Smart TSAT	DLC Switch	Smart Phone	Smart Appliance	Home PC/ Tablet	RFID Tag
PEV Onboard Telematics System	31	34P	41P						62			
EVSE Management System	32	35P	42P	45					63			66P
AMI Headend		36		46	51							
Meter Data Management System		37		47	52							
Smart-Grid Communications NMS		38		48		55		60				
Demand-Response Management System		39	43	49	53	56	58	61				
HEM System	33	40		50	54		59			64	65	
DMS			44			57						
CIS												

Red/P = Priority

Table 6-7. Application to Device

Application	Device											
	PEV	Dedicated EVSE	Shared EVSE	Smart Meter	HEM Gateway	Smart-Grid Communications Node	Smart TSAT	DLC Switch	Smart Phone	Smart Appliance	Home PC/ Tablet	RFID Tag
EVSE Locator	67		79						104			
EVSE Reservation	68		80P						105			115P
EVSE Provisioning / Monitoring		71P	81P			96						
Basic EVSE Charge	69	72P	82P									116P
Customer-Control EVSE Charge		73P			91						111	
Utility-Control EVSE Charge		74P	83P		92							
Workplace-Control Advanced EVSE Charge		75P	84P									117P
EVSE Payment Application	70	76P	85P						106P		112	118P
Utility Customer Portal				87	93				107		113	
Customer Appliance Monitoring		77			94		101		108	109	114	
Demand Response		78	86		95	97	102	103		110		
Voltage Monitoring				88		98						
Transformer Load Monitoring				89		99						
Integrated Volt/Var Management				90		100						

Red/P = Priority

Table 6-8. Application to System

Application	System								
	PEV Onboard System	EVSE Management System	AMI Headend	Meter Data Management System	Smart-Grid Communications NMS	Demand-Response Management System	HEM System	DMS	CIS
EVSE Locator	119P								
EVSE Reservation	120P								
EVSE Provisioning / Monitoring		121P			133				
Basic EVSE Charge		122P							
Customer-Control EVSE Charge		123P					139		
Utility-Control EVSE Charge		124P				137			
Workplace-Control Advanced EVSE Charge		125P							
EVSE Payment Application		126P							145
Utility Customer Portal				131					146
Customer Appliance Monitoring			127	132			140		
Demand Response			128			138	141		
Voltage Monitoring			129		134			142	
Transformer Load Monitoring			130		135			143	
Integrated Volt/Var Management					136			144	

Red/P = Priority

Table 6-9. System to System

System	System								
	PEV Onboard System	EVSE Management System	AMI Headend	Meter Data Management System	Smart Grid Communications NMS	Demand-Response Management System	HEM System	DMS	CIS
PEV Onboard System		147P							
EVSE Management System	147P				148P	149P	150P		
AMI Headend				151	152	153	154		155
Meter Data Management System			151				156		157
Smart-Grid Communications NMS		148P	152			158	159	160	
Demand-Response Management System		149P	153		158		161		
HEM System		150P	154	156	159	161			
DMS					160				
CIS			155	157					

Red/P = Priority

Table 6-10. Application to Application

Application	Application													
	EVSE Locator	EVSE Reservation	EVSE Provisioning/ Monitoring	Basic EVSE Charge	Customer-Control EVSE Charge	Utility-Control EVSE Charge	Workplace-Control Advanced EVSE Charge	EVSE Payment Application	Utility Customer Portal	Customer Appliance Monitoring	Demand Response	Voltage Monitoring	Transformer Load Monitoring	Integrated Volt/Var Management
EVSE Locator		162P							163					
EVSE Reservation System	162P		164	165	166	167	168	169P			170			
EVSE Provisioning/ Monitoring		164		171				172P		173	174			
Basic EVSE Charge		165	171					175P		176	177			
Customer-Control EVSE Charge		166						178P		179	180			
Utility-Control EVSE Charge		167						181P	182		183	184	185	186
Workplace-Control Advanced EVSE Charge		168						187P						
EVSE Payment Application		169P	172P	175P	178P	181P	187P							
Utility Customer Portal	163					182				188	189			
Customer Appliance Monitoring			173	176	179				188		190			
Demand Response		170	174	177	180	183			189	190		191	192	193
Voltage Monitoring						184					191			194
Transformer Load Monitoring						185					192			
Integrated Volt/Var Management						186					193	194		

Red/P = Priority

6.4 Priority Integration Point Roadmaps

The process used to identify the integration points is complex and encompassing. In addition to intersecting devices, systems, and applications, integration points also cross service territories and city boundaries. Figure 6-1 illustrates the complexity and challenge of the interoperability required to monitor and manage PEV and EVSE activities across the TRC. Figure 6-2 is an example of a potential future activity: aggregation of PEV loads for a demand-response event. This activity will require the integration of devices (PEVs, shared EVSE, and dedicated EVSE) and systems (PEV onboard telematics and EVSE management) to enable the new application called Demand Aggregation.

Figure 6-1. Integrating Smart Grid and EVSE Infrastructure in the TRC Region

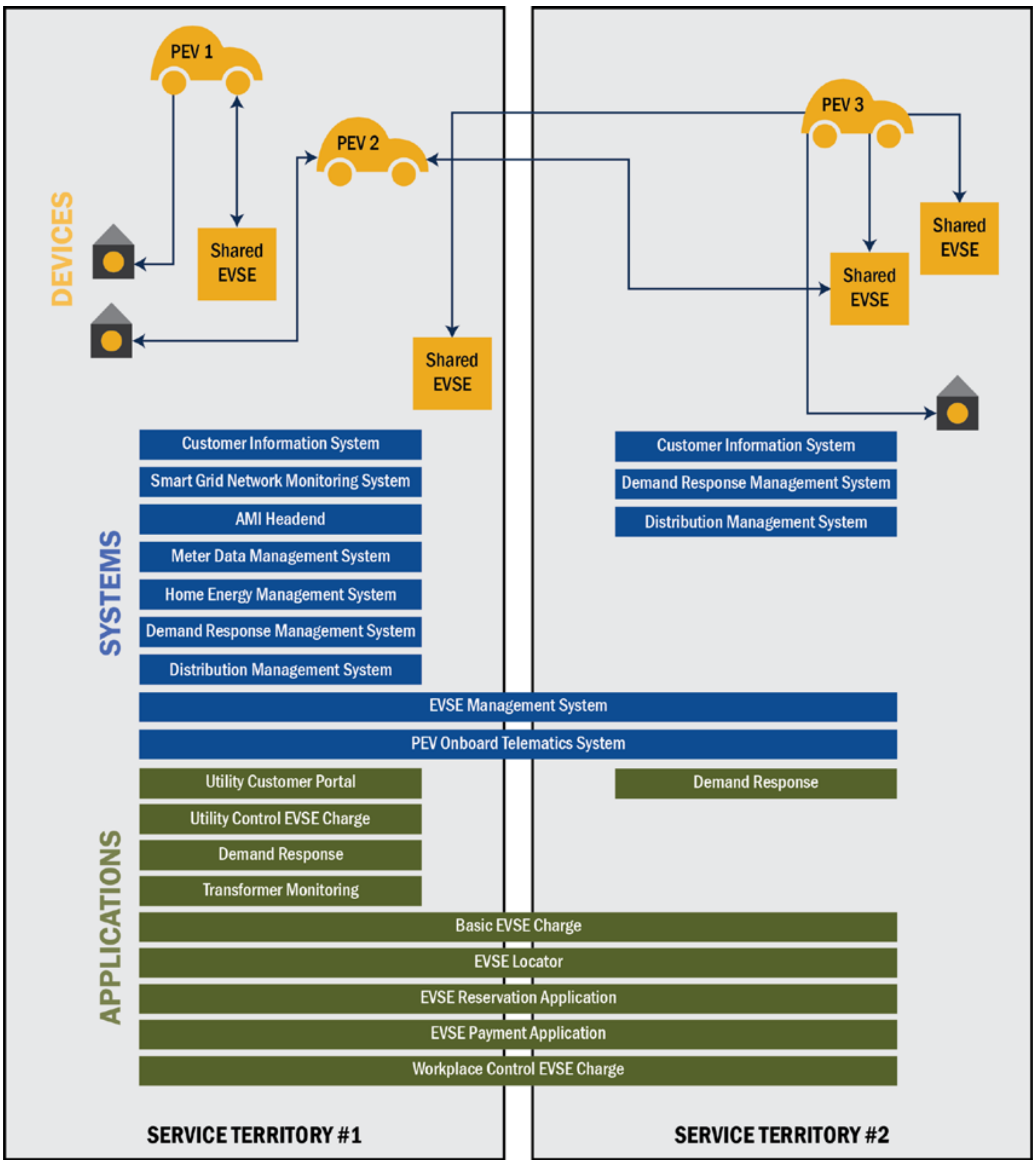
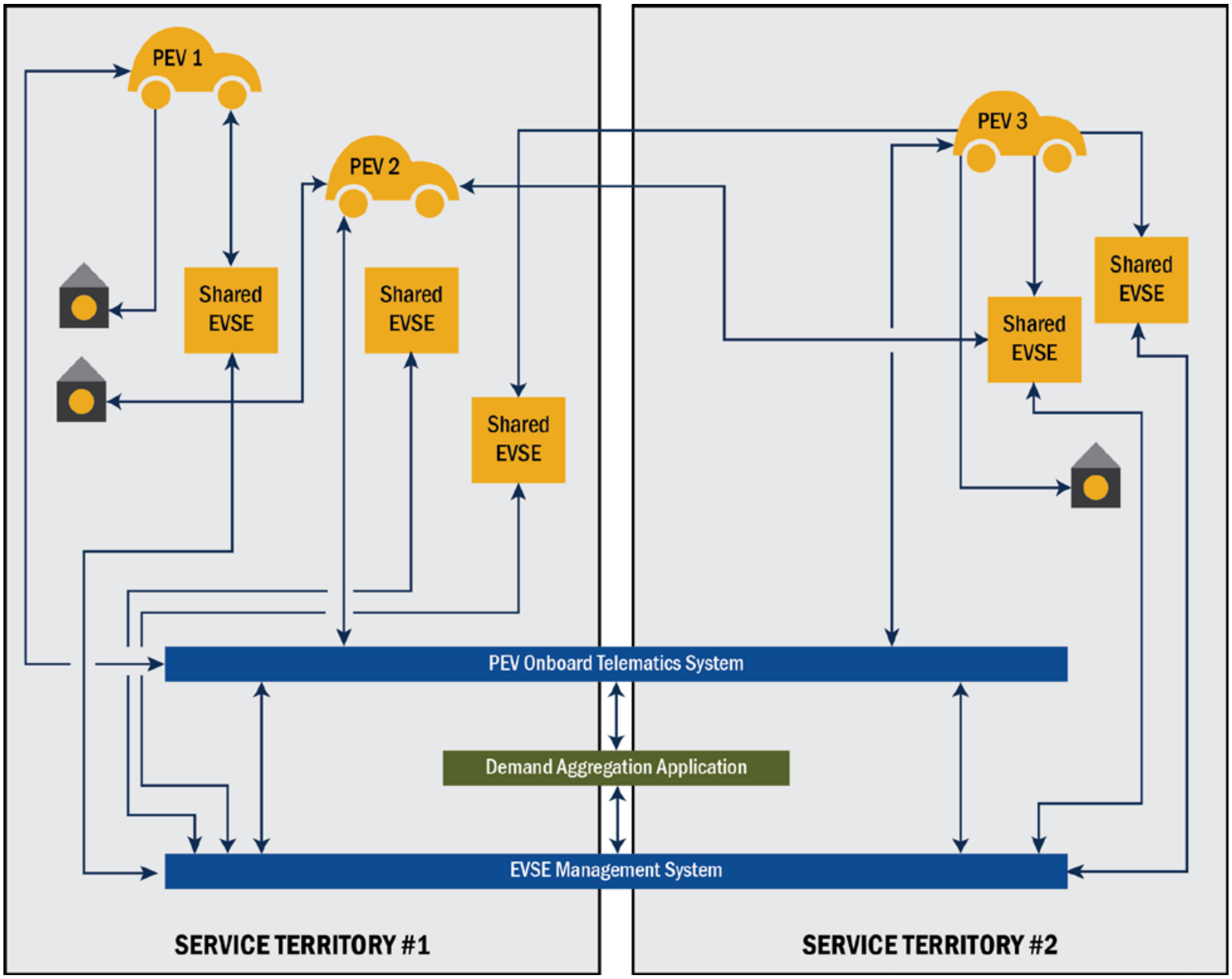


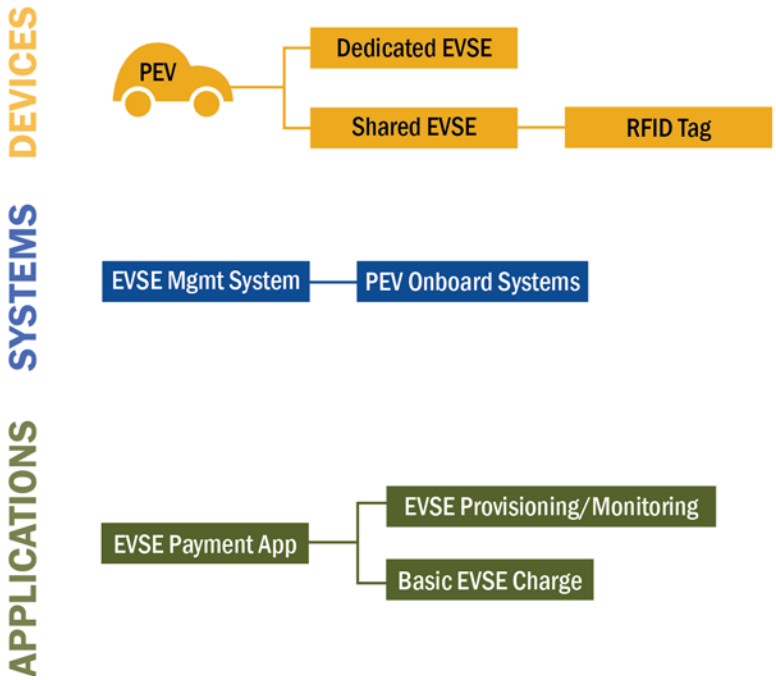
Figure 6-2. Device, System, and Application Integration Example



After identifying, documenting, and prioritizing the key integration points, the team developed roadmaps for all integration points identified as priorities that warrant immediate consideration. These roadmaps provide a visual representation for moving forward in the next phase, clearly showing the relationship among all priority integration points.

Figure 6-3 shows the priority integration points for all systems, devices, and applications required in the next two years for like components. An integration point is represented as a connecting line. For example, the PEV has two priority integration points, one with the dedicated EVSE and another with the shared EVSE.

Figure 6-3. Priority Integration Points Required in the 0-2 Year Timeframe



Figures 6-4 to 6-6 show these relationships as well, but also show priority integration points among dissimilar components. These integration points are listed within the box for each component. For example, the RFID tag device in Figure 6-4 has an integration point with the shared EVSE device, but it also has integration points with basic EVSE charge, EVSE reservation, and EVSE payment applications. The RFID tag device also has an integration point with the EVSE management system.

Note that the PEV does not have any priority integration points with applications or systems, only the two devices identified. Also note in Figure 6-6 that the EVSE reservation application does not have an integration point with another application, but does have an integration point with the RFID tag device.

Figure 6-4. Device Priority Integration Points Required in the 0-2 Year Timeframe

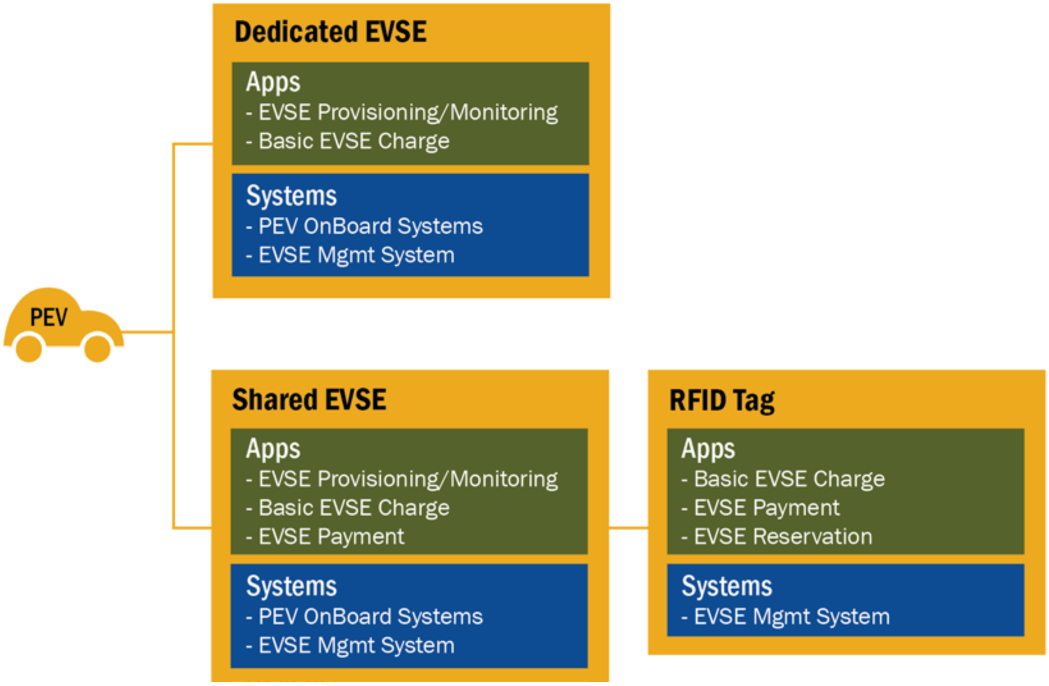


Figure 6-5. System Priority Integration Points Required in the 0-2 Year Timeframe

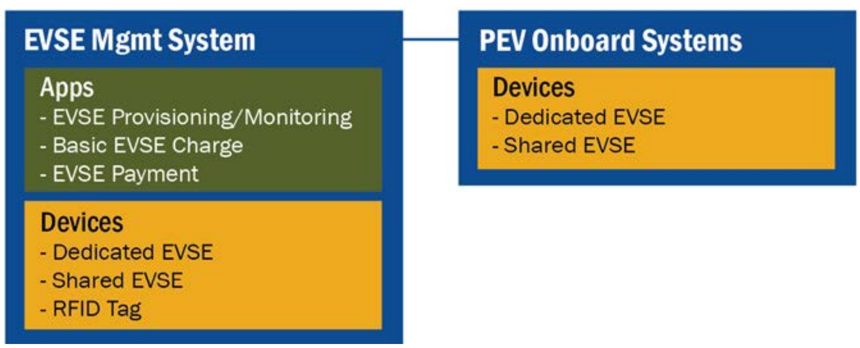
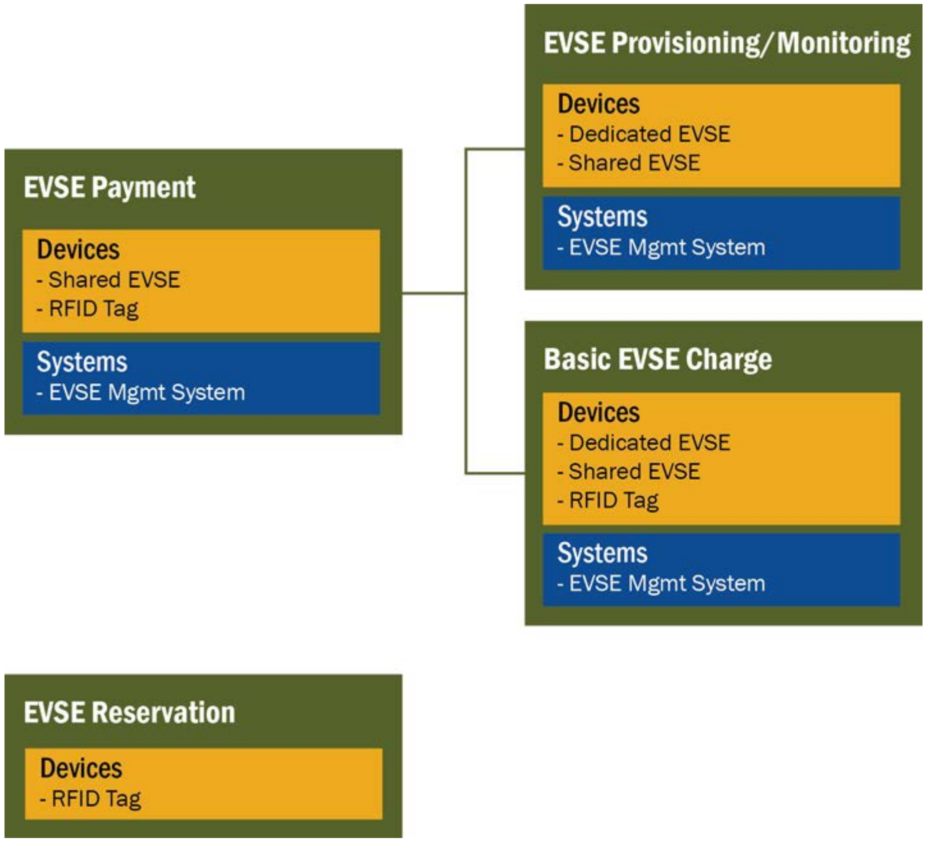


Figure 6-6. Application Priority Integration Points Required in the 0-2 Year Timeframe



Figures 6-7 through 6-10 show these same relationships for all priority integration points in the two- to five-year timeframe.

Figure 6-7. Priority Integration Points Required in the 2-5 Year Timeframe

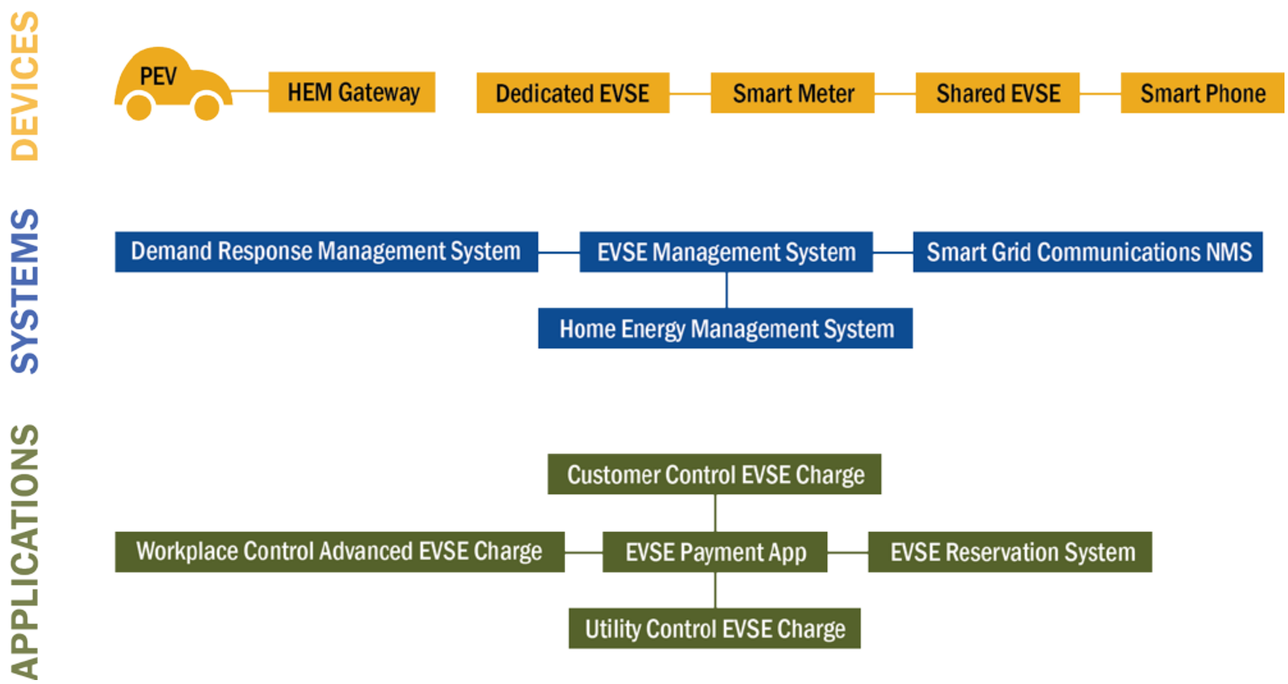


Figure 6-8. Device Priority Integration Points Required in the 2-5 Year Timeframe

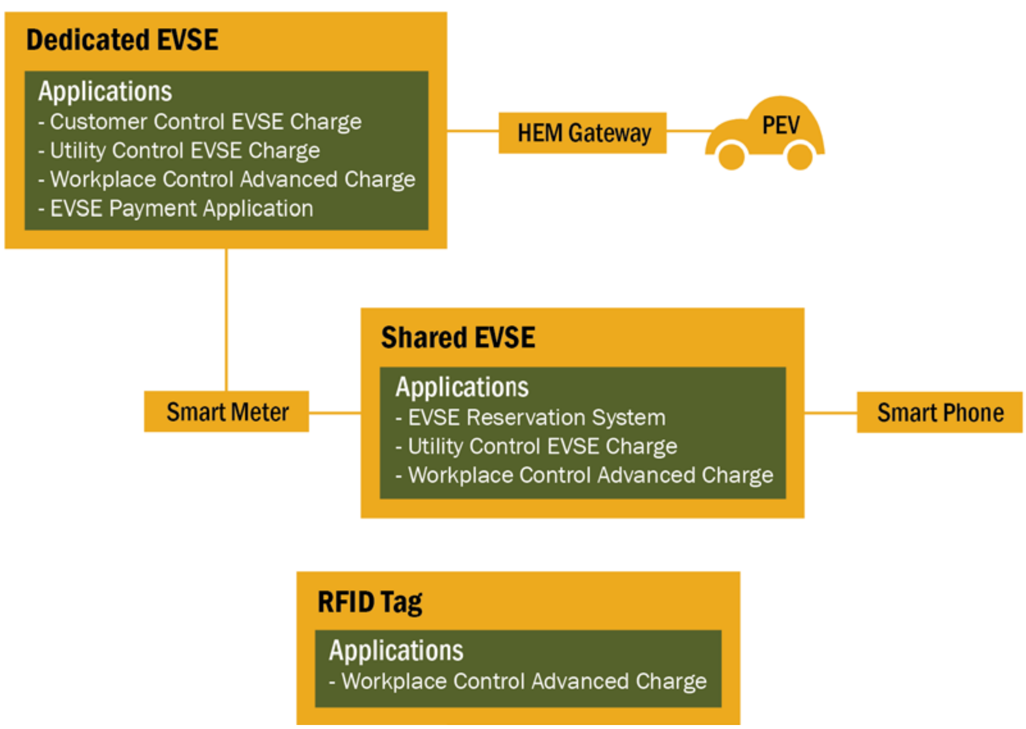


Figure 6-9. Systems Priority Integration Points Required in the 2-5 Year Timeframe

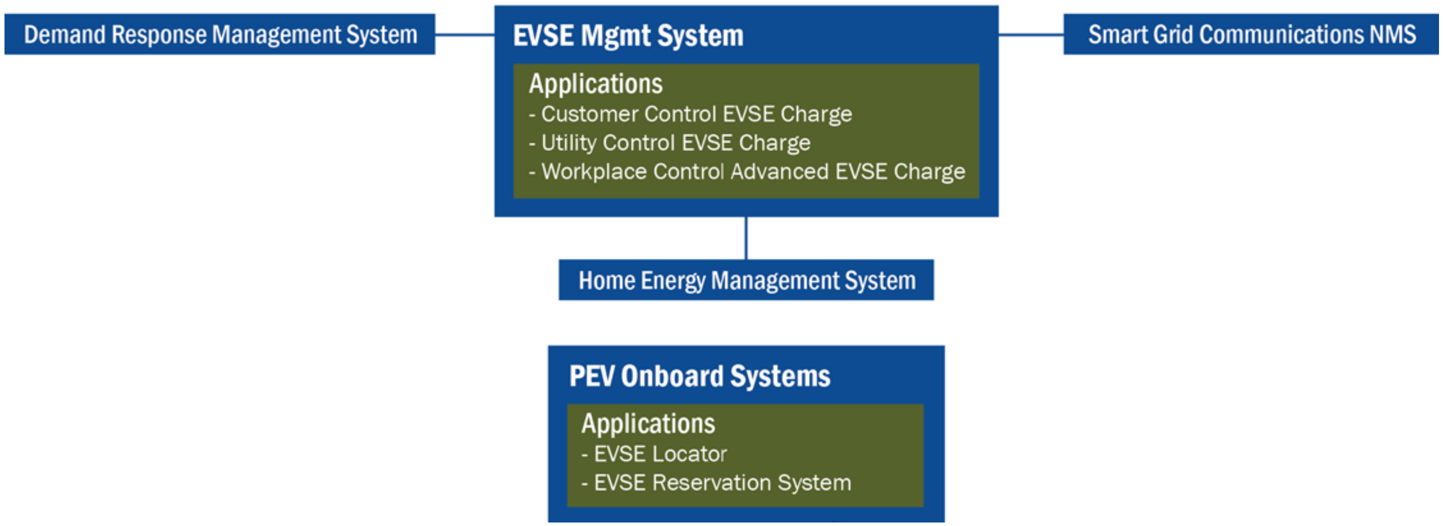
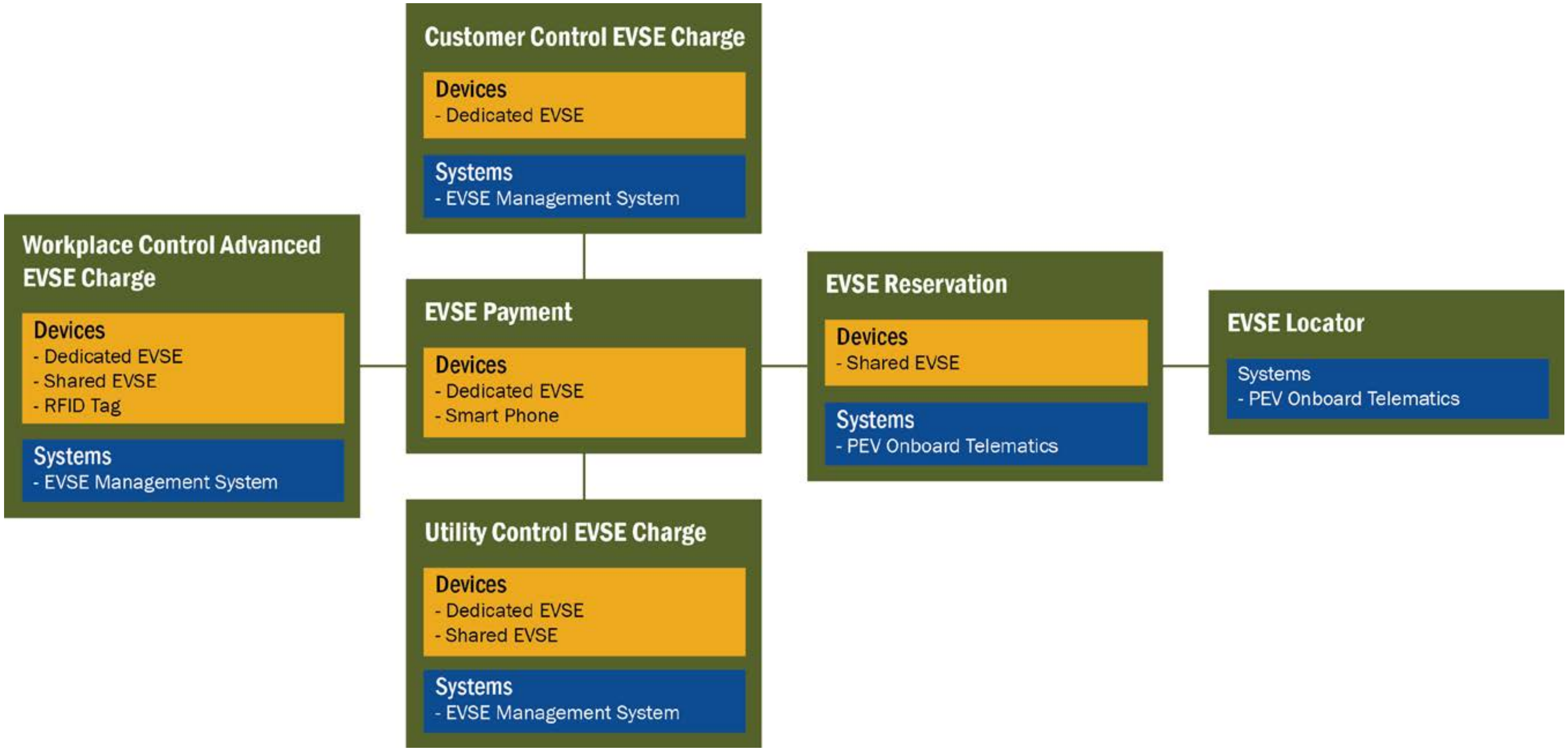


Figure 6-10. Applications Priority Integration Points Required in the 2-5 Year Timeframe



6.5 Documentation of Priority Integration Points

The primary focus of the activities described above was to document the integration points that will occur as the PEV/EVSE and utility/smart-grid industries intersect in the future. The rest of this section provides documentation and timing recommendations for the 194 integration points. Table 6-11 contains the 49 priority integration points. Table 6-12 contains the entire list of 194 integration points.

Table 6-11. Priority Integration Points

ID #	Integration Point	Matrix	Timing	Documentation
1P	PEV – Dedicated EVSE	Device to Device	0-2 years	Initial provisioning enables automatic device recognition for future charging, similar to a laptop and home wireless router. The EVSE allows multiple charging levels to optimize charging time with variable electric rates.
2P	PEV – Shared EVSE	Device to Device	0-2 years	Connection standardization will be required. EVSE accessibility issues will vary per site type (e.g., workplace, multifamily, public). One EVSE could serve multiple parking spaces and/or multiple PEVs. Real-time status of EVSE available to PEV.
3P	PEV – HEM Gateway	Device to Device	2-5 years	The HEM gateway is the hub for monitoring and controlling appliances in the home. Although it will not control the PEV, it can collect information from the PEVs onboard systems. Initial provisioning enables automatic device recognition for future communication, similar to a laptop and home wireless router. The HEM gateway location will be important with regard to signal strength and PEV parking location if using Wi-Fi communication between devices.
7P	Dedicated EVSE – Smart Meter	Device to Device	2-5 years	Several states are considering the requirement to have PEVs metered as a separate load. Unless utilities and EVSE vendors can find a way to agree to have acceptable metrology within the EVSE, a separate meter will need to be installed at the EVSE load panel. Device location will be important with regard to signal strength if Wi-Fi or ZigBee® communication is required between devices. Wired communication would require utility and EVSE collaboration.
8P	Dedicated EVSE – HEM Gateway	Device to Device	2-5 years	Device location will be important with regard to signal strength if Wi-Fi communication is used between devices. Wired Ethernet communication would also be possible.
12P	Shared EVSE – Smart Meter	Device to Device	2-5 years	Device location will be important with regard to signal strength if Wi-Fi communication is used between devices. Wired communication would require utility and EVSE collaboration. Smart meter has the capability to track multiple accounts, with fine-granularity time intervals.
14P	Shared EVSE – Smart Phone	Device to Device	2-5 years	The EVSE may use either Wi-Fi or cellular communications. Phone applications are required. Real-time status of EVSE will be available via smart phone.

ID #	Integration Point	Matrix	Timing	Documentation
15P	Shared EVSE – RFID Tag	Device to Device	0-2 years	The EVSE recognizes car characteristics and user account information, including billing and rate information. The EVSE locks out other users until current user authorizes early completion or session is complete.
34P	PEV Onboard System – Dedicated EVSE	System to Device	0-2 years	The system sends a message to user in the event of charge malfunction. The system provides the status of charging to the user via a web portal or phone application.
35P	EVSE Management System – Dedicated EVSE	System to Device	0-2 years	The EVSE management system is the basic operating system for EVSE. The system's key responsibilities include provisioning the EVSE, monitoring it on an ongoing basis, and alerting the owner if any issues arise.
41P	PEV Onboard System – Shared EVSE	System to Device	0-2 years	The system displays real-time status, charging-level capabilities, and location of devices. The system shows device availability in a reservation system, if applicable.
42P	EVSE Management System – Shared EVSE	System to Device	0-2 years	The EVSE management system is the basic operating system for EVSE. The system's key responsibilities include provisioning EVSE, monitoring it on an ongoing basis, and alerting the operator if any issues arise. Currently, EVSE management systems are tied to specific EVSE; hence, a customer wanting to install multiple EVSE types may need more than one system.
66P	EVSE Management System – RFID Tag	System to Device	0-2 years	RFID tags contain customer information associated with the PEV. This information is required to connect to an EVSE. The EVSE management system will allow transfer of information for reservations, billing, and processing.
71P	EVSE Provisioning/Monitoring – Dedicated EVSE	Application to Device	0-2 years	The EVSE is provisioned with PEV, HEM, phone, and computer. The application enables users to receive trouble calls, provides status of charge, and displays charge history. The application analyzes charging history and available rates for most cost-effective charging.
72P	Basic EVSE Charge – Dedicated EVSE	Application to Device	0-2 years	Full charging is initiated upon connection, with no further human interaction required.
73P	Customer-Control EVSE Charge – Dedicated EVSE	Application to Device	2-5 years	Preset charging parameters can be changed by the user during charging if desired.
74P	Utility-Control EVSE Charge – Dedicated EVSE	Application to Device	2-5 years	Utilities – through customers participating in demand-response programs – may require the capability to remotely monitor and manage EVSE operations.

ID #	Integration Point	Matrix	Timing	Documentation
75P	Workplace-Control Advanced EVSE Charge – Dedicated EVSE	Application to Device	2-5 years	For workplace businesses, public facilities, or commercial establishments that have a utility demand-charge component to their rates, it will be imperative to have the capability to remotely and automatically manage their EVSE to avoid setting a new peak and increasing electric costs through higher demand charges.
76P	EVSE Payment Application – Dedicated EVSE	Application to Device	2-5 years	Dedicated EVSE are either for homes or for businesses that can restrict who uses the EVSE. There may be specific instances where workplaces may offer fee-based EVSE services, and therefore will utilize a payment application.
80P	EVSE Reservation Application – Shared EVSE	Application to Device	2-5 years	The reservation process will require a penalty for broken/missed reservations. It will also require limits for the number of reservations in a given time period, time period of each reservation, and reservation advance time. Recurring reservations may be desired for certain situations such as workplaces.
81P	EVSE Provisioning/Monitoring – Shared EVSE	Application to Device	0-2 years	This application is used to initially to commission an EVSE for use, and then to monitor it regularly for any event issues.
82P	Basic EVSE Charge – Shared EVSE	Application to Device	0-2 years	This will allow a PEV owner to charge at a publicly available EVSE.
83P	Utility-Control EVSE Charge – Shared EVSE	Application to Device	2-5 years	Utilities – through customers participating in demand-response programs – may require the capability to remotely monitor and manage EVSE operations.
84P	Workplace-Control Advanced EVSE Charge – Shared EVSE	Application to Device	2-5 years	For workplace businesses, public facilities, or commercial establishments that have a utility demand-charge component to their rates, it will be imperative to have the capability to remotely and automatically manage their EVSE to avoid setting a new peak and increasing electric costs through higher demand charges.
85P	EVSE Payment Application – Shared EVSE	Application to Device	0-2 years	This application allows the shared EVSE to submit charging information for billing purposes.
106P	EVSE Payment Application – Smart Phone	Application to Device	2-5 years	This application should enable payment and charge session initiation directly from a smart phone by using credit/debit-card numbers, bank accounts, or other online accounts (e.g., PayPal®). The application should allow a user-defined monetary limit per session.
115P	EVSE Reservation Application– RFID Tag	Application to Device	0-2 years	This application allows PEV owners to utilize a system to reserve an EVSE anywhere in the TRC region.

ID #	Integration Point	Matrix	Timing	Documentation
116P	Basic EVSE Charge – RFID Tag	Application to Device	0-2 years	This application is the most common method for initiating a charge session with an EVSE. The primary challenge is to develop a universal RFID tag that can be used at any EVSE within the TRC region.
117P	Workplace-Control Advanced EVSE Charge – RFID Tag	Application to Device	2-5 years	The RFID tag will contain specific customer preferences that will tell the EVSE operator whether the customer is willing to have his or her PEV disconnected during a demand-response event.
118P	EVSE Payment Application – RFID Tag	Application to Device	0-2 years	The RFID tag contains customer information that is required to complete the EVSE charging transaction.
119P	EVSE Locator – PEV Onboard System	Application to System	2-5 years	The PEV onboard system is essentially the operating system and information hub for the PEV. This is the system that provides information to help locate EVSE. The key issue is to develop an EVSE locator that includes all EVSE within the TRC region.
120P	EVSE Reservation Application – PEV Onboard System	Application to System	2-5 years	The PEV onboard system is essentially the operating system and information hub for the PEV. This is the system that provides information to help locate and reserve EVSE. The key issue is to develop an EVSE reservation application that allows a driver to reserve EVSE throughout the TRC region.
121P	EVSE Provisioning/Monitoring – EVSE Management System	Application to System	0-2 years	The EVSE management system is the basic operating system for EVSE. A key responsibility of the system is to provision EVSE, monitor it on an ongoing basis, and alert the operator if any issues arise. Currently, EVSE management systems are tied to specific EVSE; hence, a customer wanting to install multiple EVSE types may need more than one system.
122P	Basic EVSE Charge – EVSE Management System	Application to System	0-2 years	The EVSE management system will be responsible for monitoring EVSE and authorizing charge events.
123P	Customer-Control EVSE Charge – EVSE Management System	Application to System	2-5 years	The EVSE management system will be responsible for authorizing remote customer charge or charge-suspension events.
124P	Utility-Control EVSE Charge – EVSE Management System	Application to System	2-5 years	The EVSE management system will be responsible for authorizing remote utility charge or charge-suspension events.
125P	Workplace-Control Advanced EVSE Charge – EVSE Management System	Application to System	2-5 years	The EVSE management system will be responsible for authorizing remote workplace charge or charge-suspension events.

ID #	Integration Point	Matrix	Timing	Documentation
126P	EVSE Payment Application – EVSE Management System	Application to System	0-2 years	Currently, this system and application are embedded together as part of proprietary EVSE solutions. However, one or both systems will need to become “open” if there are to be seamless charging and payment activities throughout the TRC region.
147P	PEV Onboard System – EVSE Management System	System to System	0-2 years	This is the key integration point between the PEV and EVSE. Note that there are multiple onboard systems (each auto manufacturer has one) and EVSE management systems (each EVSE manufacturer has one). The Society of Automotive Engineers (SAE®) is working on a communications standard for PEVs. The same effort must take place with EVSE.
148P	EVSE Management System – Smart Grid Communications NMS	System to System	2-5 years	The EVSE management system relies on a communication system embedded in EVSE in order to effectively manage the equipment. If the system cannot connect to an EVSE, it will rely on the smart grid communications NMS to troubleshoot and diagnose the problem.
149P	EVSE Management System – Demand-Response Management System	System to System	2-5 years	The EVSE management system controls the activities of the EVSE, including suspending charge events during a peak-load event. The utility demand-response management system is the system that authorizes (and in the future, monitors) these events.
150P	EVSE Management System – HEM System	System to System	2-5 years	The EVSE management system controls the activities of the EVSE, including suspending charge events during a peak-load event. The HEM system is the system customers will use to monitor their energy usage and load and to remotely authorize the use of such devices as the dedicated EVSE.
162P	EVSE Locator – EVSE Reservation Application	Application to Application	2-5 years	EVSE Locator and EVSE Reservation are currently separate applications. As PEVs and EVSE become more prevalent, drivers will want to locate and reserve EVSE based on their pre-determined preferences.
169P	EVSE Reservation Application – EVSE Payment Application	Application to Application	2-5 years	Minimum payment at time of reservation could be required to reduce the number of broken reservations.
172P	EVSE Provisioning/Monitoring – EVSE Payment Application	Application to Application	0-2 years	In the event of a problem with a payment session, the operator may need to monitor, troubleshoot, and diagnose the issue with the EVSE.
175P	Basic EVSE Charge – EVSE Payment Application	Application to Application	0-2 years	The specific charge information from the EVSE will flow into the EVSE payment application to complete the transaction.
178P	Customer-Control EVSE Charge – EVSE Payment Application	Application to Application	2-5 years	The EVSE payment application will need to know and document if a session was interrupted at the PEV customer’s request.

ID #	Integration Point	Matrix	Timing	Documentation
181P	Utility-Control EVSE Charge – EVSE Payment Application	Application to Application	2-5 years	The EVSE payment application will need to know and document if a session was interrupted at the utility's request.
187P	Workplace-Control Advanced EVSE Charge – EVSE Payment Application	Application to Application	2-5 years	The EVSE payment application will need to know and document if a session was interrupted at the workplace's request.

Table 6-12. The 194 Identified Integration Points

ID #	Integration Point	Matrix	Timing	Documentation
1P	PEV – Dedicated EVSE	Device to Device		See Table 6-11 above.
2P	PEV – Shared EVSE	Device to Device		See Table 6-11 above.
3P	PEV – HEM Gateway	Device to Device		See Table 6-11 above.
4	PEV – Smart Phone	Device to Device	2-5 years	The customer will be able to access information on the PEV via smart phone.
5	PEV – Home PC/Tablet	Device to Device	2-5 years	The customer will be able to access information on the PEV via home PC/tablet.
6	PEV – RFID Tag	Device to Device	0-2 years	Each owner who wants to use a shared EVSE system needs an RFID tag.
7P	Dedicated EVSE – Smart Meter	Device to Device		See Table 6-11 above.
8P	Dedicated EVSE – HEM Gateway	Device to Device		See Table 6-11 above.
9	Dedicated EVSE – Smart-Grid Communications Node	Device to Device	2-5 years	For homes without HEM systems, the smart-grid communications node will be the smart-grid device to communicate with the EVSE.
10	Dedicated EVSE – Smart Phone	Device to Device	2-5 years	The customer will be able to monitor/control the activities of a dedicated EVSE remotely with a smart phone.
11	Dedicated EVSE – Home PC/Tablet	Device to Device	2-5 years	The customer will be able to monitor/control the activities of a dedicated EVSE remotely with a home PC/tablet.
12P	Shared EVSE – Smart Meter	Device to Device		See Table 6-11 above.
13	Shared EVSE – Smart Grid Communications Node	Device to Device	2-5 years	The smart grid communications node will be the smart grid device to communicate with a shared EVSE that can be monitored by the utility.
14P	Shared EVSE – Smart Phone	Device to Device		See Table 6-11 above.
15P	Shared EVSE – RFID Tag	Device to Device		See Table 6-11 above

ID #	Integration Point	Matrix	Timing	Documentation
16	Smart Meter – HEM Gateway	Device to Device	2-5 years	Depending on the meter solution, meters may contain the communications gateway to manage other home devices. ZigBee®-enabled meters are an example of this architecture.
17	Smart Meter – Smart Grid Communications Node	Device to Device	0-2 years	The smart grid system uses either nodes or collectors to manage/monitor smart meters.
18	Smart Meter – Smart TSAT	Device to Device	2-5 years	AMI solutions with demand-response capabilities will either use the meter or an HEM system box controller as the central gateway to manage, monitor, and communicate with devices such as the smart TSAT.
19	Smart Meter – DLC Switch	Device to Device	2-5 years	AMI solutions with demand-response capabilities will either use the meter or an HEM system box controller as the central gateway to manage, monitor, and communicate with devices such as the DLC switch.
20	Smart Meter – Smart Appliance	Device to Device	5-10 years	AMI solutions with demand-response capabilities will either use the meter or an HEM system box controller as the central gateway to manage, monitor, and communicate with smart appliances.
21	Smart Meter – Home PC/Tablet	Device to Device	5-10 years	The smart meter may have the capability to push interval data to the home PC/tablet or HEM gateway to allow the customer to perform near-real-time load monitoring.
22	HEM Gateway – Smart Grid Communications Node	Device to Device		The HEM gateway will communicate with the smart grid communications node. This will allow home energy data to be transferred to the node to allow for use with distribution monitoring applications.
23	HEM Gateway – Smart TSAT	Device to Device	2-5 years	AMI solutions with demand-response capabilities will either use the meter or an HEM system box controller as the central gateway to manage, monitor, and communicate with devices such as the smart TSAT.
24	HEM Gateway – DLC Switch	Device to Device	2-5 years	AMI solutions with demand-response capabilities will either use the meter or an HEM system box controller as the central gateway to manage, monitor, and communicate with devices such as the DLC switch.
25	HEM Gateway – Smart Phone	Device to Device	2-5 years	The HEM gateway will connect with the smart phone to allow the customer to view energy and appliance activities using the utility customer portal or customer appliance-monitoring application.

ID #	Integration Point	Matrix	Timing	Documentation
26	HEM Gateway – Smart Appliance	Device to Device	6-10 years	AMI solutions with demand-response capabilities will either use the meter or an HEM system box controller as the central gateway to manage, monitor, and communicate with smart appliances.
27	HEM Gateway – Home PC/Tablet	Device to Device	2-5 years	The HEM gateway will connect with the home PC/tablet to allow the customer to view energy and appliance activities using the utility customer portal or customer appliance-monitoring application.
28	Smart Grid Communications Node – DLC Switch	Device to Device	2-5 years	If there is no HEM system or home-area network (HAN) in the home, and the utility wants to use its smart grid infrastructure for local demand-response management, the smart grid communications node can communicate with the DLC switch to execute the event.
29	Smart TSAT – Smart Phone	Device to Device	2-5 years	Some smart grid deployments will utilize the TSAT as the main gateway or in-home display for home energy management. This integration will give the customer the ability to monitor and control the TSAT using a smart phone. Nest® thermostats are an example of this functionality.
30	Home PC/Tablet – Smart TSAT	Device to Device	2-5 years	Some smart grid deployments will utilize the TSAT as the main gateway or in-home display for home energy management. This integration will give the customer the ability to monitor and control the TSAT using a home PC/tablet.
31	PEV Onboard System – PEV	System to Device	0-2 years	The PEV onboard system monitors PEV usage attributes. It will also be the connection point for other systems and applications requiring PEV information.
32	EVSE Management System – PEV	System to Device	2-5 years	The PEV has information that the EVSE management system requires in preparation for a charge event.
33	HEM System – PEV	System to Device	2-5 years	The HEM system needs the ability to monitor the PEV to understand how much energy will be required to charge the battery.
34P	PEV Onboard System – Dedicated EVSE	System to Device		See Table 6-11 above.
35P	EVSE Management System – Dedicated EVSE	System to Device		See Table 6-11 above.
36	AMI Headend – Dedicated EVSE	System to Device	2-5 years	Dedicated EVSE may contain an additional meter to measure the associated load. If it is a smart meter, it will need to connect to the AMI headend.
37	Meter Data Management System – Dedicated EVSE	System to Device	2-5 years	Dedicated EVSE may contain an additional meter to measure the associated load. If it is a smart meter, its data will be stored in the meter data management system.

ID #	Integration Point	Matrix	Timing	Documentation
38	Smart Grid Communications NMS – Dedicated EVSE	System to Device	2-5 years	Dedicated EVSE with communications capabilities will be monitored by the smart grid communications NMS to ensure ongoing connectivity.
39	Demand-Response Management System – Dedicated EVSE	System to Device	6-10 years	The demand-response management system will need to monitor the dedicated EVSE to determine if it is operating at the time of a demand-response event, and whether it has been controlled if needed.
40	HEM System – Dedicated EVSE	System to Device	2-5 years	The HEM system will need to monitor the activities of the dedicated EVSE as part of its overall functionality.
41P	PEV Onboard System – Shared EVSE	System to Device		See Table 6-11 above.
42P	EVSE Management System – Shared EVSE	System to Device		See Table 6-11 above.
43	Demand-Response Management System – Shared EVSE	System to Device	6-10 years	The demand-response management system will need to monitor the shared EVSE to determine if it is operating at the time of a demand-response event, and whether it has been controlled if needed and approved by the EVSE and/or PEV owner.
44	DMS – Shared EVSE	System to Device	6-10 years	If the shared EVSE has meter or other smart grid monitoring capabilities (e.g., voltage), it may be integrated with the DMS to help the utility monitor grid activities.
45	Smart Meter – EVSE Management System	System to Device	2-5 years	Dedicated EVSE may contain an additional meter to measure the associated load. If it is a smart meter, it will need to connect to the EVSE management system to provide charge event data.
46	AMI Headend – Smart Meter	System to Device	0-2 years	This is a fundamental integration requirement of any smart grid deployment.
47	Meter Data Management System – Smart Meter	System to Device	0-2 years	This is a fundamental, although indirect, integration requirement of any smart grid. The integration points are meter – AMI headend – meter data management system.
48	Smart Grid Communications NMS – Smart Meter	System to Device	0-2 years	The smart grid communications NMS is primarily responsible for monitoring and reporting on device activity. It needs to be integrated with the meter communications module, either directly or indirectly, to upgrade firmware and identify events and anomalies.
49	Demand-Response Management System – Smart Meter	System to Device	2-5 years	Depending on the type of AMI and HAN system deployed, the demand-response management system may require the meter to communicate with demand-response devices using ZigBee® protocol. In this solution, the meter is the gateway for demand-response activities and appliance monitoring and control.

ID #	Integration Point	Matrix	Timing	Documentation
50	HEM System – Smart Meter	System to Device	2-5 years	The HEM system may require direct access to the meter to collect real-time interval data for monitoring and control applications. The advanced HEM system will utilize interval meter data to proactively manage energy usage and load levels throughout the day. This integration will allow homeowners to remotely monitor their usage for cost or overload issues. It will also allow utilities (with the customer's permission), to monitor and control appliances during peak or emergency conditions.
51	AMI Headend – HEM Gateway	System to Device	2-5 years	Some AMI systems may not allow direct access to the meter for data. In this case, the AMI headend would push near-real-time data to the gateway when access is enabled.
52	Meter Data Management System – HEM Gateway	System to Device	2-5 years	The HEM gateway will store meter data from the meter data management system for historical analysis and comparison.
53	Demand-Response Management System – HEM Gateway	System to Device	5-10 years	The HEM gateway is the key connectivity point between the utility demand-response management system and the customer appliances that may be managed during a demand-response event.
54	HEM System – HEM Gateway	System to Device	2-5 years	The HEM system is the operating system that resides on the HEM gateway
55	Smart Grid Communications NMS – Smart Grid Communications Node	System to Device	0-2 years	The smart grid communications NMS is the operating system that resides on the smart grid communications node. It manages and monitors all activities associated with the node.
56	Demand-Response Management System – Smart Grid Communications Node	System to Device	6-10 years	Some utility smart grid architectures utilize the smart grid communications node as the gateway for demand-response event management.
57	DMS – Smart Grid Communications Node	System to Device	6-10 years	Smart grid communications nodes collect basic grid operating data (i.e., volts, amps, faults, outage notifications, and restoration timestamps) that can be collected by the DMS.
58	Demand-Response Management System – Smart TSAT	System to Device	2-5 years	The demand-response management system is responsible for sending out commands to demand-response devices during an event. For some solutions, these commands are routed through a meter or HEM system gateway to the device. In other cases, the TSAT itself is the primary device receiving the communications.
59	HEM System – Smart TSAT	System to Device	2-5 years	The HEM system is the operating system that monitors and manages appliances and devices in the home, of which one is the smart TSAT.

ID #	Integration Point	Matrix	Timing	Documentation
60	Smart Grid Communications NMS – DLC Switch	System to Device	2-5 years	The smart grid communications NMS is responsible for monitoring the communications links between various smart grid devices, including the DLC switch.
61	Demand-Response Management System – DLC Switch	System to Device	0-2 years	Traditional demand-response programs rely on direct communication from a back-office demand-response management system to a device in the home; historically, this has been the DLC switch.
62	PEV Onboard System – Smart Phone	System to Device	2-5 years	Smart phones could be used to remotely connect to the PEV onboard system and extract information or execute events if required.
63	EVSE Management System – Smart Phone	System to Device	2-5 years	This is required to allow a smart phone to initiate an EVSE charge event.
64	Home Energy Management System (HEMS) – Smart Appliance	System to Device	6-10 years	The HEMS is the operating system that monitors and manages appliances and devices in the home, of which some are smart appliances.
65	Home Energy Management System (HEMS) – Home PC/Tablet	System to Device	2-5 years	The HEMS is the operating system that monitors and manages appliances and devices in the home. The home PC/tablet is a tool customers can use to access the HEMS.
66P	EVSE Management System – RFID Tag	System to Device		See Table 6-11 above.
67	EVSE Locator – PEV	Application to Device	0-2 years	Application to allow a PEV to search for EVSE within its remaining charge miles.
68	EVSE Reservation Application – PEV	Application to Device	0-2 years	Application to reserve an EVSE throughout the TRC region.
69	Basic EVSE Charge – PEV	Application to Device	0-2 years	Application to charge a PEV.
70	EVSE Payment Application – PEV	Application to Device	0-2 years	Application for billing the owner for usage; will require data from the PEV.
71P	EVSE Provisioning/Monitoring – Dedicated EVSE	Application to Device	0-2 years	See Table 6-11 above.
72P	Basic EVSE Charge – Dedicated EVSE	Application to Device	0-2 years	See Table 6-11 above.
73P	Customer-Control EVSE Charge – Dedicated EVSE	Application to Device	0-2 years	See Table 6-11 above.
74P	Utility-Control EVSE Charge – Dedicated EVSE	Application to Device	0-2 years	See Table 6-11 above.
75P	Workplace-Control Advanced EVSE Charge – Dedicated EVSE	Application to Device	0-2 years	See Table 6-11 above.

ID #	Integration Point	Matrix	Timing	Documentation
76P	EVSE Payment Application – Dedicated EVSE	Application to Device	0-2 years	See Table 6-11 above.
77	Customer Appliance Monitoring – Dedicated EVSE	Application to Device	2-5 years	The dedicated EVSE will be one of the largest loads in the home. Therefore, the customer appliance-monitoring application will need to have the ability to monitor and collect information on its usage.
78	Demand-Response – Dedicated EVSE	Application to Device	2-5 years	Utility demand-response applications will need to include the ability to control – with the customer's permission – the dedicated EVSE.
79	EVSE Locator – Shared EVSE	Application to Device	2-5 years	This integration will allow PEV owners to locate publicly available EVSE.
80P	EVSE Reservation Application – Shared EVSE	Application to Device		See Table 6-11 above.
81P	EVSE Provisioning/Monitoring – Shared EVSE	Application to Device		See Table 6-11 above.
82P	Basic EVSE Charge – Shared EVSE	Application to Device		See Table 6-11 above.
83P	Utility-Control EVSE Charge – Shared EVSE	Application to Device		See Table 6-11 above.
84P	Workplace-Control Advanced EVSE Charge – Shared EVSE	Application to Device		See Table 6-11 above.
85P	EVSE Payment Application – Shared EVSE	Application to Device		See Table 6-11 above.
86	Demand-Response – Shared EVSE	Application to Device	6-10 years	Utility demand-response applications will need to include the ability to control – with the customer's permission – the shared EVSE.
87	Utility Customer Portal – Smart Meter	Application to Device	0-2 years	Many utilities have developed their own customer portal applications as a way for customers to see their interval smart-meter data, including interval energy data, interval voltage data, alerts, and alarms. The integration points can occur two ways, depending on whether the utility plans to give customers real-time access to the data: Meter – AMI headend – meter data management system – portal Meter – AMI headend – portal
88	Voltage Monitoring – Smart Meter	Application to Device	2-5 years	The smart meter provides interval voltage data. The voltage-monitoring application analyzes this data – either real-time from the meter or historically through the meter data management system.
89	Transformer Load Monitoring – Smart Meter	Application to Device	2-5 years	Interval electricity usage (kWh) data from the smart meters being served by a transformer are a key input in the transformer load-monitoring application.

ID #	Integration Point	Matrix	Timing	Documentation
90	Integrated Volt/Var Management – Smart Meter	Application to Device	6-10 years	Interval voltage data from the smart meters can be a key input in the integrated volt/Var-management application if it can be delivered in a timely manner.
91	Customer-Control EVSE Charge – HEM Gateway	Application to Device	2-5 years	The HEM gateway will be the center of all energy monitoring and control activities for the home, including the ability for the customer to control the EVSE using a customer-control EVSE charge application.
92	Utility-Control EVSE Charge – HEM Gateway	Application to Device	6-10 years	The HEM gateway will be the center of all energy monitoring and control activities for the home, including the ability for the utility – with the permission of the homeowner – to control the EVSE using a utility-control EVSE charge application.
93	Utility Customer Portal – HEM Gateway	Application to Device	2-5 years	The HEM gateway will need to connect to the utility customer portal to receive any utility-initiated messages or data.
94	Customer Appliance Monitoring – HEM Gateway	Application to Device	6-10 years	The HEM gateway will be the center of all energy monitoring and control activities for the home, including the ability for the customer to monitor and manage appliances using a customer appliance-monitoring application.
95	Demand Response – HEM Gateway	Application to Device	2-5 years	Demand response is a major utility application that will rely on integration with the customer's HEM gateway for control of customer appliances.
96	EVSE Provisioning/Monitoring – Smart Grid Communications Node	Application to Device	2-5 years	This integration will be required for those utilities that decide to either own and operate their own EVSE or operate EVSE on behalf of others using their smart grid communications infrastructure.
97	Demand Response – Smart Grid Communications Node	Application to Device	2-5 years	The smart grid communications node may be the gateway for demand response if there is no smart-meter or HEM system gateway installed. The node has communication capabilities and a processor and memory to store applications and execute events.
98	Voltage Monitoring – Smart Grid Communications Node	Application to Device	2-5 years	The smart grid communications node measures secondary voltage as part of its regular operations; this could be used in a voltage-monitoring application.
99	Transformer Load Monitoring – Smart Grid Communications Node	Application to Device	2-5 years	Most smart grid communications nodes are located at or near transformers. The node can either monitor the transformer directly or aggregate interval meter data from the meters it serves as part of a transformer load-monitoring application.

ID #	Integration Point	Matrix	Timing	Documentation
100	Integrated Volt/Var Management Smart Grid Communications Node	Application to Device	2-5 years	The smart grid communications node measures secondary voltage as part of its regular operations; this could be used in an integrated volt/Var-management application.
101	Customer Appliance Monitoring – Smart TSAT	Application to Device	2-5 years	The heating, ventilation, and air-conditioning (HVAC) system represents one of the largest loads in the home; the TSAT directly manages this system. Therefore, the customer appliance-monitoring application needs to be integrated with the TSAT.
102	Demand Response – Smart TSAT	Application to Device	2-5 years	Demand response is a major utility application. Programs have been developed to control HVAC functions through managing and monitoring TSATs.
103	Demand Response – DLC Switch	Application to Device	2-5 years	Demand response is a major utility application. Traditional programs have relied on communication with DLC switches to control appliances such as hot-water heaters and central air-conditioning compressors.
104	EVSE Locator – Smart Phone	Application to Device	2-5 years	Applications have and will be developed to allow PEV owners to locate EVSE using an EVSE locator application.
105	EVSE Reservation Application – Smart Phone	Application to Device	2-5 years	Applications have and will be developed to allow PEV owners to reserve EVSE using an EVSE reservation application.
106P	EVSE Payment Application – Smart Phone	Application to Device		See Table 6-11 above.
107	Utility Customer Portal – Smart Phone	Application to Device	2-5 years	Customers will want to use their smart phones to access information via the utility customer portal.
108	Customer Appliance Monitoring – Smart Phone	Application to Device	6-10 years	Customers will want to use their smart phones to access information via the customer appliance-monitoring application.
109	Customer Appliance Monitoring – Smart Appliance	Application to Device	6-10 years	The customer appliance-monitoring application needs to incorporate all appliances in the home with communications capabilities.
110	Demand Response – Smart Appliance	Application to Device	6-10 years	Demand response is major utility application. Future capacity and energy savings will come through managing and monitoring new smart appliances.
111	Customer-Control EVSE Charge – Home PC/Tablet	Application to Device	2-5 years	Customers need to be able to remotely monitor and manage their EVSE using their home PC/tablet.
112	EVSE Payment Application – Home PC/Tablet	Application to Device	2-5 years	Customers need to be able to remotely review and pay for EVSE charging events using their home PC/tablet.

ID #	Integration Point	Matrix	Timing	Documentation
113	Utility Customer Portal – Home PC/Tablet	Application to Device	0-2 years	Most utilities that have installed smart grid and AMI infrastructure have developed a utility customer portal, which allows customers to view their energy usage online using their home PC/tablets.
114	Customer Appliance Monitoring – Home PC/Tablet	Application to Device	2-5 years	Any customer appliance-monitoring application will need to allow customers to manage and monitor appliances online using their home PC/tablets.
115P	EVSE Reservation Application – RFID Tag	Application to Device		See Table 6-11 above.
116P	Basic EVSE Charge – RFID Tag	Application to Device		See Table 6-11 above.
117P	Workplace-Control Advanced EVSE Charge – RFID Tag	Application to Device		See Table 6-11 above.
118P	EVSE Payment Application – RFID Tag	Application to Device		See Table 6-11 above.
119P	EVSE Locator – PEV Onboard System	Application to System		See Table 6-11 above.
120P	EVSE Reservation Application – PEV Onboard System	Application to System		See Table 6-11 above.
121P	EVSE Provisioning/Monitoring – EVSE Management System	Application to System		See Table 6-11 above.
122P	Basic EVSE Charge – EVSE Management System	Application to System		See Table 6-11 above.
123P	Customer-Control EVSE Charge – EVSE Management System	Application to System		See Table 6-11 above.
124P	Utility-Control EVSE Charge – EVSE Management System	Application to System		See Table 6-11 above.
125P	Workplace-Control Advanced EVSE Charge – EVSE Management System	Application to System		See Table 6-11 above.
126P	EVSE Payment Application – EVSE Management System	Application to System		See Table 6-11 above.
127	Customer Appliance Monitoring – AMI Headend	Application to System	2-5 years	Interval AMI data may be needed for certain applications that are faster than those available through a meter data management system (e.g., demand-response and circuit-overload monitoring). In this case, data can be pulled through the meter by the AMI headend and sent to the home, where the data could reside in the HEM gateway and be accessed using the customer appliance-monitoring application.

ID #	Integration Point	Matrix	Timing	Documentation
128	Demand Response – AMI Headend	Application to System	2-5 years	If the demand-response application needs 15-minute interval data in near real-time to verify or measure the impact of an event, it may need to access the data via the AMI headend.
129	Voltage Monitoring – AMI Headend	Application to System	2-5 years	If the voltage-monitoring application needs 15-minute interval data in near real-time to verify or measure the impact of an event, it may need to access the data via the AMI headend.
130	Transformer Load Monitoring – AMI Headend	Application to System	2-5 years	If the transformer load-monitoring application needs 15-minute interval data in near real-time to verify or measure the impact of an event, it may need to access the data via the AMI headend.
131	Utility Customer Portal – Meter Data Management System	Application to System	0-2 years	Utilities that have developed a utility customer portal have populated it with historical interval energy and voltage data from the meter data management system.
132	Customer Appliance Monitoring – Meter Data Management System	Application to System	6-10 years	The customer appliance-monitoring application will utilize historical meter data for usage comparisons, threshold analysis, energy and cost savings benchmarking, etc. This historical, validated data will come from the meter data management system.
133	EVSE Provisioning/Monitoring – Smart Grid Communications NMS	Application to System	2-5 years	Utilities wanting to own and/or operate their own EVSE will want to be able to provision and monitor the equipment using their smart grid communications NMS.
134	Voltage Monitoring – Smart Grid Communications NMS	Application to System	2-5 years	The smart grid communications NMS monitors devices to ensure they are operating. If the voltage-monitoring application encounters lost or intermittent data streams, it can send alerts to the NMS to troubleshoot and diagnose the devices in question.
135	Transformer Load Monitoring – Smart Grid Communications NMS	Application to System	2-5 years	The smart grid communications NMS monitors devices to ensure they are operating. If the transformer load-monitoring application encounters lost or intermittent data streams, it can send alerts to the NMS to troubleshoot and diagnose the devices in question.
136	Integrated Volt/Var Management – Smart Grid Communications NMS	Application to System	2-5 years	The smart grid communications NMS monitors devices to ensure they are operating. If the integrated volt/var-management application encounters lost or intermittent data streams, it can send alerts to the NMS to troubleshoot and diagnose the devices in question.

ID #	Integration Point	Matrix	Timing	Documentation
137	Utility-Control EVSE Charge – Demand-Response Management System	Application to System	6-10 years	The demand-response management system will need to integrate with new applications that have the ability to control appliances during peak-capacity events. The utility-control EVSE charge is a future application that will allow the utility to interrupt or prevent a charge event during time of grid operational necessity.
138	Demand Response – Demand-Response Management System	Application to System	2-5 years	The demand-response management system oversees and manages all demand-response applications that may be occurring within a utility service territory.
139	Customer-Control EVSE Charge – HEM System	Application to System	6-10 years	The HEM system should have the functionality to allow customers to remotely and/or automatically control their EVSE using a customer-control EVSE charge application.
140	Customer Appliance Monitoring – HEM System	Application to System	2-5 years	Customer appliance monitoring is a fundamental application for the HEM system.
141	Demand Response – HEM System	Application to System	2-5 years	Future demand-response applications will rely on successful (and customer-permitted) integration with the HEM system in each home.
142	Voltage Monitoring – DMS	Application to System	6-10 years	DMS will become the primary distribution grid operation tool. It will integrate with applications such as voltage monitoring.
143	Transformer Load Monitoring – DMS	Application to System	6-10 years	DMS will become the primary distribution grid operation tool. It will integrate with applications such as transformer load monitoring.
144	Integrated Volt/Var Management – DMS	Application to System	6-10 years	DMS will become the primary distribution grid operation tool. It will integrate with applications such as integrated volt/var management.
145	EVSE Payment Application – CIS	Application to System	2-5 years	Utility CIS contain valuable information that could be used in an EVSE payment application to the extent the utility or a utility partner is responsible for EVSE payments.
146	Utility Customer Portal – CIS	Application to System	2-5 years	Data from CIS may be components of the utility customer portal.
147P	PEV Onboard System – EVSE Management System	System to System		See Table 6-11 above.
148P	EVSE Management System – Smart Grid Communications NMS	System to System		See Table 6-11 above.
149P	EVSE Management System – Demand-Response Management System	System to System		See Table 6-11 above.
150P	EVSE Management System – HEM System	System to System		See Table 6-11 above.

ID #	Integration Point	Matrix	Timing	Documentation
151	AMI Headend – Meter Data Management System	System to System	0-2 years	AMI headend systems are the element-management systems that manage the extraction of data from meters and collectors. These data elements are moved to the meter data management system, where they are stored.
152	AMI Headend – Smart Grid Communications NMS	System to System	0-2 years	The AMI headend manages the smart grid devices. The smart grid communications NMS manages the communication infrastructure associated with the devices.
153	AMI Headend – Demand-Response Management System	System to System	2-5 years	AMI systems that utilize the same technology as HAN (e.g., ZigBee®) will require interfaces between the AMI headend and demand-response management system to execute demand-response events.
154	AMI Headend – HEM System	System to System	2-5 years	The AMI headend will be the system to move near-real-time interval data to the HEM system to allow the customer to see energy usage throughout the day.
155	AMI Headend – CIS	System to System	2-5 years	Specific data components from the CIS need to be in the AMI headend. Examples include premise ID, meter ID, global positioning system (GPS) coordinates, address, and in some cases, transformer ID.
156	Meter Data Management System – HEM System	System to System	2-5 years	Historical interval meter and voltage data from the meter data management system will need to be incorporated into the HEM system.
157	Meter Data Management System – CIS	System to System	0-2 years	Meter data management system data require CIS data as they pertain to each customer for a variety of applications, from appliance monitoring to transformer load monitoring.
158	Smart Grid Communications NMS – Demand-Response Management System	System to System	2-5 years	Demand-response management systems that will be controlling devices directly will need to troubleshoot and diagnose any issues through the smart grid communications NMS
159	Smart Grid Communications NMS – HEM Systems	System to System	2-5 years	Utilities will want to use the smart grid communications NMS to monitor the local-area network (LAN) and HAN to ensure the HEM system is active and communicating with the back office.
160	Smart Grid Communications NMS – DMS	System to System	6-10 years	DMS will utilize information from devices on the smart grid network. The smart grid communications NMS will help troubleshoot and diagnose any issues with communications and device connectivity.
161	HEM System – Demand-Response Management System	System to System	6-10 years	The HEM system is the primary system to manage and monitor devices within the home. The demand-response management system will use this system to execute customer-approved demand-response events.

ID #	Integration Point	Matrix	Timing	Documentation
162P	EVSE Locator – EVSE Reservation Application	Application to Application		See Table 6-11 above.
163	EVSE Locator – Utility Customer Portal	Application to Application	2-5 years	Utilities that own and/or operate their own EVSE fleet will want the ability for customers to locate publicly owned EVSE through their utility customer portals.
164	EVSE Reservation Application – EVSE Provisioning/Monitoring	Application to Application	2-5 years	EVSE owner/operators want to know if their EVSE are available before they indicate their availability through the EVSE reservation application. The EVSE provisioning/monitoring application provides this functionality.
165	EVSE Reservation Application – Basic EVSE Charge	Application to Application	2-5 years	Information will need to flow from the EVSE reservation application to the basic EVSE charge application to allow for a charge event to start when the appropriate PEV is connected.
166	EVSE Reservation Application – Customer-Control EVSE Charge	Application to Application	6-10 years	Customers reserving the EVSE may also be part of a program that allows them to control charging operations according to some predetermined criteria, such as time-of-use rates or marketing programs that are profiled in the customer-control EVSE charge application.
167	EVSE Reservation Application – Utility-Control EVSE Charge	Application to Application	6-10 years	An EVSE may be part of a utility-control EVSE charge application. The EVSE reservation application needs to have this information to be able to inform customers before they elect to reserve the EVSE.
168	EVSE Reservation Application – Workplace-Control Advanced EVSE Charge	Application to Application	2-5 years	An EVSE may be part of a workplace-control advanced EVSE charge application. The EVSE reservation application needs to have this information to be able to inform customers or employees before they elect to reserve the EVSE.
169P	EVSE Reservation Application – EVSE Payment Application	Application to Application		See Table 6-11 above.
170	EVSE Reservation Application – Demand Response	Application to Application	6-10 years	An EVSE may be part of a demand-response program and have certain restrictions associated with its use. The EVSE reservation application needs to have this information to be able to inform customers before they elect to reserve the EVSE.
171	EVSE Provisioning/Monitoring – Basic EVSE Charge	Application to Application	2-5 years	The EVSE provisioning/monitoring application will be used to help diagnose any issue that may cause an EVSE to not operate properly during a charge event.
172P	EVSE Provisioning/Monitoring – EVSE Payment Application	Application to Application		See Table 6-11 above.

ID #	Integration Point	Matrix	Timing	Documentation
173	EVSE Provisioning/Monitoring – Customer Appliance Monitoring	Application to Application	6-10 years	Any issues with reaching the EVSE to monitor its use via the customer appliance-monitoring application will be troubleshot and diagnosed using the EVSE provisioning/monitoring application.
174	EVSE Provisioning/Monitoring – Demand Response	Application to Application	6-10 years	Any issues with reaching the EVSE to execute a demand-response application will be troubleshot and diagnosed using the EVSE provisioning/monitoring application.
175P	Basic EVSE Charge – EVSE Payment Application	Application to Application		See Table 6-11 above.
176	Basic EVSE Charge – Customer Appliance Monitoring	Application to Application	2-5 year	Applications involved in a home energy-optimization scenario would intersect to determine how much the load might need to be adjusted to meet utility or customer objectives.
177	Basic EVSE Charge – Demand Response	Application to Application	2-5 years	EVSE owners/operators may elect to enroll some or all of their EVSE in a utility demand-response program. The purpose of the program would be to allow the utility to interrupt or prevent a basic EVSE charge when required.
178P	Customer-Control EVSE Charge – EVSE Payment Application	Application to Application		See Table 6-11 above.
179	Customer-Control EVSE Charge – Customer Appliance Modeling	Application to Application	6-10 years	This allows for the customer appliance-modeling application to identify whether a customer is proactively controlling his or her dedicated EVSE. This information could then be used for future modeling and benchmarking purposes.
180	Customer-Control EVSE Charge – Demand Response	Application to Application	2-5 years	These two applications need to be integrated to allow a utility demand-response application to request a customer EVSE to be controlled using the customer-control EVSE charge application. (This application provides the parameters by which customers allow the utility to control their dedicated EVSE.)
181P	Utility-Control EVSE Charge – EVSE Payment Application	Application to Application		See Table 6-11 above.
182	Utility-Control EVSE Charge – Utility Customer Portal	Application to Application	6-10 years	This allows for utility-control EVSE charge events to be documented in real time on the utility customer portal.
183	Utility-Control EVSE Charge – Demand Response	Application to Application	6-10 years	The demand-response application will look to shed load using a variety of applications, devices, and scheduling criteria. The utility-control EVSE charge application is one that targets EVSE available for control through previous contractual arrangements with the owners/operators.

ID #	Integration Point	Matrix	Timing	Documentation
184	Utility-Control EVSE Charge – Voltage Monitoring	Application to Application	6-10 years	This integration allows for utilities to control EVSE for voltage support, if required, via the voltage-monitoring application.
185	Utility-Control EVSE Charge – Transformer Load Monitoring	Application to Application	6-10 years	This integration allows for utilities to control EVSE for transformer overload mitigation, if required, via the transformer load-monitoring application.
186	Utility-Control EVSE Charge – Integrated Volt/Var Management	Application to Application	6-10 years	This integration allows for utilities to control EVSE for volt/Var support, if required, via the integrated volt/Var-management application.
187P	Workplace-Control Advanced EVSE Charge – EVSE Payment Application	Application to Application		See Table 6-11 above.
188	Utility Customer Portal – Customer Appliance Monitoring	Application to Application	6-10 years	This connects the universally offered utility customer portal with the customer appliance-monitoring application, primarily to transfer utility energy and billing-system information.
189	Utility Customer Portal – Demand Response	Application to Application	2-5 years	The utility customer portal will be the fundamental application the utility uses to provide information to customers with respect to demand-response events and how they affect the customer.
190	Customer Appliance Monitoring – Demand Response	Application to Application	2-5 years	The customer appliance-monitoring application will need to contain historical information on which appliances were controlled via a demand-response application/event.
191	Demand Response – Voltage Monitoring	Application to Application	2-5 years	Demand-response events may be executed in specific areas to help solve a voltage-monitoring alert or alarm.
192	Demand Response – Transformer Load Monitoring	Application to Application	2-5 years	Demand-response events may be executed in specific areas to help solve a transformer overload alert or alarm.
193	Demand Response – Integrated Volt/Var Management	Application to Application	6-10 years	Demand-response events may be executed in specific areas to help solve a volt/Var alert or alarm.
194	Voltage Monitoring – Integrated Volt/Var Management	Application to Application	6-10 years	The voltage-monitoring application may provide real-time voltage-data inputs to an integrated volt/Var-management application.

7.1 Overview

The Central Texas region encompasses two major metropolitan areas in and around Austin and San Antonio and has the unique designation as an American hot spot for growth with the addition of one million residents to the area within the past decade. The Texas River Cities Plug-in Electric Vehicle Initiative (TRC) addresses the need for a plan that can be implemented region-wide to increase the long-term success of PEV adoption from the charging infrastructure to education on resources and businesses that support this newly emerging technology. Through the TRC Initiative a number of partners have collaborated on identifying needs specific to plug-in electric vehicle (PEV) adoption that include: centralized regional information, public education resources, and word-of-mouth campaigns that distinguish the benefits of PEVs based on performance advantages, the value of independence from foreign fuels, and the economic benefits of supporting domestic resources.

7.2 Recommendations

Recommendation 1

TRC will promote the use of the communications plan outlined in Section 7 as the foundation for its marketing communications plan moving forward. The plan will serve to inform and educate those interested in the deployment of electric vehicles and charging-station infrastructure in the TRC region.

7.3 Communications Plan

Attached is the Communications Plan.

TEXAS RIVER CITIES ELECTRIC VEHICLE INITIATIVE
COMMUNICATIONS PLAN 2012

PHOTO COURTESY PECAN STREET INC.

TEXAS RIVER CITIES

Plug-In Electric Vehicle Initiative

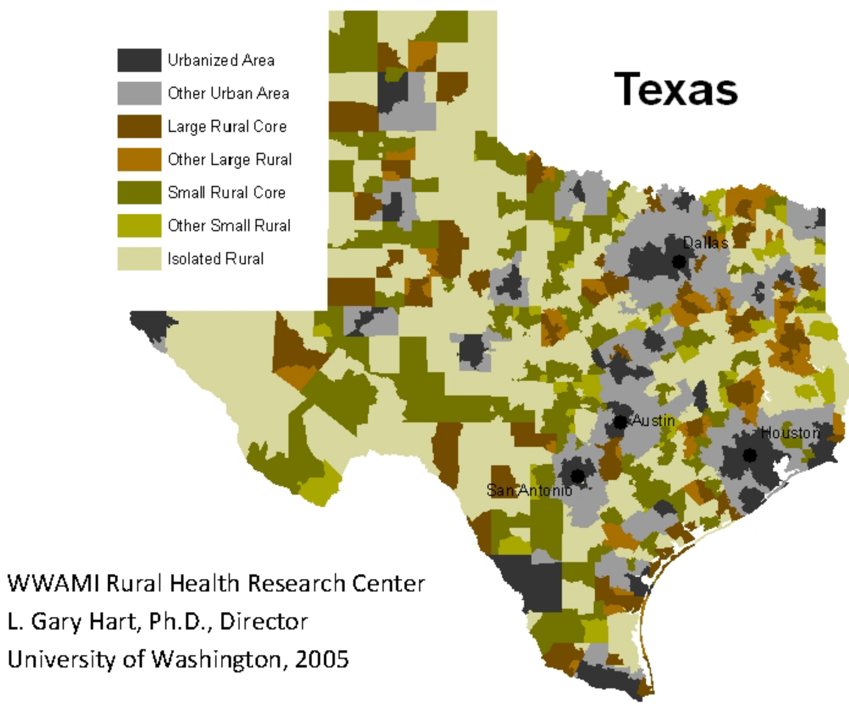
Texas River Cities Plug-In Electric Vehicle Initiative Communications Plan

Table of Contents

Plan Overview

The Central Texas region encompasses two major metropolitan areas in and around Austin and San Antonio and has the unique designation as an American hot spot for growth with the addition of one million residents to the area within the past decade. The Texas River Cities Plug-In Electric Vehicle Initiative (TRC) addresses the need for a plan that can be implemented region-wide to increase the long-term success of PEV adoption from the charging infrastructure to education on resources and businesses that support this newly emerging technology. Through the TRC, a number of partners have collaborated to identify needs specific to plug-in electric vehicle (PEV) adoption that include: centralized regional information, public education resources, and word-of-mouth campaigns that distinguish the benefits of PEVs based on performance advantages, the value of independence from foreign fuels, and the economic benefits of supporting domestic resources. The following map demonstrates population density increases between major metropolitan areas of Texas, specifically the closing gap between San Antonio and Austin.

Figure 1. Texas Population Density



Background

In September 2011, the U.S. Department of Energy (DOE) awarded two grants dedicated to managing charging infrastructure for electric vehicles in Texas, the TRC and the Texas Triangle

PEV Readiness Plan. Austin Energy is leading the TRC to create a plan for PEV charging infrastructure deployment in participating Central Texas communities. The Center for the Commercialization of Electric Technologies (CCET) received funding to lead the Texas Triangle Plug-In Electric Vehicle Readiness Plan that addresses PEV charging infrastructure for corridor travel between the four major metro areas of Texas (San Antonio, Dallas, Houston, and Austin). Together these initiatives will address the current and future charging needs of Texas PEV drivers at home, at work, and on the go.

Nationally, the Electric Drive Transportation Association (EDTA) and other similar organizations have identified the need to reach consumers with messages that extend beyond environmental benefits – a challenge faced by the industry in general – and inform consumers of local resources and current PEV options. EDTA has plans to unveil a national education and marketing campaign in early 2013, which will complement this regional effort to target potential PEV drivers and infrastructure providers in Central Texas.

Marketing Communications Committee

In planning for the TRC communications efforts, a committee of 17 industry advisors with expertise in marketing and outreach formed the TRC marketing communications committee and were tasked with contributing to the various plan elements and reviewing deliverables. The marketing communications committee completed an open-ended, 10-question survey in April 2012 that helped shape the focus of the marketing communications plan. The committee, in addition to the internal and external TRC team and stakeholders, helped to shape the overall contents of this plan including: mission, vision, fact sheet, frequently asked questions, and strengths, weaknesses, opportunities, and threats (SWOT) analysis, and identified target audiences, plan objectives, strategies, and tactics.

Marketing Communications Committee Survey

1. Please describe your organization’s overall mission and involvement with Plug-In Electric Vehicles (PEVs), PEV charging infrastructure, or facilitation of PEVs? Website address?
2. How does your program fit into your organization as a whole or into the overall marketing efforts?
3. Are there other points of contact for PEVs in your organization? If so, can we communicate with them and what is their email address?
4. Do you currently have a marketing plan for your program?
5. What are you currently doing to market your PEV program and/or other related environmental programs? How do you reach potential and current PEV drivers?
6. Can you tell me about any best practices when it comes to community outreach efforts?
7. Have you encountered opposition or pitfalls to avoid that you would like to share?
8. Are there any opportunities you would like to share for cross-promotion or partnerships?

9. Do you have a specific PEV program logo? Are there any photographs, logos, or marketing materials you would like to share with the program for planning and/or outreach efforts?
10. Are there other groups we should know about in your area that may be connected to and/or supporting PEVs?

Marketing Communications Committee Survey Compilation

There were nine survey respondents and this section provides a summary of those responses categorized by entity name. Also included are a few highlighted responses that the TRC team found directly applicable to the marketing communications plan.

Pecan Street Inc.

Pecan Street Inc. is a consortium of research and industry partners focused on developing and testing advanced technology, business model, and customer behavior surrounding energy management systems.

Pecan Street hosts an “electric vehicle research program,” incentivizing participants with rebates of $3,000 and $7,500 to lease or purchase a PEV that is in addition to the federal tax credits. Through the research program, Pecan Street is studying grid load and monitoring home energy use through management equipment.

Highlighted response (Question 5)

Pecan Street Inc. conducts outreach via community newsletters, emails, and various educational events where prospective buyers can meet with different car dealers, Pecan Street staff, and Austin Energy Electric Vehicles and Emerging Technologies department experts.

CPS Energy

CPS Energy is the public electric utility serving San Antonio and surrounding communities.

At this time the electric vehicle program has minimal support and resources with one dedicated employee to manage rebates due to public demand and funding availability. CPS Energy did host a successful screening of the movie *Revenge of the Electric Car*. Other groups TRC can target in the San Antonio area include City of San Antonio and Alamo Area Council of Governments (AACOG).

Bluebonnet Electric

Bluebonnet is an electric utility cooperative headquartered in Bastrop.

Bluebonnet Electric launched a research and discovery initiative into PEVs, with a plan to integrate a PEV initiative into the corporate vision. It continues to monitor industry and market trends, and participates in the TRC.

Austin Energy

Austin Energy is the municipally owned electric utility serving the City of Austin and surrounding communities.

Austin Energy in 2005 initiated a national marketing campaign called Plug-in Partners to demonstrate PEV demand from city fleets, private vehicle owners, and businesses. That campaign is now the Plug-in Partners™ brand associated with the residential customer rebate offering. This campaign is a part of Plug-in EVerywhere™, which is the network brand of charging stations the utility installed with funding from the ChargePoint® America grant.

Austin Energy marketing and outreach efforts include press releases, advertising, program milestones, social media, giveaway items, participation in area conferences and showcases, public speaking, and educational materials.

City of Georgetown

The City of Georgetown is implementing overarching marketing efforts including environmental and conservation services. Future planning has addressed a conservation plan with active goals, but there is no PEV-specific program. The City of Georgetown installed chargers and purchased a Chevy Volt. Unfortunately, public feedback has included negative perceptions of the vehicle purchase.

Highlighted response (Question 9)

The City of Georgetown has a "conservation super hero program" for kids that include caricatures of city staff as super heroes participating in daily conservation activities. Kids that aspire to be GUS Guy or GUS Girl (Gus being Georgetown Utility Systems), can go through a short training session, sign a conservation contract, and earn their cape (a long bronze satin cape with a big G on the back). The program has had success with kids and adults and is being promoted through the website and at local events and presentations. Through this program, the City of Georgetown is trying to make conservation fun and familiar, by using local settings, buildings, and staff that citizens will recognize.

Center for Commercialization of Electric Technologies (CCET) Texas Triangle

CCET currently has a contract with DOE, similar to that of TRC, to prepare a "PEV Readiness in the Texas Triangle" plan. As part of the marketing plan, CCET plans to launch a centralized website for general PEV consumer information specifically for Texas residents.

Highlighted response (Question 6)

CCET plans for a Texas "PEV-friendly community program" that would encourage and provide guidance for municipalities and local groups to set up readiness efforts and PEV charging infrastructure. Unfortunately, CCET has found that city managers and mayors have had little interest or sense of urgency in participating in the planning for this program or PEVs in general.

City of San Antonio

While the City of San Antonio has implemented a number of PEV initiatives, including charging stations, rebate incentives, expedited permitting process, and a Build San Antonio Green program and Mission Verde program, nothing is currently being done in the way of marketing or promoting those efforts. Electric transportation is part of the mission of the City's Office of Environmental Policy. The electrification of transportation is one of the joint city and CPS Energy areas of focus for economic development and to improve air quality. The City of San Antonio and CPS Energy held press events to raise awareness of PEV charging options and have observed that some people are opposed to government expenditure on PEV charging. Signage of parking spaces for PEV charging can be a challenge and the State of Texas' guidance on the issue can be another obstacle.

Highlighted response (Question 8)

A map for the I-35 corridor showing PEV charging stations should be developed for distribution especially at car dealerships and on PEV-related websites.

Highlighted response (Question 10)

Other entities we could pursue partnerships with include: Alamo City Electric Auto Association, Southwest Research Institute, and UTSA Sustainable Energy Research Institute.

Central Texas Clean Cities (CTCC)

CTCC is a DOE-supported program designed to create public-private partnerships to reduce our nation's dependence on foreign oil.

PEVs are part of the mission directive, as are the installation of charging stations. This organization is housed in the City of Austin Transportation Department and focuses on PEV deployment. CTCC uses a variety of methods for outreach including educational opportunities, e-newsletters, workshops, outdoor demonstrations, seminars for stakeholders and last summer conducted a six week event that partnered with Don Hewlett Chevrolet to showcase the VOLT at Plug-In EVerywhere™ partner sites. CTCC is currently focused on working with fleets to promote the use of alternative fuels and advanced vehicle technologies such as PEVs.

Highlighted response (Question 7)

There is a huge educational void on PEVs, and the bad press PEVs have received does not help that void and marketing efforts.

Highlighted response (Question 8)

CTCC is working with the Heart of Texas Green Expo in Bastrop, June 8-9. Specific efforts include an Eaton exhibit with a Level 2 charging station and solar-powered canopy to demonstrate how easy it is to charge PEVs. The event is expected to attract 4,000-5,000 attendees.

Dave Tuttle (Industry Advisor)

Currently, Tuttle is involved with multiple organizations, including the University of Texas Department of Electrical and Computer Engineering with research in the integration of electric vehicles and the grid, the Pecan Street Consortium's Smart grid projects, and the Texas Triangle project. Through these various efforts there is potential for cross-promotion through website and video development.

Highlighted response (Question 5)

Tuttle is developing content for an interactive communications plan that includes compiling the content already available for PEVs, identification of useful sources of content that can be leveraged, and creation of Texas-unique relevant content which can help educate Texans about the benefits, costs, implications, types, and considerations of PEVs.

MISSION STATEMENT, VISION STATEMENT, AND TARGET AUDIENCES

The mission and vision statements for the TRC were created through input from the TRC plan team and stakeholders. These statements are a reflection of the current needs of the region and a focus for business strategy in PEV adoption. The target audiences identified represent the consumer and business side of PEV adoption and are categorized as primary and secondary based on TRC stakeholder feedback.

Mission Statement

The primary purpose of TRC is to prepare a regional readiness plan for the ongoing deployment and increased adoption of PEVs and associated charging infrastructure for participating Central Texas communities.

Vision Statement

Educate the Central Texas region on the freedom and mobility of electrified transportation with a focus on driver experience and support of domestic resources and local economic impact.

Target Audiences

Primary

- Potential PEV drivers
- Future PEV drivers
- Dealerships
- Fleet managers
- Local governments

Secondary

- Charging equipment installers
- Regional utilities
- State government
- TRC partners
- Current PEV drivers (early adopters)

STRENGTHS, WEAKNESSES, OPPORTUNITIES, AND THREATS (SWOT) ANALYSIS

This section will address the strengths, weaknesses, opportunities, and threats of TRC and PEVs in the Central Texas Region. The information and assessment included in this section is based on preliminary public perception industry research and feedback from TRC stakeholders.

Strengths (Internal)

- TRC includes a diverse set of stakeholders with varying degrees of PEV experience and advocacy efforts
- Austin Energy has a history of successfully demonstrating sustainable energy programs and renewable generation, is supportive of PEVs both regionally and nationally, and is leading the TRC
- Pecan Street Inc. provides unique research and a development lab/resource
- Many TRC partners are energetic and passionate PEV supporters and are involved in related organizations
- The Central Texas region is served by public power entities that create unique opportunities for public and private charging

Weaknesses (Internal)

- Lack of cohesive or centralized information resource on PEVs in Texas
- Limited resources and staff for outreach
- Lack of a motivated, well-supported business or individuals to establish TRC as an ongoing entity engaged with PEV implementation in Texas
- Lack of lacking long-term secured funding for TRC
- Market structure in Central Texas not conducive to third-party providers of PEV products and services

Opportunities (External)

- TRC will be a coordinating entity for PEVs in the Central Texas region and centralized location for PEV information
- PEVs are not limited to environmentally conscious consumers, the “PEV Effect” must be emphasized to sell PEVs as a better driving experience than a conventional vehicle
- PEVs are a means to reduce dependence on foreign oil, and support West Texas wind energy development and related job and local economic growth

- PEV technologies and programs evolve at a rapid pace and are attractive to technology early adopters and environmentally conscience consumers
- Early adopters typically educate themselves on PEVs and are good advocates for the PEV industry
- Regional dealerships could benefit from PEV training materials and consumer marketing
- Regional support is robust for green technology, including annual conferences, festivals, ride and drives, and related events with potential for growth
- Government rebates are available for PEVs and PEV charging equipment on the local to federal levels in most areas of Central Texas
- Texas Triangle initiative will play an integral role with the TRC in centralizing efforts for Texas PEV information
- PEVs have lower maintenance requirements, no oil changes, and the ability to significantly reduce tailpipe emissions and noise pollution on a large scale
- Gas prices are volatile whereas electric rates tend to be steadier and cheaper in the gas vs. electricity energy model for vehicles

Threats (External)

- Extensive information available on PEVs but no centralized location for Texas-specific information, coupled with media-fueled PEV myths
- Range anxiety and extended charging time seen as inconvenience by conventional vehicle drivers
- Physical infrastructure and communication interoperability barriers
- PEV myths and misperceptions include: safety, stranded PEV drivers, political party alignment, and subsidies for clean technology
- Politicization of PEVs and related gas prices (potential for sudden drop in prices with higher PEV adoption)
- Adoption of PEVs can be considered a high-risk investment given pricing and unknown maintenance costs, which can deter potential PEV consumers

Objectives, strategies, and tactics are the essential core of any marketing plan and serve as the guide to accomplishing the program's goals and as key indicators of success.

Objective I. Build Awareness

Advance the centralization of information and public access to resources available on PEVs in Central Texas

Strategy

Launch strategically targeted electronic resources through a variety of media to demonstrate ease of use and access of alternative transportation

Tactics

Develop key messaging and implement viral solutions with cohesive branding and concise information

Web-based solutions include:

- Web site
  - Landing page will provide four directions: consumer, fleet managers, commercial, and government
  - Regional resources links
  - Videos
  - Event calendar
  - Regional map and partner network promotion
- Blog
- Social Media
  - Twitter
  - Facebook
  - Google+
  - YouTube
- Smart phone application for PEV drivers (may partner with PlugShare, per previous conversation with the company)
- Videos (educational and promotional)
- Photography (educational and promotional)

Objective II. Education/Outreach

Build awareness of PEVs, resources, current regional options from preparing to purchase to actual purchase of PEVs, and benefits of diversifying transportation modes

Strategy

Make educational outreach materials with cohesive branding and messaging to disseminate to the public

Tactics

Educational/Outreach materials to include:

- PEV guide for fleet managers
- PEV guide for first responders
- PEV guide highlighting current rebate incentives for dealerships

Educational/Outreach videos to include:

- Educational videos for fleet managers, consumers, and decision-makers on the use of PEVs

Educational/Outreach meetings and workshops to include:

- Provisions of training and resources in conjunction with local dealer associations to offer regionally relevant PEV information such as charging and/or parking programs, contacts for installing electric vehicle supply equipment (EVSE), and incentives for consumers and auto dealers
- Organize and host alternative fuel vehicle workshops for natural gas and electric vehicles in the Central Texas region for potential fleet users
- Set up meetings with city officials on an individual basis to educate them on the implementation of electric transportation and electric vehicle programs.

Objective III. “Texas Fuel Independence” Campaign

Improve the regional economic impact of PEVs through the increased adoption of diverse methods of transportation

Strategy

Promote PEV usage through a variety of grassroots and business-to-business (B2B) efforts

Tactics

Marketing:

- Logo and branding
- Quick Reference (QR) Code linked with web site to be placed on:
  - Public charging stations

  - Green energy applications
  - Print collateral

Public Relations:

- Perform Ride and Drive Demonstrations – create and utilize a PEV-centric booth and public speaking opportunities targeting:
  - Neighborhood associations
  - Schools
  - Industry-related conventions and trade shows
  - Fairs
  - Festivals
- Regional media pitches
- Editorial boards
- Work with schools, elementary through university level, on outreach and involvement
- Team up with local events and movements to have community presence including:
  - Pet rescue groups/shelters
  - Farmers markets
  - Sports events
  - Artist markets

Advertising:

- Strategic placement of campaign ads in regional publications

Additional opportunities have been identified for regional participation in marketing communications efforts including events, cross-promotional partnerships, outreach, and a speaker's bureau. These concepts are based on current implementation efforts and TRC stakeholders' input.

Events Calendar

JANUARY	FEBRUARY	MARCH	APRIL
	- San Antonio Rodeo	- South by Southwest® (SXSW®) (Austin)	- Fiesta events (San Antonio) - Hill Country Wine and Music Festival (Fredericksburg) - Earth Day
MAY	**JUNE**	**JULY**	**AUGUST**
- Annual Car Show (Blanco)	- Texas Folk Life Festival (San Antonio) - Heart of Texas Green Expo (Bastrop)	- Dick's Classic Garage Car Museum "Cruise in Night" (San Marcos)	- Kendall County Fair (Boerne) - Home and Garden Show (Austin)
SEPTEMBER	**OCTOBER**	**NOVEMBER**	**DECEMBER**
- Comal County Fair (New Braunfels) - Texas State Fair (Dallas) - San Antonio Home and Garden Show	- Texas State Fair (Dallas) - ACL Music Festival (Austin) - Guadalupe County Fair (Seguin)	- Wurstfest (New Braunfels) - Formula 1 Race (Austin)	- Armadillo Christmas Bazaar (Austin)

Partnerships/B2B Opportunities

TRC offers a unique opportunity to regional dealerships, utilities, city governments, PEV manufacturers, PEV equipment installers, and every related business to coordinate a network to funnel efforts toward the increased adoption of PEVs. TRC has brought a number of area partners into the planning process to ensure that a formed entity will reflect a solution based on identified needs. A resounding need was uncovered at the four TRC stakeholder meetings in 2012 for an entity to bring together partners and inform potential consumers about PEVs. TRC plans to keep stakeholders informed of educational and marketing opportunities, help to coordinate representation of various partners at outreach events, and to continue to offer networking and strategy sessions at least twice a year. With at least one networking opportunity in San Antonio and a second in Austin, this will allow partners the chance to meet other vendors, collaborate, place joint advertisements, co-host events or booths at area events, and identify additional needs and solutions.

Cross-promotion will benefit a number of PEV-related businesses, and a cooperative opportunity might include a PEV giveaway that is promoted at area sports games and/or through radio and television promotion. With enough interest and support, a PEV giveaway coupled with a short web series on the new owner of a PEV winning the vehicle and the winner's first month of usage, will demonstrate firsthand the excitement of becoming a PEV owner.

Outreach

The primary purpose of TRC is to increase PEV adoption in the Central Texas region through education and outreach. A strategic approach is outlined in this plan, including a branded effort to educate consumers on PEVs in Central Texas, a website including a list of PEV vendors and a public charging station map, social media outlets that promote the latest PEV trends and news, public workshops, regional media pitches, and TRC representation at cornerstone regional events.

Outreach for TRC in 2012 included presence at Clean Texas Forum in Austin, SXSW in Austin, 2012 Go Green Conference in Austin, 2012 Earth Day at Pecan Street Inc. in Austin, National Auto Show in Austin, Heart of Texas Green Expo in Bastrop, and Plug-In 2012 Conference in San Antonio. At these events, the TRC team took time to shake hands with industry professionals and Central Texas community residents alike to discuss the mission of this initiative and assess needs to incorporate into the planning process.

Figure 2. TRC Team at SXSW

Figure 3. TRC and Texas Triangle share a booth at Plug-In 2012

Figure 4. TRC Team at Plug-In 2012

Speakers Bureau

Through TRC, a speaker's bureau will be created with one lead contact, presumably the outreach coordinator, who will reach out to organizations to offer public speakers on PEVs and/or facilitate requests. The speaker's bureau will operate as a committee of TRC partners actively involved with TRC and interested in speaking about general and specific PEV issues in Central Texas. Speakers for the bureau will include committee members and the TRC outreach coordinator. The web site will include a page indicating the availability of speakers for area educational events. Organizations to target include schools (primary through university), community organizations (i.e., Lions, Rotary, Chambers of Commerce, garden clubs, PTAs, industry specific), churches, and business lunches and learning sessions.

PLAN EXECUTION TIMELINE

The timeline for execution is based on a two-year period with at least one TRC project coordinator conducting outreach efforts. See calendar on next page.

Objectives	Task Description	Oct. '12	Nov. '12	Dec. '12	Jan. '13	Feb. '13	Mar. '13	Apr. '13	May '13	June '13	July '13	Aug. '13	Sep. '13	Oct. '13	Nov. '13
1	Videos and Photography														
1	Social Media and Blog														
1	Web-site														
1	Smart Phone Application														
2	Education and Outreach														
3	Central Texas Fuel Independence Campaign Events														
3	Logo and Branding of Program														
3	QVC Code														
3	Regional Media Pitches														
3	Advertising														
	Development/Maintenance of Materials/Programs														
	Launch of Activity/Deliverable														

Objectives	Task Description	Dec. '13	Jan. '14	Feb. '14	Mar. '14	Apr. '14	May '14	June '14	July '14	Aug. '14	Sep. '14	Oct. '14
1	Videos and Photography											
1	Social Media and Blog											
1	Web-site											
1	Smart Phone Application											
2	Education and Outreach											
3	Central Texas Fuel Independence Campaign Events											
3	Logo and Branding of Program											
3	QVC Code											
3	Regional Media Pitches											
3	Advertising											
	Development/Maintenance of Materials/Programs											
	Launch of Activity/Deliverable											

The TRC marketing budget is based on a two-year period of time with at least one TRC project coordinator conducting outreach efforts.

Marketing Budget

	2012	2013	2014	Total
Education/Outreach				
Press Pitches	$ -	$ -	$ -	$ -
PEV Guides	$ -	$ 3,000	$ 3,000	$ 6,000
PEV Educational Videos	$ -	$ 1,500	$ 1,500	$ 3,000
PEV Educational Workshops	$ -	$ 1,000	$ 1,000	$ 2,000
PEV Outreach Booth	$ -	$ 5,000	$ 5,000	$ 10,000
Press Pitches	$ -	$ -	$ -	$ -
Blog	$ -	$ -	$ -	$ -
Public Relations Total	**$ -**	**$10,500**	**$10,500**	**$ 21,000**
Marketing Communications				
Logo and Branding	$10,000	$ -	$ -	$ 10,000
Website	$20,000	$ -	$ -	$ 20,000
QR Code	$ -	$ 250	$ 250	$ 500
Promotional PEV Videos	$ -	$ 500	$ 500	$ 1,000
Smart Phone Application	$ -	$ 5,000	$ -	$ 5,000
Photography	$ -	$ 2,500	$ -	$ 2,500
Internet marketing	$ -	$ 1,500	$ 1,500	$ 3,000
Collateral	$ -	$ 2,500	$ 1,500	$ 4,000
Events	$ -	$10,000	$10,000	$ 20,000
Marketing Communications Total	**$30,000**	**$22,250**	**$13,750**	**$ 66,000**
Advertising				
Print		$ 5,000	$ 5,000	$ 10,000
Online		$ 5,000	$ 5,000	$ 10,000
Advertising Total	**$ -**	**$10,000**	**$10,000**	**$ 20,000**
Other				
Postage	$ -	$ -	$ -	$ -
Telephone	$ -	$ -	$ -	$ -
Travel	$ -	$10,000	$10,000	$ 20,000
Computers and office equipment	$ -	$ -	$ -	$ -
Other Total	**$ -**	**$10,000**	**$10,000**	**$ 20,000**
Total Marketing Budget	**$30,000**	**$52,750**	**$44,250**	**$127,000**

TRC Charter Purpose

- The primary purpose of the Texas River Cities Plug-In Electric Vehicle Initiative (TRC) is to prepare a regional PEV readiness plan for the ongoing deployment and increased adoption of these vehicles and associated charging infrastructure for participating Central Texas communities.

Business Participation

- TRC is committed to building a network of PEV partners including local and area businesses, governments, utilities, and supporters to facilitate business opportunities and services that meet the needs of PEV drivers.
- A key part of business outreach is to develop information related to training opportunities for charging infrastructure installers, PEV mechanics, and other related professionals.

Consumer Focus

- Through this initiative, TRC is creating a comprehensive plan that will address the current and future charging needs of PEV drivers at home, at work, and on the go.
- TRC is committed to meeting the needs of its stakeholders and will facilitate comprehensive research to ensure quality results for future planning that will be made available in the public domain to benefit regional partners and beyond, including open forums, surveys, and demographic statistics.
- TRC will promote key consumer benefits supporting PEV drivers in the TRC region, including cleaner air, lower fuel costs, and a clean driving experience. TRC will support efforts to maximize consumer exposure to the experience of PEV driving.
- TRC supports the goal of decreasing the nation’s dependency on petroleum and diversifying the nation’s modes of transportation to include alternative-fuel vehicles.

Stakeholders and interested parties can stay connected with TRC by visiting www.texasrivercities.com.

The following templates and deliverables can be utilized by a variety of regional communities and organizations in facilitating the adoption of PEVs.

TRC Fact Sheet

Overview

In September 2011, the U.S. Department of Energy (DOE) awarded two grants dedicated to managing charging infrastructure for plug-in electric vehicles (PEVs) in Texas, the Texas River Cities PEV Initiative (TRC) and the Texas Triangle PEV Readiness Plan. Austin Energy is leading TRC to create a plan for PEV charging infrastructure deployment in participating Central Texas communities. The Center for the Commercialization of Electric Technologies (CCET) is leading the Texas Triangle Plug-In Electric Vehicle Readiness Plan to plan for PEV charging infrastructure for corridor travel between the four major metro areas of Texas (San Antonio, Dallas, Houston, and Austin). Together these initiatives will address the current and future charging needs of Texas PEV drivers at home, at work, and on the go.

Purpose

The primary purpose of TRC is to prepare a regional readiness plan for the ongoing deployment and increased adoption of these vehicles and associated charging infrastructure for participating Central Texas communities.

Defining Plug-In Electric Vehicles

There are a number of electric vehicles on the road today, including:

- **Extended-Range Electric Vehicles (EREV)—**Powered through two systems: conventional gasoline-fueled engine and electric power from the electric grid, or an on-board electric generator to extend the vehicle’s range.
- **Plug-In Hybrid Electric Vehicles (PHEV)—**Also powered through two systems: conventional gasoline engine and electric power through batteries.
- **Battery Electric Vehicles (BEV)—**Only uses electric power drawn from the electric grid, and may include two-wheel electric scooters, bicycles, and motorcycles. BEVs also include low-speed Neighborhood Electric Vehicles (NEVs).

Plug-In Electric Vehicle Charging

TRC is committed to creating a network of PEV partners including local and area businesses, governments, utilities, car dealerships, electric vehicle supply equipment (EVSE) manufacturers, PEV manufacturers, consumers, and supporters to facilitate business opportunities and services that meet the needs of PEV drivers. Currently, there are more than 250 public access charging stations in the TRC area, including 180 in San Antonio and 113 in Austin, as well as charging options at home and at many work places. There are also active efforts to increase availability of home, work, and public access charging in San Antonio, Austin, and surrounding areas.

Benefits of Plug-In Electric Vehicles

PEV drivers can save approximately $1,200 per year on fuel—based on U.S. average per-mile costs for gasoline versus electricity.[9] Driving an electric car saves significantly on gasoline-related fuel and maintenance costs. All-electric vehicles use no gasoline and do not use oil, eliminating routine oil changes. Both BEVs and PHEVs are much quieter in electric-only mode and reduce or eliminate overall emissions. Electricity costs vary by region, but these costs are usually one-third to one-half the cost of gasoline per mile driven. Since most electricity is produced using domestic fuel sources, the widespread use of PEVs is a means to reduce U.S. dependence on foreign oil. The electric grid is powered by a variety of electricity sources, including an increasing supply of renewable energy, all with the potential to help us become more energy-independent. The climate benefits of using electricity as a fuel will continue to improve as utilities procure more generation from renewable energy sources. Other benefits of driving PEVs include cleaner air, lower emissions, and a clean driving experience.

For more information visit www.texasrivercities.com

Resources

www.afdc.energy.gov/afdc/pdfs/51017.pdf
www.plugintexas.org
www.pluginamerica.org/incentives
www.electricdrive.org
www.theEVproject.com
www.EVconnect.net

[9] Union of Concerned Scientists. June 2012. "*State of Charge: Electric Vehicles' Global Warming Emissions and Fuel-Cost Savings Across the United States*." http://www.ucsusa.org/assets/documents/clean_vehicles/electric-car-global-warming-emissions-report.pdf.

Frequently Asked Questions

What are the current ranges on PEVs?

Most battery electric vehicles (BEV) can go approximately 100 miles before recharging and plug-in hybrid electric vehicles (PHEV) can go approximately 300 miles before refueling.

	Typical Charging Time	Charging Voltage	Location
Level 1	6 to 20 hours	120 V	Home or workplace
Level 2	3 to 8 hours	240 V	Home or public charging
Fast Charging	20-30 minutes	480 V	Commercial or retail

*Information provided by the U.S. Department of Energy

What are the current electric vehicle models on the market?

There are a number of electric vehicles currently available for purchase in the area and many auto manufacturers are launching new electric vehicles every year. For a complete list of plug-in electric vehicles (PEVs) visit www.hybridcars.com/electric-car.

Do I need a special plug?

Most new electric vehicles can plug into a standard 120-volt household outlet with a converter, which can supply (overnight) most people with the energy they need for their daily commute, which is typically less than 40 miles a day. If you have an all-electric vehicle or want the option of faster charging at home, you will likely want to install a 240-volt charging station in your garage or carport. This is a dedicated higher-voltage electrical circuit similar to what is used for your furnace, water heater, or clothes dryer. The plug (J1772) and receptacle on the car have been standardized among EVSE manufacturers so you will not have to buy a new charging unit for each car you purchase. Additionally, most PEVs come equipped with a Level 1 charging cable and plug.

Why use electricity to fuel our cars?

The use of electricity as a fuel produces fewer emissions than the extraction, refining, and combustion of gasoline in a vehicle—that means zero tailpipe emissions overall (greenhouse gases as well as other pollutants). Even the use of the heaviest carbon dioxide-emitting source of electricity – coal – only produces two-thirds the carbon dioxide of petroleum used in a conventional vehicle, and only half the carbon dioxide of Alberta tar sands synthetic oil, the dominant new source of gasoline in North America. If electricity is generated using wind (which typically blows strongest at night when PEVs are most likely to be charging), hydropower, solar, or biofuels, there is the potential to significantly reduce emissions even further. Finally, electric vehicles save the consumer fuel costs, since the cost of electricity per mile is much less than gasoline.

Are there rebates or tax credits available for purchasing a plug-in vehicle?

Yes. U.S. federal tax credits are available up to $7,500, depending on the capacity of the battery of your vehicles. In addition, some states and local governments offer incentives for purchasing plug-in electric vehicles. For more information visit www.afdc.energy.gov/afdc/laws and www.irs.gov.

When is the best time to charge my electric car when at home?

Most utilities prefer that you charge your electric car at night or during other off-peak hours. At night, the demand on the grid is much lower than during peak or daytime hours. Some utilities may offer lower rates to incentivize you to charge your vehicle during off-peak hours. Utilities pay more for electricity generation during the day when loads are high, so the cost may be higher to customers when they choose to charge during daytime hours. How this cost is passed on to the consumer depends on the local utility.

How will I charge a plug-in electric car if I live in a multi-unit dwelling?

If you live in a multi-unit dwelling you will want to investigate the options for charging your vehicle at home before making a purchase or lease of a plug-in electric vehicle (PEV). Your landlord, management company, or condo/coop board will likely have rules regarding charging your vehicle at your place of residence. If you have access to a 120-volt outlet where you park your car, approval may be an easier process. However, if you want to have access to fast charger using 240 volts, your building management will need to have an electrician conduct power quality and load studies to determine existing power capacity before installing this equipment. In the case of a multifamily unit, building owners are likely to install a meter to track and bill individuals for the power they consume when charging their vehicle.

How do I go about getting a charger installed in my home?

You need to contact your utility to get information on PEV rates, demand response programs, meter options, and impact on your bill from the added electric load. Your automaker or utility may have a list of preferred installers. You will also need to have a licensed electrical contractor assess the condition of your home electrical system, provide you with options for 120- and 240-volt charging, and provide the cost estimate for installing any circuits, panels, meters, and charging equipment.

Can the electric grid handle an influx of plug-in electric vehicles?

Yes. Numerous studies have shown that the electric grid can support a large number of PEVs, especially when the majority of battery recharging occurs at night when demand is lower. Many utilities are incorporating the additional usage of electric vehicles in their electricity load forecasting and system planning.

What if I wanted to go on a long trip in my electric car?

If you are driving a PHEV, you can typically go a range of 40 miles or more on pure electricity. When the battery is depleted, your car has a backup internal combustion engine that serves as a generator for the battery and will function and travel as far as a gas powered vehicle. If you are driving an all-electric car you will want to map out your trip distance and determine if and when you may need to recharge. Most PEVs have a range of approximately 40-80 miles. Public charging equipment is installed throughout North America with thousands more on the way. To map out current charging stations on your travel route visit www.cleancarmaps.com, www.plugshare.com, or www.afdc.energy.gov/afdc/fuels/stations.html. Other options for long distance travel include some recreational vehicle (RV) campgrounds, particularly those with 50 Amp service.

Will public charging stations become more common?

Governments at all levels are providing grants and incentives to charging station manufacturers, municipalities, and corporate employers to install public charging stations. Public charging stations are planned and in many cases they are installed in and around major metropolitan areas, including Austin, Dallas, Houston, San Antonio, San Francisco, Sacramento, Los Angeles, Detroit, New York, Washington, D.C., and many other North American cities.

Do PEVs just shift pollution from gasoline cars to power plants?

Overall, PEVs reduce greenhouse gases and other pollutants. The emissions from power plants are concentrated in one location. It is far easier to control emissions emitted by a small number of power plants rather than millions of vehicles, particularly as pollution reduction technology improves. In many regions of the United States and Canada, electricity is also produced from clean sources such as hydropower, nuclear, wind, and solar power. Additionally, many of today's power plants have been modified to lower emissions while a number of older, less efficient plants have been retired. The increasing use of wind, solar, and other renewable power sources will continue to make electricity a cleaner alternative than fossil fuels.

Can I plug a charger in while standing in water or when it is raining?

Yes. There is no issue with plugging in a charger while having contact with water, for two reasons. First, the charging cable is not "live" while you are handling it. The connection must be made to the vehicle and the charger has to sense that the connection is properly made before the electric current will be turned on for charging. Second, the charger has a sophisticated ground fault circuit interrupter (GFCI) system that is much more precise than the ground fault interrupter (GFI) installed in your home's kitchen or bathroom. The charger will stop charging with just a few mili-amps of current leakage detected, which is a very low amount.

How much does it cost to install a charger at my house?

Typical costs range from $1,500 to $2,500, and may be less depending upon the incentives utilities offer in your area.

Will there be chargers at my work?

This depends upon where you park and the charging services offered by employers or parking services. Public parking lots and garages may or may not charge additional fees for plugging into their charging stations and some have installed 120-volt slow charging for all-day use. Other public charging stations require a membership card, key fob, or other payment system. Employers are beginning to install charging stations and many are now offering them to their employees to encourage the use of electric vehicles.

How much maintenance is required on a PEV relative to a conventional car?

Since a battery PEV has few moving parts in the motor and drive train, the only routine maintenance is for tire inflation, rotation, windshield washer fluid, and the occasional alignment, so the costs are reduced dramatically. For PHEVs, maintenance costs will be similar to a conventional car, however if the vehicle is driven primarily in electric mode the frequency of service and maintenance may be significantly reduced. All usable parts of a vehicle can wear, so one should occasionally inspect to be sure the PEV remains in good working order. This also includes communications systems, connectors, and lights.

Information on PEVs is provided by Austin Energy's Plug-In Partners, at http://www.pluginpartners.org.

Station Host Quick Fact Sheet for Customers

We are proud to host an Austin Energy® Plug-In EVerywhere™ Electric Vehicle Charging Station as a courtesy to our customers and visitors.

Plug-In EVerywhere™

What are the benefits of Plug-In Electric Vehicle (PEV) charging?
PEVs help clean Austin's air. Electricity is also cheaper than gasoline—current subscribers to the network pay less than $5 per month for unlimited charging. All charging stations in the Plug-In EVerywhere™ (PIE) network are 100% powered by GreenChoice® (renewable energy).

How does it work?
The station(s) are part of the Austin Energy PIE network. To start a charging session, simply swipe your PIE card or RFID-enabled credit card in front of the station screen, which will unlock the connector. Connect the plug to your vehicle, and verify that the vehicle is charging. Currently, PIE members enjoy unlimited charging for just $25 for 6 months, or you can pay $2 per hour using your RFID-enabled credit card.

GreenChoice® CHARGING STATION
Green-e

How safe is it?
The station is Underwriters Laboratories (UL) listed, which means that extensive third party testing has found charging stations to be safe for consumers. The locked plugs are not energized until connected to the vehicle, another safety feature that protects PEV drivers in the rain.

What do I do if I am having problems with my PIE card, charging station, or if another vehicle is parked in the PEV designated spot that is not utilizing the charging station?
Please call 3-1-1.

How can I find stations in Austin?
Please call 3-1-1 or visit www.chargepoint.com.

For more information visit pluginpartners.com or call 311

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Plug-In EVerywhere™

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How can I find stations in Austin?
Please call 3-1-1 or visit www.chargepoint.com.

For more information visit pluginpartners.com or call 311

Media Release

CONTACTS: NAME, PHONE NUMBER, EMAIL
DATE: MONTH XX, 2012

TITLE

AUSTIN, TEXAS — TEXAS RIVER CITIES PLUG-IN ELECTRIC VEHICLE INITIATIVE (INSERT EVENT OR ANNOUNCEMENT OVERVIEW)

WHO: (INSERT DIGNITARIES, SPEAKERS, ATTENDEES TO NOTE)

WHAT: (INSERT NAME OF PEVENT)

WHEN: (INSERT EVENT DATE, MONTH XX, 2012)
(INSERT TIMES/CEREMONY BREAKDOWN)

WHERE: (INSERT LOCATION AND DIRECTIONS)

BACKGROUND: The primary purpose of the Texas River Cities Plug-In Electric Vehicle Initiative (TRC) is to prepare a regional readiness plan for the ongoing deployment and increased adoption of these vehicles and associated charging infrastructure for participating Central Texas communities.

www.texasrivercities.com

Section 8
PROJECTION OF PEV MARKET PENETRATION FOR THE TRC REGION

8.1 Overview

The University of Texas San Antonio (UTSA), a stakeholder in the TRC initiative, was tasked with investigating existing electric vehicle adoption models as well as adoption models developed for other technologies such as residential central air conditioning, hybrid vehicles, diesel vehicle adoption in Europe, personal computers and many others. Researchers identified key variables, collected and analyzed data for each variable and developed a series of customized technology adoption models that project PEV market penetration for Bexar County (including San Antonio). TRC will work with UTSA to expand its models to incorporate the entire TRC region to predict PEV adoption rates.

In 1999, hybrid vehicles debuted in the North American market. They represented the newest breed of innovation in the automobile industry and a significant step forward towards significantly increasing vehicle mileage while maintaining performance without sacrificing emissions. In December of 2010, the Chevrolet Volt, a plug---in hybrid electric vehicle was released. Soon after, Nissan released the Leaf, a 100% plug---in electric vehicle. As of summer of 2012, many of the top---selling carmakers have started selling electric vehicles in the U.S. market. Those include Honda, Mitsubishi, Tesla, Ford, BMW, Mini Cooper, and Coda. Many other vehicles are available in the European and global markets.

The attached report in Appendix D – ***"Driving the Future: An Adoption Model for Electric Vehicles in San Antonio"*** - summarizes the findings of the investigation including previous adoption forecasting models, market incentives, market barriers and a series of key economic and social variables that may affect the way electric vehicles are adopted.

At the present time, there is a considerable body of literature discussing and analyzing the intricacies of the electric vehicle industry, from their design, complexity and cost to their place in the market as well as their ability to effectively compete with and replace their gasoline and diesel driven counterparts. Other topics covered in the literature include development plans, future R&D needs, public policy analyses, infrastructure development strategies, consumer perception and availability and access to reliable charging infrastructure.

A variety of forecasting models were evaluated for use as tools for predicting adoption of EVs in the San Antonio market. A number of key studies have been published and are publicly available. The Michigan study and the Berkeley study are two great examples. In the Michigan study, researchers projected adoption of electric vehicles using the same Michigan---Bass (Combined) model. Other studies reviewed included the Pure Innovation Model, the Pure Imitative Model, the EPRI study, and the market saturation model. The team developed its own predictive model using a multi---variate adoption approach that used a combination of socio---economic and industry indicators and their respective coefficients to predict adoption.

The Michigan and EPRI studies appeared to be more optimistic of the adoption rate as compared to recent data for the San Antonio area. Given the results of the team's model, we believe that adoption of electric vehicles in the San Antonio market will lag behind national averages.

The Bass Algorithm uses two main parameters, namely innovation and imitation. The innovation parameter is concerned with the technology and financial matters of the issue. The imitation parameter is concerned with the awareness and news one hears about a particular issue, as well as recommendations one gets from family and friends.

The UTSA model takes into account the same factors as the Bass model, plus replacement (a minor factor at this stage), plus gas/electricity pricing, income and education levels of the population under study. It is based on the assumption that all factors are multiplicative, and that each factor can be seen as a subset of the next, and so on. For example, automobile owners in the San Antonio area with advanced degrees, exceeding a certain income level, sensitive to fuel prices, and sensitive to news stories relating to electric vehicles may be influenced to purchase an EV. In other words, automobile owners meeting several criteria are likely buyers. That early adopting group is also known as the "Innovators." As a comparison point, sales of hybrid vehicles represent about 2% of total vehicle sales in the U.S., which would indicate that the hybrid vehicles market has not transitioned into the next stage of adoption represented by the "Early Adopters."

Based on preliminary findings, adoption of electric vehicles is being hampered by the following factors:

- Significant price premium between EVs and equivalent size vehicles, even within the same car manufacturer Costs associated with operation of maintenance of an EV are mostly uncertain, given the short track record (since 2010)
- Current federal tax incentives ($7,500) are not high enough to overcome the price premium paid by consumers
- Costs associated with purchase and installation of the necessary charging infrastructure can be significant and are commonly not rolled into the financing of the vehicle
- EVs represent a significant paradigm shift in the mind of consumers, one for which the American public may not be ready
- Cost of battery pack are high and its replacement frequency is uncertain (cars have been in operation for the last couple of years while car manufacturers guarantee the battery pack for a period of 7 to 8 years)
- Lack of clear policies at the local, state and federal level incentivizing adoption of EVs

Models studied only indicate purchases if economic incentives are present, or said another way; purchases are only likely to occur if there is a net neutral financial advantage of the new EV over the old gasoline driven vehicle at the very least. New technology-based products only "take-off" when there is a distinct financial advantage of the new technology over the old.

UTSA's public policy analysis indicates that a series of federal government policy moves, such as air quality improvement, attempts to force gas prices upward, rebates and tax reduction incentives, and incentives or pressures placed upon auto manufacturers to offer electric vehicles, all have the affect of forcing auto industry offerings on the one hand, and the acceptance of potential purchasers for the EV product.

Additional research is required to further refine the proposed adoption models. It is recommended that the team continues to collect EV sales data for the San Antonio area as well as other meaningful consumer related data as to evaluate the likelihood of area residents of purchasing an EV the next time they are faced with replacing their existing vehicle.

8.2 Recommendations

Below are recommendations for next steps:

Recommendation 1

Report on alternative pricing models for PEVs in an effort to reduce or mitigate the current price premium versus internal combustion engine (ICE) vehicles.

Recommendation 2

TRC will work with the University of Texas at San Antonio (UTSA) to expand its model to incorporate the entire TRC region to predict adoption rates. Currently, the model looks at Bexar County only.

8.3 PEV Adoption Model

Appendix D contains the research report written by UTSA. The report provides information on the process and analysis used by UTSA to complete the PEV adoption model.

Section 9
CREATION, ADMINISTRATION, GROWTH OF TEXAS RIVER CITIES INITIATIVE

9.1 Overview

In September 2011, the U.S. Department of Energy (DOE) awarded two grants dedicated to managing charging infrastructure for plug-in electric vehicles (PEVs) in Texas: the Texas River Cities Plug-In Electric Vehicle Initiative (TRC) and the Texas Triangle Plug-In Electric Vehicle Readiness Plan. Austin Energy led the TRC to create a plan for PEV charging infrastructure deployment in participating Central Texas communities. The Center for the Commercialization of Electric Technologies (CCET) received funding to lead the Texas Triangle Plug-In Electric Vehicle Readiness Plan to plan for PEV charging infrastructure for corridor travel between the four major metro areas of Texas (San Antonio, Dallas, Houston, and Austin). Together these initiatives address the current and future charging needs of Texas PEV drivers at home, at work, and on the go in their respective regions.

As part of the TRC plan, governmental, municipal, and utility entities, and industry experts formed an alliance, known as Texas River Cities (TRC). One of the goals for the TRC is to establish the alliance as a formal, self-sustaining entity that will implement the plan and continue to coordinate efforts for the regional deployment of PEVs.

Austin Energy staff members met with representatives of existing non-profits and alliances in the TRC region to gather information on best practices, lessons learned from administering non-profits, and feedback on a permanent TRC entity. Staff members compiled the information received and drafted four potential paths forward that TRC can implement for a formal entity:

1. Grant-funded
2. Stand-alone non-profit
3. Merger with existing non-profit
4. Alliance

The four paths/models are further discussed in Section 9.3, Recommendations, below.

Key Findings

Key Finding 1

Members of the TRC alliance strongly agree the TRC activities should continue moving forward after this report is finalized.

Key Finding 2

The source of funding is a primary determinant for the scope of the TRC alliance.

Key Finding 3

PEV industry representatives bring considerable value to the ongoing deployment of PEVs.

9.2 Recommendations

Recommendation 1

Create a formalized entity to carry out TRC implementation efforts.

Recommendation 2

Establish a governance structure for the organization,

Recommendation 3

TRC will pursue the recommended implementation efforts of the adopted elements of the plan, and will continue to facilitate ongoing deployment and increased adoption of PEVs and PEV charging infrastructure.

Recommendation 4

TRC will create subject-matter working/advisory groups within the overall alliance to include interoperability, marketing/communications, and business models.

9.4 Texas River Cities: Options for Permanent Entity

9.4.1 Grant Funded

The first path explored, and most desired, is the grant-funded path. In June 2012, Austin Energy submitted an application for “The Central Texas Fuel Independence Project” under DOE’s funding opportunity announcement DE-FOA-0000708. The objective of the proposed project is to continue the efforts of TRC, implement strategies recommended by the TRC initiative, and reduce barriers to the widespread use of alternative-fuel vehicles, including natural-gas vehicles. Grant funding provides a reliable funding source to allow for permanent administrative support and a smooth transition for the implementation of the TRC initiatives. Below, please find an outline for a grant-funded business model.

Mission: The primary purpose of the Central Texas Fuel Independence Project is to reduce barriers to the widespread use of cleaner, domestic, and more secure alternative- and renewable-fuel vehicles in the Austin and San Antonio region.

Governance: Austin Energy and Clean Cities are proposed lead agencies.

Administration: Austin Energy, Clean Cities, City of San Antonio, and University of Texas at San Antonio will administer the grant, with Austin Energy as project lead, and supported by inter-local agreements.

Forum: City of Austin, City of San Antonio, Texas Department of Transportation, Texas Commission on Environmental Quality, State Energy Conservation Office, Electric Reliability Council of Texas, and private industry representatives

Goals:

1. Continuation, implementation, and expansion of TRC, which received DOE funding in September 2011 under funding opportunity announcement (FOA)-451.
2. Satisfy a business need to create a centralized regional consumer, local government, utility and business information resource that has been identified as a future need through TRC's goal of creating a regional alternative-fuel infrastructure.
3. Fund activities of the Clean Cities organizations serving the region, enabling them to better execute their mission as the primary resource for training and education, supporting a transition away from oil as the primary transportation fuel source.
4. Support local climate-protection plans, such as the Austin Energy Resource and Climate Protection Plan 2020 and the San Antonio Mission Verde Plan, and lower emissions in the Federal Implementation Plan (FIP) region, a region on the verge of falling into clean air non-attainment.
5. Strengthen partner business models through cross-fuel and regional partnerships.

Clients: Local governments, utilities, clean cities organizations, and industry advisors

Program:

- Develop policy initiatives involving key decision-makers from state and local agencies to positively impact local, regional, and state regulations, plans, codes, and/or incentives regarding the use of alternative transportation fuels.
- Lead investigations leading to action items for barrier-reduction measures.
- Implement safety and training initiatives and activities.
- Market electric and natural-gas vehicles as the more attractive choice to consumers in the region.

Funding:

- DOE grant (DE-FOA-0000708)

Budget:

- Approximately $650,000 over 24 months

Pros and Cons:

- Pros:
  - Established funding
  - Administrative support
  - Continuation of momentum from TRC Regional Plan
- Cons:
  - Grant may not allow for separate entity (501(c)(3)) to be formed

9.4.2 Stand-Alone Non-Profit

Should Austin Energy not receive grant funding under FOA-708, another option for continuation of the TRC entity is creation of a 501(c)(3). TRC has an established interest and database of stakeholders that can easily fold into a membership list for a new non-profit. The envisioned single entity will champion the program and funding solicitation, contributing to the success of the mission. A non-profit, however, requires substantial operational involvement in addition to the initial founding work, and thus the need for a full-time employee. Mission success may fluctuate with personnel gaps. Below, we provide an outline for a non-profit business model.

Mission: The primary purpose of TRC is to facilitate ongoing deployment and increased adoption of PEVs and associated charging infrastructure for participating Central Texas communities, and could also include alternative fuels.

Governance: Board of directors nominated by members [501(c)(3): public charities]; potentially made up of a majority of public powers (including CPS Energy & Austin Energy), private industry advisors, and representatives of membership; could potentially utilize an inter-local agreement

Administration: Executive director selected by the board of directors

Members: Local governments, utilities, clean cities organizations, and private industry advisors

Goals:

1. Continue, implement, and expand TRC, which received DOE funding in September 2011 under FOA-451.
2. Advance the centralization of information and public access to resources available on alternative-fuel vehicles in Central Texas.
3. Build awareness of PEVs, resources, current regional options from preparing to purchase to actual purchase of PEVs, and benefits of diversifying transportation modes.
4. Improve the regional economic impact of PEVs through increased adoption of diverse methods of transportation.
5. Support the recommendations from the TRC plan adopted by TRC.

Clients: Current and future PEV drivers, at home, work, and on the go

Program:

Promote PEV usage through a variety of grassroots and business-to-business efforts.

- Launch strategically targeted electronic resources through a variety of mediums to demonstrate ease of use and access of alternative transportation.
- Develop educational outreach materials with cohesive branding and messaging to disseminate to the target audiences.
- Promote PEV usage through a variety of grassroots and business-to-business efforts.

Deliverables to Members:

- Exposure for members, i.e., logos on web page, logo shown at events

- Public events, including panel discussions and the like
- Change in public policy at municipal and state levels

Funding:

- Membership model (tiered system), donations and gifts, grants

Budget:

- To be determined; need a budget for a full-time employee and marketing $650,000 over 24 months

Pros and Cons:

- Pros:
    - A single entity championing program
    - Already established interest and database of stakeholders
    - Ability to solicit big players (e.g., CPS, AE, Bluebonnet) to contribute and support mission success
    - A flexible entity
- Cons:
    - Setting up a 501(c)(3) is time consuming.
    - Non-profit administration requires significant operational involvement and will require a staff member.
    - Mission success can fluctuate with personnel gaps.
    - Having big players on board is essential to success.

9.4.3 Merger with an Existing Non-Profit

Austin Energy staff researched the option to incorporate the TRC mission into an established non-profit as another means for continuation of TRC. An existing non-profit has an established administration, funding source, and reputation. TRC members may not need to spend of the required time and effort to set up a 501(c)(3) if an existing non-profit accepts the scope of the TRC mission. The mission for TRC, however, may receive less focus as more attention is paid to the primary mission of the established non-profit. Below we outline a business model for merging with an existing non-profit.

Mission: The primary purpose of TRC is to facilitate ongoing deployment and increased adoption of PEVs and associated charging infrastructure for participating Central Texas communities. (*The mission is subject to change based on the existing entity, but must be kept in alignment with the TRC mission.*)

Governance: Existing governance; potentially expanded board of directors; potentially a 501(c)(3)

Administration: Existing administration; potentially an executive director

Members: Local governments, utilities, clean cities organizations, private industry advisors, and existing members.

Goals:

1. Continue, implement, and expand TRC, which received DOE funding in September 2011 under FOA-451.
2. Advance the centralization of information and public access to resources available on alternative-fuel vehicles in Central Texas.
3. Build awareness of PEVs, resources, current regional options from preparing to purchase to actual purchase of PEVs, and benefits of diversifying transportation modes.
4. Improve the regional economic impact of PEVs through increased adoption of diverse methods of transportation.
5. Support recommendations from TRC plan adopted by TRC.

Clients: Current and future PEV drivers at home, work, and on the go; existing clients of the non-profit entity

Program:

- Launch strategically targeted electronic resources through a variety of mediums to demonstrate ease of use and access to alternative transportation
- Create educational outreach materials with cohesive branding and messaging to disseminate to the public.
- Promote PEV usage through a variety of grassroots and business-to-business efforts.

Funding:

- Existing funding, including (but not limited to) donations, gifts, membership model, grants, and potential for payment by clients of existing entity

Budget:

- To be determined; need a budget for half of the salary of a full-time employee and marketing

Pros and Cons:

- Pros:
  - Established entity with administration
  - Established funding
  - Established reputation
- Cons:
  - Merge with existing mission
  - Less focus on the TRC mission
  - Existing board may not want to take on TRC mission

9.4.4 Alliance

Another path considered by Austin Energy staff for continuation of TRC is an informal alliance. An example of an alliance is a represented coalition of stakeholders that convenes to represent a particular issue, while remaining neutral to a particular stakeholder interest. For example, the Texas Energy Storage Alliance "is a diverse and technology neutral coalition of energy storage technology product or services companies and allies pursuing an open and fair legal and regulatory environment in the Texas and ERCOT markets." [10] An informal alliance requires less paperwork and administrative tasks than a non-profit, reducing budget costs. Alliances are flexible and amiable to membership requirements. Due to the informal nature of the group, however, commitment by members is potentially lessened and the group's influence on the mission is thus reduced. Below we provide an outline for an alliance business model.

Mission: The primary purpose of the TRC alliance is to facilitate ongoing deployment and increased adoption of PEVs and associated charging infrastructure for participating Central Texas communities. This could also include alternative-fuel vehicles.

Governance: Informal structure, but would need public powers within membership; could potentially utilize an inter-local agreement

Administration: Membership makes decisions unanimously/through consensus; no staff required.

Members: Local governments, utilities, clean cities organizations, and private industry advisors

Goals:

1. Continue, implement, and expand TRC, which received DOE funding in September 2011 under FOA-451.
2. Advance centralization of information and public access to resources available on alternative-fuel vehicles in Central Texas.
3. Build awareness of PEVs, resources, current regional options from preparing to purchase to actual purchase of PEVs, and benefits of diversifying transportation modes.
4. Improve the regional economic impact of PEVs through increased adoption of diverse methods of transportation.
5. Support recommendations from the TRC plan adopted by TRC.

Clients: Current and future PEV drivers at home, work, and on the go.

Program:

- Launch strategically targeted electronic resources through a variety of mediums to demonstrate ease of use and access to alternative transportation
- Create educational outreach materials with cohesive branding and messaging to disseminate to the public.
- Promote PEV usage through a variety of grassroots and business-to-business efforts.

[10] http://texasenergystorage.org/

Deliverables to Members:

- Exposure for members, i.e., logos on web page, logo shown at events
- Public events
- Change in public policy at municipal and state levels
- Facilitated communication between groups

Funding:

- Annual membership dues ($5,000 to $10,000 per year)

Budget:

- To be determined; need a budget to pay for a part-time employee and marketing

Pros and Cons:

- Pros:
  - Flexible
  - Less paperwork and administration
- Cons:
  - Membership commitment difficult
  - Potentially less influence than as a formalized organization

9.4.5 Recommendation

As mentioned previously, the TRC alliance recommends creation of a formal entity to review the plan outlined in TRC report, adopt plan elements, and pursue implementation of adopted elements/recommendations. TRC's preferred path for moving forward is the grant-funded business model under FOA-708. Austin Energy staff, through the term of the TRC grant, will continue to explore potential routes for a formal entity until DOE announces awards for FOA-708. At the time of announcement, Austin Energy will either move forward with the grant-funded business model or solicit feedback from TRC members and stakeholders on one of the other three potential paths forward. Austin Energy will hold an implementation kickoff meeting at the appropriate time to further discuss the plans for TRC.

10.1 Overview

In order to examine the issues and barriers to plug-in electric vehicle (PEV) adoption among workplace and multifamily locations, several surveys were taken to gather direct input from stakeholders within the Texas River Cities Plug-In Electric Vehicle Initiative (TRC) region. This section provides information and results on the following five surveys:

- Multifamily (apartment, townhouse, duplex) property owners
- Multifamily residents
- Large employers, parking lot owners, and garage management
- Electric vehicle owner needs analysis
- Business utility model survey

The answers and the original survey questions are provided in this section.

10.2 Surveys

Survey Methodology

This section first looks at overall results of the five surveys and provides insight into:

- Survey methodology
- Commonalities between surveys
- Differences between the survey respondents
- The current state of PEVs in the TRC region
- Current PEV participation model
- Potential PEV participation model

The focus then shifts to information on and experience with PEVs and electric vehicle supply equipment (EVSE) installations gathered from management and technical staff from both workplaces and multifamily housing units in the TRC region.

Survey Summary

Table 10-1 summarizes the surveys for the various groups and subtasks.

Table 10-1. TRC Surveys Conducted

Survey	Section	Survey Title	No. of Respondents	General Location of Respondents
1	4	Apartment Managers	251	Austin, San Antonio, San Marcos, New Braunfels, & Georgetown
2	4	Apartment Residents	501	Austin, San Antonio, San Marcos, New Braunfels, & Georgetown
3	4	Large Employers	147	Austin
4	2	EV Owners Needs Analysis	39	Customers of Austin Energy & CPS Energy
5	5	Business Model	147	Across United States

Commonalties among Survey Answers

All surveys reported common PEV-related issues in three areas:

- Monetary
  - Cost of vehicle
  - Cost of infrastructure
- Technology
  - Battery
  - Range
- Charging speed
  - Size/capacity of car

The high up-front cost of PEVs and infrastructure was a deterrent to buyers, as was the fairly limited battery range and the length of the charging times required. The size of the cars themselves was also a concern, since smaller cars are lighter but also provide less room for occupants and personal items.

Differences between Survey Responses

There were some noteworthy differences across the surveys regarding:

- The need for direct current (DC) fast charging
- Gas prices as a motivator to purchase a PEV
- The use of “EV Pass” as a way to pay for public charging

The survey groups had very different answers or levels of support for these three issues. For example, current owners listed gas prices as one of the top drivers for purchasing a PEV, whereas gas prices were not one of the top priorities for non-owners or potential owners. The need for DC fast charging also varied depending on the group. Current PEV owners were more likely to support the idea of an EV Pass method as a way of paying for public charging. This service was not as popular with non-owners.

Current State

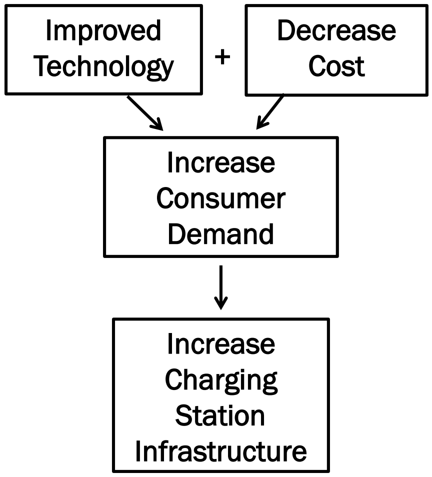
Based on the six surveys generated and hundreds of responses gathered for the TRC project, we see the current TRC environment as one of limited but growing adoption of PEVs and EVSE infrastructure. Current obstacles to PEV deployment include:

- Lack of awareness and education on PEVs
- High cost of vehicles and infrastructure
- Battery-range-limited driving distance
- Small size of PEVs
- Lack of employee/resident demand

Current Participation Model

The current market is not an “if you build it, they will come” model, but the industry requires an increase in education and awareness to offset negative perceptions of cost and technology. These results are supported by the business utility model survey. As illustrated in Figure 10-1, improved technology and decreased cost will lead to increased consumer demand, which will lead to an increase in charging-station infrastructure.

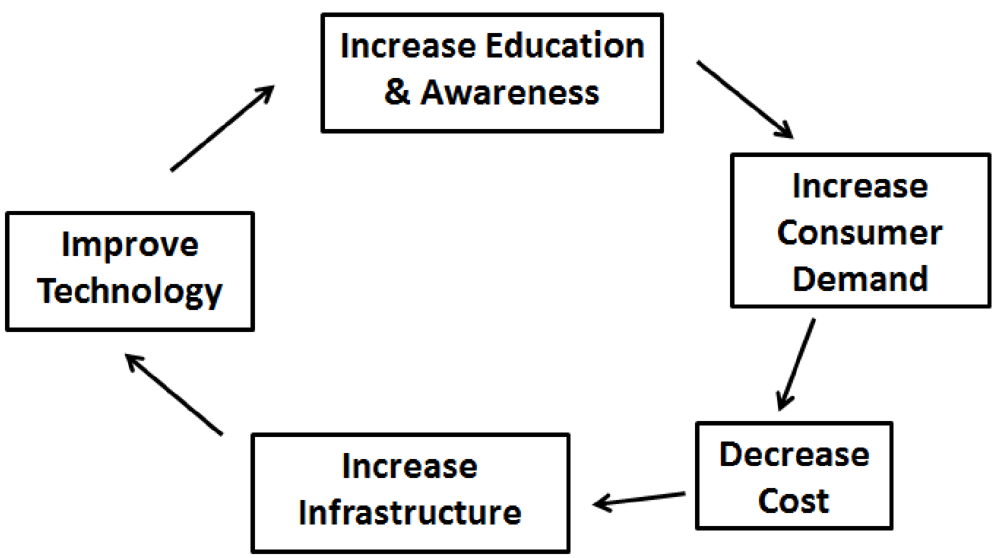
Figure 10-1. PEV and EVSE Demand Drivers



Potential Participation Model

The potential model for participation incorporates ideas suggested in the business model survey, in which supported models are both business-based and competition-based development. An increase in education and awareness increases consumer demand. Increased demand leads to economies of scale from a manufacturing standpoint, driving costs lower. Lower costs and more PEVs on the highways will increase demand for EVSE infrastructure, which leads to competition and improvements in technologies. As technology improves, marketing and education follow, continuing the cycle illustrated in Figure 10-2.

Figure 10-2. PEV and EVSE Demand Cycle



10.3 Texas River Cities Electric Vehicle Owners Survey and Results

10.3.1 Survey Instrument

1) Do you currently own a plug-in electric car?
( ) Yes

( ) No

2) What are the year, make, and model of your plug-in electric car?
Year: _________________________

Make: _________________________

Model: _________________________

3) What type of electric vehicle do you own?
( ) Battery Electric Vehicle

( ) Plug-In Hybrid Electric Vehicle

4) Is your plug-in electric car the only car you drive?
( ) Yes

( ) No

5) Why do you no longer own a plug-in electric car?

6) What would have to change for you to own a plug-in electric car as your primary or only car?

7) On average, how many miles do you travel daily, roundtrip, in your plug-in electric car?
( ) 0-10 miles

( ) 11-20 miles

( ) 21-30 miles

( ) 31-40 miles

( ) 41-50 miles

( ) 51-60 miles

( ) 61+ miles

8) How many miles is your work commute round trip?
( ) 0-10 miles

( ) 11-20 miles

( ) 21-30 miles

( ) 31-40 miles

( ) 41-50 miles

( ) 51-60 miles

( ) 61+ miles

( ) Do not travel from home to work

9) At what times do you typically charge your plug-in electric car? Select all that apply.
[ ] Midnight to 6 a.m.

[ ] 6 a.m. to 10 a.m.

[ ] 10 a.m. to Noon

[ ] Noon to 2 p.m.

[ ] 2 p.m. to 4 p.m.

[ ] 4 p.m. to 6 p.m.

[ ] 6 p.m. to 8 p.m.

[ ] 8 p.m. to Midnight

10) On average, how long do you typically charge your plug-in electric car?
( ) Less than1 hour

( ) 1-2 hours

( ) 3-5 hours

( ) 6-9 hours

( ) 10+ hours

11) Where do you typically charge your plug-in electric car? Select all that apply.
[ ] At home with a charging station.

[ ] At home plugged into a standard 110 volt electric outlet.

[ ] At work plugged into a charging station.

[ ] At work plugged into a standard 110 volt electric outlet.

[ ] Public Charging Stations (i.e. grocery stores, etc...)

[ ] Other

12) Where did you obtain your home charging station?

13) Who installed your home charging station?

14) Where on your property did you have your home charging station installed?

15) What is the make and model of your home charging station?
Make: ________________________

Model: ________________________

16) Have you ever used a public charging station?
( ) Yes

( ) No

17) Why not?

18) What would make charging your vehicle better/easier for you?

19) When using a public charging station, how would you prefer to pay for charging your plug-in electric car?
( ) Credit card at the charger

( ) Monthly bill detailing charging sessions

( ) Monthly fee to the charging station operators

( ) Prepaid "EV" Pass that allows you to charge at all chargers in the area that accept the card

( ) Other: _________________*

20) Please provide the zip code of the location where you most frequently charge your vehicle during the day while you are away from your home.

21) Thinking of your average monthly electric bill, how much has your electric bill increased, in dollars, as a result of charging your plug-in electric car at home?

22) Thinking of your Plug-In Hybrid Electric Vehicle use in the last month, if available, how many gas miles have you driven?

23) Thinking of your Plug-In Hybrid Electric Vehicle use in the last month, if available, how many gallons of gas have you used?

24) What is the main reason you purchased a plug-in electric car?

25) What do you like best about your plug-in electric car?

26) What are the main things you would like to change about your plug-in electric car?

27) Did you research your plug-in electric vehicle online before visiting the dealership?
( ) Yes

( ) No

28) Were there differences between the plug-in electric vehicle information available on the internet versus the information available at the dealership?
( ) Yes

( ) No

29) Please tell us about those differences.

30) Compared to your last gas powered vehicle purchase, were there differences in the purchasing experience of your plug-in electric vehicle? Please explain.

31) Based on your purchase experience, would you recommend a plug-in electric vehicle to others?
( ) Yes

( ) No

( ) I do not know

32) What would have made purchasing your plug-in electric vehicle better or easier?

33) Would you consider purchasing another plug-in electric car?
( ) Yes

( ) No

( ) I do not know

34) Based on your driving experience, would you recommend a plug-in electric vehicle to others?
( ) Yes

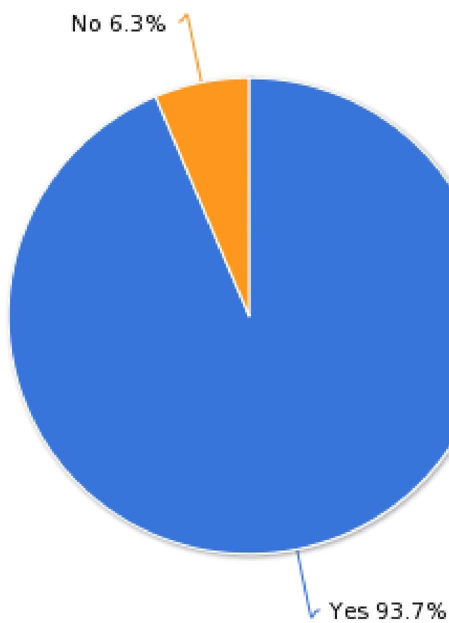
( ) No

( ) I do not know

Thank you for taking our survey. Your response is very important to us.

10.3.2 Texas River Cities Electric Vehicle Owners Survey Results

1) Do you currently own a plug-in electric car?



Value	Count	Percent
Yes	59	93.7%
No	4	6.3%

2) What are the year, make, and model of your plug-in electric car? (count by year)

Count	Response
1	2002
1	2008
1	2010
39	2011
15	2012

3) What are the year, make, and model of your plug-in electric car? (count by make)

Count	Response
32	Nissan
21	Chevrolet
2	Toyota
1	Fisker
1	Tesla

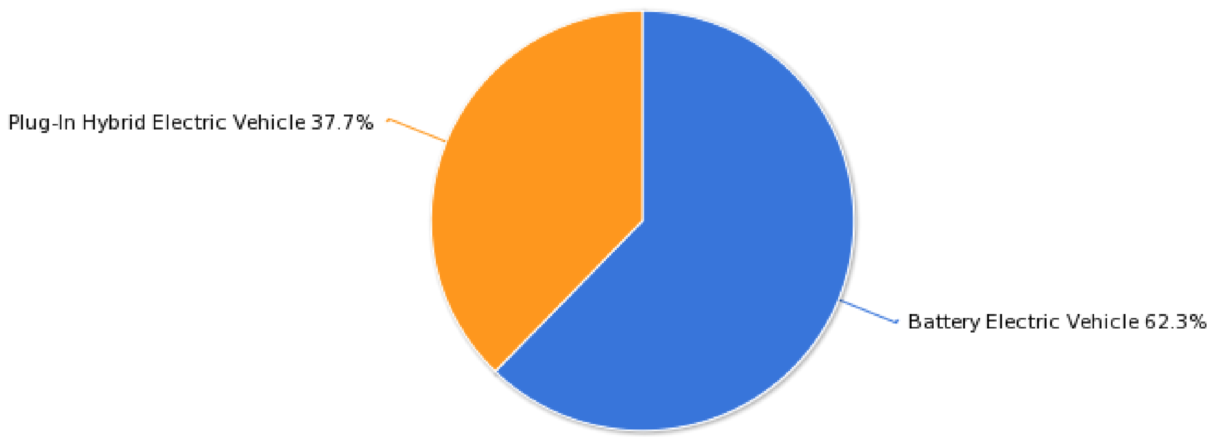
4) What are the year, make, and model of your plug-in electric car? (count by model)

Count	Response
32	Leaf
21	Volt
1	Blazer
1	Karma
1	Plug in Hybrid
1	Prius
1	Roadster
1	Think

5) What are the year, make, and model of your plug-in electric car? Electric or Hybrid

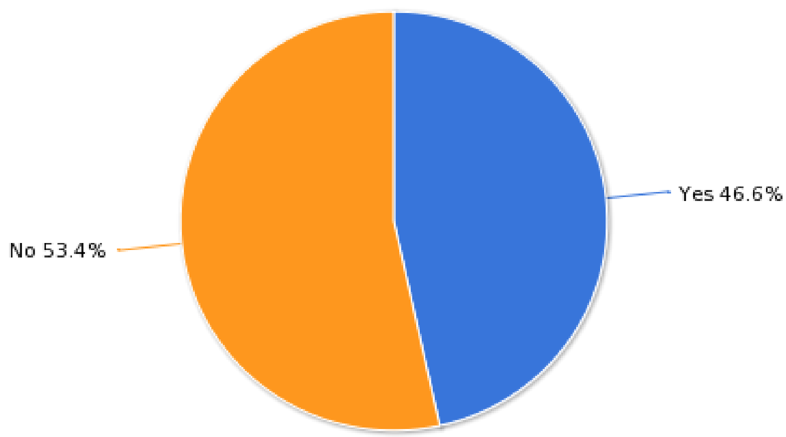
Count	Response
3	Electric
1	Hybrid

6) What type of electric vehicle do you own?



Value	Count	Percent
Battery Electric Vehicle	33	62.3%
Plug-In Hybrid Electric Vehicle	20	37.7%

7) Is your plug-in electric car the only car you drive?



Value	Count	Percent
Yes	27	46.6%
No	31	53.4%

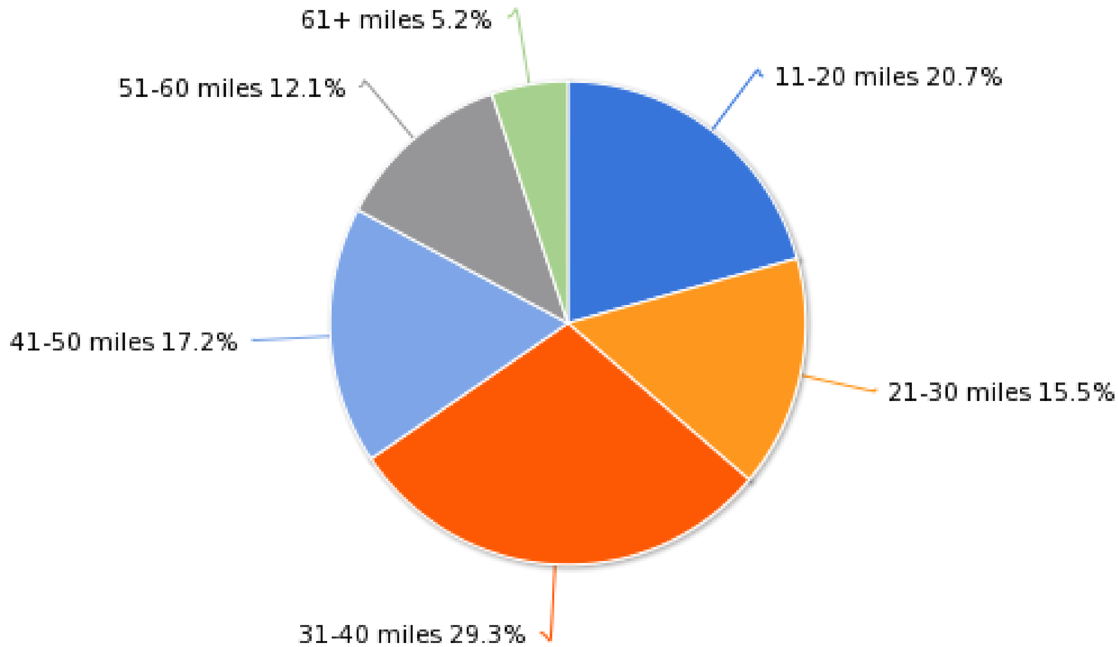
8) Why do you no longer own a plug-in electric car?

Count	Response
1	Too expensive to consider at this time.

9) What would have to change for you to own a plug-in electric car as your primary or only car?

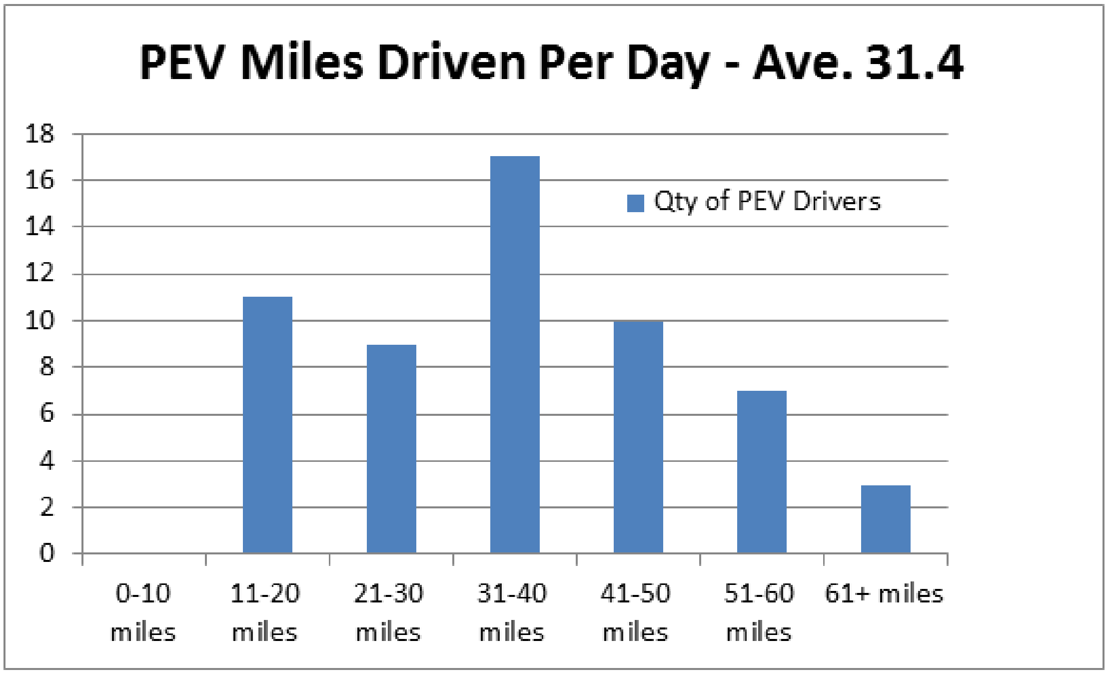
Count	Response
5	Greater range
4	Greater Range (> 60-100 miles) and Level 3 Charging (fast 30 minute 80% charge)
2	It is my primary car. I use the other car when we need two cars at once (rarely) or when we go out of town. If there were plug-ins along major highways I would take the Leaf on trips as well.
1	Better payload capacity and better range. I would say that my plug-in electric Volt is my primary car, but I do drive my Trailblazer sometimes when I need to haul things.
1	Current range is 70 miles per charge. Range would need to be increased to 120 miles per charge, and charge rate increased.
1	Divorce
1	FAST charging along highways
1	Hauling power for long distances
1	I also have an older SUV to tow the boat. I have "tow anxiety" that PHEVs/eREVs would have to solve. I'm not ready to pay $79k for a Via Silverado eREV
1	I drive my LEAF 99% of the time, but a battery car just doesn't make sense for a drive to Dallas
1	It is my primary car but I also own a small truck to haul stuff in.
1	It is my primary car.
1	It is my primary car. I have a pickup in the garage for hauling large items, and for the rare trip that exceeds the Leaf's range.
1	Larger size
1	My electric car IS my primary car. I use it about 95% of the time. It isn't my only car because I want to drive to Houston or San Antonio occasionally. I don't have the range in my electric car for that, so I use my 2007 Prius for that.
1	My electric car is my primary, but my two other cars are utility and fun.
1	Nothing. I have multiple cars and trucks, so it's not a matter of having only one model or another; I simply like to have multiple vehicles.
1	One fewer driver in the house
1	Remove range constraints
1	The Nissan Leaf is not our only car, but it is already our primary car: we only use our Honda Civic for road trips. For the Nissan Leaf to be our only car, we would need DC quick charging Chademo stations between Austin and Dallas, Austin and Houston, and one between Austin and San Antonio would greatly help as well.
1	Towing capacity
1	Vehicle size to accommodate family members, car seats, dog all-wheel drive to access roads that require chains or traction tires for winter conditions greater vehicle range and/or more DC fast-chargers to travel out of local area on weekend excursions or work trips
1	We still have some need for a 2nd car and for a longer-range vehicle.

10) On average, how many miles do you travel daily, roundtrip, in your plug-in electric car?

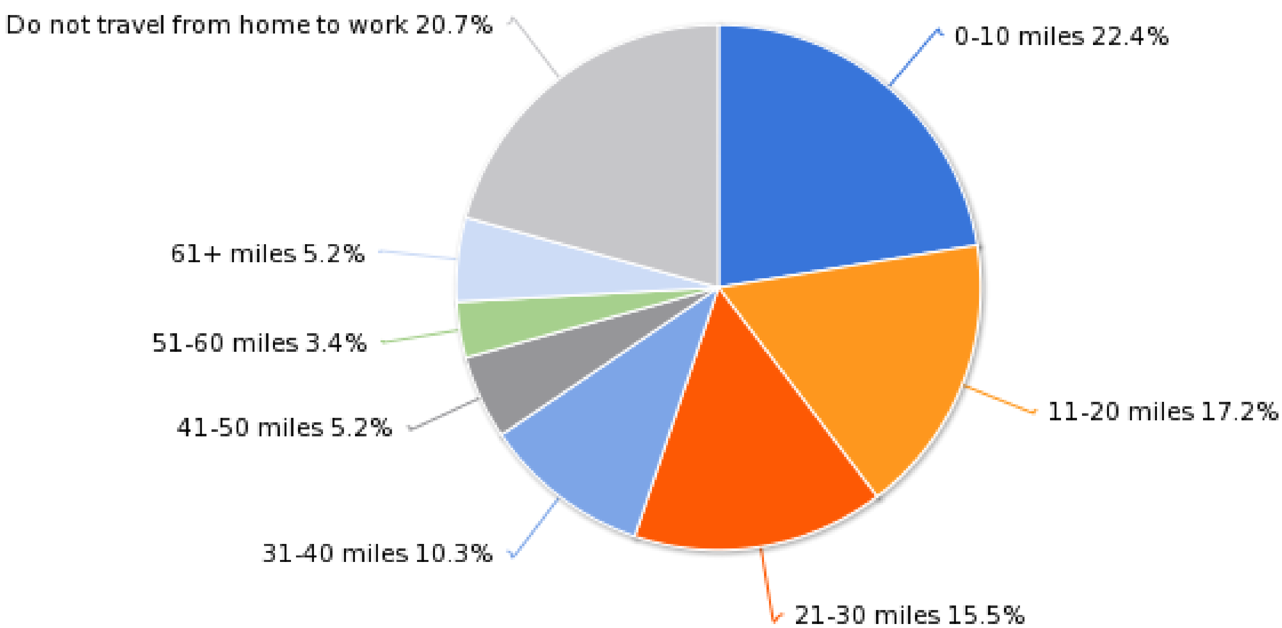


Value	Count	Percent
0-10 miles	0	0%
11-20 miles	12	20.7%
21-30 miles	9	15.5%
31-40 miles	17	29.3%
41-50 miles	10	17.2%
51-60 miles	7	12.1%
61+ miles	3	5.2%

Statistics	
Total Responses	58
Sum	1,798.0
Average	31.0
StdDev	14.50
Max	61.0



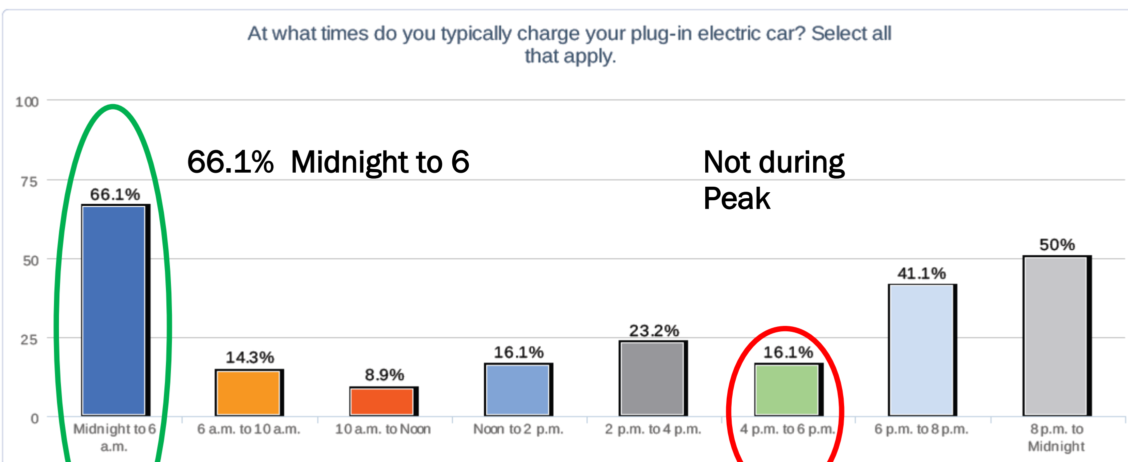
11) How many miles is your work commute round trip?



Value	Count	Percent
0-10 miles	13	22.4%
11-20 miles	10	17.2%
21-30 miles	9	15.5%
31-40 miles	6	10.3%
41-50 miles	3	5.2%
51-60 miles	2	3.4%
61+ miles	3	5.2%
Do not travel from home to work	12	20.7%

Statistics	
Total Responses	58
Sum	893.0
Average	27.1
StdDev	15.75
Max	61.0

12) At what times do you typically charge your plug-in electric car? Select all that apply.

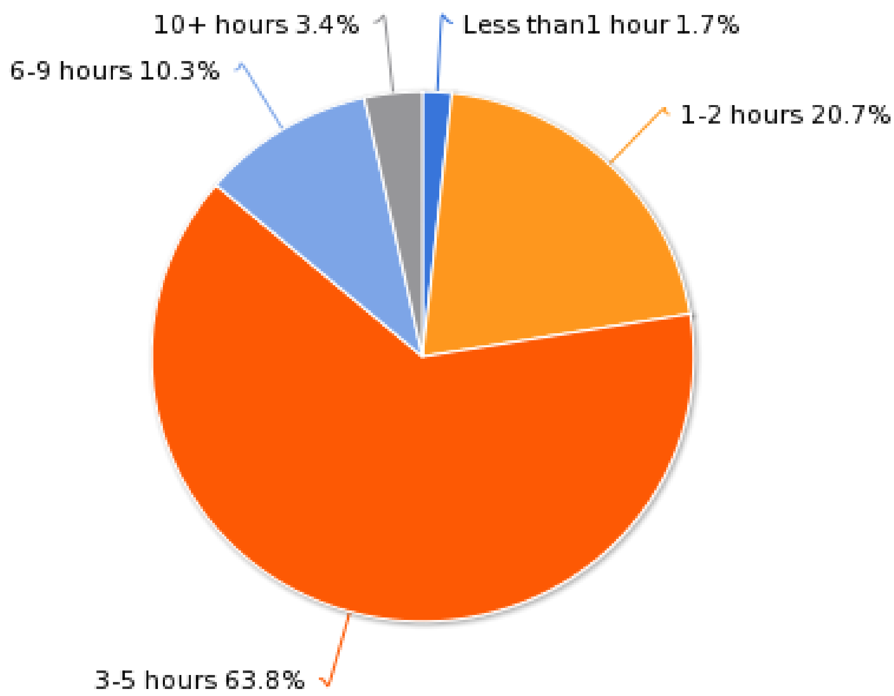


Vast majority of charging between 6 p.m. and 6 a.m.
Even with “block” rates

Value	Count	Percent
Midnight to 6 a.m.	38	66.7%
6 a.m. to 10 a.m.	8	14%
10 a.m. to Noon	5	8.8%
Noon to 2 p.m.	9	15.8%
2 p.m. to 4 p.m.	13	22.8%
4 p.m. to 6 p.m.	9	15.8%
6 p.m. to 8 p.m.	23	40.4%
8 p.m. to Midnight	28	49.1%

Statistics	
Total Responses	57
Sum	522.0
Average	6.1
StdDev	2.25
Max	10.0

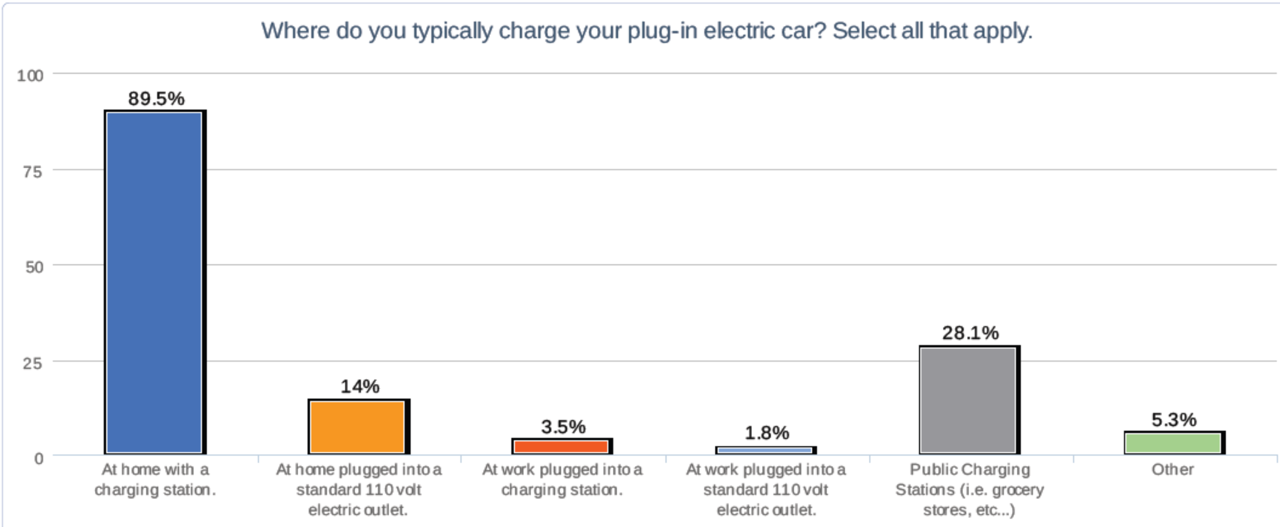
13) On average, how long do you typically charge your plug-in electric car?



Value	Count	Percent
Less than 1 hour	1	1.7%
1-2 hours	12	20.7%
3-5 hours	37	63.8%
6-9 hours	6	10.3%
10+ hours	2	3.4%

Statistics	
Total Responses	58
Sum	179.0
Average	3.1
StdDev	1.87
Max	10.0

14) Where do you typically charge your plug-in electric car? Select all that apply.



Value	Count	Percent
At home with a charging station.	52	89.7%
At home plugged into a standard 110 volt electric outlet.	8	13.8%
At work plugged into a charging station.	2	3.4%
At work plugged into a standard 110 volt electric outlet.	1	1.7%
Public Charging Stations (i.e. grocery stores, etc...)	16	27.6%
Other	3	5.2%

Statistics	
Total Responses	58
Sum	2.0
Average	2.0
Max	2.0

15) Where did you obtain your home charging station?

Count	Response
8	Schneider Electric
7	Nissan
7	SPX
6	AeroVironment
3	Dealer's Electric Supply
2	Ebay
2	EVConnect
2	From an electric contractor
2	Online
2	Pecan street
2	Upgraded the cable that came with the car.
2	Wright Electric
1	Chargepoint

Count	Response
1	Don't remember
1	Home Depot
1	Local dealer
1	Lowes
1	Manufacturer
1	Not sure program with the city
1	Thru Chevy when I bought my car

16) Who installed your home charging station?

Count	Response
13	A licensed electrician
6	SPX
5	Self Installed
3	Bryant Electric
3	Warren Wright Electric
2	AeroVironment
2	Nissan
2	Pecan Street
1	AC Electric LLC (Mike Short)
1	Aus electric recommended
1	Brother
1	Carl Gees, local electrician
1	EVConnect
1	Industrial Electric
1	KDR Services
1	Klock Electric
1	McBride
1	Mr. electric
1	Neely Electrical Service
1	Pritchard Electric

17) Where on your property did you have your home charging station installed?

Count	Response
42	Garage
8	Outdoor near house
3	Carport

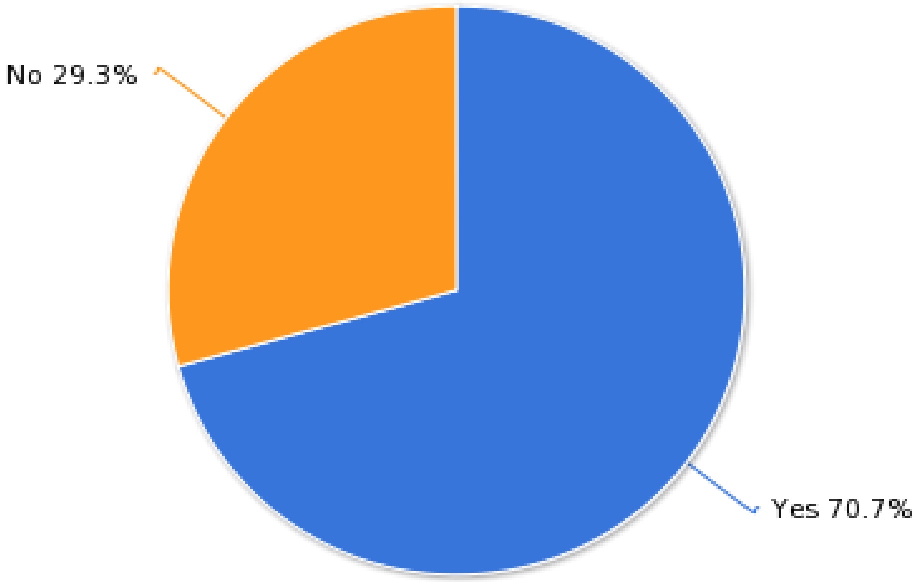
18) What is the make and model of your home charging station? (count by make)

Count	Response
11	AeroVironment
10	ChargePoint
6	Schneider
5	SPX
3	Don't know
3	Nissan
2	ClipperCreek
2	Voltec
1	GE
1	Karma
1	Panasonic
1	Tesla

19) What is the make and model of your home charging station? (count by model)

Count	Response
9	Don't know
8	CT-500
7	EV2430WS
5	Level 2 EVSE
3	EVSE-RS
3	Voltec
2	LCS
1	EV link
1	EVLink 30amp
1	Home Charging Station
1	HPC
1	Lear
1	Network
1	no model designated
1	SPX

20) Have you ever used a public charging station?



Value	Count	Percent
Yes	41	70.7%
No	17	29.3%

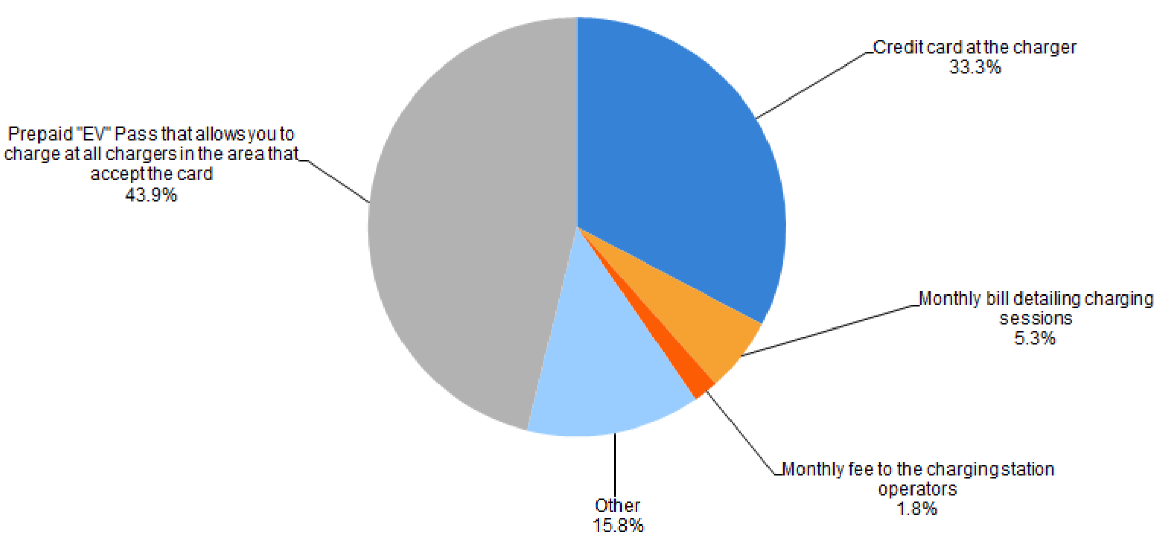
21) Why not?

Count	Response
5	Have not needed to
2	Don't know where they are.
2	It costs money.
2	Not conveniently located.
1	Because they are all Level II charging stations--the same one I have at home. I can't see myself waiting 4-6 hours somewhere. I will start using public stations when if they are Level 3 charges (charge time 24+ minutes!)
1	Didn't have the right card enabled thingy
1	For infrequent use, the charge stations cost more than the equivalent gasoline for my range extender.
1	My home charging station serves all my needs.
1	Never park near one
1	The only time I can imagine using a public station is if I'm so low I can't get home, and/or it's a place I would be at for a long time. I think stations at large employer's parking lots & garages make sense. Major shopping areas, grocery stores, etc. maybe. But the library? Zilker Park? I can't see myself ever using those.
1	They all require special tap cards. If they took ordinary credit cards, I would use them.

22) What would make charging your vehicle better/easier for you?

Count	Response
14	Additional charging stations.
10	DC charging for faster turn-around when needed
7	Convenient places that I frequent such as restaurants, grocery stores, gyms etc.
7	Happy with current situation.
3	EV parking only
2	Charging station at my office
2	Time-of use billing structure
2	Wireless charging
1	A home charging station which will be installed soon.
1	A larger capacity charger in the car, which has a 3.3 kW charger. Newer LEAFs has a 6.6 kW charger.
1	Credit card payments
1	Having a map of public charging stations.
1	If public stations were more reliable! Public stations often not operational or have errors.
1	I'm very happy charging at home. My commute is short; I only charge 2-3 times/week.
1	More charging stations on public streets with dedicated parking similar to the Car2Go program. Enforcement of electric vehicle parking spots, especially city street ones with warnings of towing non-electric vehicles, or at least ticketing.
1	Not having to drag the cord through snow in the winter, or dirt. Not having to balance the batteries (it's a home-made converted truck)
1	Public charging stations are too slow to be of much benefit.
1	The price must make sense. Right now it's ridiculously expensive to use a public charger. Approx $10-$12 to get enough charge to only go ~40 miles or so.
1	To have free chargers everywhere. Paying will not work.

23) When using a public charging station, how would you prefer to pay for charging your plug-in electric car?



Value	Count	Percent
Credit card at the charger	19	33.3%
Monthly bill detailing charging sessions	3	5.3%
Monthly fee to the charging station operators	1	1.8%
Prepaid "EV" Pass that allows you to charge at all chargers in the area that accept the card	25	43.9%
Other	9	15.8%

24) Please provide the zip code of the location where you most frequently charge your vehicle during the day while you are away from your home.

Count	Response	Count	Response	Count	Response
1	45230	1	78702	1	78751
1	60532	7	78703	1	78756
1	78203	4	78704	3	78757
1	78216	1	78705	1	78758
1	78226	1	78727	1	78759
1	78227	1	78731	1	95610
1	78230	1	78732	1	97204
1	78250	1	78745	1	Varies
3	78701	1	78750	7	N/A

25) Thinking of your average monthly electric bill, how much has your electric bill increased, in dollars, as a result of charging your plug-in electric car at home?

Count	Response
3	$0 (solar panels)
1	Less than $5.
2	$5
1	$9
2	$10
1	$12
4	$15
3	$20
1	$24
8	$25
9	$30
2	$35
2	$40
1	$45
4	$50
3	Don’t know
8	I really can't tell a difference

26) Thinking of your Plug-In Hybrid Electric Vehicle use in the last month, if available, how many gas miles have you driven?

Count	Response
1	2
1	5
1	10
1	less than 10
1	13
1	20
1	25
1	30
1	32
1	65
1	100
1	less than 100 miles
1	160
1	187
1	200
1	600
1	719
1	784
1	1500
1	2,400

27) Thinking of your Plug-In Hybrid Electric Vehicle use in the last month, if available, how many gallons of gas have you used?

Count	Response
1	0
2	.1
1	.5
1	0.8
4	1
2	2
1	2.5
1	3
1	less than 3 gallons
1	5.5
2	8
1	20
1	35
1	60

28) What is the main reason you purchased a plug-in electric car?

Count	Response
15	Cleaner running and environmentally friendly.
12	Better for the environment, less dependence on foreign oil.
12	Eco-friendly, new technology
6	Fuel savings
3	Economics
2	Eco-friendly and convenient
1	Best car I've ever owned. Drive a Volt and you won't need to ask this question.
1	Didn't
1	Early adopter of clean energy vehicle
1	Fun car
1	I didn't purchase it, I built it with help from the local EAA
1	I've often wished to be able to drive an electric car.
1	Mid-life crisis
1	To have the combined advantage of electric driving around town and the ability to take a trip

29) What do you like best about your plug-in electric car?

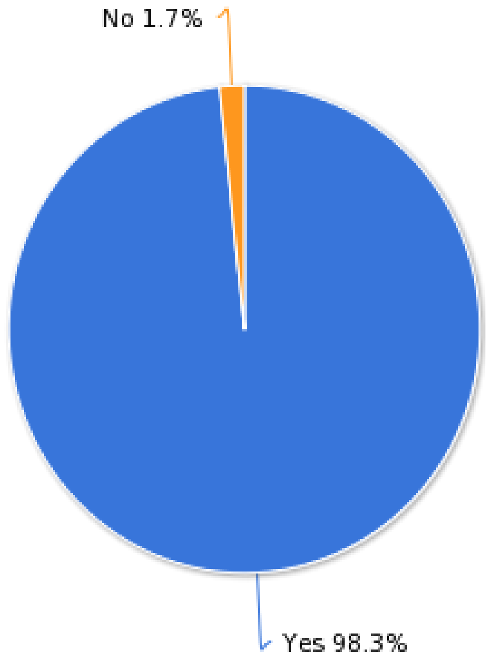
Count	Response
20	Acceleration, ride and quietness
19	Fuel cost savings
8	Fun to drive, never having to gas up or change oil
5	Environment
2	Contributing to research
2	Ease of use, quick acceleration and awesome gas mileage.
2	EVERYTHING!
1	Company car - it's quiet, rides and drives smooth as silk. Very little gasoline.
1	Don't go to gas stations or convenience stores any more.
1	Electric driving range
1	I can charge it at home
1	I love it's low cost of operation.
1	I'm generally happy with it and don't have one best feature.
1	Performance and low operating cost.
1	Saving money over time.

30) What are the main things you would like to change about your plug-in electric car?

Count	Response
32	Range
6	Fast charging
4	Cost
4	Nothing
3	Larger size to accommodate family needs, weekend trips
3	Seat comfort
2	Faster public charging

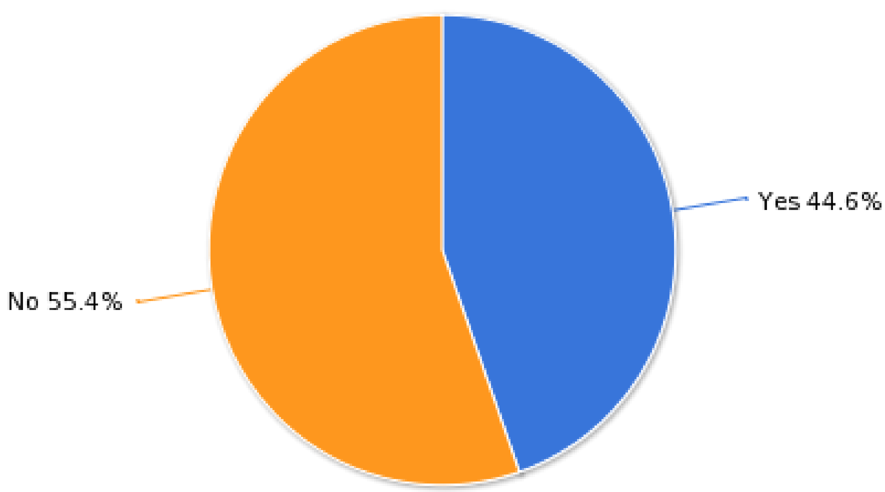
Count	Response
1	Charger at work
1	Easier Charging
1	Gadgets, quiet cabin/ride
1	I consider the design of the PIP to be a reasonable compromise with amazing results
1	Make it smaller (90% I'm the only occupant) and lighter (see "smaller"). Give it a bigger charger (6.6 kW vs 3.3 kW). Give it better suspension and tires.
1	Minivan version.
1	More cargo room
1	More EV mechanics that are aware of the cars
1	More luxury features
1	More range on its batteries
1	Not much. I'm pretty well satisfied.
1	Not much. It would be better if I could access the charger without having to flip the release inside the car. Common scenario: get home, forget to plug it in, go out, have to get into the car just to release the little door in front of the charge, and then plug in the charger.
1	Smaller car design.
1	Styling (chopped off trunk line looks "goofy", needs higher roof line for entry/exit, add a sun roof option, needs electric seats to accommodate multiple drivers.
1	Sun roof
1	The heater is poor in the sub-zero winters
1	The rear seat belts
1	Vehicle-to-Grid
1	Volt- visibility

31) Did you research your plug-in electric vehicle online before visiting the dealership?



Value	Count	Percent
Yes	58	98.3%
No	1	1.7%

32) Were there differences between the plug-in electric vehicle information available on the internet versus the information available at the dealership?



Value	Count	Percent
Yes	25	44.6%
No	31	55.4%

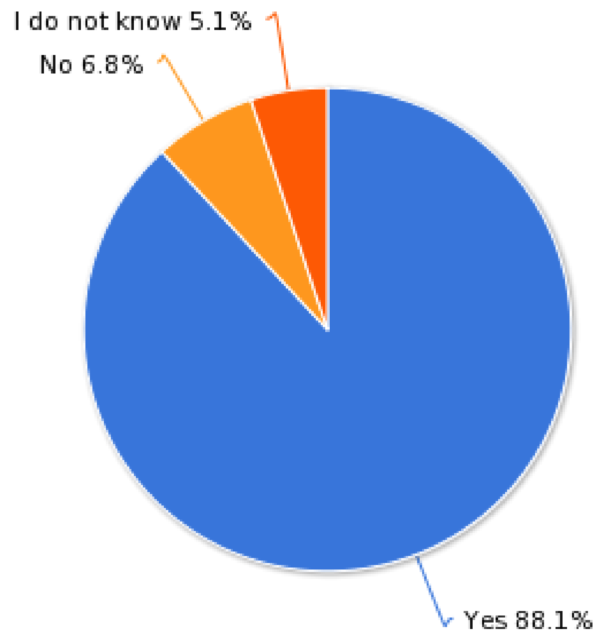
33) Please tell us about those differences.

Count	Response
18	Dealers don't know as much about the cars as they should
8	Internet had more technical detail
1	Couldn't 440 Quick-charge more than once/day was a surprise.
1	Dealer had more vehicles to test drive
1	Videos, customer reviews, government recall/problem information
1	With the volt you never have to worry about running out of charge, you are never stuck. With a pure EV that is an issue...yet I don't have a gas engine in the volt...I like that

34) Compared to your last gas powered vehicle purchase, were there differences in the purchasing experience of your plug-in electric vehicle? Please explain.

Count	Response
21	I made a "reservation" on-line, then select a dealer for price negotiation and delivery.
17	No major difference
8	Yes the salesman was not very knowledgeable about the vehicle
7	No ability to negotiate price, MSRP is only price available.
4	Had to wait for delivery.
1	All car buying experiences are stressful for me - this was no different!! The only difference was that I was getting a vehicle that really makes a difference.
1	Did not buy any maintenance contract since the car needs no oil changes, spark plugs etc
1	I bought the truck used from the paper, as it had a blown engine. Transmission was still good so I could convert it.
1	I did not purchase one.
1	I ordered the LEAF online and went to the dealer only to take delivery
1	It couldn't have gone smoother. No hassle at all.
1	Leaf was our first online car purchase.
1	More hoops to jump through with an EV.
1	Not really.. I went into the dealership, negotiated the price, placed my order and then eventually took delivery. The only difference was that I knew far more about the Volt than they did.
1	Switched from Toyota to Nissan, faster and less hassle with Nissan.
1	There was a lot more review regarding care of car- in particular, how to care for the battery.
1	There was no negotiation as it was a new "take it or leave it" price.
1	Yes, big time. This vehicle purchase was done completely online. I had to register early and "get in line" just to purchase the vehicle. Then, all communications regarding the electric vehicle order was performed online.
1	Yes, new tech, they screwed up the computers.
1	Yes. I had to wait for a year to take delivery. I really had to work to learn about the vehicle, its costs as well as how it might meet my in-town needs.

35) Based on your purchase experience, would you recommend a plug-in electric vehicle to others?



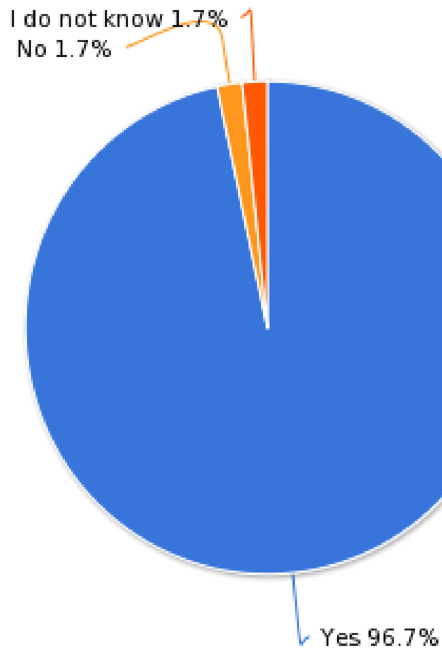
Value	Count	Percent
Yes	52	88.1%
No	4	6.8%
I do not know	3	5.1%

36) What would have made purchasing your plug-in electric vehicle better or easier?

Count	Response
10	If they were cheaper!!
9	More knowledge at the dealership.
7	Nothing
4	Availability of EVs.
3	Better info about tax credit.
2	If dealer was familiar with the vehicle and had them in stock for test drives.
1	Accurate real world range numbers in advertising. Adverts give 100 miles, actual is about 75.
1	Better trade in my old car
1	Broader range of choices
1	Charger compatibility/ interoperability
1	Expanded infrastructure of quick charge and (220v) stations. Higher availability of vehicles, lower price point.
1	I don't know.
1	I think it would have been helpful if the dealer gave more information on how to better utilize local public charging infrastructure (e.g. Info on the Plugin EVerywhere program)
1	I wanted to see a demo model Leaf, but it was not possible in my city. I wanted to get delivery updates every 2-4 weeks. I wanted to have charger network in place.
1	I wasn't provided to special lease option for the Volt, but I wouldn't have been able to take it anyway due to my annual mileage.
1	I would not make a PEV recommendation based just on a purchase experience. That is a two hour experience; PEV ownership is a 10 year experience!

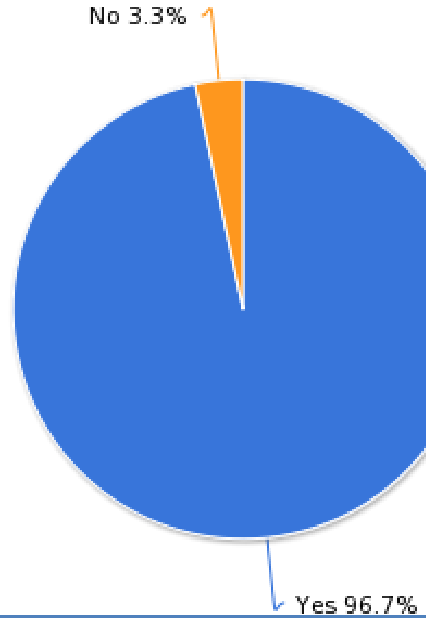
Count	Response
1	Knowing how great it is to have one. It's much better than I imagined.
1	Knowledge about good battery management systems.
1	More dealer stock and/or shorter delivery times.
1	Not having to deal with a car salesman and/or their horrible finance counterparts.
1	The charger installation and inspection process could have been more streamlined but wasn't too bad.

37) Would you consider purchasing another plug-in electric car?

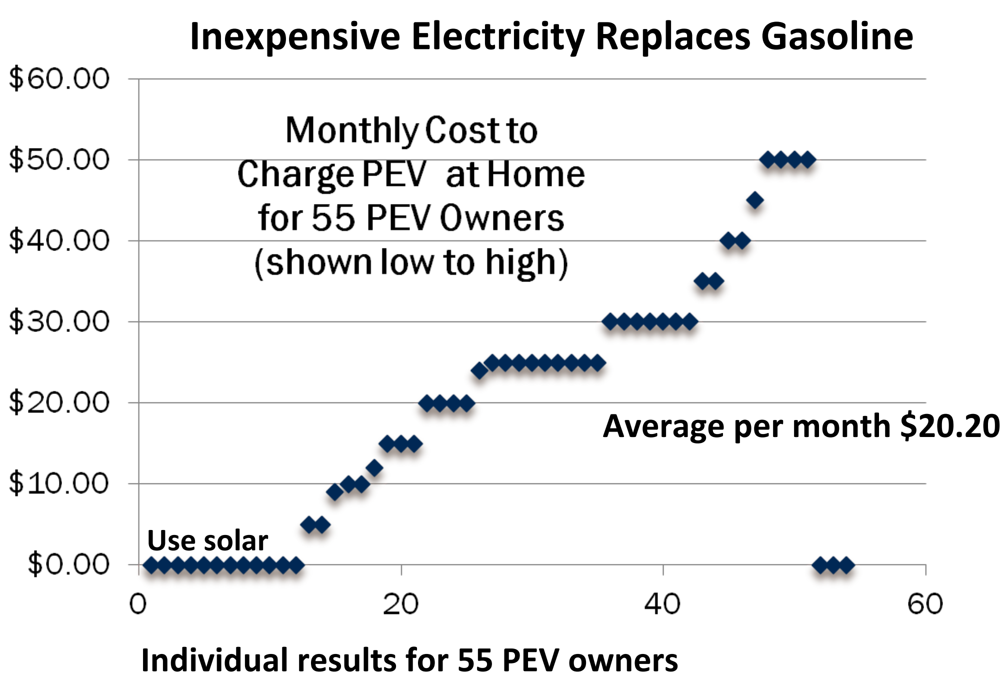


Value	Count	Percent
Yes	58	96.7%
No	1	1.7%
I do not know	1	1.7%

38) Based on your driving experience, would you recommend a plug-in electric vehicle to others?



Value	Count	Percent
Yes	58	96.7%
No	2	3.3%
I do not know	0	0%



10.4 Multifamily Property Owner Survey

10.4.1 Multifamily Property Owner Survey Instrument

MultiFamily Property Management Survey Instrument

ASK FOR APARTMENT MANAGER.

IF LEAVING MESSAGE ON ANSWERING MACHINE:
Hello, (Mr./Mrs.) _____. My name is _____ with ______ in ______, Texas. We have been contracted by The Texas River Cities Plug-In Electric Vehicle Initiative to conduct a market research study with a select group of area multifamily property managers. If you would like to participate in this study, please call 1-877-530-9646 and give them your name and the telephone number I just called and that you would like to participate in the EV Apartment complex management project. Thank you.

INTRODUCTION

Hello, my name is ____ with Creative Consumer Research, a Texas-based marketing research company. We are calling on behalf of The Texas River Cities Plug-In Electric Vehicle Initiative. This is a group of communities and stakeholders in Central Texas planning for the use of plug in electrical vehicles throughout Texas.

(Today/this evening), we are conducting a study among south and Central Texas area multifamily property managers and would like to include your opinions. Let me assure you that this is not a sales call, and your name will not be placed on a mailing list. We are only interested in your opinions.

The information obtained in this study will be used for research purposes only, and all responses will be kept confidential.

For quality purposes, this call may be monitored or recorded.

S1. BY OBSERVATION: Market **(CHECK QUOTAS)**

Austin	1
Georgetown	2
San Marcos/New Braunfels	3
San Antonio	4

1. For this survey we will be talking about all-electric cars. **(Explanation)** Typically all-electric cars can be fully charged by plugging them into a standard 120 volt outlet overnight. Plug-in vehicles can also be charged in just a few hours by plugging them into a charging station. Vehicle owners using a charging station would plug in their vehicle and swipe a payment card. A typical plug-in electric car charging station could cost $3,500 to purchase and $3,500 to install.

Has your management company installed any electric vehicle, or EV, charging stations at the property or properties you manage?

Yes **(SKIP TO Q3)**
No **(GO TO Q2)**
DK **(GO TO Q2)**

2. Do you plan on installing an electric vehicle charging station within the **next 3 years**?

Yes **(GO TO Q3)**
No **(SKIP TO Q18)**
DK **(SKIP TO Q18)**

EV charging stations installed/planning to install

3. How many EV charging stations has your company installed or is planning to install? **(DO NOT ACCEPT RANGES. PROBE FOR BEST ESTIMATE.)**

_____ _____

Do not know

4. Where on your property have you installed or are you planning to install EV charging stations? **(READ LIST. RECORD ALL MENTIONS.)**

a. In prospective resident parking area
b. In front of common areas – pools, fitness centers
c. In assigned surface parking areas
d. In unassigned surface parking area
e. In assigned garage parking space
f. In unassigned garage parking space
g. Or some other place? **(Specify)** ___________________________
(Do Not Read) Don’t know/unsure

(IF NO IN Q1, SKIP TO Q18. ELSE GO TO Q5.)

5. What factors influenced your placement of the EV charging stations? **(READ LIST. ROTATE ORDER. RECORD ALL MENTIONS.)**
   a. Cost of purchase and installation of the EV charging station
   b. Infrastructure limits of the parking area
   c. The recommendation of your electrician
   d. ADA guidelines
   e. Visibility for showcasing the charging stations
   f. Or some other reason? **(Specify)** ___________________________
   (Do Not Read) Don't know/unsure

6. What are the biggest obstacles your company faced when installing the EV charging stations? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS UNTIL UNPRODUCTIVE.)**

   a. Information about the installation of EV charging stations
   b. Information about the use of EV charging stations
   c. Residents have not requested an EV charging station
   d. The cost to purchase and install an EV charging station
   e. No plans for operation of EV charging station
   f. Constraints of infrastructure (space limitations)
   g. Lack of work space for installers
   h. Current electrical wiring does not permit the installation of EV charging stations
   I. Difficulty in dealing with permitting departments for obtaining necessary permits.
   j. Lack of EV drivers
   Other **(Specify)** ____

7. How do your residents charge their EV's? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS, UNTIL UNPRODUCTIVE.)**

   a. They schedule a time to use EV charging stations
   b. They plug their EV's into any accessible 120V outlets
   c. They plug their EV's into designated 120V outlets
   Other **(Specify)** ____
   d. We have no current users

8. Do you currently provide (or plan on providing) free EV charging or do EV owners pay a fee to use the chargers?

   a. The charging stations are free to use **(SKIP TO Q13)**
   b. Residents pay a fee to plug their cars in for charging **(GO TO Q9)**
   Other **(Specify)** ____

9. To whom do users pay the fee for charging their cars? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS.)**

   a. Property Manager
   b. Austin Energy service provider
   c. CPS energy service provider
   d. Charging station vendor
   e. Other electrical energy service provider

10. How is this fee paid? **(DO NOT READ LIST)**

   a. Card swiped at Meter
   b. Coin or token at meter
   Other **(Specify) ____**

11. Does your company receive a portion of the charging station fee?

   Yes **(GO TO Q12)**
   No **(SKIP TO Q13)**
   Do not know **(SKIP TO Q13)**

12. What percent or amount does your company receive? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE.)**

   _____%

13. Who pays for the electricity used to power the charging stations? **(PROBE FOR SPECIFICS.)**

   ____

   ____

14. Which of the statements below best describes the costs you incurred to **<u>install</u>** the charging station(s)? **(READ LIST)**

   a. My company received federal, state or local grants to pay for the installation of charging stations
   b. A charging station vendor paid the installation costs
   c. A third party vendor paid for all or most of the installation costs
   d. The utility paid the installation costs
   e. My company, the property management firm, paid the cost to install EV charging station
   f. Our electrical utility subsidized some of the installation costs of the EV charging station

g. My company received tax credits to help pay for some of the installation costs
Other **(Specify) ____**

15. Do your charging stations have network communications capabilities?

Yes **(GO TO Q15b)**
No **(SKIP TO Q17)**
Don’t know **(SKIP TO Q17)**

15b. What data do you receive from the EV charging stations on your properties? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS, UNTIL UNPRODUCTIVE.)**

a. Charger ID
b. Location
c. Owner
d. Model
e. Status - availability
f. Time of use
g. Duration of charging time per vehicle
h. Energy consumption
i. Operation errors or failure
j. No data is being collected at this time **(SKIP TO Q17)**
Other **(Specify) ____**
Don’t know

16. How do you plan to use this data? **(PROBE FOR SPECIFICS)**

____

____

17. Is there someone within your staff who monitors the charging station?

Yes **(GO TO Q17b)**
No **(SKIP TO Q35)**
Don’t know **(SKIP TO Q35)**

17b. Who on your staff monitors the charging station? **(DO NOT READ LIST.)**

Complex Manager
Maintenance Manager
Other **(Specify) ____**

(IF YES ON Q1, SKIP TO Q35, ELSE GO TO Q18)
Section 2 – No experience with EV charging stations

18. Where do your residents park their vehicles? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS)**
    a. In prospective resident parking area
    b. In front of common areas – pools, fitness centers
    c. Residential street
    d. Commercial parking garage
    e. Commercial parking lot
    f. Assigned surface parking areas
    g. Unassigned surface parking area (parking where space available)
    h. Assigned garage parking space
    i. Unassigned garage parking space
    Other **(Specify)** ___________________________________

19. Does your property offer premium parking spaces, or personal garage parking spaces for an additional fee?

    Yes
    No
    DK

20. Which of the following parking options does your property have? **(READ LIST. MARK ONE RESPONSE.)**

    Surface parking lot **only**
    Garage parking **only**
    Or **both** surface parking lot and garage parking

(REFER TO Q20. FOR EACH PARKING OPTION OFFERED, ASK Q21.)

21. Does your (RESPONSE IN Q20) have **120** volt outlets that are accessible in your (RESPONSE IN Q20)?

	Surface Parking Lot	Parking Garage
Yes	1	1
No	2	2
DK	3	3

(REFER TO Q21. FOR EACH 'YES', ASK Q22 & Q23.)

22. How many **120** volt outlets are accessible to residents within your (RESPONSE IN Q21)? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE. RECORD RESPONSE BELOW, FOR APPROPRIATE PARKING TYPE.)**

Surface Parking Lot ___ ___

Parking Garage ___ ___

23. Is your (RESPONSE IN Q21) electrical system equipped to have all of your **120** volt electrical outlets in use at the same time?

	Surface Parking Lot	Parking Garage
Yes	1	1
No	2	2
DK	3	3

(REFER TO Q20. FOR EACH PARKING OPTION OFFERED, ASK Q24.)

24. Does your (RESPONSE IN Q20) have **220** volt outlets that are accessible in your (RESPONSE IN Q20)?

	Surface Parking Lot	Parking Garage
Yes	1	1
No	2	2
DK	3	3

(REFER TO Q24. FOR EACH 'YES', ASK Q25 & Q26.)

25. How many **220** volt outlets are accessible to residents within your (RESPONSE IN Q24) for use with a charging station? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE. RECORD RESPONSE BELOW, FOR APPROPRIATE PARKING TYPE.)**

Surface Parking Lot ___ ___

Parking Garage ___ ___

26. Is your (RESPONSE IN Q41) electrical system equipped to have all of your **220** volt electrical outlets in use at the same time?

	Surface Parking Lot	Parking Garage
Yes	1	1
No	2	2

DK	3	3

(IF Q2 = YES SKIP TO Q28.)

27. Have you investigated plug-in electric vehicles or EV charging stations for your properties?

Yes
No
Don't know

28. Have current or prospective residents asked you about the availability of 120 volt electrical outlets for charging electric vehicles?

Yes **(GO TO Q29)**
No **(SKIP TO Q30)**
DK **(SKIP TO Q30)**

29. How often have you been asked about charging electric vehicles? **(READ LIST)**

a. Once/twice in the last 6 months
b. Once/twice per month
c. Once/twice a week
d. Daily

30. Using a 10-point scale where '1' is not at all and '10' is very likely, how likely would your company be to install an electric vehicle charging station within the **next 3 years**?

Not at all									Very	DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

(IF Q30 = 1 – 7, ASK Q31. OTHERWISE, SKIP TO Q33.)

31. What are the primary reasons you would not install a charging station for resident use? **(READ LIST. ROTATE ORDER. RECORD ALL MENTIONS.)**

a. Your company does not know enough about EV charging stations
b. Your company does not have a demand for EV charging stations
c. The $7,000 cost for the purchase and installation of an EV charging station is too much
d. Our property's electrical system cannot handle the demands of a charging station
e. Our property has limitations on parking spaces
f. Electrical vehicles will never catch on with the general public
g. Electrical vehicles are a fad and are unnecessary
Other **(Specify)** ____

32. What would have to occur for your company to install an electric vehicle charging station? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS, UNTIL UNPRODUCTIVE.)**

a. If we received technical support by contractor
b. If we received inquiries from prospective residents about charging electrical vehicles
c. If you received inquiries from current residents about charging electric vehicles
d. If you could contract out the purchase, installation and operation of the EV charging stations.
e. If there were other favorable business models

(IF 32b MENTIONED, ASK Q32bb.)

32bb. How many inquiries from **prospective residents** would your company need to receive to begin the process of installing an EV charging station? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE.)**

_____ _____ _____

(IF 32c MENTIONED, ASK Q32cc.)

32cc. How many inquiries from **current residents** would your company need to receive to begin the process of installing an EV charging station? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE.)**

_____ _____ _____

33. Would you be more likely to purchase and install an electric car charging station if a percent of the cost was rebated?

Yes **(GO TO Q34)**
No **(SKIP TO Q35)**
Don’t know **(SKIP TO Q35)**

34. What **percent** of the total cost of a charging station would need to be rebated for your company to install a charging station? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE.)**

_____ _____ _____ %

35. What currently prevents you from installing electric vehicle charging stations? **(PROBE FOR SPECIFICS.)**

____

____

(REFER TO Q20. FOR EACH PARKING OPTION OFFERED, ASK Q36 & Q37.)

36. If you were to install a **120** volt charging station, how many charging stations do you think you would install on your property (RESPONSE IN Q20)? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE. RECORD RESPONSE BELOW, FOR APPROPRIATE PARKING TYPE.)**

Surface Parking Lot ___ ___

Parking Garage ___ ___

Depends on resident demand
Other **(Specify)** ____

37. If you were to install a **220** volt charging station, how many charging stations do you think you would install on your property (RESPONSE IN Q20)? **(DO NOT ACCEPT RANGES. IF RESPONDENT IS UNSURE, ASK FOR BEST ESTIMATE. RECORD RESPONSE BELOW, FOR APPROPRIATE PARKING TYPE.)**

Surface Parking Lot ___ ___

Parking Garage ___ ___

Depends on resident demand
Other **(Specify)** ____

38. What do you see as your company's benefits of installing EV charging stations? **(PROBE FOR SPECIFICS.)**

____

____

39. From whom would you be **most** likely to receive reliable information about the purchase and
installation of EV charging stations? **(DO NOT READ LIST)**

a. EV charging station vendors and contractors
b. Electricians
c. Electric utility providers
d. Multifamily property management associations
e. Regional transportation organizations
f. Your property's regional or district management
Other **(Specify)** ____

(ASK ALL)
40. How would you prefer to learn more about plug-in electric vehicles and charging stations? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS.)**

a. Contractor or vendor visit
b. Phone call
c. E-mail
d. Web page
e. News letter
f. Trade show
g. Association **(Specify)**
Other **(Specify)** ____

Demographics

D1. What is your job title or position within the property management company? **(DO NOT READ LIST.)**

a. Regional Manager
b. District Manager
c. Complex Manager
d. Community Director
e. Assistant Manager
f. Leasing Agent
g. Owner
Other **(Specify)** ____

D2. How many total **<u>units</u>** do you manage or own? **(DO NOT READ LIST.)**

a. Less than 50
b. 50 but less than 75
c. 75 but less than 100
d. 100 but less than 150
e. 150 but less than 200
f. 200 but less than 250
g. 250 but less than 500
h. 500 but less than 750
I. 750 but less than 1,000
j. 1,000 but less than 3,000
k. 3,000 but less than 5,000
l. Greater than 5,000

Don't Know

D3. What type of units do you manage? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS, UNTIL UNPRODUCTIVE.)**

a. Townhouse/Duplex
b. Condo
c. Apartment
d. Other

D4 How many complexes do you manage that are rated … **(READ LIST)**

A?	_____	_____
B?	_____	_____
C?	_____	_____
D?	_____	_____

D5. What are the approximate ages of your multifamily properties?

	A	B	C	D
1 to 5 years old	_____	_____	_____	_____
6 to 10 years old	_____	_____	_____	_____
10 to 15 years old	_____	_____	_____	_____

15 to 20 years old _____ _____ _____ _____

Greater than 25 years old ...._____ _____ _____ _____

D6. Would you like to receive information about electric vehicle charging stations from The Texas River Cities Plug-In Electric Vehicle Initiative organization? **[IF NECESSARY, REPEAT DESCRIPTION:** The TRC is a group of communities and stakeholders in Central Texas planning for the use of plug in electrical vehicles throughout Texas.**]**

Yes What is the email address where you would like to receive information from TRC?

(CLARIFY AND REPEAT SPELLING.)

____________________________________@ ________________ . __________

No

DK

In case my supervisor would like to verify that I conducted this survey with you, I need to confirm that I'm talking to:

NAME: ____

And that I called:

COMPANY NAME: ____

@ TELEPHONE: (_________) ____

THAT CONCLUDES OUR SURVEY.

THANK YOU VERY MUCH FOR YOUR TIME.

INTERVIEWER: ____________________________DATE:____________________

END
TIME: __________

10.4.2 Multifamily Property Owner Survey Results

Methodology

- Creative Consumer Research conducted 250 telephone interviews with apartment complex managers or managers of other multifamily complexes in Austin, San Antonio, San Marcos, New Braunfels, and Georgetown, TX.
  - Interviews were conducted between May 14 and June 12, 2012.
- To participate, respondents must be decision makers with regards to installation or addition of property improvements such as PEV charging stations.
- Throughout these charts small base sizes (N<20) occur.
- Tables that contain small base sizes for the current quarter will show the number of responses rather than the percentage of the base.
- Small base sizes appearing throughout the charts occur based on skip patterns within the questionnaire.
- This apartment complex managers survey report is composed of the findings of 250 completed surveys from apartment complex managers in Austin, Georgetown, San Marcos, and San Antonio. The survey results indicate that 2 percent of those surveyed (n=6) have installed a charging station, and another approximately 2 percent (n=5) complexes have plans to install a charging station in the future.
- Much of this report describes the six apartment complexes that have installed a charging station. Caution should be used if attempting to generalize the findings of these six apartment complexes to a greater population.

Key Findings

- Lack of resident demand is a barrier to increased installations of electric vehicle (or plug-in electric vehicle [PEV]) charging stations among multifamily housing complexes.
- The key driver to persuading apartment complexes to install PEV charging stations will be the residents. Without buy-in and increased PEV usage by the general public, apartment complexes are not willing to invest the money into charging stations.
  - Austin Energy and TRC need to market the benefits of PEV to consumers.
  - Adding rebates will further entice complexes to install PEV charging stations, but resident demand is still paramount.

Executive Summary

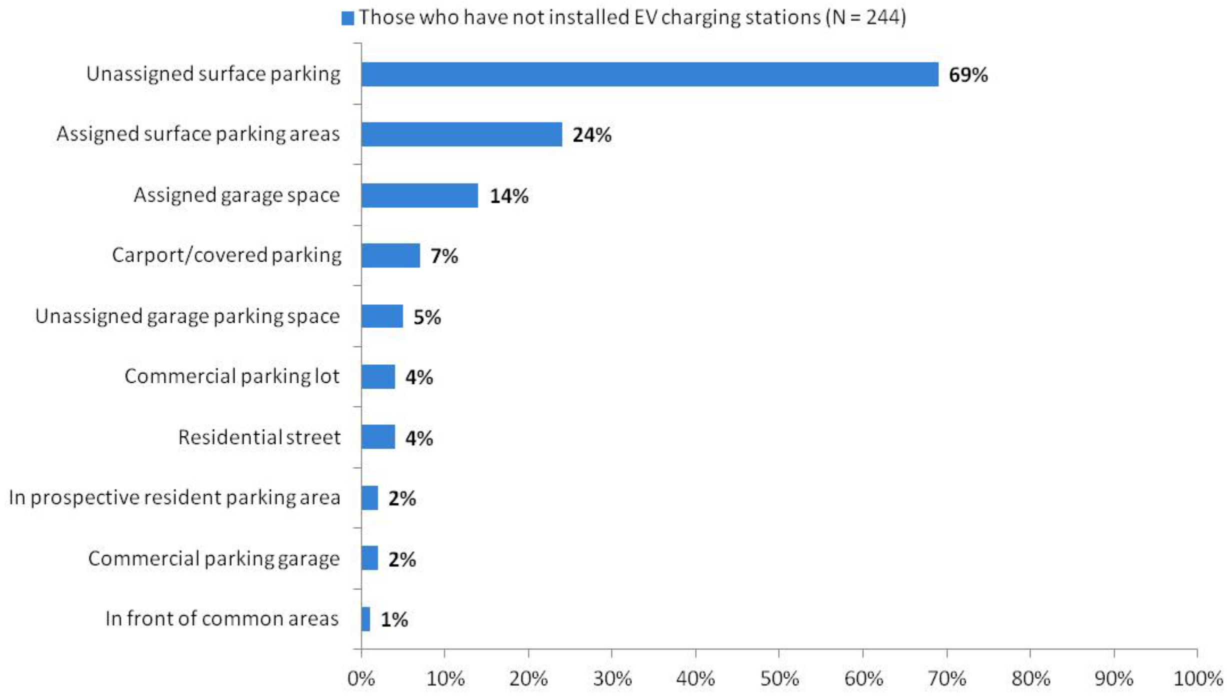
- Most multifamily housing complexes do not currently have charging stations for electric vehicles.
  - Very few are planning to install them within the next 3 years.
  - Those with charging stations charge their residents a fee to use the stations.
- 95 percent of those that have not installed PEV charging stations say their residents use surface parking, while only 31 percent use garage parking.

- Most surface parking is unassigned.
- Only about one-third of managers say they offer premium parking spots.

- Very few complexes have electrical outlets available in the surface lots. However, about half (55percent) of the complexes with garage parking have accessible 120v outlets.
  - Complexes generally do not have 220v outlets available. Only 3 percent of surface lots and 7 percent of garages have 220v available.
  - Those garages that have 120v outlets available typically have 40 outlets available within the garage and 68 percent say they can all be used at the same time.
- Apartment complexes are currently not likely to install PEV charging stations.
  - Because very few have actually received inquiries or requests from residents for charging stations, they feel there is no demand for the charging stations.
  - Some complexes have infrastructure issues such as the electrical system or parking limitations that prevent the installation.
- About half (49 percent) say that they would install charging stations if they received inquiries from current residents, and one-third (29 percent) say they would install charging stations if they received inquiries from prospective residents.
  - On average, complex managers say they would need about 75 inquiries from residents and 82 from potential residents in order to consider installing PEV charging stations.
- About half (55 percent) say they will be more likely to install the charging station if a portion of the cost were rebated.
  - While some say as little as 10 percent would need to be rebated in order to increase their likelihood of installing, others say as much as a complete 100 percent rebate. The average rebate needed to increase likelihood of installation is 51 percent.

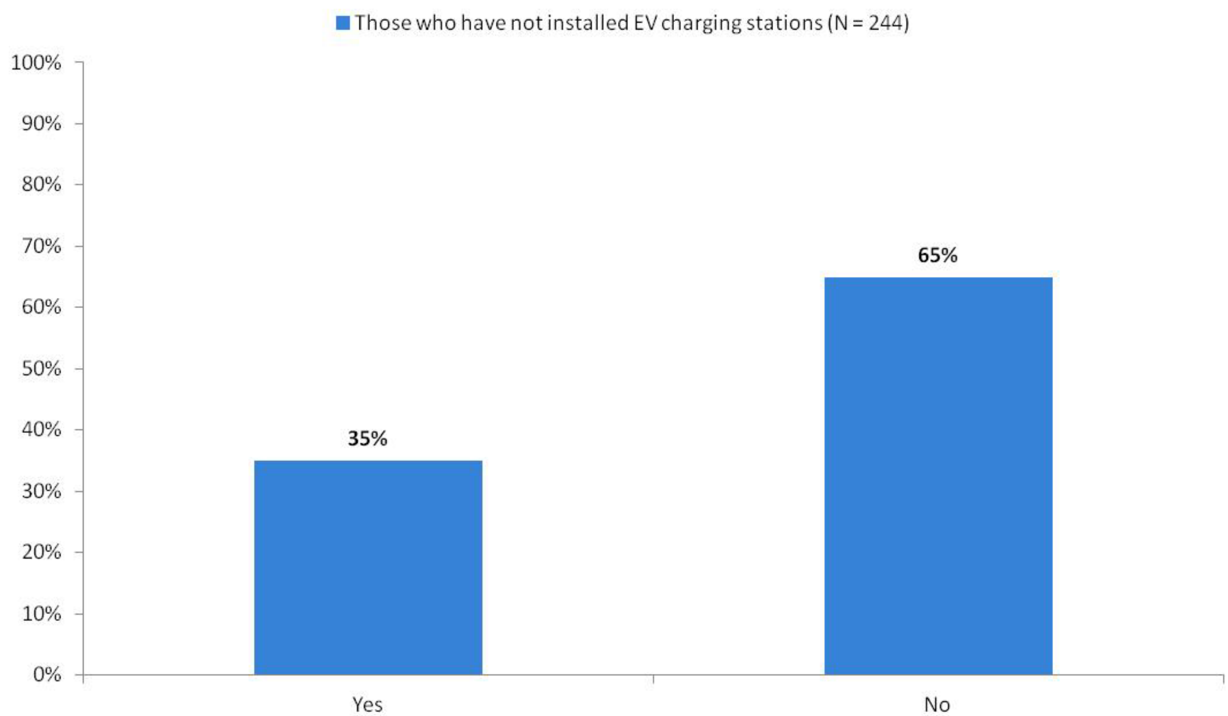
No Experience with PEV Charging Stations

18. Where do your residents park their vehicles?

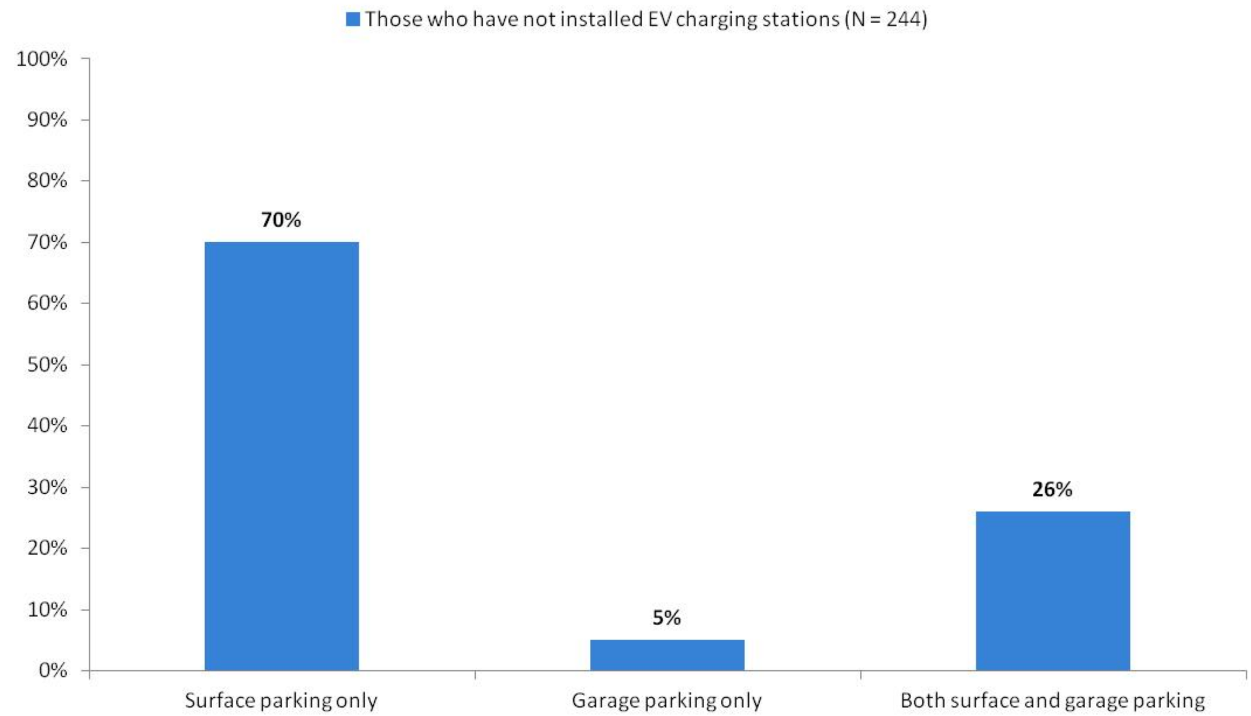


Note: Number of responses adds up to more than 100% due to multiple responses.

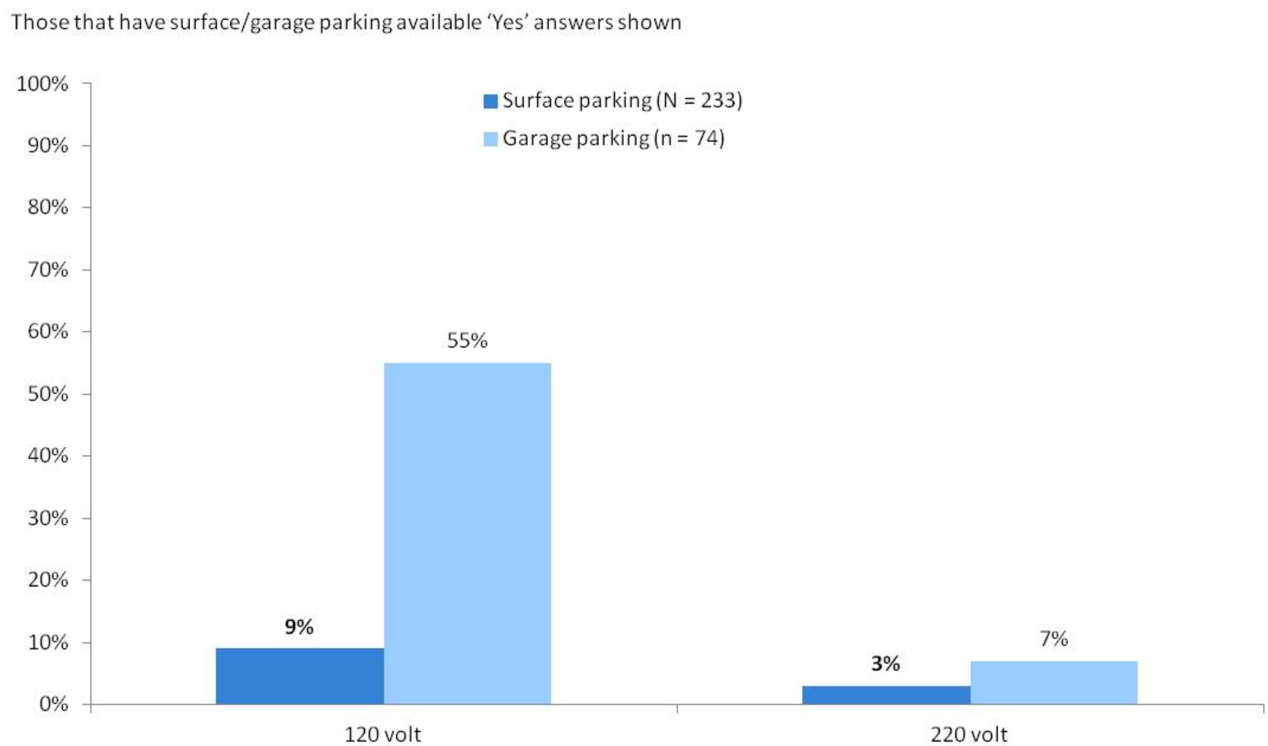
19. Does your property offer premium parking spaces or personal garage parking space for an additional fee?



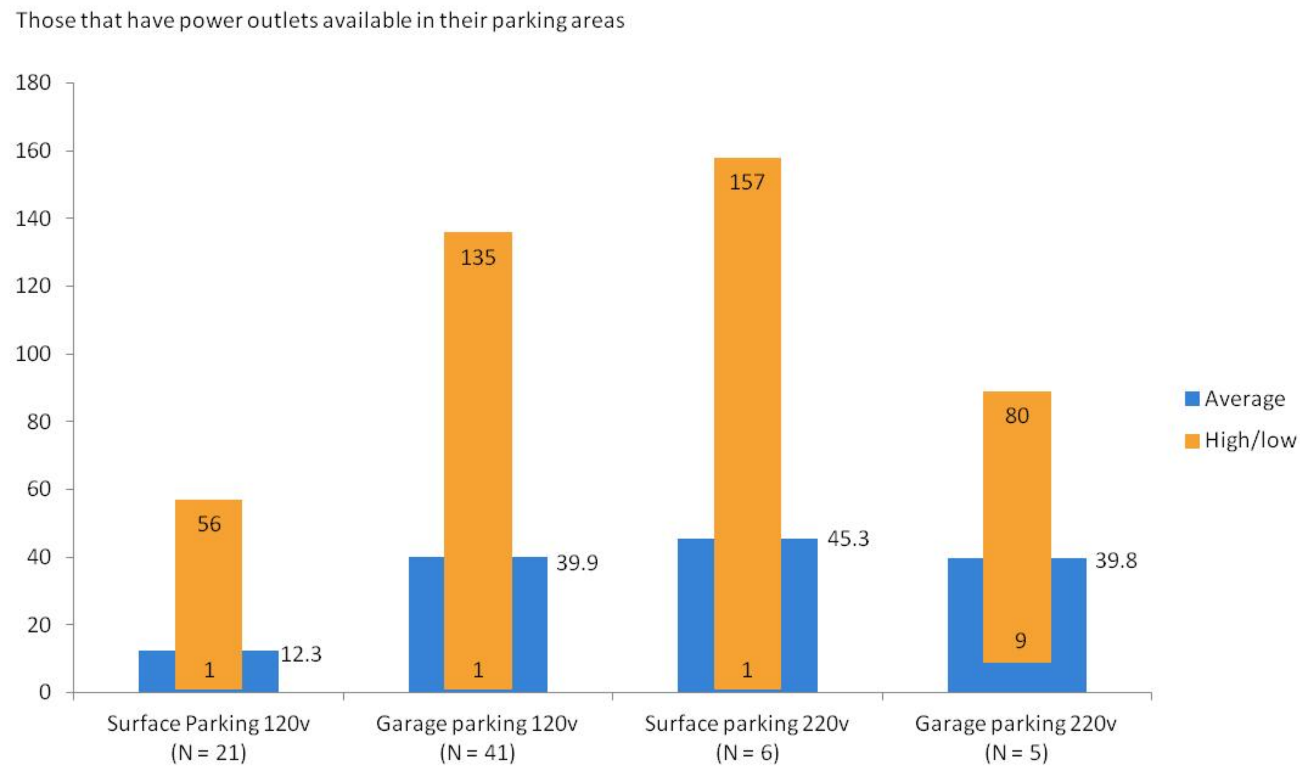
20. Which of the following parking options does your property have?



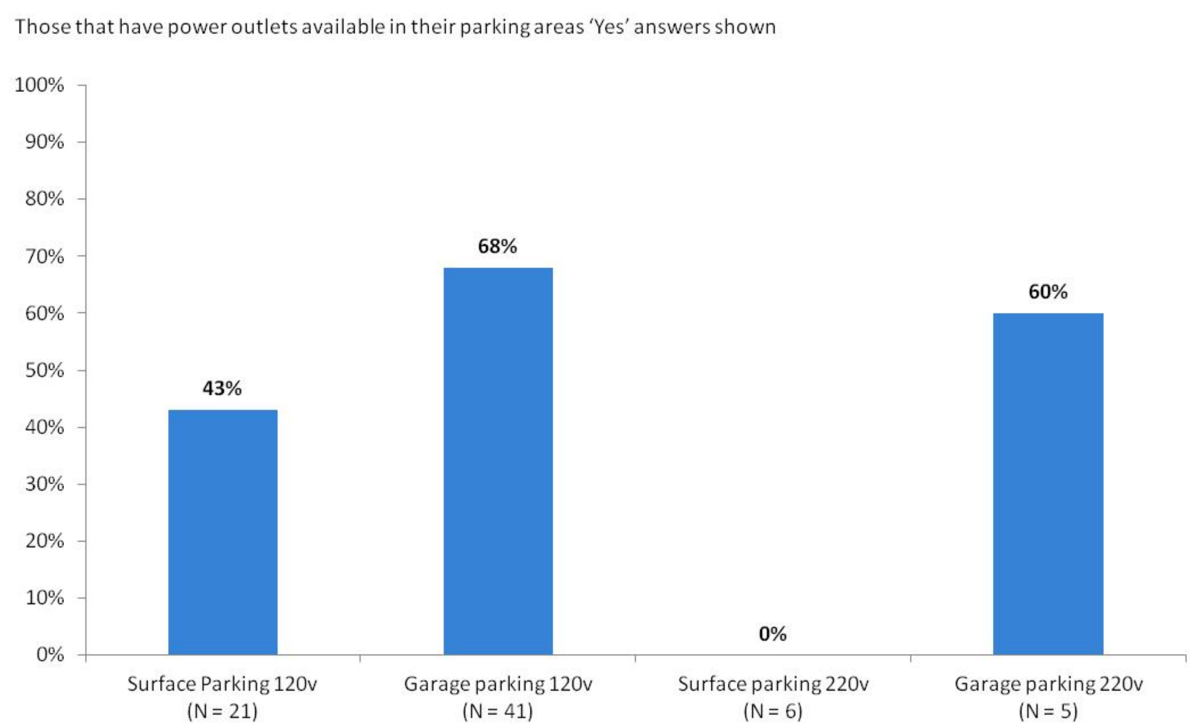
21/24. Does your surface/garage parking have 120/220 volt outlets that are accessible?



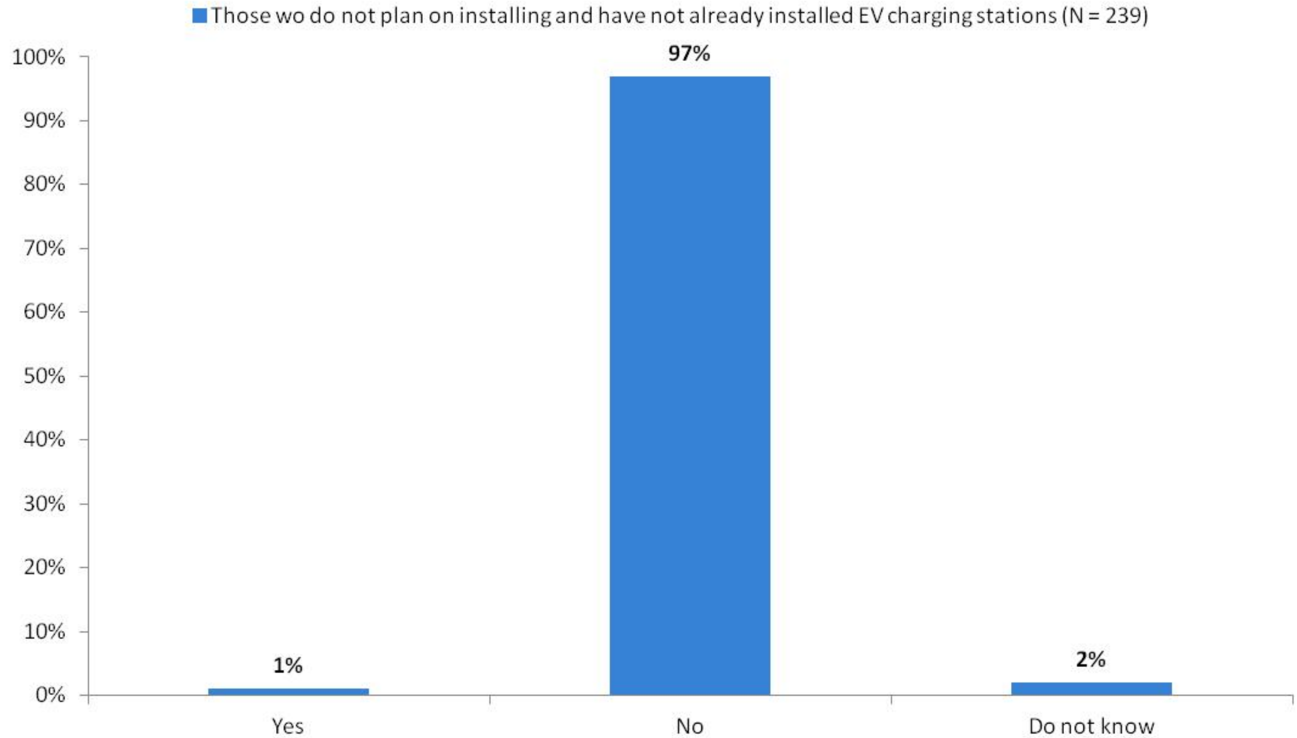
22/25. How many 120/220v outlets are accessible to residents within your surface/garage parking?



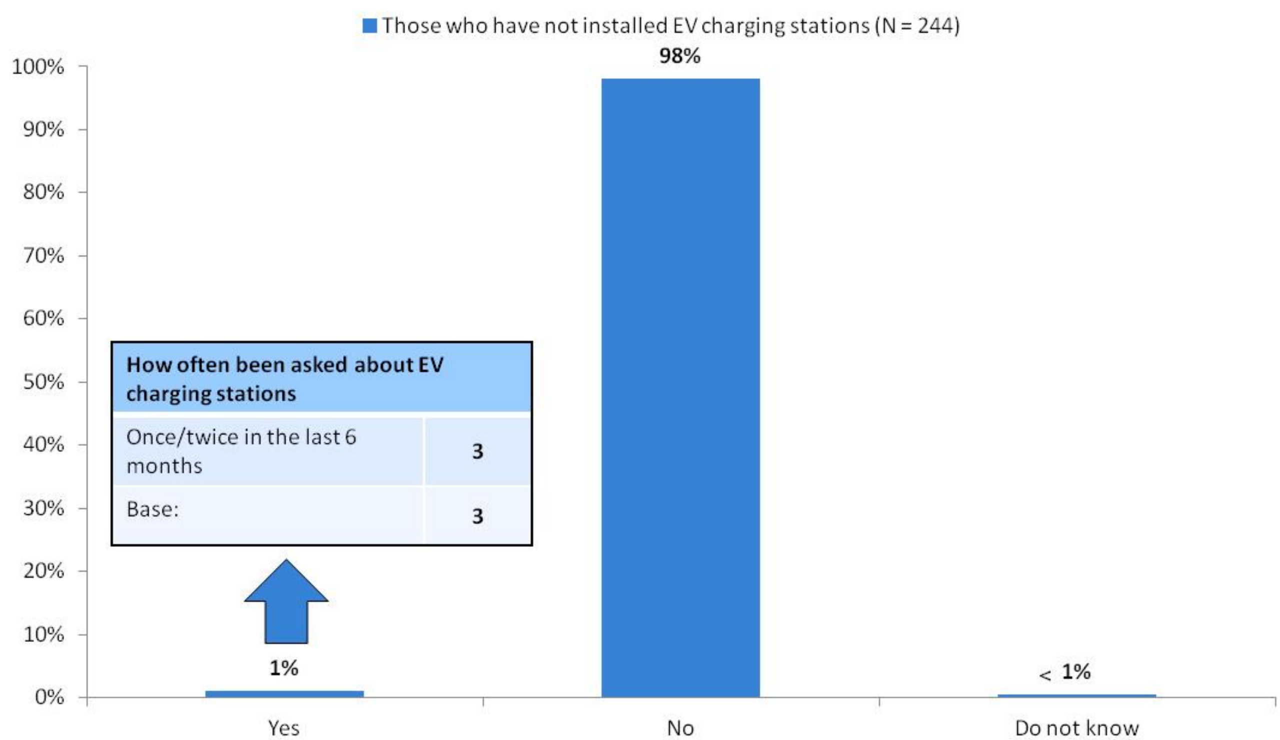
23/26. Is your surface/garage parking electrical system equipped to have all of your 120/220v electrical outlets in use at the same time?



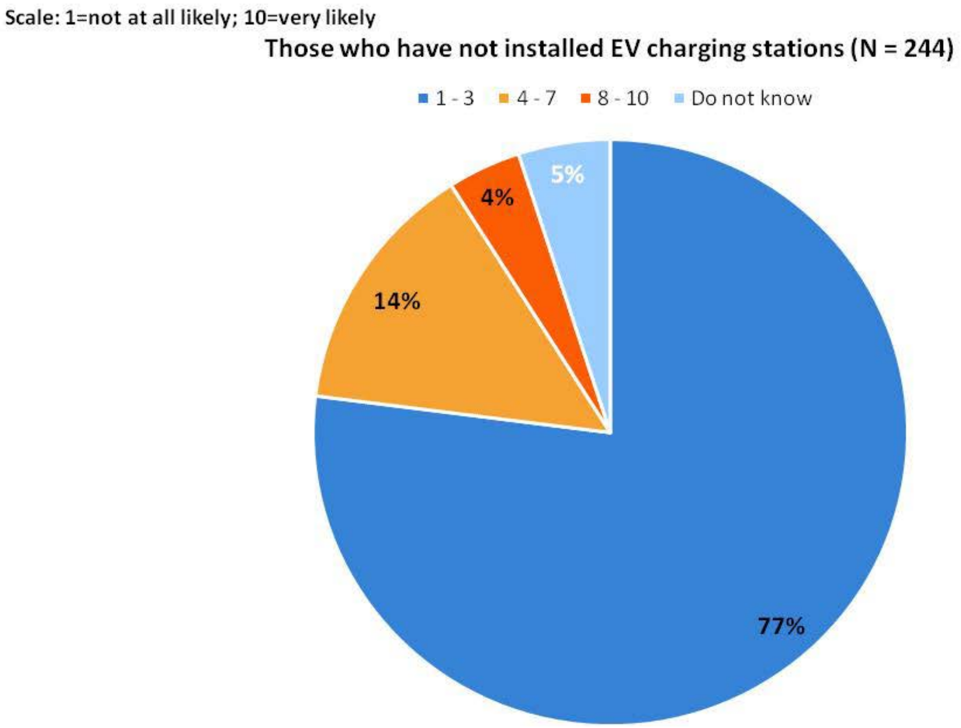
27. Have you investigated plug-in electric vehicles or EV charging stations for your properties?



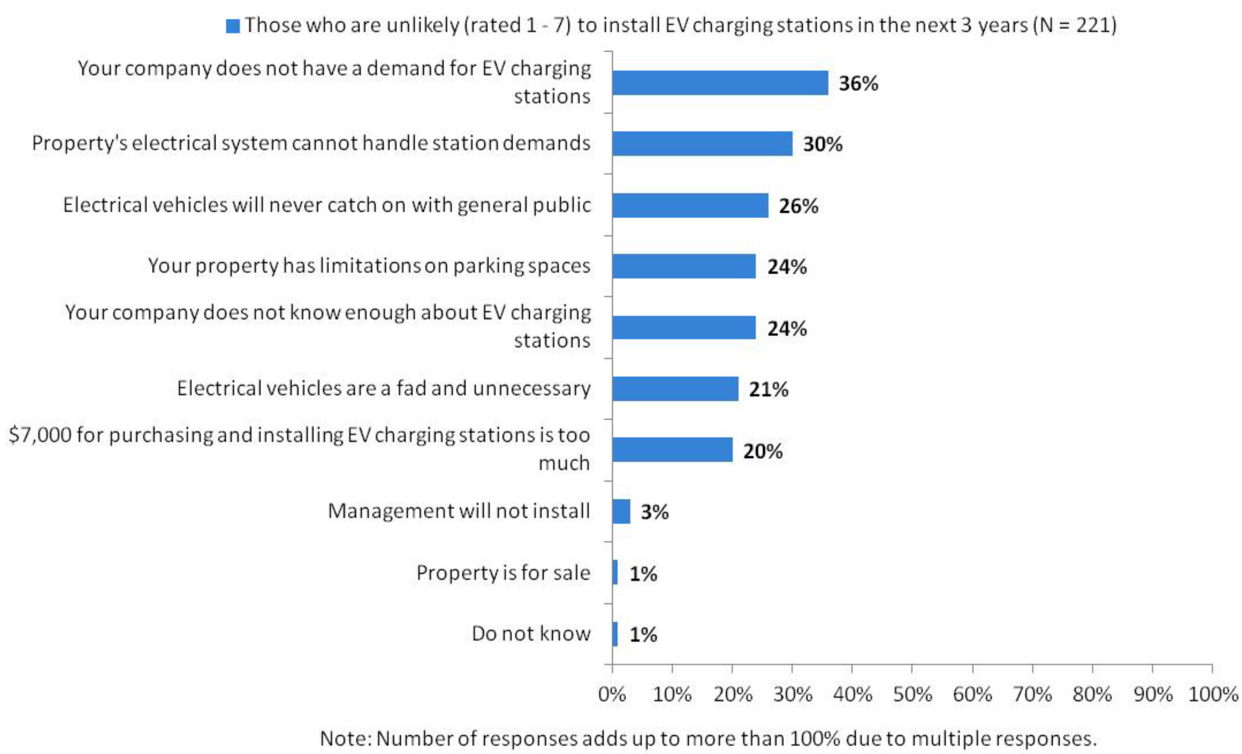
28. Have current or prospective residents asked you about the availability of 120 volt electric outlets for charging electric vehicles?



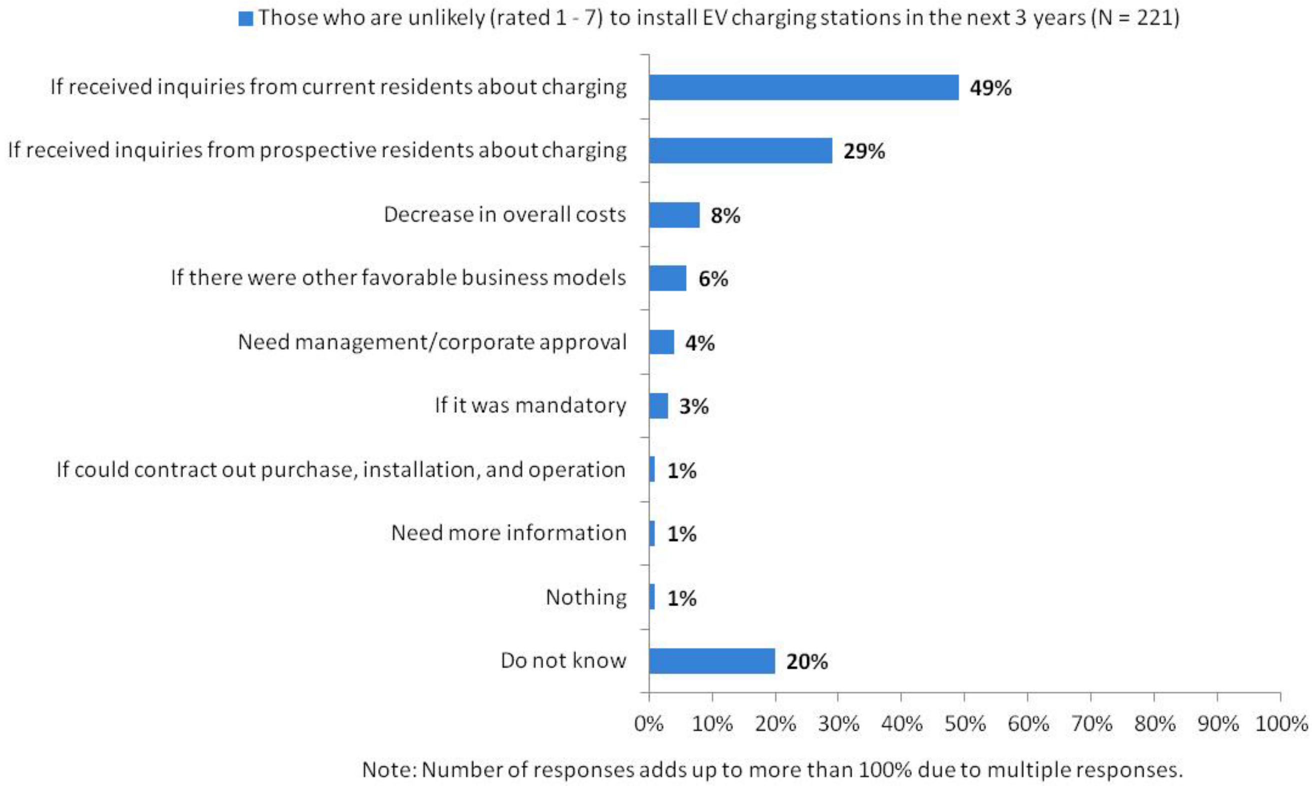
30. Using a 10-point scale where '1' is not at all likely and '10' is very likely, how likely would your company be to install an electric vehicle charging station within the next 3 years?



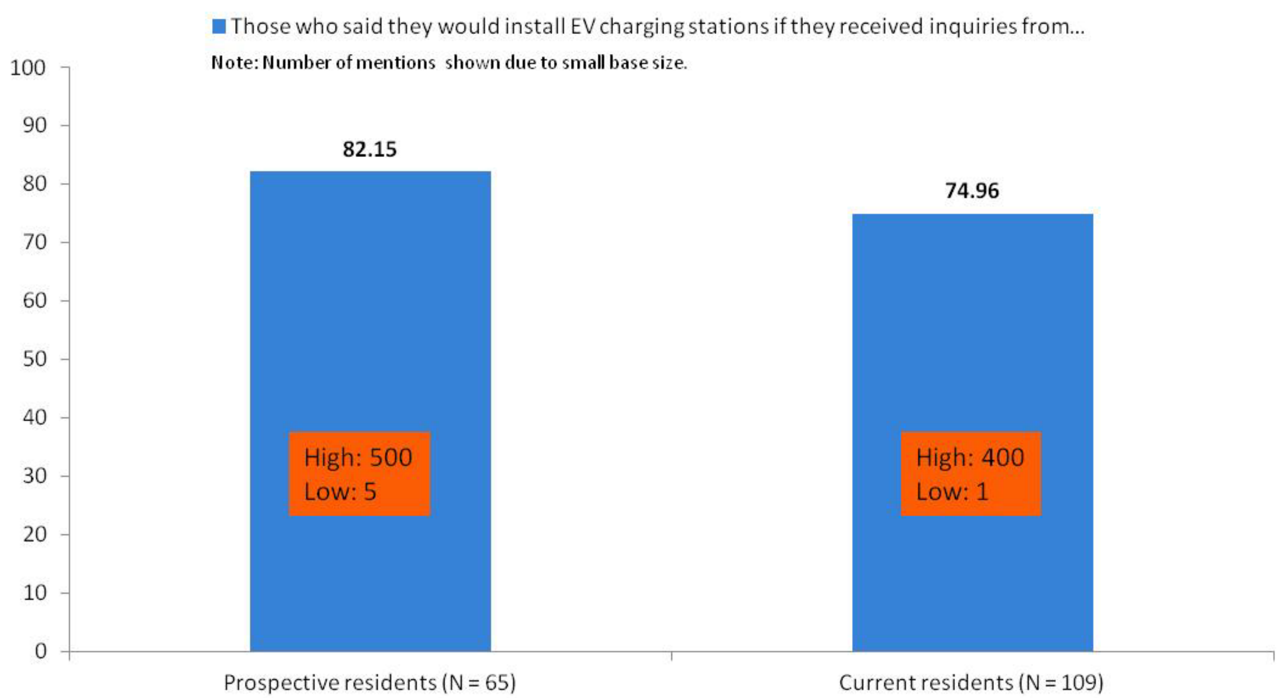
31. What are the primary reasons you would not install a charging station for resident use?



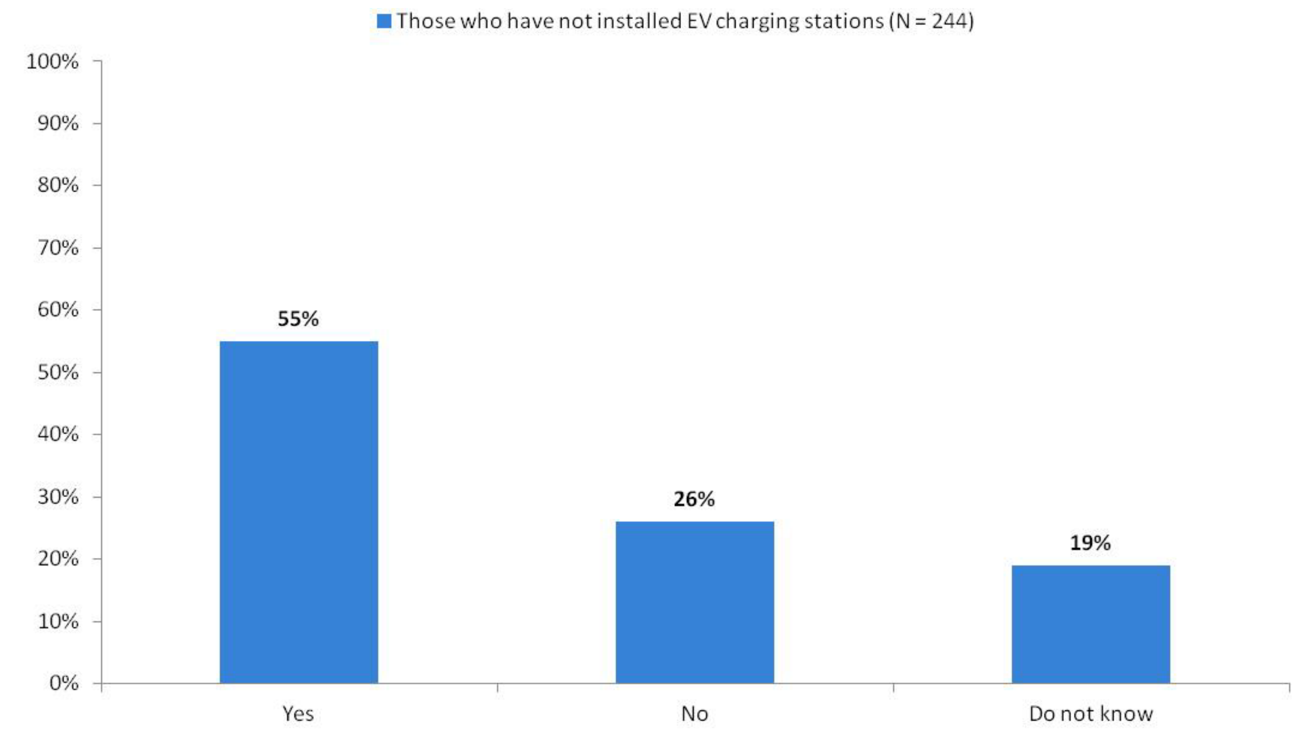
32. What would have to occur for your company to install an electric vehicle charging station?



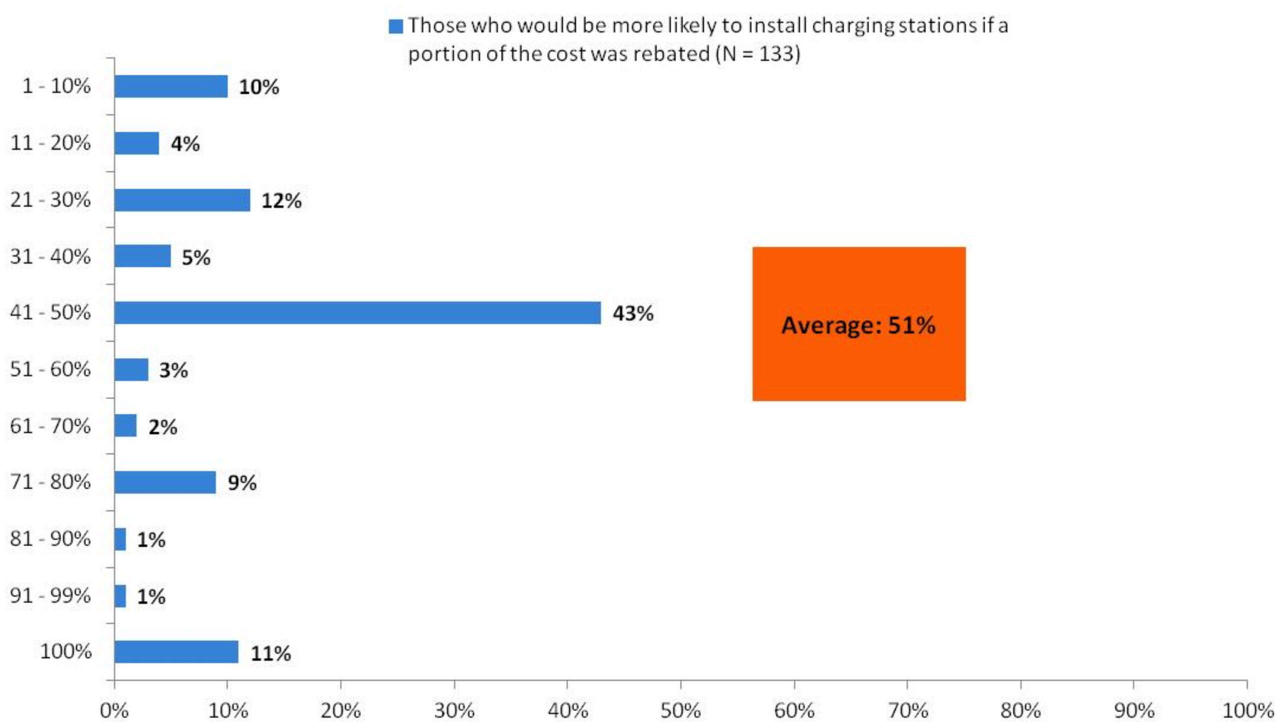
32bb. How many inquiries from prospective/current residents would your company need to receive to begin the process of installing an EV charging station?



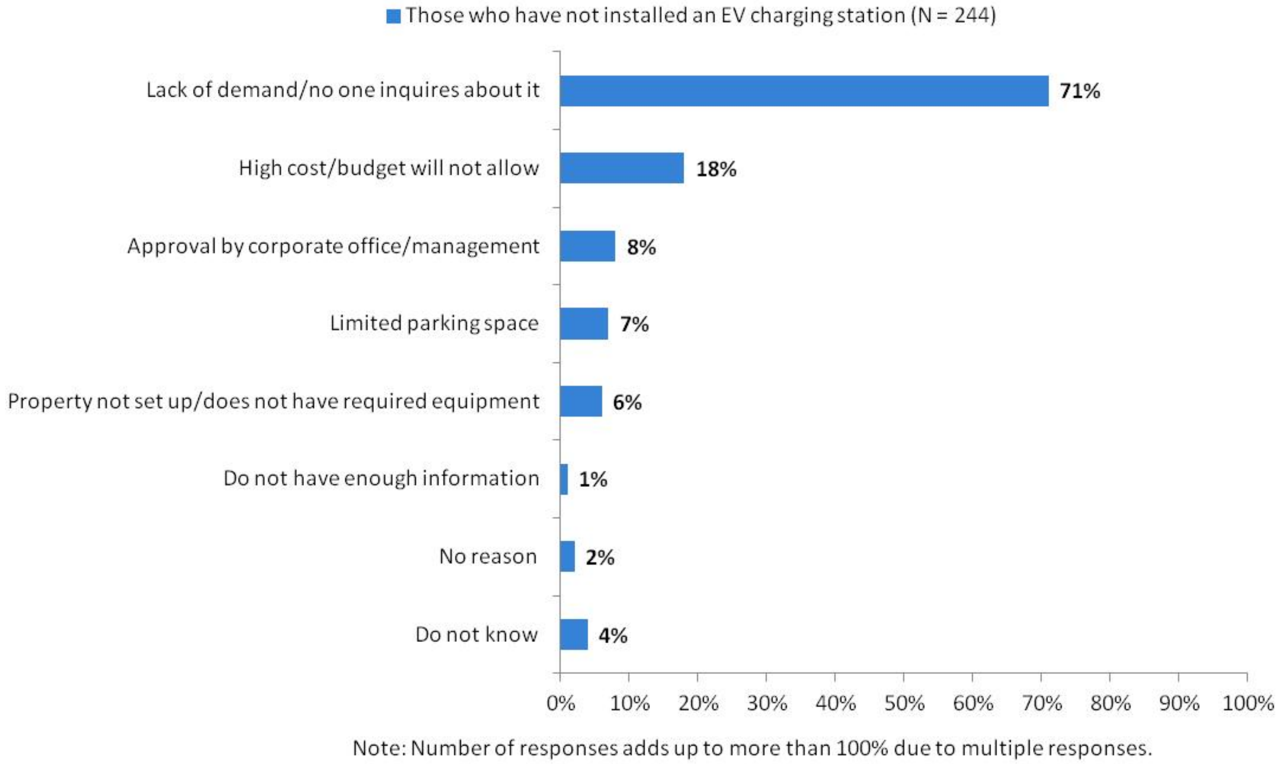
33. Would you be more likely to purchase and install an electric car charging station if a percent of the cost was rebated?



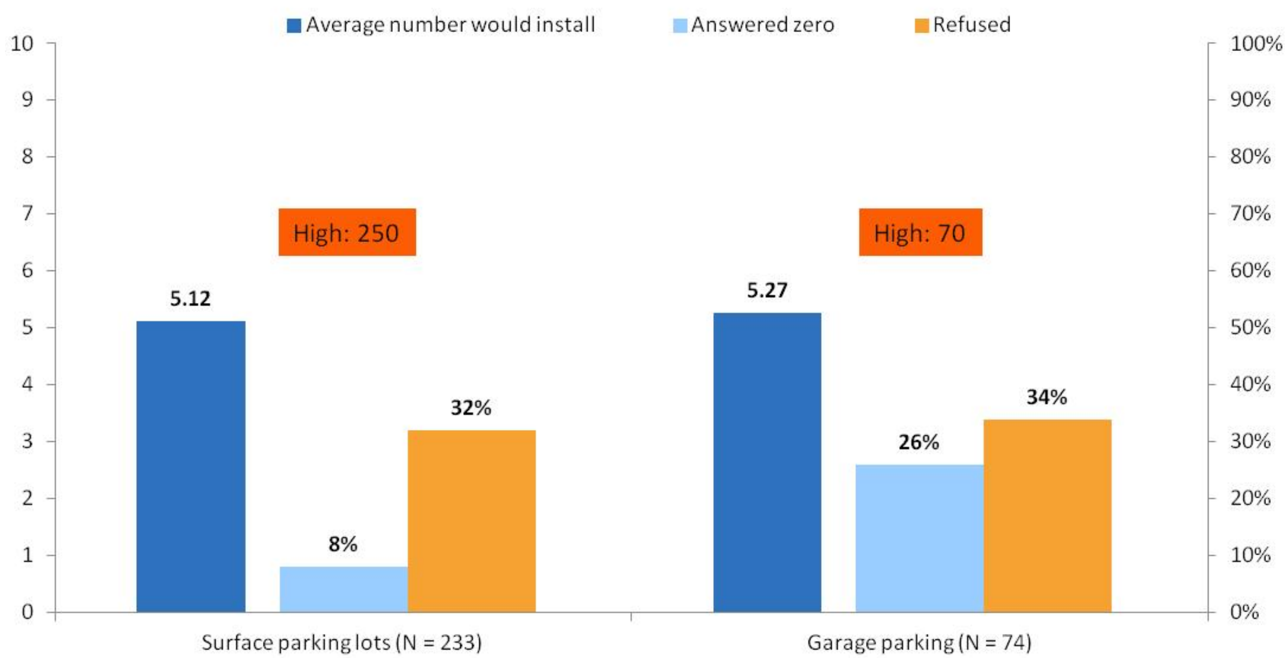
34. What percent of the total cost of a charging station would need to be rebated for your company to install a charging station?



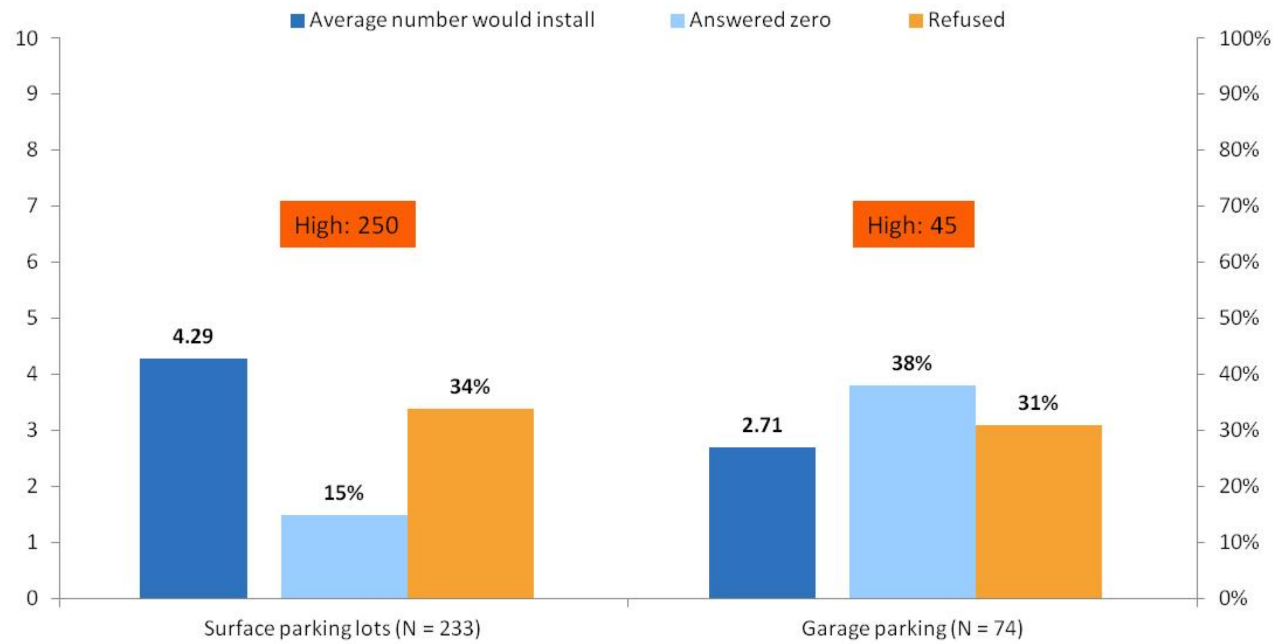
35. What currently prevents you from installing electric vehicle charging stations?



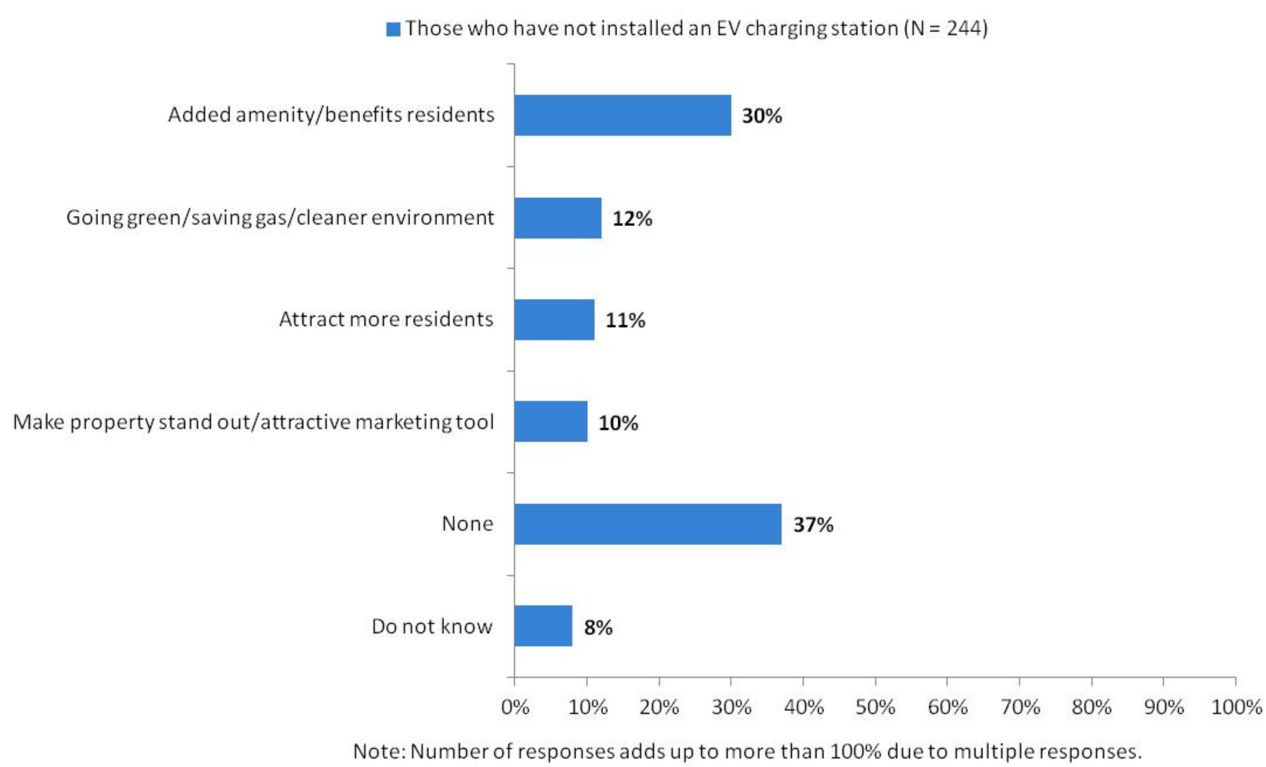
36. If you were to install a 120v charging station, how many charging stations do you think you would install?



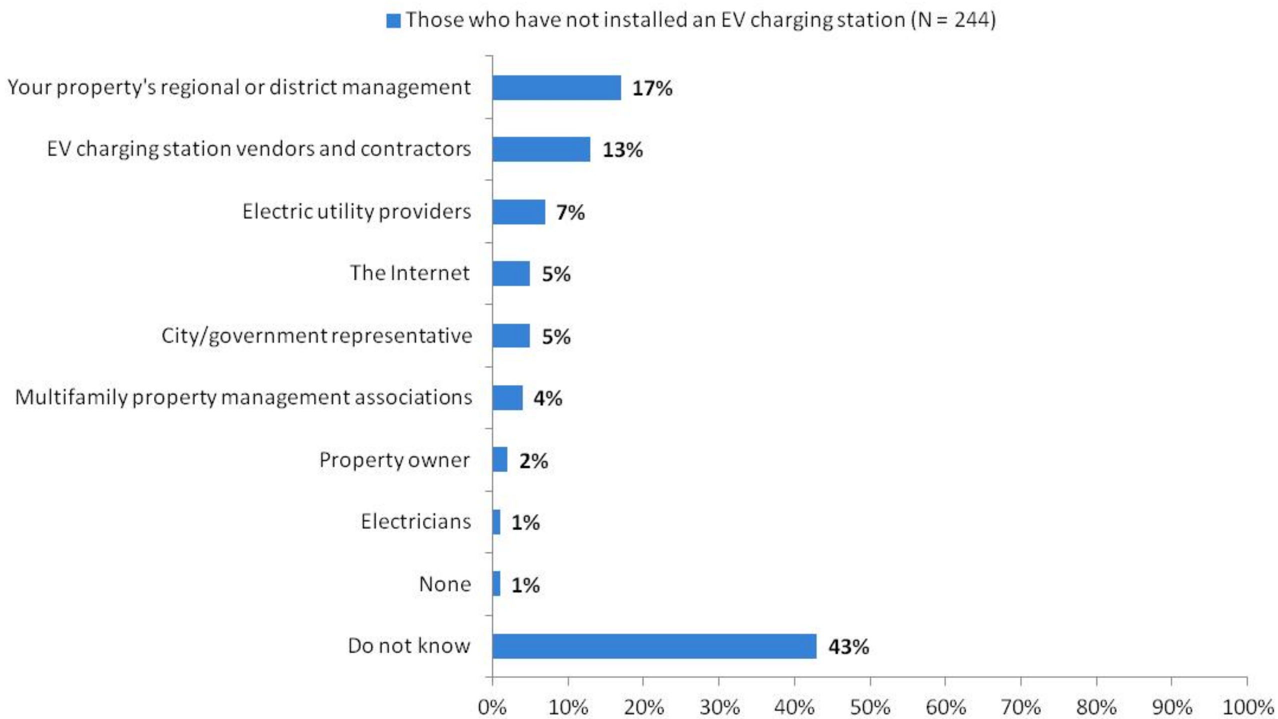
37. If you were to install a 220v charging station, how many charging stations do you think you would install?



38. What do you see as your company's benefits of installing EV charging station?



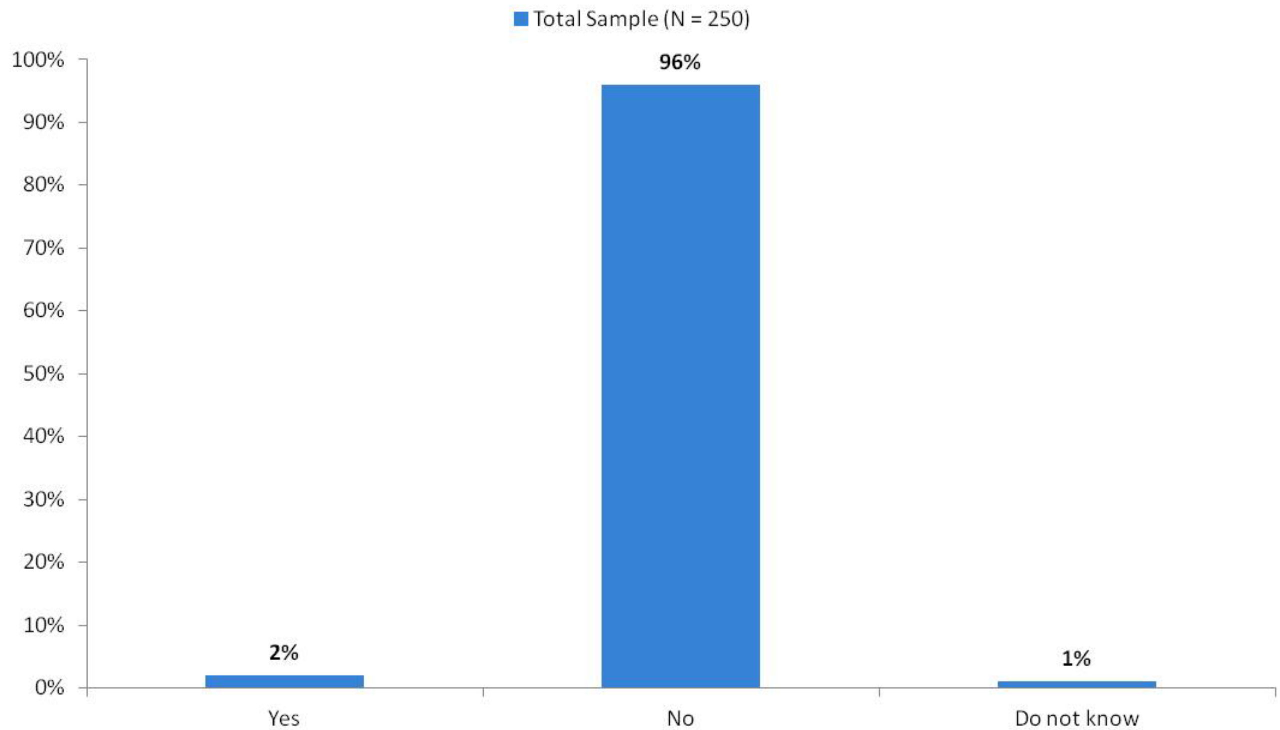
39. From whom would you be most likely to receive reliable information about the purchase and installation of EV charging stations?



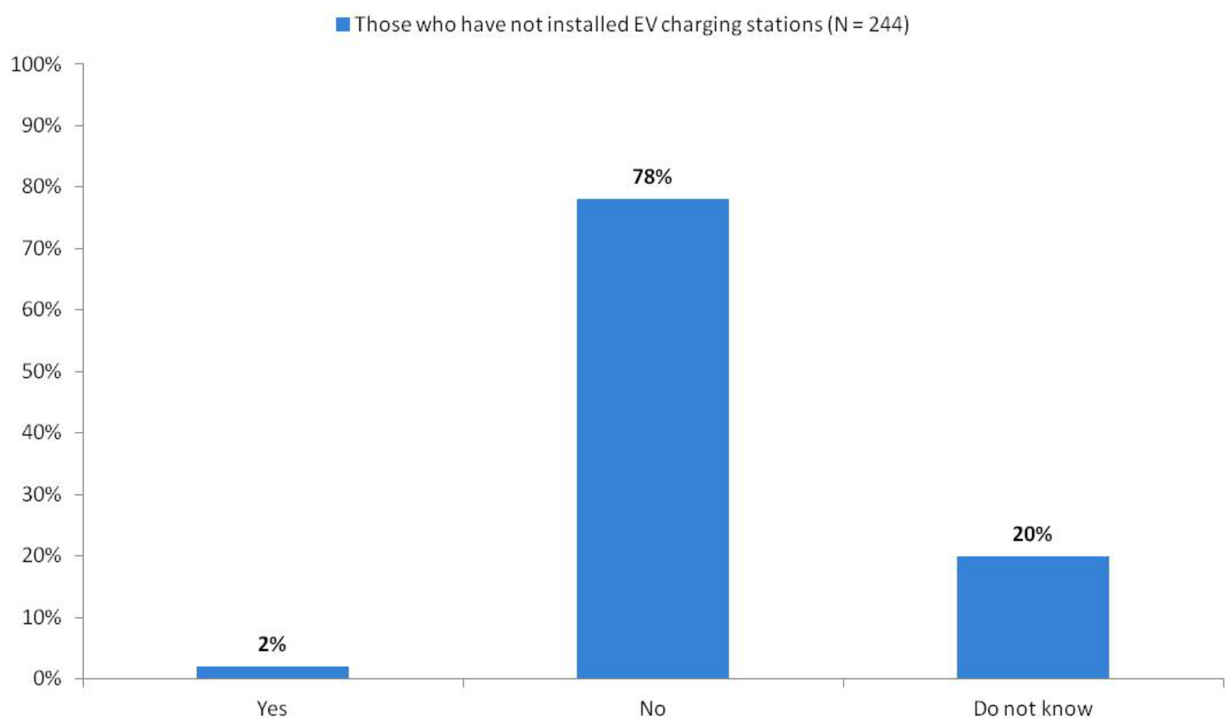
Note: Number of responses adds up to more than 100% due to multiple responses.

PEV Charging Stations Installed or Planning to Install

1. Has your management company installed any electric vehicle, or EV, charging stations at the property or properties you manage?



2. Do you plan on installing an electric vehicle charging station within the next 3 years?



3. How many EV charging stations has your company installed or is planning to install?

	Number of Respondents	Average
1 EV charging station	3	5.0
2 EV charging stations	1	
8 EV charging stations	2	
14 EV charging stations	1	
Refused	4	
Base: Those who have installed or plan on installing an EV charging station	**11**	

4. Where on your property have you installed or planning to install EV charging stations?

	Number of Respondents
In assigned garage parking space	3
In front of common areas	1
In prospective resident parking area	1
In unassigned garage parking space	1
One per building	1
Close to apartment complex office	1
Location not planned	1
Do not know/unsure	2
Base: Those who have installed or plan on installing an EV charging station	**11**

Note: Number of mentions shown due to small base size.

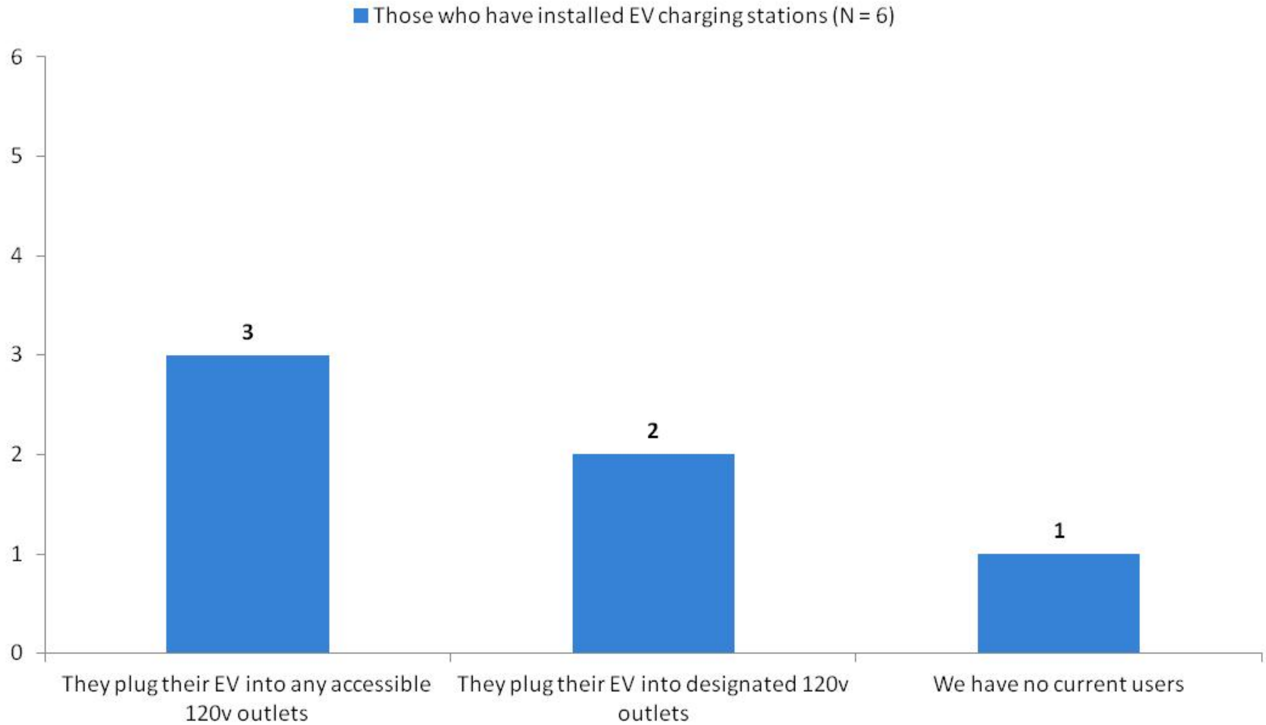
5. What factors influenced your placement of the EV charging stations?

	Number of Respondents
Green/LEED requirements	2
Cost of purchase and installation of the EV charging station	1
Supervisor's decision	1
Do not know/unsure	2
Base: Those who have installed an EV charging station	**6**

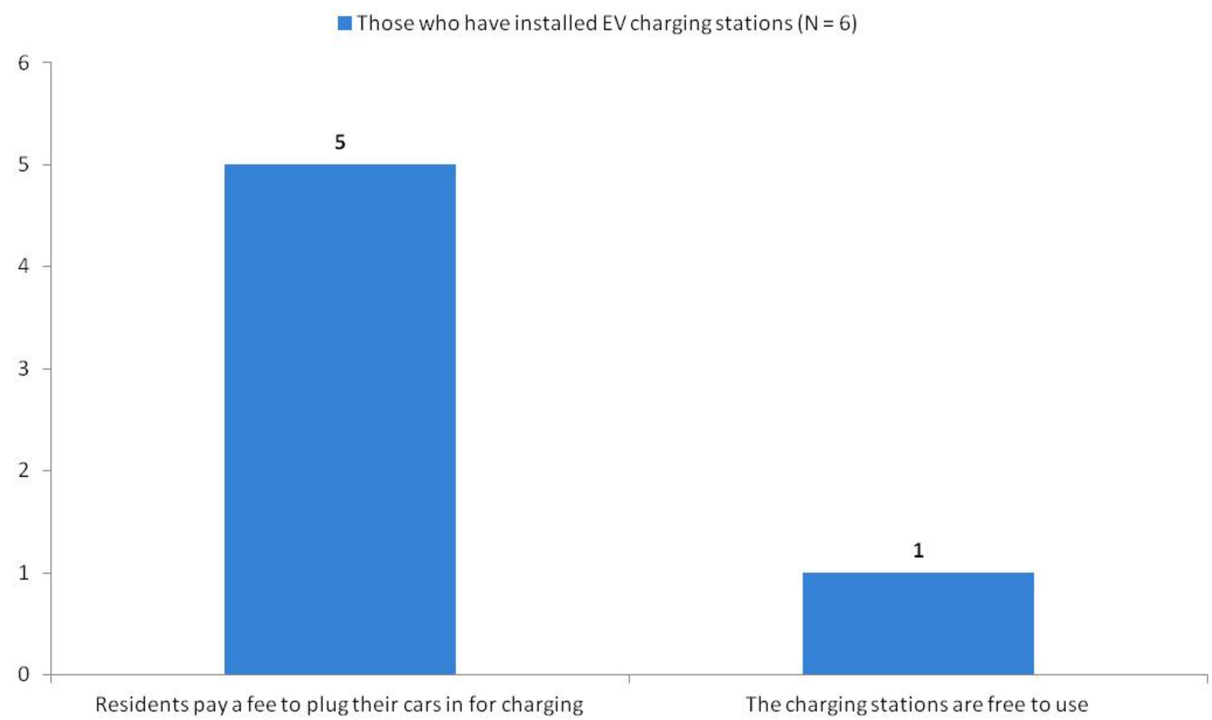
6. What are the biggest obstacles your company faced when installing the EV charging stations?

	Number of Respondents
The cost to purchase and install an EV charging station	1
No plans for operation of EV charging station	1
Constraints of infrastructure	1
Difficulty dealing with permitting departments for obtaining necessary permits	1
Do not know	1
No obstacles were faced	2
Base: Those who have installed an EV charging station	**6**

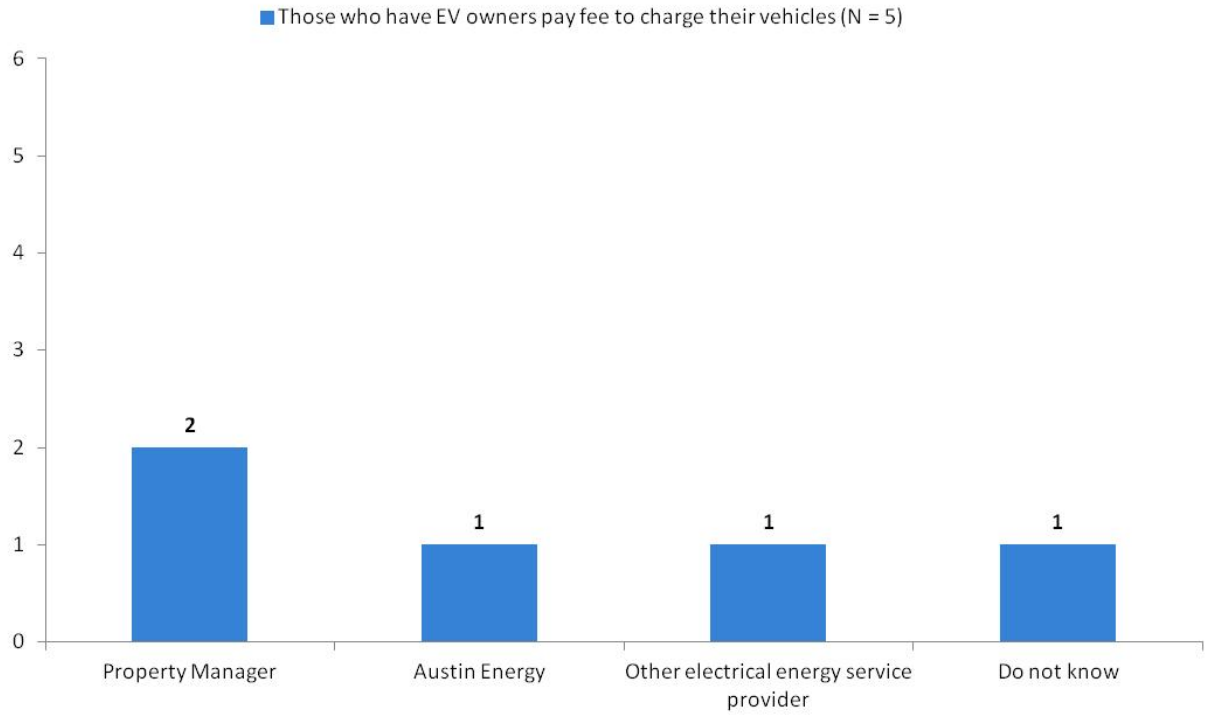
7. How do your residents charge their electric vehicles?



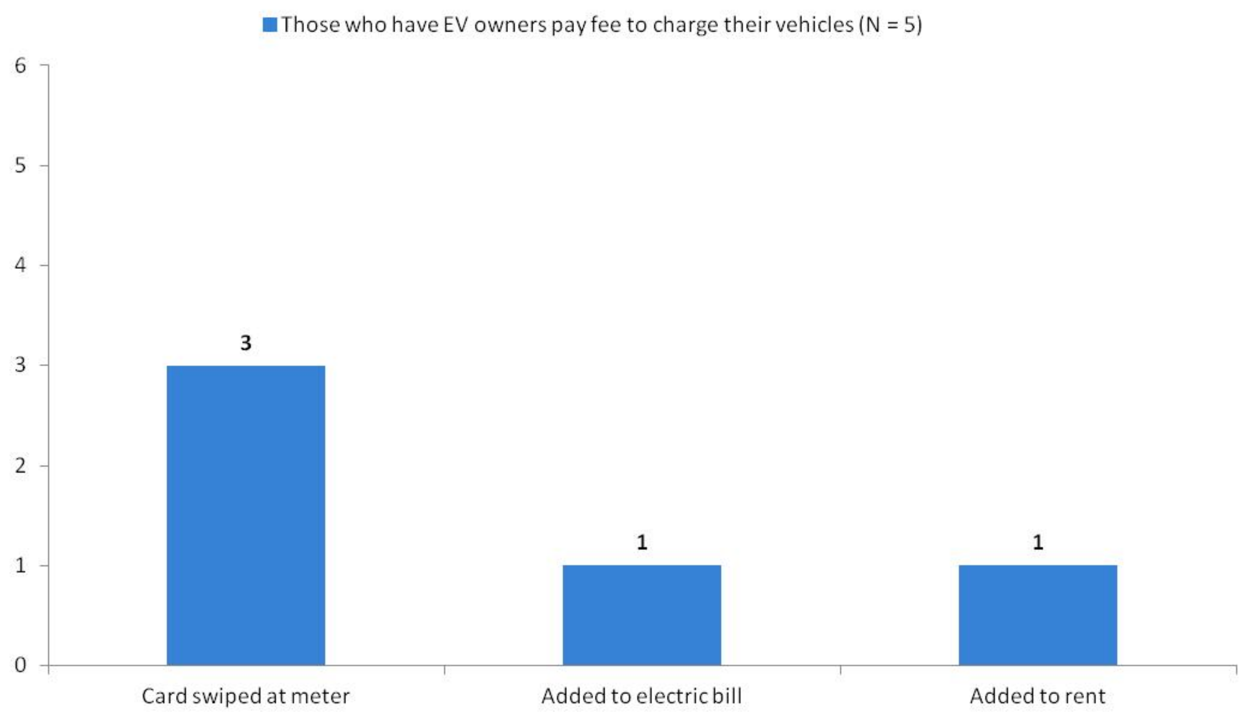
8. Do you currently provide or plan on providing free EV charging or do EV owners pay a fee to use the chargers?



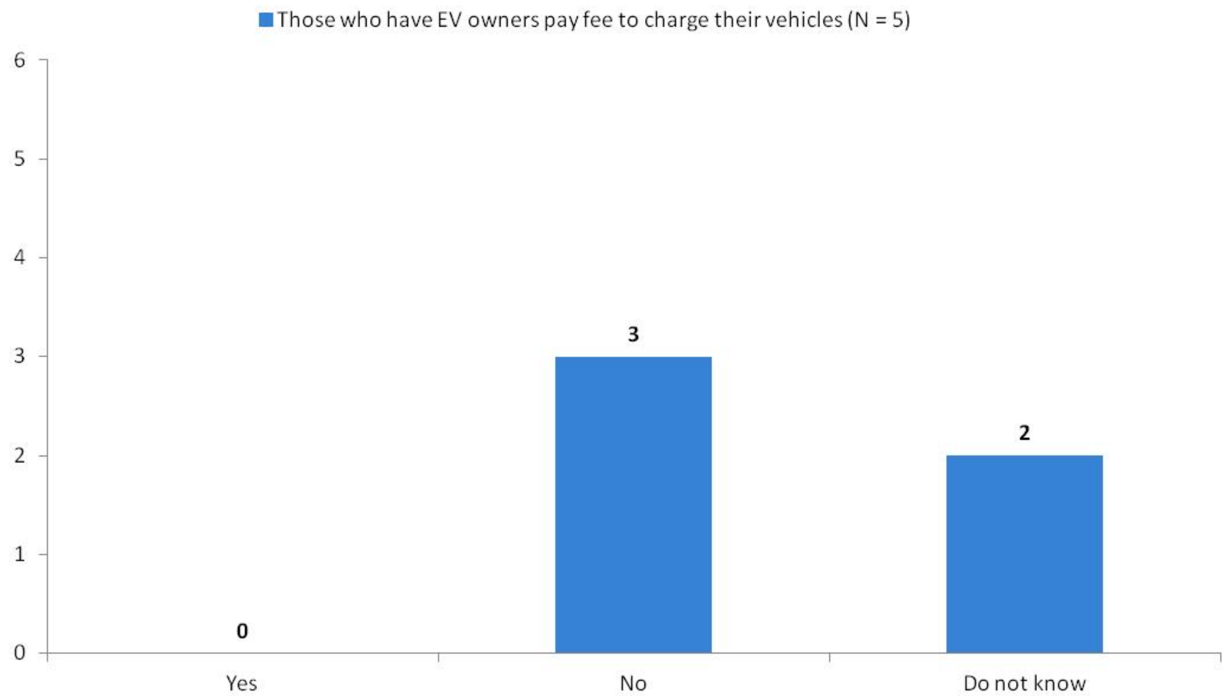
9. To whom do users pay the fee for charging their electric cars?



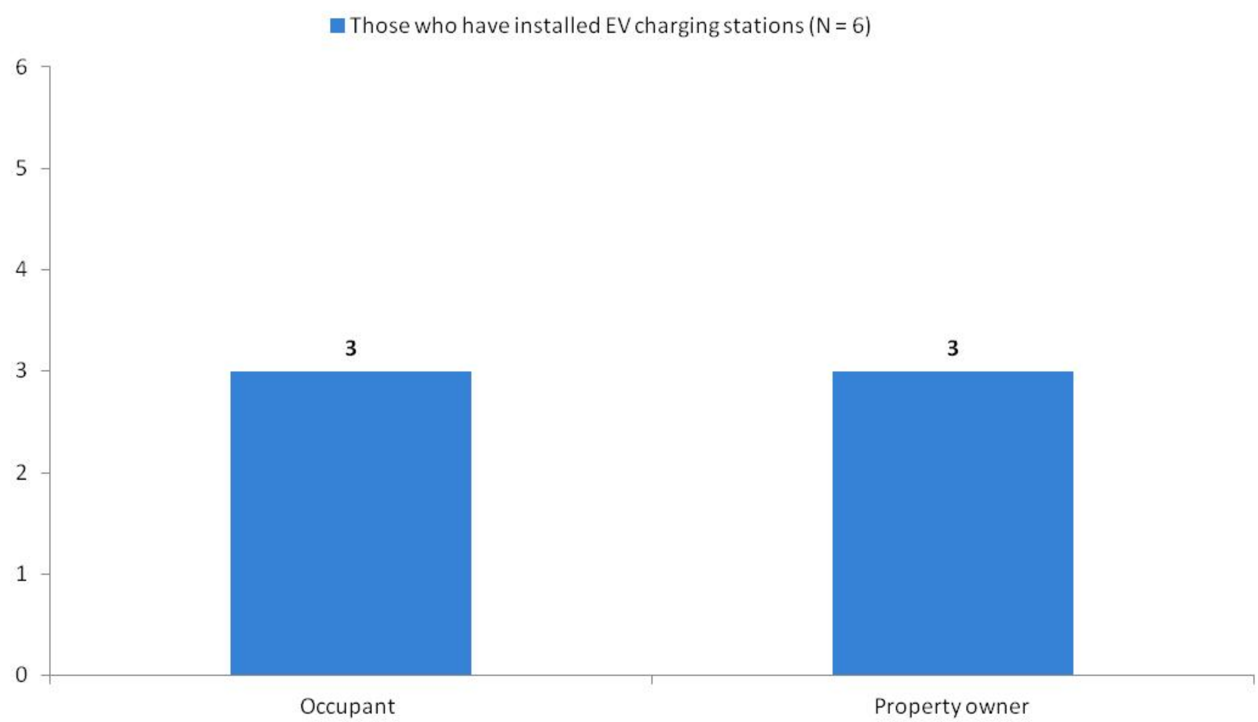
10. How is the fee paid?



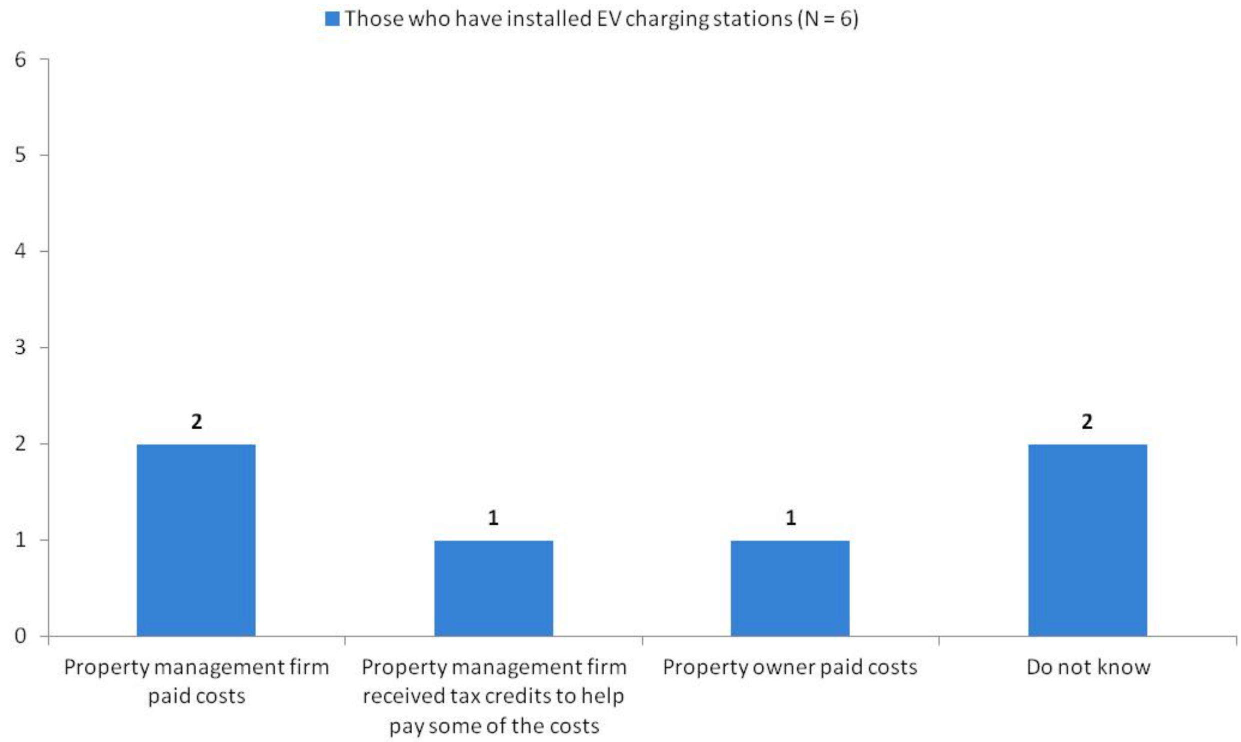
11. Does your company receive a portion of the charging station fee?



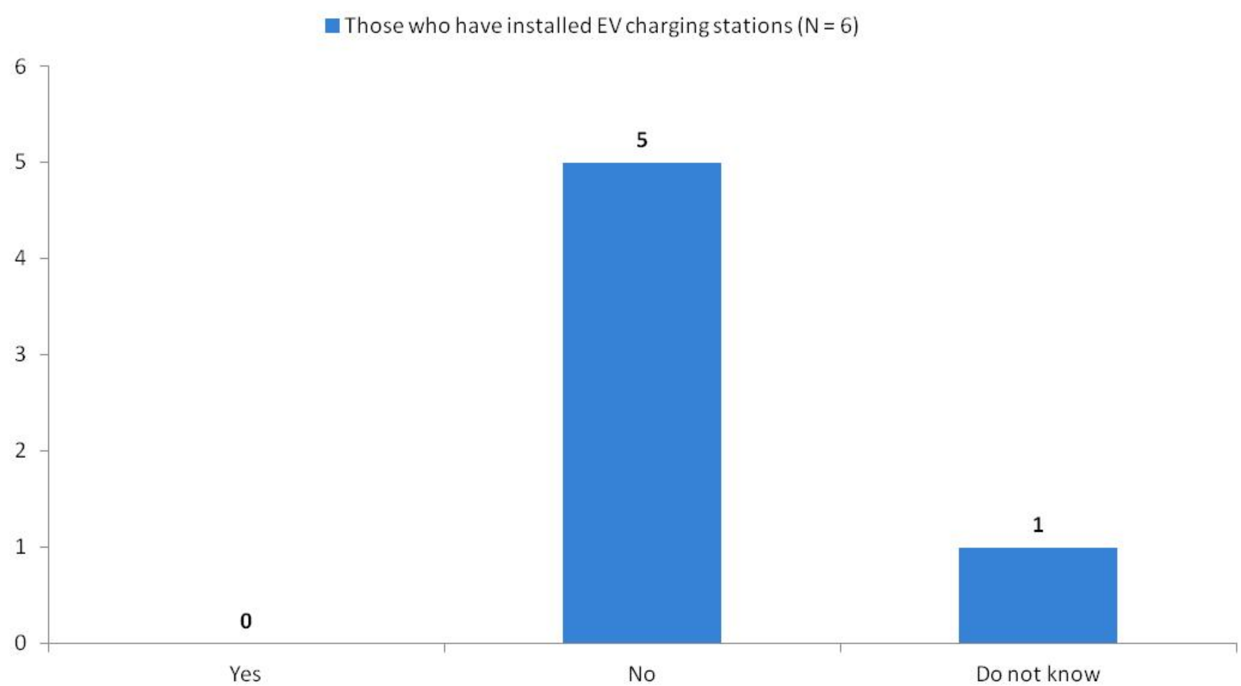
13. Who pays for the electricity use to power the charging stations?



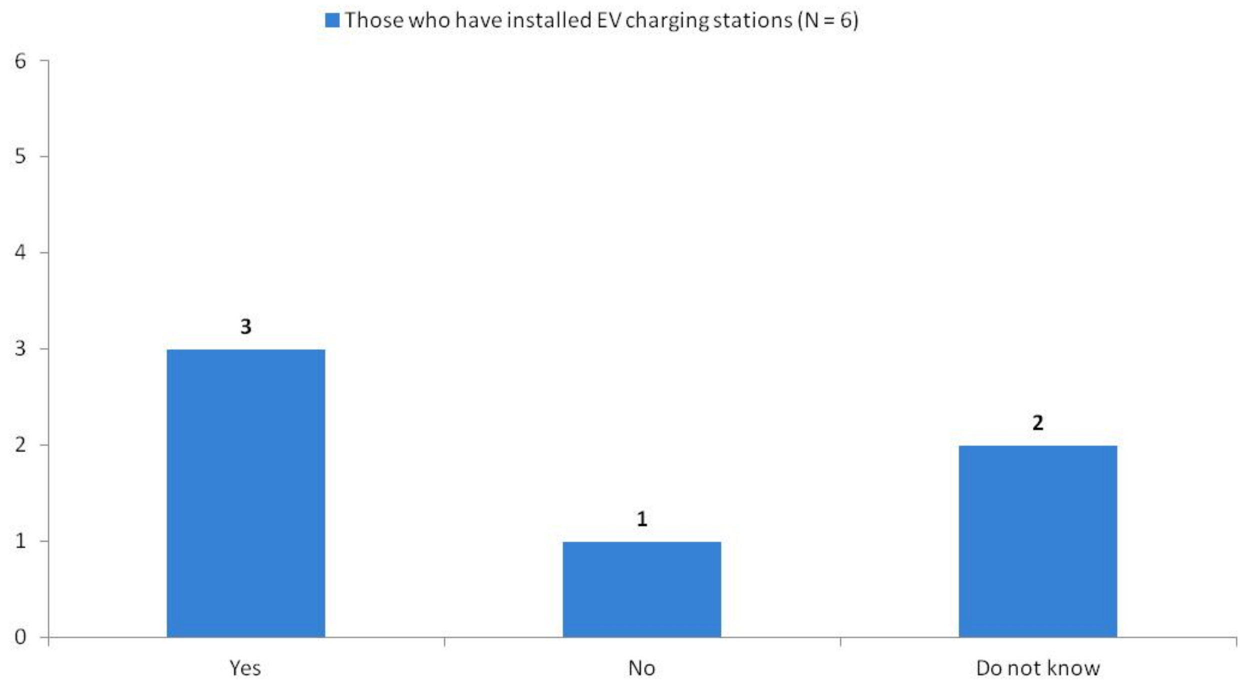
14. Which of the statements below best describes the costs you incurred to install the charging stations?



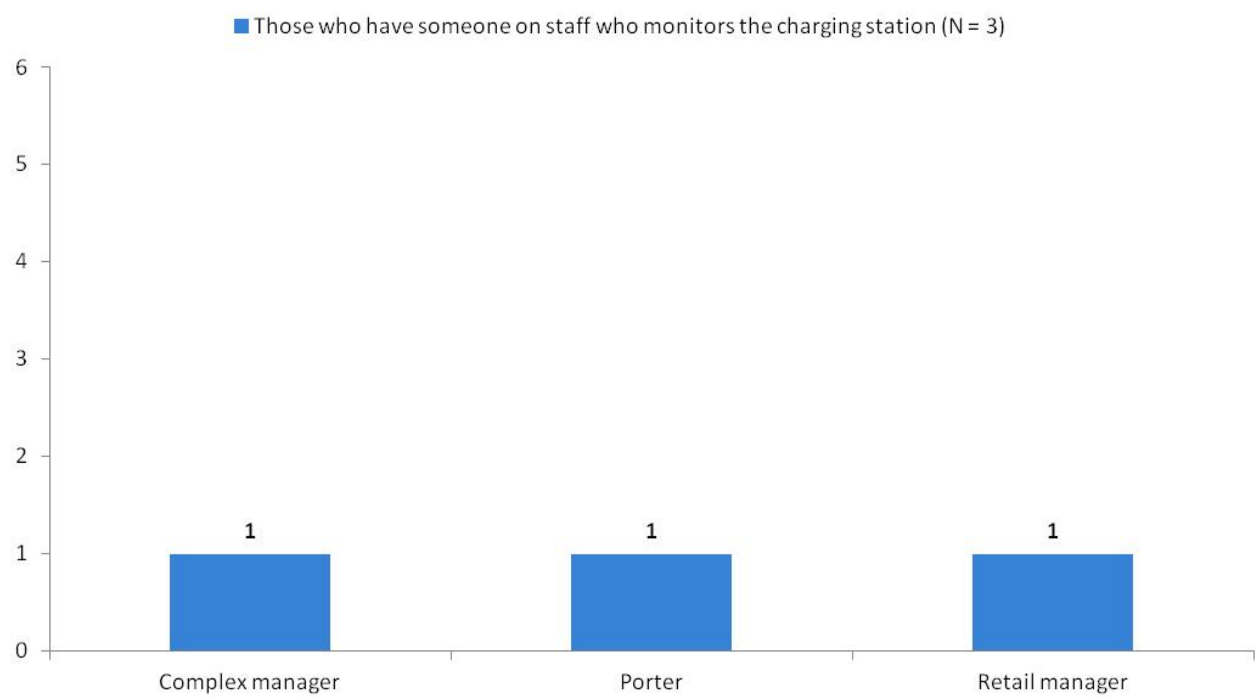
15. Do your charging stations have network communications capabilities?



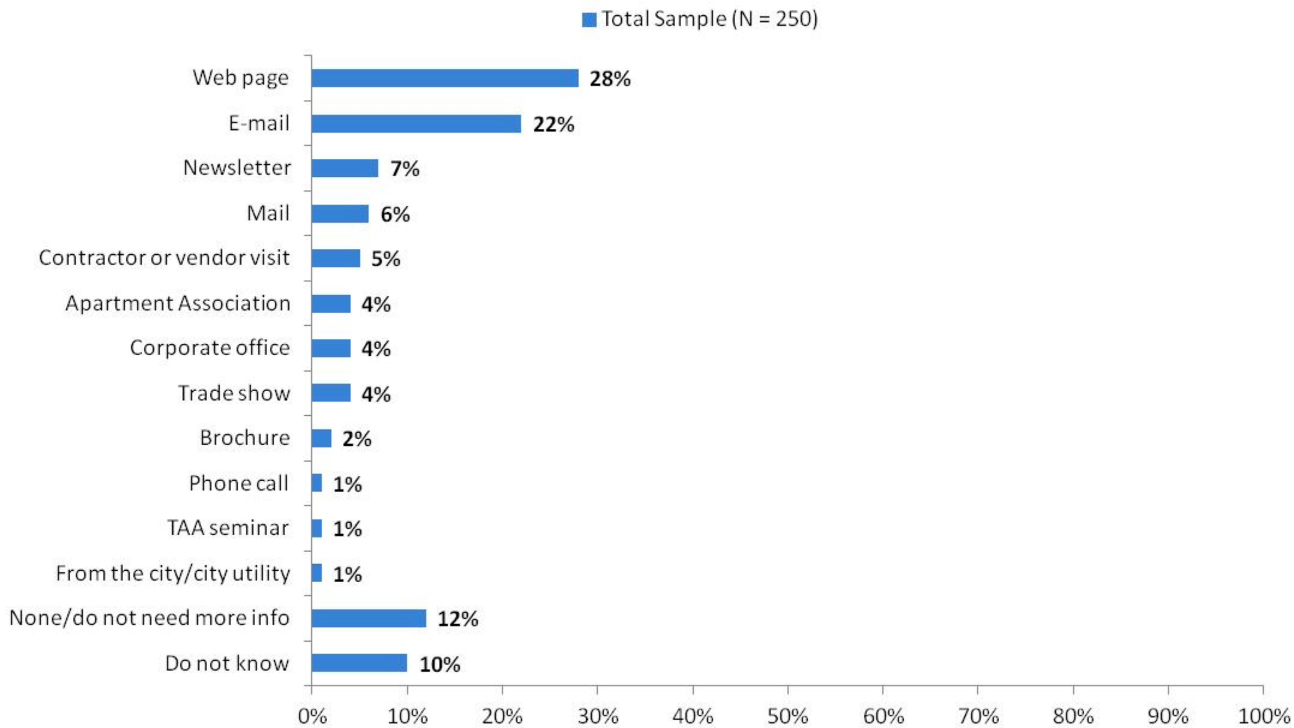
17. Is there someone within your staff who monitors the charging station?



17b.Who on your staff monitors the charging station?



40. How would you prefer to learn more about plug-in electric vehicles and charging stations?



Note: Number of responses adds up to more than 100% due to multiple responses.

Demographics

	Total Sample
Complex manager	49%
Assistant manager	20%
Leasing agent	14%
Community director	4%
Owner	3%
District manager	2%
Regional manager	2%
Office/business manager	2%
CEO/president	1%
Accountant/bookkeeper	1%
Refused	1%
Base:	250

	Total Sample
Apartment	88%
Townhouse/duplex	12%
Condo	6%
Homes/single family housing	3%
Low income housing	1%
Average number of units managed:	*246*
Base:	250

10.5 Survey 3- Apartment Complex Residents Survey

10.5.1 Apartment Complex Residents Survey

Apartment Complex Residents Questions

IF LEAVING MESSAGE ON ANSWERING MACHINE:
Hello, (Mr./Mrs.) _____. My name is _____ with ______ in ______, Texas. We have been contracted by The Texas River Cities Plug-In Electric Vehicle Initiative to conduct a market research study with a select group of area residents. If you would like to participate in this study, please call 1-877-530-9646 and give them your name and the telephone number I just called and that you would like to participate in the EV **Residents** project. Thank you.

INTRODUCTION

Hello, my name is ____ with Creative Consumer Research, a Texas-based marketing research company. We are calling on behalf of The Texas River Cities Plug-In Electric Vehicle Initiative. This is a group of communities and stakeholders in Central Texas planning for the use of plug-in electrical vehicles throughout Texas.

(Today/this evening), we are conducting a study among south and Central Texas area residents and would like to include your opinions. Let me assure you that this is not a sales call, and your name will not be placed on a mailing list. We are only interested in your opinions.

The information obtained in this study will be used for research purposes only, and all responses will be kept confidential.

For quality purposes, this call may be monitored or recorded.

S1. BY OBSERVATION: Market **(CHECK QUOTAS)**

START
TIME: __________

Austin	1
Georgetown	2
San Marcos/New Braunfels	3
San Antonio	4

S2. Are you one of the heads of your household and **21** years of age or older?

Yes **(CONTINUE)**
No **(ASK TO SPEAK TO APPROPRIATE PERSON.**
IF UNAVAILABLE, TERMINATE & TALLY)

S3. Are you or is anyone in your household or immediate family employed in any of the following areas? **(READ LIST. IF 'YES' TO ANY, TERMINATE & TALLY)**

Market research
Advertising
An electric or gas utility company
Automobile dealer

S4. Are you a licensed driver?

Yes
No **(THANK; TERMINATE AND TALLY)**

S5. Which of the following best describes your home? **(READ LIST)**

Townhouse
Duplex
Condo
Apartment,
Other **(TERMINATE & TALLY)**

S6. Do you rent or own your residence?

Rent
Own
DK/unsure

Demographics

D1. Gender (BY OBSERVATION; **CHECK QUOTAS)**

Male
Female

D2. To be sure that we talk to a variety of residents, please tell me which of the following categories includes your age. **(READ LIST. CHECK QUOTAS.)**

18 to 20 **(TERMINATE & TALLY)**
21 to 24
25 to 34
35 to 44
45 to 54
55 to 59
60 to 64
65 years of age or older
(Do Not Read) Refused

D3a. Again to be sure that we talk to a variety of residents, please tell me which of the following best describes your ethnic background. Are you of Hispanic origin, such as Mexican American, Latin American, Puerto Rican, or Cuban?

Yes
No

D3b.And which of the following categories best describes your race?

White
African American
Asian, Pacific Islander
Aleutian, Eskimo, or American Indian
Other ***(Specify)*** ____________________
DK/unsure
Refused

D4. Please tell me your **home** zip code.

_____ _____ _____ _____ _____

Don't know/refused

Awareness & Adoption

1. Have you seen, read or heard anything about plug-in electric cars?

Yes **(GO TO Q2)**
No **(SKIP TO Q3)**
Don't know **(SKIP TO Q3)**

2. Have you seen a plug-in electric car on the road or in a car dealer showroom?

Yes
No
Don't know

Explanation

Examples of plug-in electric cars are the Nissan Leaf, the Chevy Volt, and the Ford Focus EV. These cars can go about 75 miles before needing to be plugged in and recharged. These cars can be plugged into any standard 120 volt outlet and charged in 12 hours, or they can be plugged into a charging station and charged in approximately 4 hours.

3. Knowing this, please rate on a 1 to 10 scale where 1 is not at all likely and 10 is extremely likely, how likely is it that you would **consider** a plug-in electric car when shopping for your next car?

Not at all									Extremely	DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

(IF Q3=RATING OF 8, 9, OR 10, SKIP TO Q4b.)
(IF Q3=RATING LESS THAN 8, GO TO Q4.)

4. What is the main reason you would **not** consider a plug-in electric car for your next car? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS. RECORD ALL MENTIONS.)**

The distance traveled between charging
Cost
Time to charge
Size of car
Lack of charging stations to recharge electric car
No access to outside electrical outlet
Safety concerns
Other ***(Specify)*** ____________________________

4b. If cost was **not** a factor, please rate on a 1 to 10 scale where 1 is not at all likely and 10 is extremely likely, how likely is it that you would **consider** a plug-in electric car when shopping for your next car?

Not at all								Extremely		DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

(IF Q4b=8 OR HIGHER, GO TO Q4c. OTHERWISE, SKIP TO Q6.)

4c. What is your **main** reason for considering a plug-in electric car? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS. RECORD ALL MENTIONS.)**

Save money on gas
Good for the environment
Helps to achieve energy independence
Interest in new technology
Other ***(Specify)*** ____________________________
Don't know

5. Please rate on a 1 to 10 scale where 1 is not at all likely and 10 is very likely, how likely is it that you will **purchase** a plug-in electric car when shopping for your next car?

Not at all								Extremely		DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

(IF Q5 RATING = 8, 9, OR 10, GO TO Q5b. OTHERWISE, SKIP TO Q6.)

5b. When do you expect to purchase your plug-in electric car? **(READ LIST)**

Within the next 30 days
Within the next 3 months
Within the next 6 months
Within the next 12 months
Within the next 24 months
Longer than 24 months
(Do Not Read) Not sure / Don't know

5c. If you were to purchase a plug-in electric car, would this be your primary car, or a secondary car?

Primary car
Secondary car

Charging

6. These electric cars can be plugged into any standard 120 volt outlet and charged in 12 hours, or they can be plugged into a charging station and charged in approximately 4 hours. **If you drove a plug-in electric car**, how likely would you be to ask your apartment or condo complex to install a charging station?

Not at all								Extremely		DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

7. Typical plug-in electric cars need to be charged every 75 miles. **If you drove an electric car**, where would you expect to be able to plug this car in to be charged? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS. RECORD ALL MENTIONS.)**

At my residence, with a standard electrical outlet
At my residence, with a charging station
At my place of work
At a shopping center, mall, or movie theater
At a public charging station on the street
Public parking facilities
Highway rest stops
Other ***(Specify)*** ______________________________
Don’t know/refused

8. Where within the **complex parking area** would you expect to find a plug-in charging station? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS. RECORD ALL MENTIONS.)**

Designated surface parking area
Designated space within parking garage
Non residence parking areas
Common area parking
Other ***(Specify)*** ______________________________
Don’t know/refused

9. How would you prefer to pay for charging your electric car? **(READ LIST. RECORD ALL MENTIONS.)**

Charging fee would be included in the rent
Credit card at the charger
Monthly fee to the landlord
Monthly fee to my electric utility
Monthly fee to the charging station operators
Prepaid “EV” Pass that allows you to charge at all chargers in the area that accept the card
Or some other method? ***(Specify)*** ______________________________

COMMUNICATION

10. How would you prefer to learn about plug-in vehicles? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS.)**

Website (specify)
Facebook
Twitter
YouTube
Flicker
Blogs
E-mail
Text message
TV ads
Radio ads
Direct mail
Bill insert
Billboard
Newspaper
Phone call
Actual EV owners
Car Dealers
Other ***(Specify)*** ______________________________

11. Who are you more likely to believe is providing accurate information about plug-in electric cars? **(DO NOT READ LIST. PROBE FOR MULTIPLE MENTIONS.)**

Auto dealers
Electric utility
Newscasters
Politicians
University professors
Scientists
Family/friends/co-workers
Magazines
Community groups
Faith-based organizations
Mailers
Government officials
Environmental groups
Other **(specify)**

(IF Q3 <u>OR</u> Q4B <u>OR</u> Q5 = 8-10, SKIP TO DEMOGRAPHICS.)

12. After learning about electric cars and charging stations, please rate on a 1 to 10 scale where 1 is not at all likely and 10 is extremely likely, how likely is it that you would **consider** a plug-in electric car when shopping for your next car?

Not at all								Extremely		DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

(IF Q12 = 4 – 7, ASK Q13. OTHERWISE, SKIP TO DEMOGRAPHICS.)

13. What would motivate you to consider purchasing an electric car? **(PROBE FOR SPECIFICS. PROBE FOR MULTIPLE MENTIONS.)** What else?

____

____

____

Demographics

These last questions will allow us to group your responses with those of other survey participants.

D5. What is the highest grade of school you have completed? Is it ... **(READ LIST)**

Some high school
Graduated high school
Some college
Graduated college
Post-graduate work
(Do Not Read) DK/unsure
(Do Not Read) Refused

D6. What is your current employment situation? Are you . . . **(READ LIST)**

Employed part-time
Employed full-time
Unemployed
Student
Retired
Homemaker
(Do Not Read) DK/unsure
(Do Not Read) Refused

D7. Who is your electric utility provider? **(REPEAT; CLARIFY RESPONSE)**

____

D8. I am going to provide a number of ranges describing income. In order to make statistical projections, we do not need your exact income. Which of the following categories best describes your total family income for 2011, before taxes? Would it be … **(READ LIST)**

Under $10,000
$10,000 to under $25,000
$25,000 to under $40,000
$40,000 to under $50,000
$50,000 to under $60,000
$60,000 to under $75,000
$75,000 to under $100,000
$100,000 or more
(Do Not Read) DK/unsure
(Do Not Read) Refused

In case my supervisor would like to verify that I conducted this survey with you, I need to confirm that I'm talking to:

NAME: ____

And that I called: (_________) ____

THAT CONCLUDES OUR SURVEY.

THANK YOU VERY MUCH FOR YOUR TIME.

INTERVIEWER: _____________________________DATE:_____________________

END TIME: __________

10.5.2 Multifamily Renter Survey Results

Methodology

- Creative Consumer Research conducted 501 telephone interviews with apartment and other multifamily housing residents in Austin (204), San Antonio (218), San Marcos (24), New Braunfels (29), and Georgetown (26), TX.
  - Interviews were conducted between May 14 and June 18, 2012
- To participate, respondents must live in a multifamily housing complex (apartment, townhouse, duplex, condo) and be the head of household.
- Respondents must also be at least 21 years of age and not work in market research, advertising, for an electric or gas utility company, or for an automobile dealer.
- Quotas were implemented to reflect the population of the markets for:
  - Age, Gender, Ethnicity

Key Findings

- One in five respondents is likely to consider a plug-in electric car when shopping for their next vehicle. However, only one-third of respondents plan on making a purchase in the next two years.
- Those who are not likely to consider a plug-in electric car are hard to sway in their beliefs. Many are concerned about the distance they can travel between charges. Cost of the vehicle is also a barrier.
- While most do not or do not plan on owning a plug-in electric car, about half say that if they did, they would ask for charging stations within their complex.
- Awareness of plug-in electric cars is very high among respondents.
- Respondents would expect charging stations to be available throughout the area as well as at their residences.
  - The availability of charging stations throughout the area could increase interest, though cost is still a factor.
- Of the markets surveyed, Austin residents appear to be the most likely to consider purchasing PEVs.
- Those under 45 are also more likely to consider PEVs.
- While men and women are equally likely to consider PEVs, men show more concern over the distance traveled between charges.
- Caucasians have the most awareness of PEVs; however, likelihood to consider is equal among ethnicities.
  - African Americans least likely to purchase.

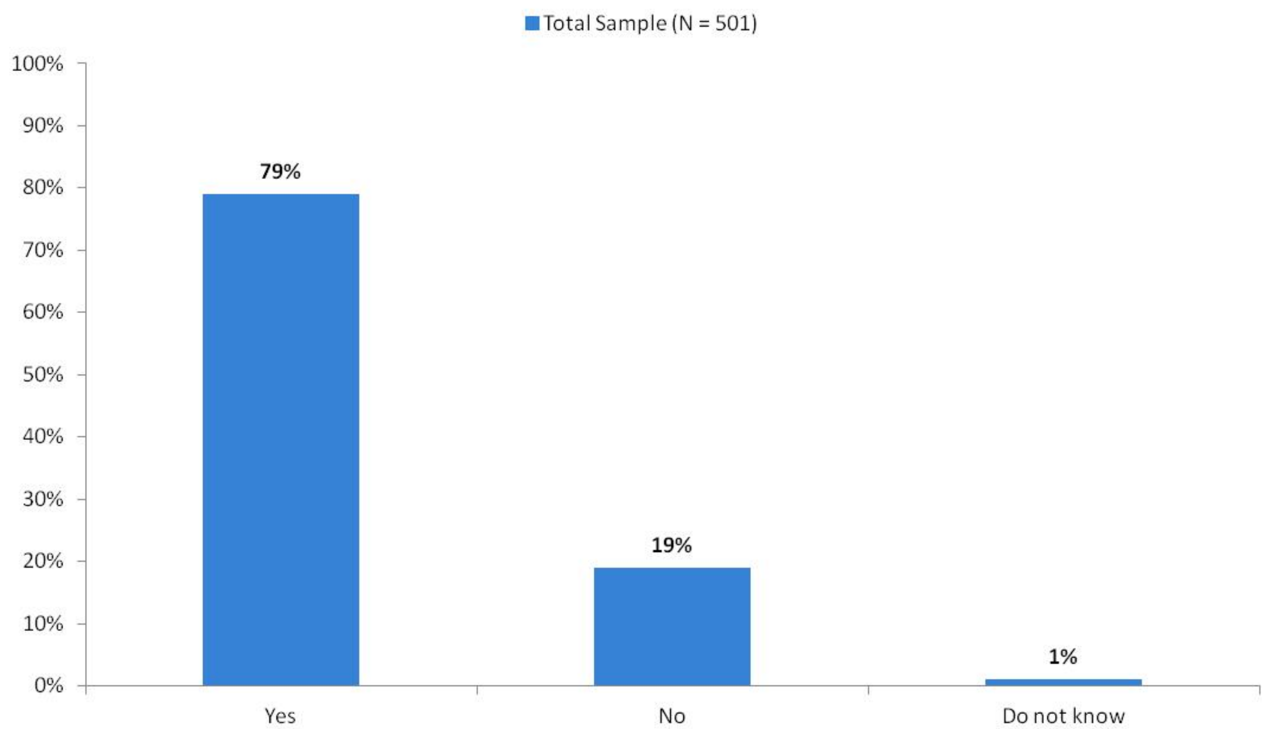
Executive Summary

- Over three-fourths (77 percent) of respondents live in an apartment.
  - Most respondents (86 percent) rent their residences.
- Most respondents (79 percent) have seen, read, or heard about plug-in electric cars.
  - About half (48 percent) have seen a plug-in electric car on the road or in a showroom.
- About one in five respondents (20 percent) say they are likely to consider a plug-in electric car for their next car.
  - When asked why they were not likely to consider a plug-in electric car, 26 percent of those who are unlikely (rated 7 or below) to purchase said the distance traveled between charging.
  - Other top answers were the cost of vehicle (21 percent) and lack of charging stations (17 percent).
- If cost was not a factor, the number of those likely to consider a plug-in electric car increases to 35 percent.
  - The reason given most for considering a plug-in electric car is to save money on gas (53 percent).
  - An equal portion of respondents said that it is good for the environment (47 percent).
- Of those who said they would be likely to consider purchasing a plug-in electric vehicle (176 respondents), 43 percent say they are likely to purchase one when shopping for their next car.
  - However, the majority (61 percent) do not have any plans to purchase a new plug-in electric car within the next two years.
- Four out of five (81 percent) of those likely to purchase a plug-in electric car will use it for their primary vehicle.
- Half of respondents (48 percent) say that if they owned a plug-in electric car, they would ask their complex to install charging stations.
  - Within their complexes, respondents would most commonly expect to find the charging stations in common parking areas (24 percent).
  - Others would expect to find the charging stations in designated surface (19 percent) or designated garage parking (13 percent).
- Respondents would expect to charge their cars at their residence both with a standard outlet (35 percent) and a charging station (19 percent).
  - Respondents would also expect to charge their cars while they are out and about in places such as a shopping center, mall, or movie theater (17 percent), public charging stations on the street (15 percent), and at their place of work (15 percent).
- The idea of a prepaid EV Pass that allows charging at all chargers in the area was mildly accepted, with about a third (31 percent) of respondents preferring to pay this way.
  - Simply using a credit card at the charger was equally preferred (29 percent).

    - One quarter (25 percent) of respondents wish to pay a monthly fee to their electric utility.
- Respondents most want to use the Internet (31 percent) as a research method for learning about plug-in electric cars.
- Respondents feel as though they are most likely to get accurate information about EVs from auto dealers (28 percent).
- After learning more about electric vehicles, those who previously were unlikely to consider an electric vehicle for their next car (318 respondents) are, for the most part, still unlikely to consider with only 5 percent saying they would now be likely to consider a plug-in electric car.
- Those who are on the fence about electric cars (rated likelihood to consider 4 to 7) say that they would be more motivated to consider a plug-in car if they were more affordable (28 percent of 103 respondents).
    - Additionally, 21 percent say they would be more likely to consider a plug-in electric car if there were more charging stations available.
    - Other top motivators for considering plug-in electric cars are increasing the distance/time between charges (17 percent) and an increase in the price of gas (17 percent).

Response Details

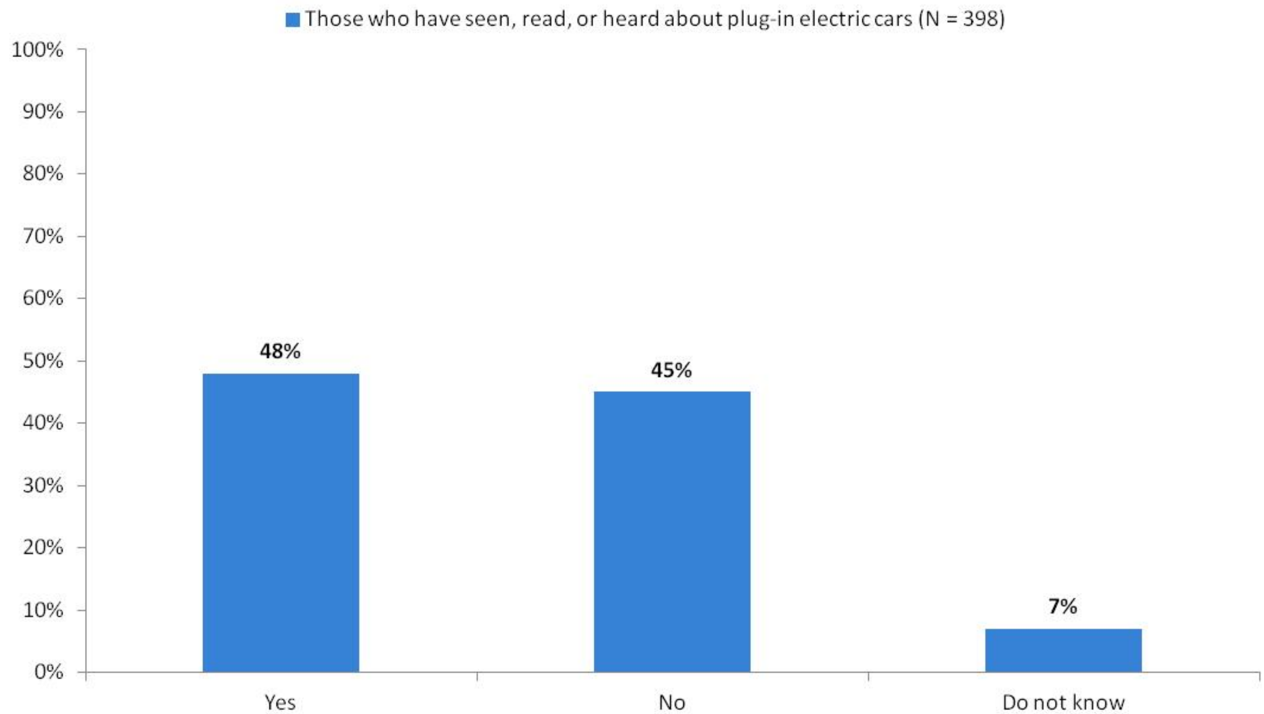
1. Have you seen, read, or heard anything about plug-in electric cars?



Differences

- More respondents (83 percent) 45 and over have seen, read, or heard about plug-in electric cars than those under 45 (75 percent).
- More Caucasians (88 percent) than Hispanics (69 percent), African Americans (69 percent), or Asians (48 percent) have seen, read, or heard about plug-in electric cars.
  - More Hispanics (69 percent) have seen, read, or heard about plug-in electric cars than Asians (48 percent).

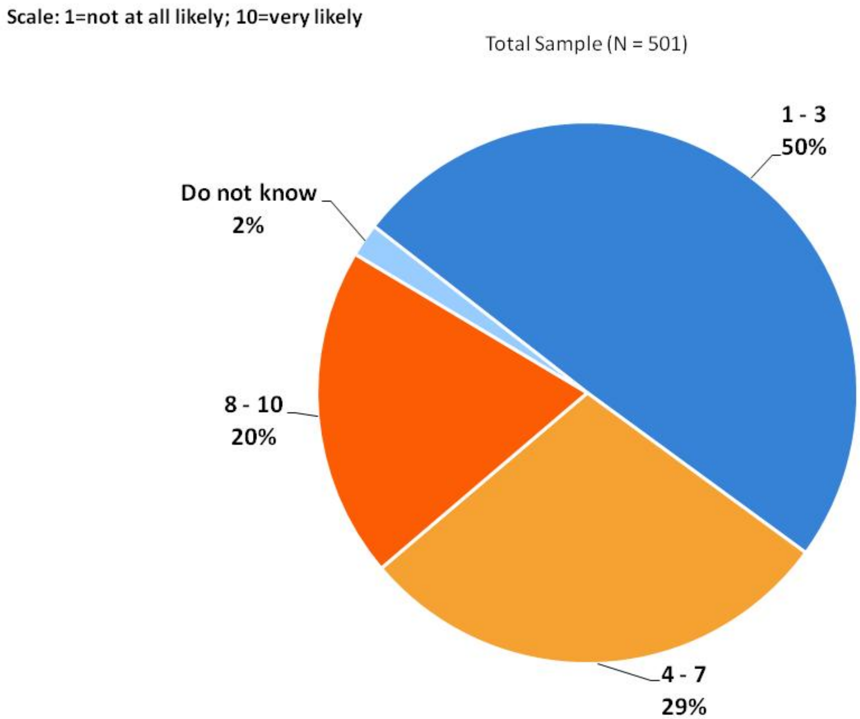
2. Have you seen a plug-in electric car on the road or in a car dealer showroom?



Differences

- More Austin resident (62 percent) have seen plug-in electric cars on the road or in a showroom than both San Antonio (36 percent) and San Marcos/New Braunfels (44 percent) residents.
- Those under 45 (55 percent) have seen plug-in electric cars on the road or in showrooms more than those 45 or over (43 percent).
- More males (55 percent) have seen plug-in electric cars on the road or in showrooms than females (43 percent).

3. How likely would you be to consider a plug-in electric car when shopping for your next car?



Differences

- More San Antonio residents (56 percent) and San Marcos/New Braunfels residents (62 percent) are not likely (rated 1 to 3) to consider a plug-in electric car than those in Austin (40 percent).
- More of those 45 and over (59 percent) say they are not likely to consider a plug-in electric car than those younger than 45 (40 percent).

4. What is the main reason you would not consider a plug-in electric car for your next car?

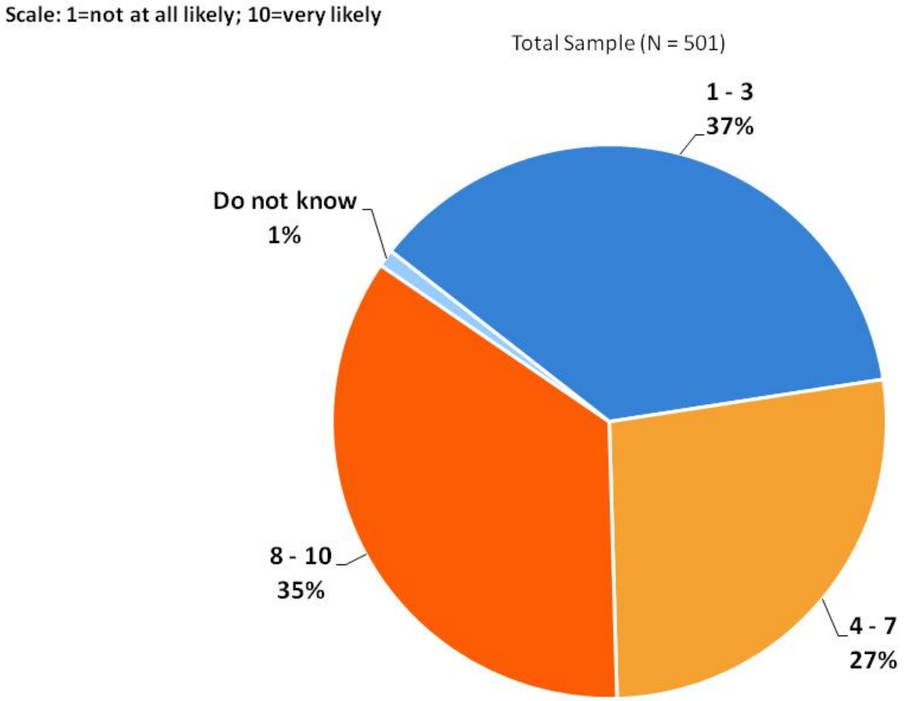
The distance traveled between charging	**26%**
Cost	**21%**
Lack of charging stations to recharge electric car	**17%**
Time to charge	**7%**
Size of car	**6%**
No access to outside electrical outlet	**5%**
Do not want one/not the car I want/no interest	**5%**
Do not have enough information about them	**5%**
Inconvenient/hassle to plug in every 75 miles	**5%**
Base: Those who rated likelihood to consider plug-in electric car less than 8	**393**

Note: All other responses mentioned by 4% or less of respondents

Differences

- Of those who would not consider a plug-in electric car, Austin residents (34 percent) say they would not consider a plug-in because of the distance traveled between charging more than residents of both San Antonio (22 percent) and San Marcos/New Braunfels (15 percent).
  - Lack of charging stations was more of a reason not to consider a plug-in electric car for both Austin (17 percent) and San Antonio (20 percent) than those in Georgetown (0 percent).
- Males (31 percent) are more concerned with the distance between charges than females (21 percent).
- More Caucasians (29 percent) than Hispanics (18 percent) would not consider a plug-in electric car because of the distance between charging.
  - African Americans (12 percent) say they do not have enough information about plug-in electric cars more than Caucasians (3 percent) as a reason for not considering them.

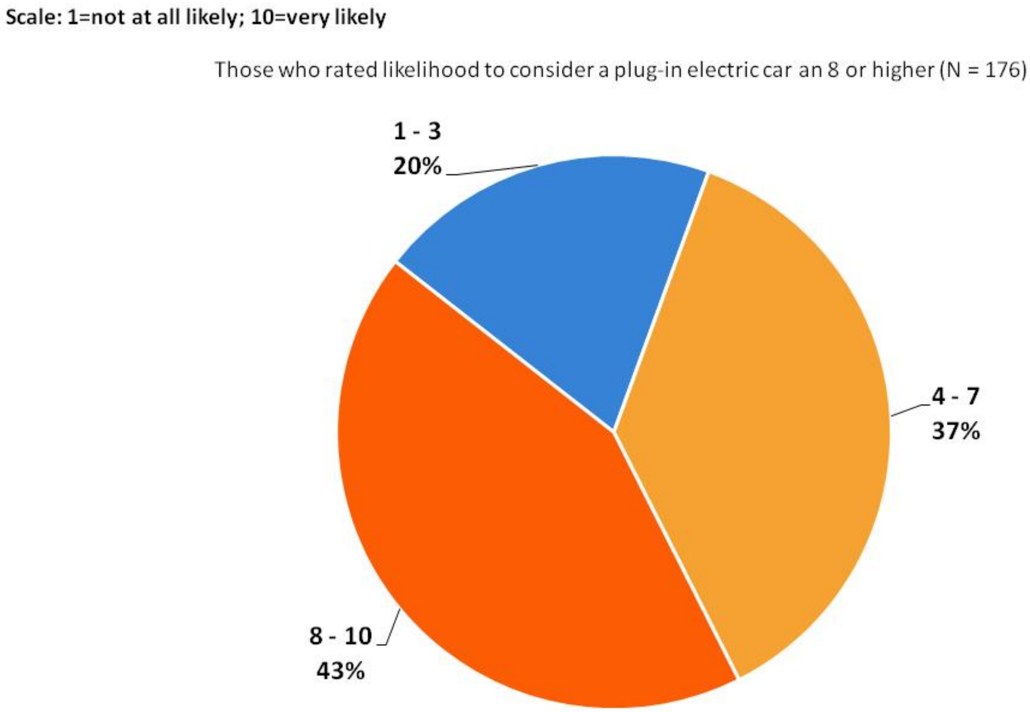
4b. If cost was not a factor, please rate on a 1 to 10 scale where 1 is not at all likely and 10 is extremely likely, how likely is it that you would consider a plug-in electric car when shopping for your next car?



Differences

- Even if cost were not a factor, more respondents in San Antonio (43 percent) and San Marcos/New Braunfels (45 percent) are not likely to consider a PEV than Austin residents (28 percent).
- More of those 45 and over (44 percent) are not likely to consider PEVs if cost were not a factor than those under 45 (28 percent).
- More Asians (52 percent) are likely to consider a plug-in electric vehicle if cost were not a factor than African Americans (26 percent).
- Caucasians (56 percent), Hispanics (38 percent), and Asians (46 percent) all would consider a plug-in electric vehicle more than African Americans (0 percent) because it is good for the environment.
  - Caucasians also state this as a reason for considering a PEV more than Hispanics.

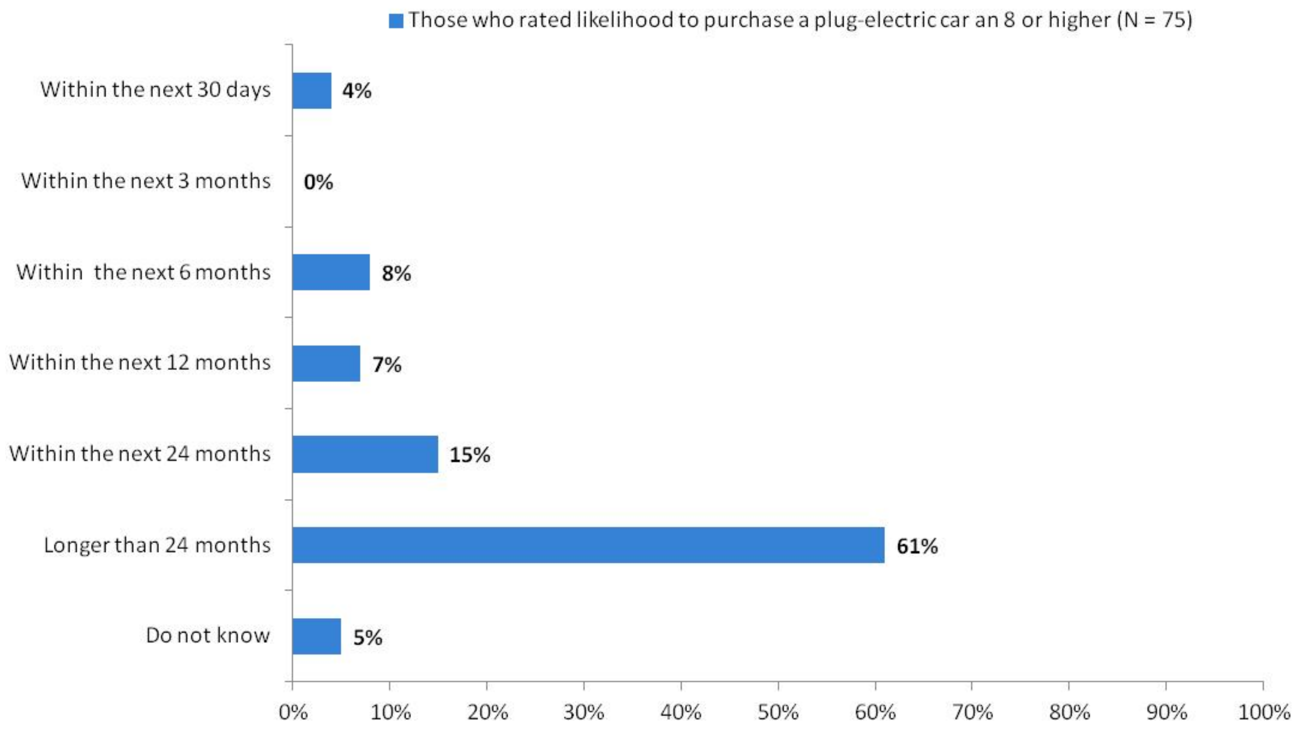
5. Please rate on a 1 to 10 scale where 1 is not at all likely and 10 is very likely, how likely is it that you will purchase a plug-in electric car when shopping for your next car?



Differences

- Of those who are likely to consider a plug-in electric car (176 respondents), more of those 45 and over (28 percent) are not likely to consider purchasing than those under 45 (13 percent).
- African Americans (55 percent) say they are unlikely to purchase a plug-in electric vehicle more than Caucasians (23 percent), Hispanics (9 percent), and Asians (8 percent).
  - Caucasians are also less likely to purchase than Hispanics.

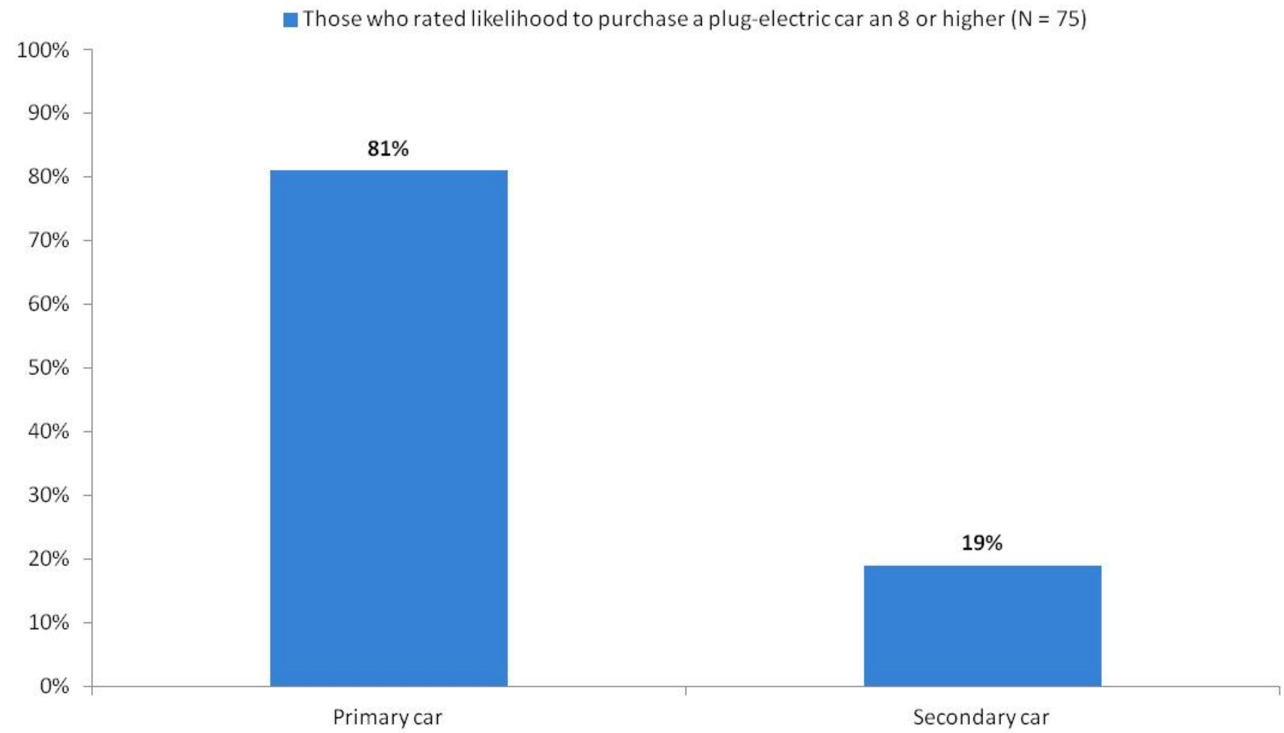
5b. When do you expect to purchase your plug-in electric car?



Differences

- Of those likely to purchase a plug-in electric vehicle (75 respondents), Hispanics on average expect to purchase sooner (18.03 months) than Caucasians (25.28 months).

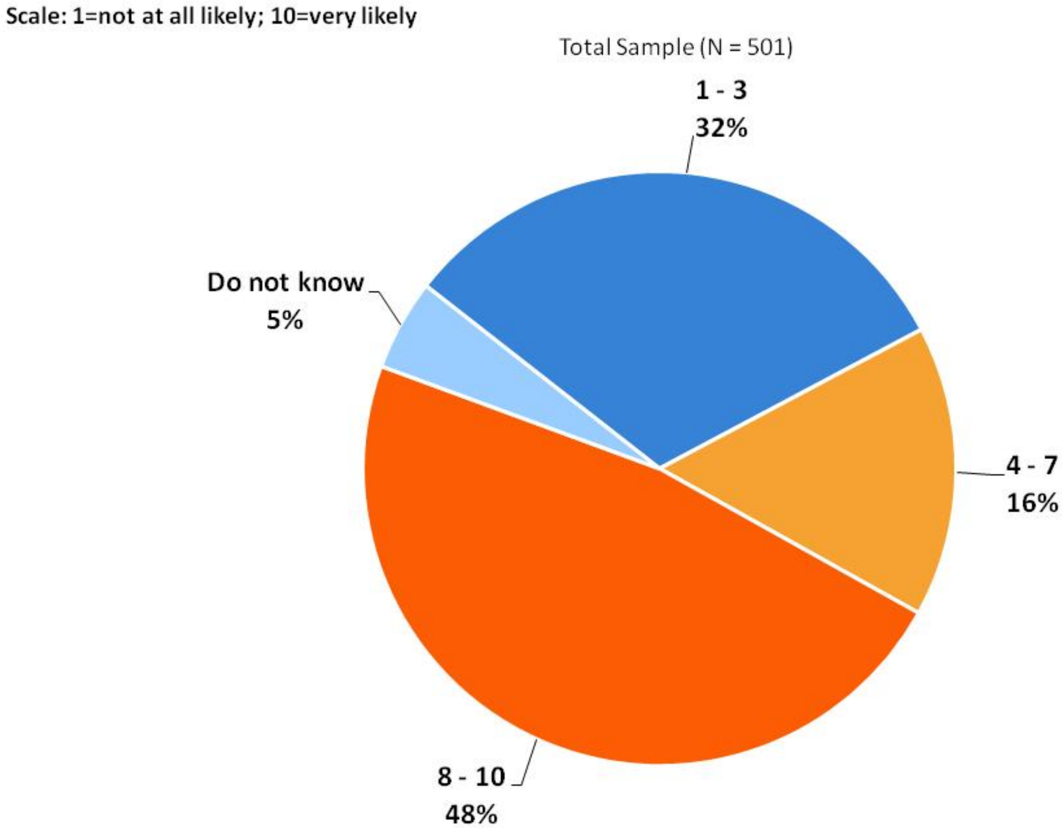
5c. If you were to purchase a plug-in electric car, would this be your primary car or a secondary car?



Differences

- More Caucasians (93 percent) say they would use a plug-in electric car as their primary vehicle than Hispanics (73 percent), African Americans (33 percent), and Asians (60 percent).

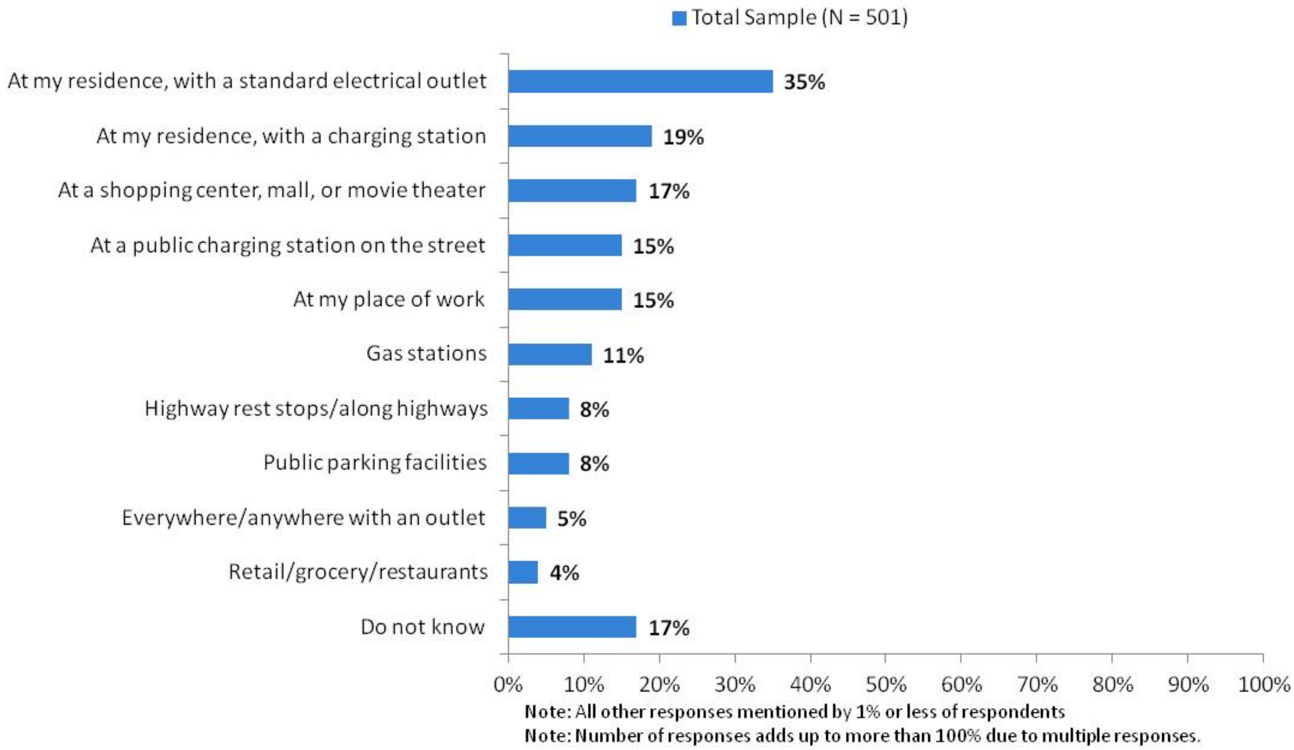
6. If you drove a plug-in electric car, how likely would you be to ask your apartment or condo complex to install a charging station?



Differences

- Both Austin residents (54 percent) and those from San Antonio (47 percent) have more residents than San Marcos/New Braunfels (30 percent) who would be likely to ask for charging stations in their apartment or condo complex.
- Those under 45 (53 percent) say they are likely to ask for a charging station in their complex more than those 45 and over (43 percent).

7. If you drove an electric car, where would you expect to be able to plug in to be charged?

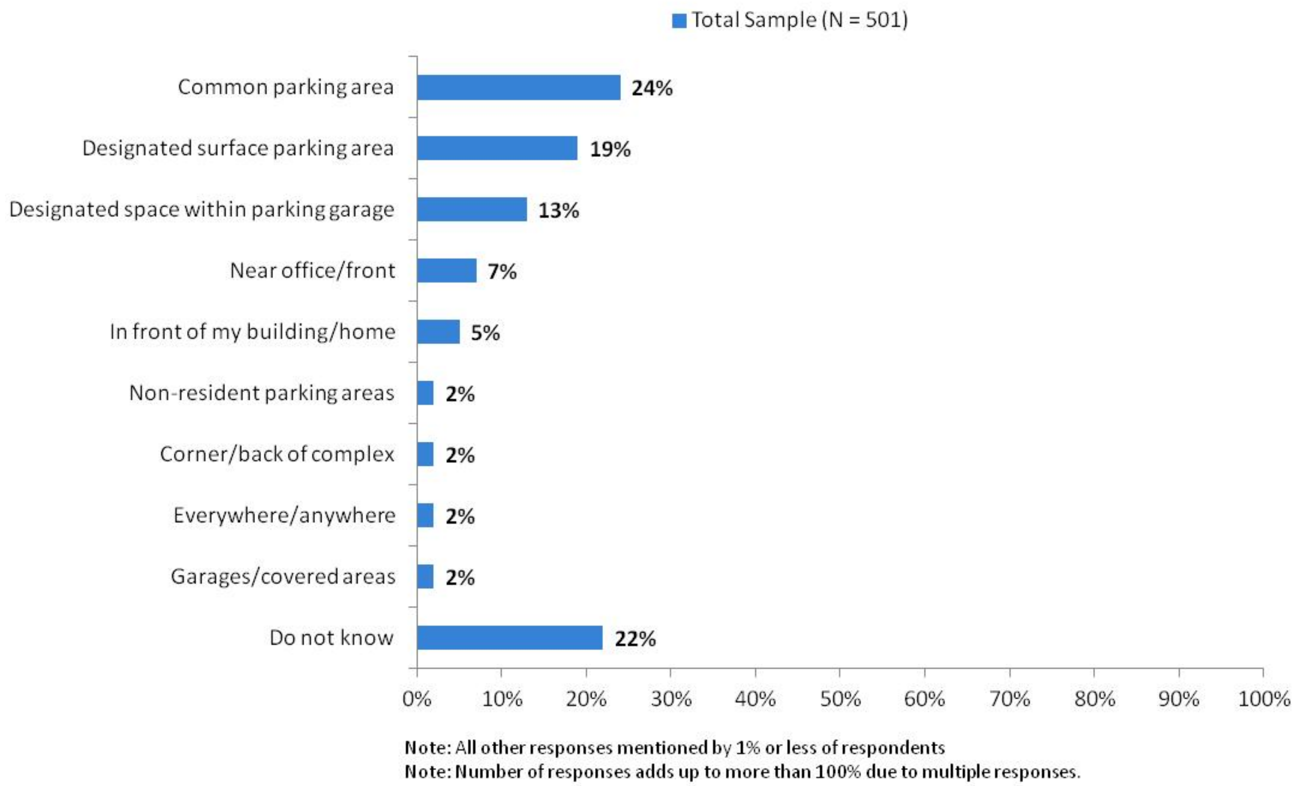


Differences

- More of those in Austin (41 percent) say they would expect to charge a plug-in electric car at their residence with a standard electrical outlet than respondents in San Antonio (28 percent).
  - Austin (22 percent) residents also would expect to charge their plug-in electric car at shopping centers more than those in San Marcos/New Braunfels (6 percent) and Georgetown (4 percent).
    - Those in San Antonio also expect to charge in shopping centers more than those in San Marcos/New Braunfels.
  - Austin (20 percent) residents also want to charge at their place of work more than those in San Antonio (11 percent).
- Those who are under 45 expect to be able to charge at their residence with a standard outlet (39 percent), at shopping centers (21 percent), at their place of work (22 percent), and at gas stations (16 percent) more than those 45 and over (30 percent, 13 percent, 8 percent, and 7 percent, respectively).
- More males (20 percent) expect to charge at their place of work than females (10 percent).
- Both Caucasians (39 percent) and Hispanics (33 percent) would expect to charge at their residence with an outlet more than African Americans (14 percent).
  - More Caucasians (22 percent) and African Americans (26 percent) than Hispanics (12 percent) would expect to charge at their residence with a charging station.

- Hispanics (19 percent), African Americans (24 percent), and Asians (24 percent) all say they would expect to charge their plug-in electric vehicles at public charging stations on the street more than Caucasians (11 percent).

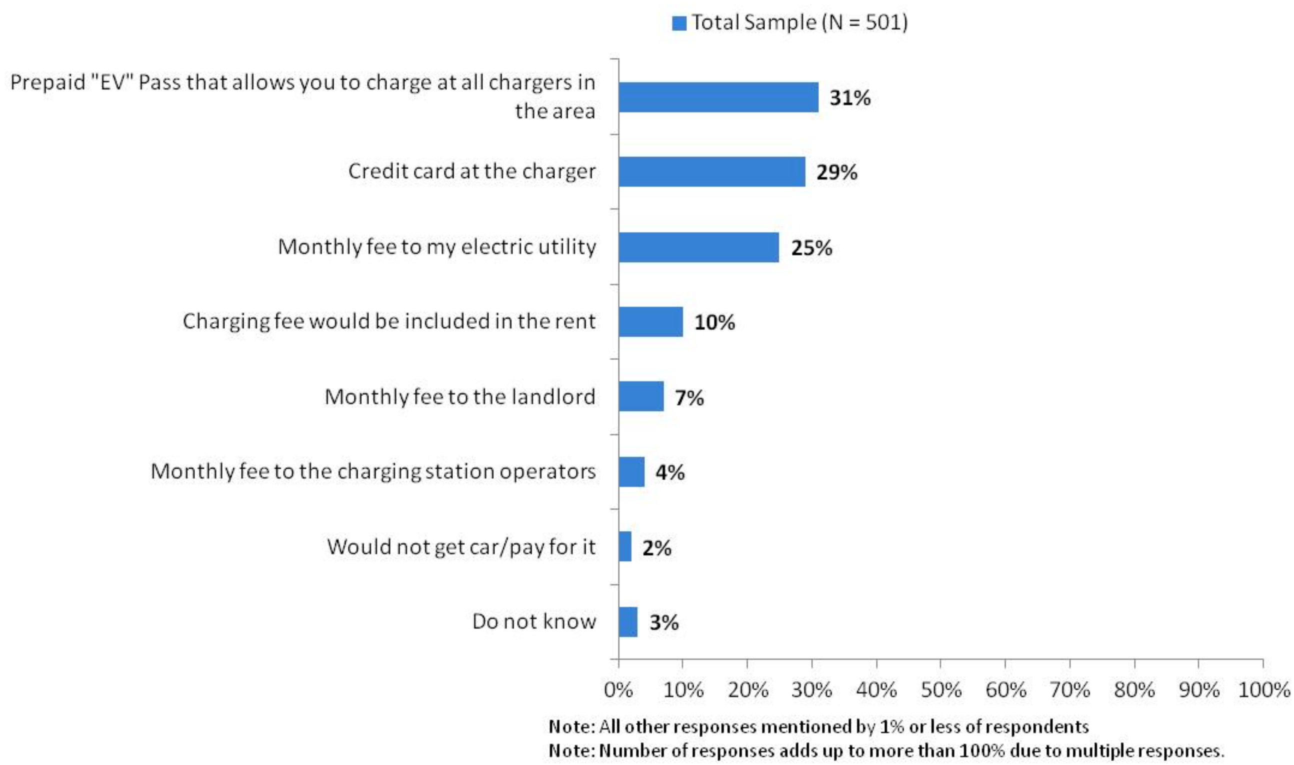
8. Where within the complex parking area would you expect to find a plug-in charging station?



Differences

- Within their complex, those in Georgetown (19 percent) would expect to find charging stations near the office more than those in San Antonio (5 percent) and San Marcos/New Braunfels (4 percent).
- Those under 45 (10 percent) would also expect to find charging stations near the office/front more than those 45 and over (4 percent).
- Hispanics (26 percent) expect to have charging stations in designated surface parking areas more than African Americans (7 percent).
  - Asians expect to find charging stations in both designated parking areas with the parking garage (28 percent) and near the office/front (16 percent) more than Caucasians (11 percent and 5 percent, respectively).

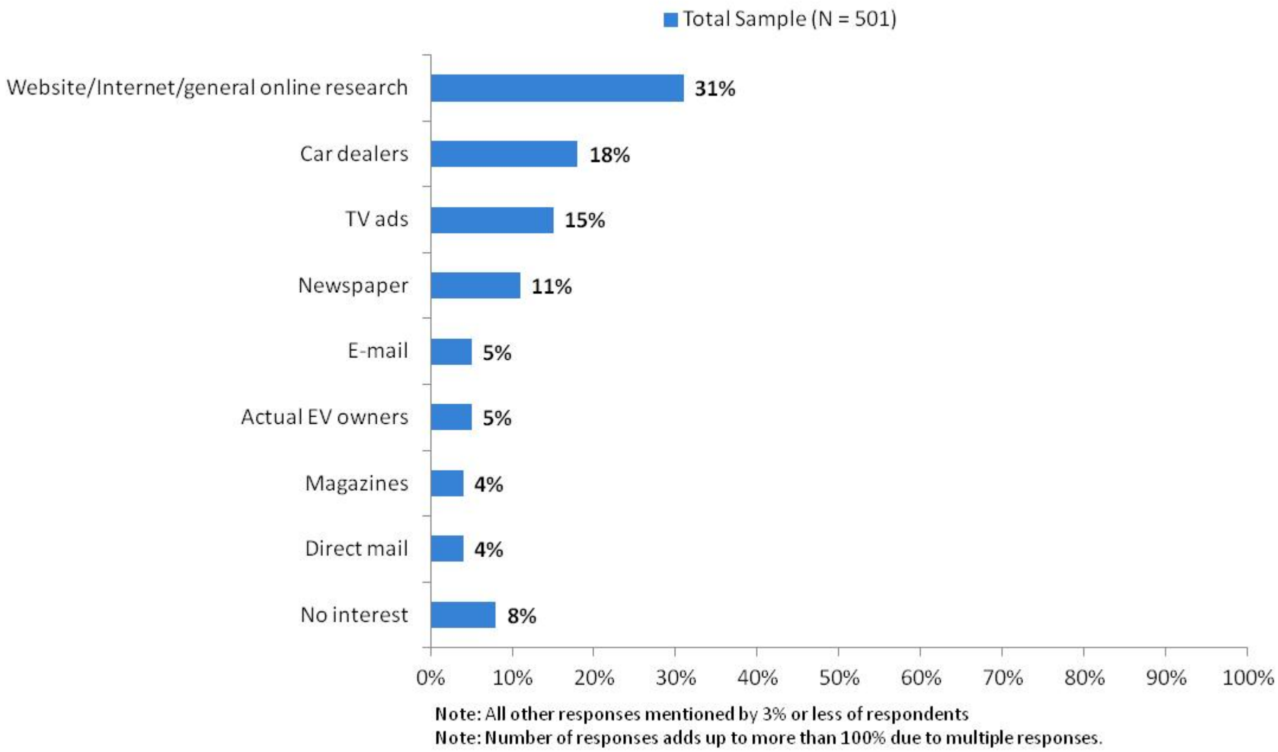
9. How would you prefer to pay for charging your electric car?



Differences

- Georgetown residents (42 percent) would prefer to use prepaid PEV passes more than those in San Marcos/New Braunfels (21 percent).
  - Those in Austin (30 percent) prefer to pay through a monthly fee on their electric bill more than those in Georgetown (12 percent).
- Those under 45 (30 percent) prefer to pay for electric vehicle charging through a monthly fee over those 45 and over (21 percent).
- Caucasians (33 percent) say they would prefer to pay using a credit card at the charger more than both Hispanics (22 percent) and African Americans (17 percent).

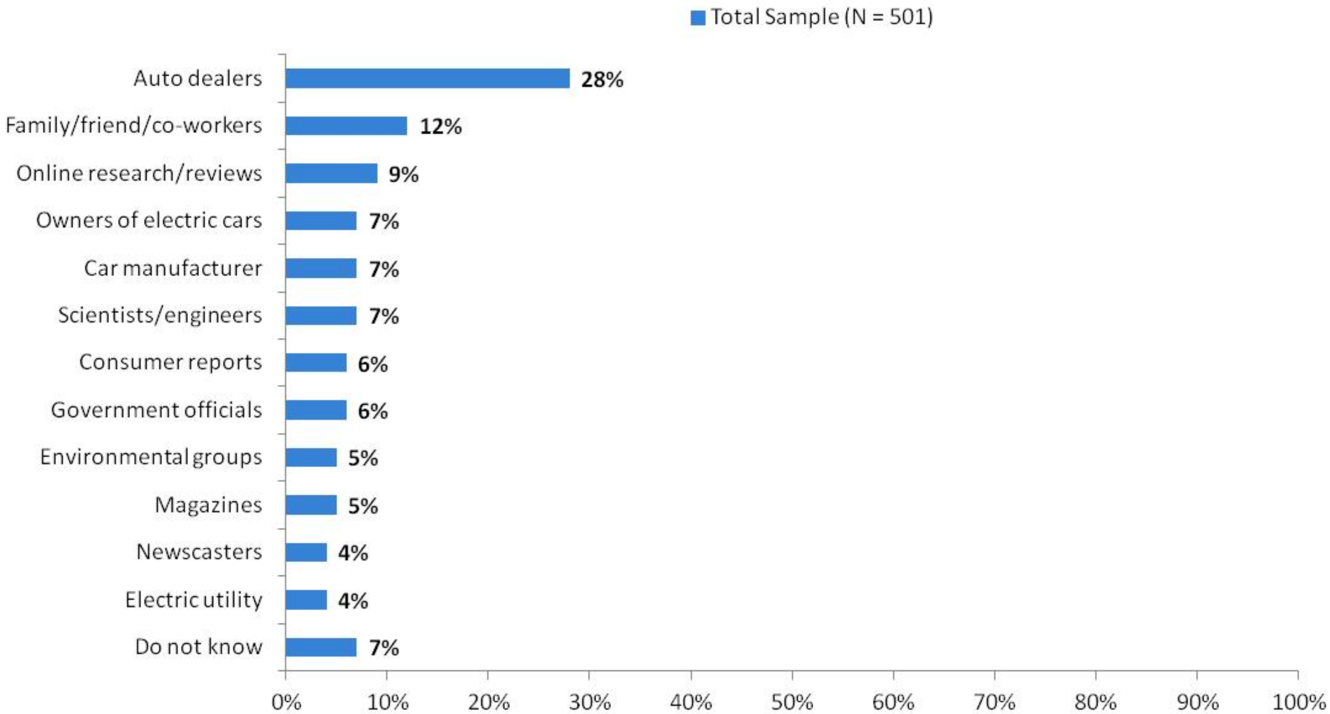
10. How would you prefer to learn about plug-in electric vehicles?



Differences

- More of those in Austin (39 percent) prefer to learn about PEVs through the Internet than those in San Antonio (27 percent) and those in San Marcos/New Braunfels (23 percent).
  - Those in San Antonio (22 percent) would prefer to learn about PEVs from car dealers more than those in Austin (13 percent).
  - San Marcos/New Braunfels residents (25 percent) prefer to learn about plug-in electric vehicle from the newspaper more than both Austin (8percent) and San Antonio (9 percent) residents.
  - Georgetown residents (15 percent) say they prefer to learn about PEVs from research such as the library and books more than those in Austin (2 percent) and San Antonio (3 percent).
- Those under 45 (40 percent) use the Internet more than those 45 and over (23 percent) for learning about plug-in electric vehicles.
  - Those 45 and over use both TV ads (20 percent) and the Newspaper (16 percent) to learn about plug-in electric vehicles more than those under 45 (11 percent and 5 percent, respectively).

11. Who are you more likely to believe is providing accurate information about plug-in electric cars?



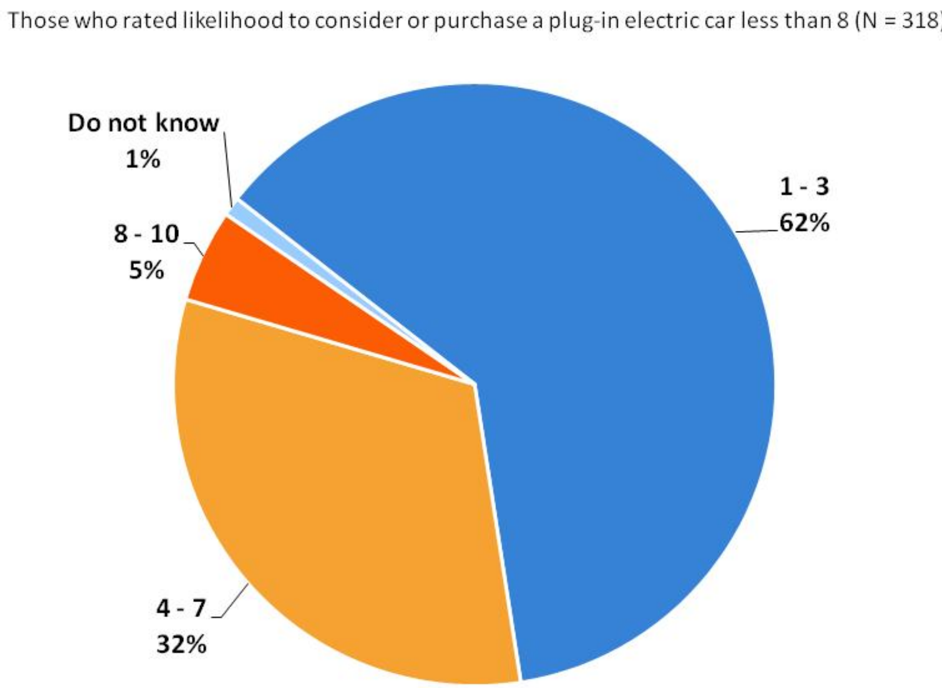
Note: All other responses mentioned by 3% or less of respondents
Note: Number of responses adds up to more than 100% due to multiple responses.

Differences

- Those in San Antonio (33 percent) are more likely to believe that auto dealers are providing accurate information about plug-in electric cars than those in Austin (22 percent).
  - Both Austin (14 percent) and San Marcos/New Braunfels (17 percent) residents are more likely to believe family, friends, and coworkers for accurate information about PEVs than those in Georgetown (0 percent).
- African Americans (45 percent) are more likely to believe auto dealers as a source of accurate information about PEVs than Caucasians (24 percent).
  - More Asians (24 percent) than both Caucasians (8 percent) and Hispanics (8 percent) are likely to believe that online research is providing accurate information about PEVs.
  - Asians (16 percent) are also more likely to believe that government officials are giving accurate information than African Americans (0 percent).

12. After learning about electric cars and charging stations, how likely is it that you would consider a plug-in electric car when shopping for your next car?

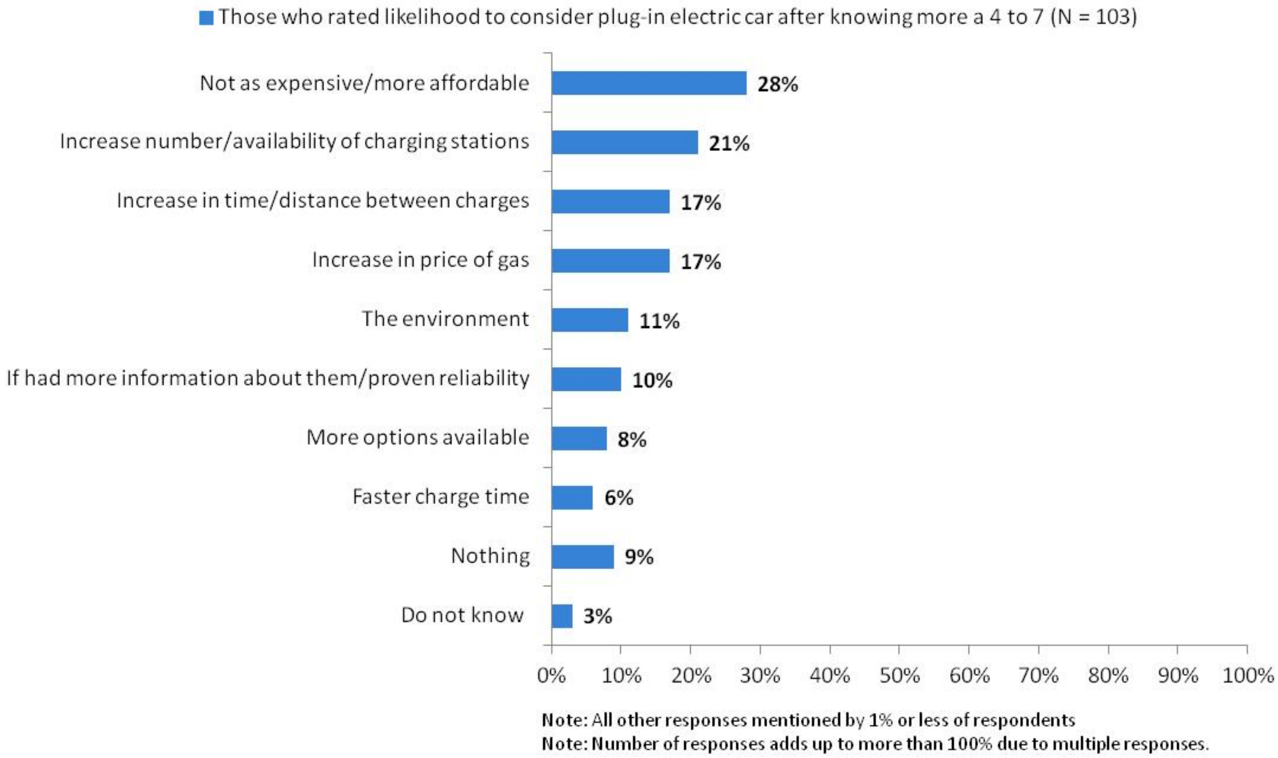
Scale: 1=not at all likely; 10=very likely



Differences

- After learning more about electric cars, San Antonio (67 percent) and San Marcos/New Braunfels (76 percent) residents are less likely to consider purchasing a plug-in electric vehicle than Austin residents (51 percent) previously unlikely to consider plug-in electric vehicles.
- Those 45 and over (68 percent) remain more unlikely to consider PEVs than those under 45 (54 percent) even after learning more about them.
- Asians (18 percent) are more likely to consider a PEVs after learning more about them than Caucasians (3 percent).

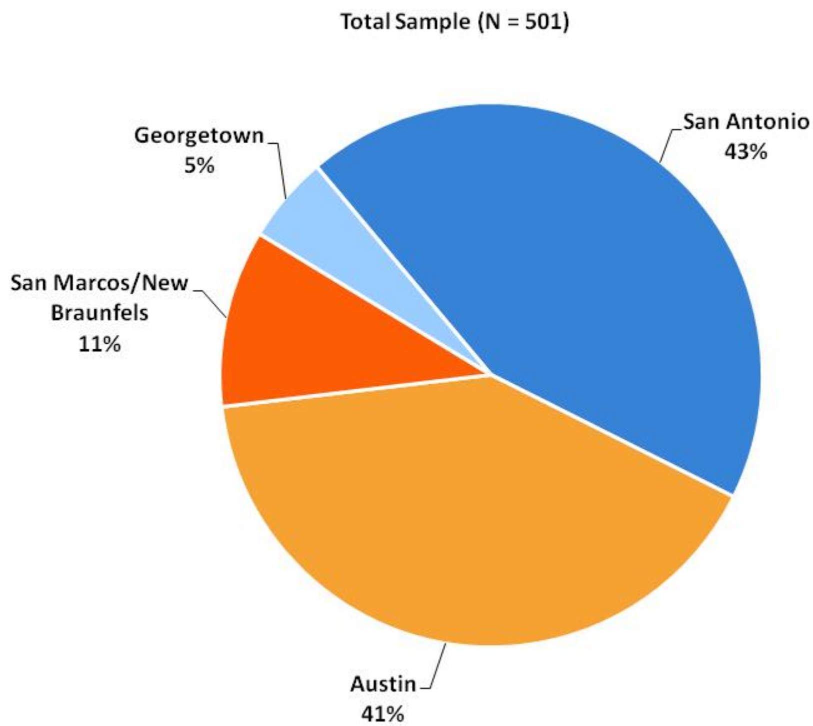
13. What would motivate you to consider purchasing an electric car?



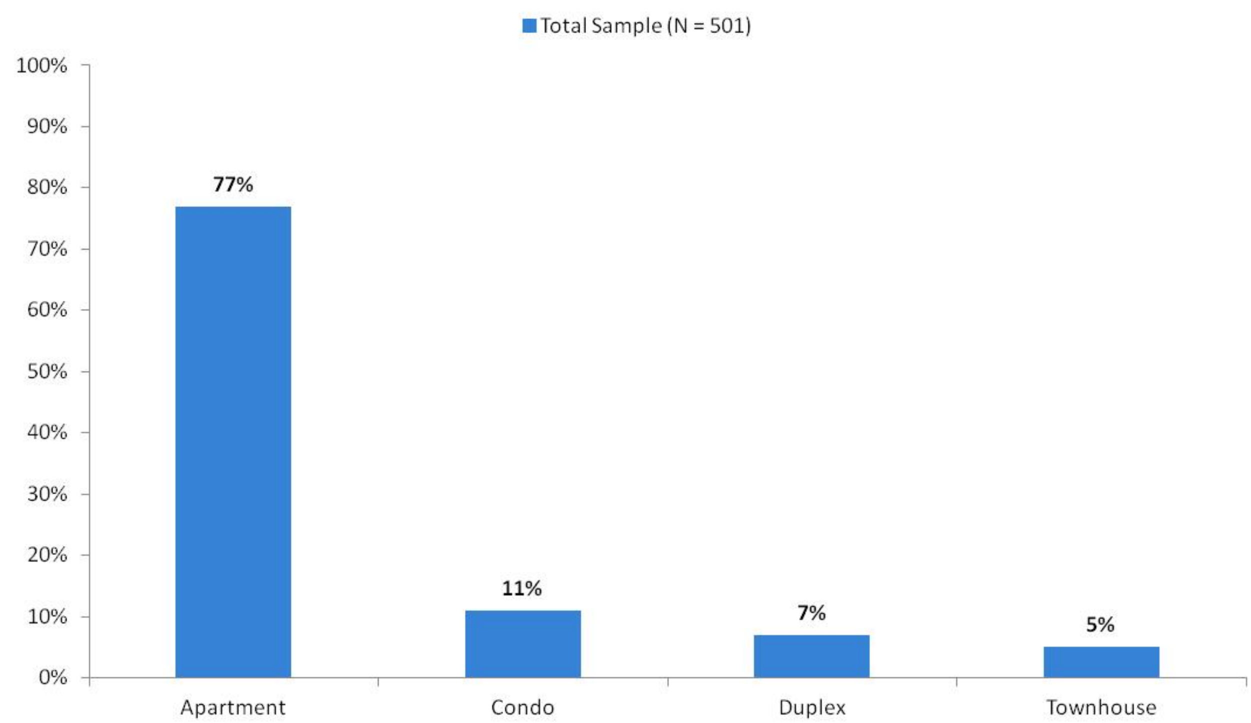
Differences

- Of those still of the fence about considering PEVs (103 respondents), those in Austin (33 percent) and San Marcos/New Braunfels (57 percent) would be motivated by an increase in available charging stations more than those in San Antonio (3 percent).
  - Residents of San Marcos/New Braunfels are also motivated by availability of charging stations more than those in Georgetown (0 percent).
  - Georgetown residents (40 percent) would be motivated to consider purchasing an electric vehicle if they had more information more than both Austin (8 percent) and San Antonio (5 percent).
    - San Marcos/New Braunfels residents (29 percent) are also more motivated by this than those in San Antonio.
- Males (26 percent) would be motivated to consider purchasing PEVs by an increase in the distance between charges more than females (9 percent).

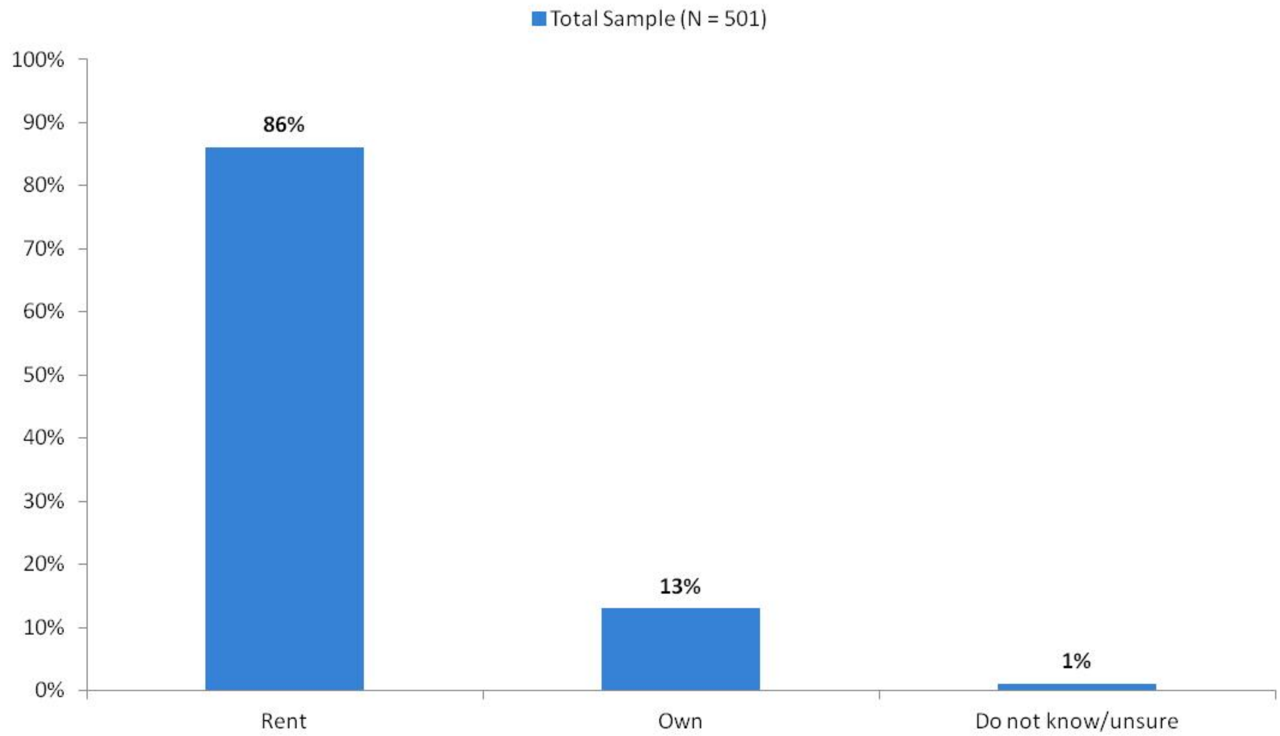
Demographics



S5. Which of the following best describes your home?



S6. Do you rent or own your residence?



Gender	
Male	54%
Female	46%
Ethnicity	
Caucasian	58%
Hispanic	26%
African American	8%
Asian	5%
Other	3%
Age	
Average	47.48
Base:	501

Note: Numbers are based on representative quotas

Education	
Some high school	2%
Graduated high school	15%
Some college	31%
Graduated college	34%
Post-graduate work	16%
Do not know/refused	2%
Base:	501

Employment Status	
Employed full-time	45%
Employed part-time	6%
Student	6%
Homemaker	4%
Retired	30%
Unemployed	7%
Do not know/refused	2%
Income	
Average	$44,870
Base:	501

10.6 Survey 4 – Large Employers, Retailers, and Parking Lots Survey

10.6.1 Large Employers Retailers, and Parking Lots Survey Instrument

IF LEAVING MESSAGE ON ANSWERING MACHINE:
Hello, (Mr./Mrs.) _____. My name is _____ with ______ in ______, Texas. We have been contracted by The Texas River Cities Plug-In Electric Vehicle Initiative to conduct a market research study with a select group of facility managers. If you would like to participate in this study, please call 1-877-530-9646 and give them your name and the telephone number I just called and that you would like to participate in the EV facility management survey. Thank you.

ASK FOR FACILITY MANAGER.

INTRODUCTION

Hello, my name is ____ with Creative Consumer Research, a Texas-based marketing research company. We are calling on behalf of The Texas River Cities Plug-In Electric Vehicle Initiative. This is a group of communities and stakeholders in Central Texas planning for the use of plug in electrical vehicles throughout Texas.

(Today/this evening), we are conducting a study among south and Central Texas area business facility managers or their corporate offices and would like to include your opinions. Let me assure you that this is not a sales call, and your name will not be placed on a mailing list. We are only interested in your opinions.

The information obtained in this study will be used for research purposes only, and all responses will be kept confidential.

FOR QUALITY PURPOSES, THIS CALL MAY BE MONITORED OR RECORDED.

S1. We are calling today with regards to your ________ location.
(CHECK QUOTAS)

START TIME: __________

Austin
Georgetown
San Marcos/New Braunfels
San Antonio

S2. Who at your location is the primary or secondary decision-maker regarding property or facility additions or modifications, such as parking facility maintenance or improvements, installing security gates, etc.?

Respondent
Respondent and other
Other **(ASK TO SPEAK TO APPROPRIATE PERSON. IF UNAVAILABLE, THANK RESPONDENT, NOTE THE APPROPRIATE PERSON AND SCHEDULE A CALLBACK)**
Corporate office handles this **(SAY "CAN I PLEASE GET THE NAME AND NUMBER OF THE PERSON I SHOULD TALK TO ABOUT THIS AT THE CORPORATE OFFICE". RECORD INFORMATION ON INFORMATION SHEET AND SCHEDULE AS A GENERAL CALLBACK.)**

S3. To be sure that we talk to representatives from a variety of area businesses, which of the following **best** describes your company? **(READ LIST)**

Large commercial facility or office
Large retailer or commercial property management
Commercial parking lot or garage management
Other **(THANK, TALLY, AND TERMINATE)**

S4. Again be sure that we talk to representatives from a variety of area businesses, please tell me the industry of your company. **(DO NOT READ LIST.)**

Commercial parking lot or garage management
Commercial parking lot management
Commercial parking garage management

Large retailer or commercial property management
Mall management company
Retail strip mall management company
Retail property management company
Entertainment property management
Hospital / medical park management
Retail
Property Management – Commercial

Large commercial facility or office
Industrial park management company
Communications
Computers (hardware)
Computer software
Data centers
Education
Energy (oil & gas)

Financial
Food service
Government
Health care
Hi-tech
Hotel/motel
Manufacturing
Public works (water, etc.)
Wholesale trade

D1. How many people does your company employ in (MARKET IN Q1)? **(DO NOT READ LIST)**

Less than 10 employees
10 but less than 25 employees
25 but less than 50 employees
(FOR COMMERCIAL FACILITY ONLY, TERM)
50 but less than 100 employees
100 but less than 500 employees
500 employees or more
(DO NOT READ) Don't know/refused

1. Where do your employees or customers park their vehicles? (**READ LIST, ACCEPT *MULTIPLE RESPONSES)***

In commercial area, street parking
In residential area, street parking
Assigned surface parking area
Unassigned surface parking area
Assigned garage parking space
Unassigned garage parking space
Commercial parking garage
Commercial parking lot
Other ***(Specify)***
(DO NOT READ) Don't know

2. Does your company charge employees or customers for parking?

Yes
No
DK/prefer not to answer

3. Does your company offer premium or valet parking spaces, or garage parking spaces for additional fees?

Yes
No
DK/prefer not to answer

Explanation
For this survey we will be talking about all-electric cars. Typically all-electric cars can be driven 75 miles and be fully charged by plugging them into a standard 120 volt outlet overnight. Plug-in vehicles can also be charged in just a few hours by plugging them into a charging station. Vehicle owners using a charging station would plug in their vehicle and swipe a payment card. A typical plug-in electric car charging station could cost $3,500 to purchase and $3,500 to install. In addition, hybrid vehicles which run on gas and electricity would also be able to recharge at a charging station.

4. Has your company installed any electric vehicle, or EV, charging stations in your parking lots?

Yes **(SKIP TO Q22)**
No **(GO TO 5)**
DK

EMPLOYERS WHO HAVE NOT YET INSTALLED ANYTHING

5. Does your organization have any plans to install electric vehicle charging station, or offer access to a bank of outlets, within the next 2 years?

Yes
No
DK

(**REFER TO Q1)**
6. How many **120-**volt outlets are accessible to employers or customers within your…?

Surface Parking Lot ___ ___

Parking Garage ___ ___
IF ZERO ON BOTH, GO TO Q8

7. Is your (RESPONSE IN Q6) electrical system equipped to have all of your **120** volt electrical outlets in use at the same time?

	Yes	No	DK
Surface Parking	1	2	3
Parking Lot Garage	1	2	3

(**REFER TO Q1)**

8. How many **220** volt outlets are accessible to your employees or customers for use with a charging station?

Surface Parking Lot ___ ___

Parking Garage ___ ___

IF ZERO ON BOTH, GO TO Q10

9. Is your (RESPONSE IN Q8) electrical system equipped to have all of your **220** volt electrical outlets in use at the same time?

	Yes	No	DK
Surface Parking	1	2	3
Parking Lot Garage	1	2	3

10. Have you investigated plug-in electric vehicles or EV charging stations for your properties?

Yes
No **(SKIP TO Q12)**
Don't know **(SKIP TO Q12)**

11. What is the main reason you investigated or are considering installing charging stations for your properties? **(DO NOT READ LIST. RECORD ALL MENTIONS.)**

Employee demand
An employee benefit or perk
Corporate sustainability / environmental goals
Commuter options program.
Other ***(Specify)***

12. How often have you been asked about charging electric vehicles? **(READ LIST)**

Once/twice in the last 6 months
Once/twice per month
Once/twice a week
Daily

Awareness

13. Prior to my call have you seen, read or heard anything about plug-in electric cars?

Yes
No
Don't know

14. Knowing that a typical plug-in electric car charging station could cost $3,500 to purchase and $3,500 to install, how likely would your company be to purchase and install an electric vehicle charging station for the use of your employees or customers in the **next 2 years**? Use a '1' to '10' scale where '1' is not at all likely and '10' is extremely likely.

Not at all								Extremely		DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

(IF RATED Q14 8,9, OR 10, SKIP TO Q 16, ELSE ASK Q15)

15. Why did you rate your company's likelihood of installing a charging station a ___? **(DO NOT READ LIST. PROBE FOR ALL MENTIONS)**

Your company does not know enough about EV charging stations
Your company does not have a demand for EV charging stations
The $7,000 cost for the purchase and installation of an EV charging station is too much
Your property's electrical system cannot handle the demands of a charging station
Your property has limitations on parking spaces
Electrical vehicles will never catch on with the general public
Electrical vehicles are a fad and are unnecessary
Other (specify)___________________________________

16. What percentage of your employees or customers would have to drive a plug-in vehicle in order for you to install electrical outlets or an electrical vehicle charging station on your property?

_____%

17. Assuming your company purchased and installed a charging station, how likely would your company be to charge employees or customers a fee to use the charging station? Use the same '1' to '10' scale where '1' is not at all likely and '10' is extremely likely.

Not at all								Extremely		DK/Unsure
1	2	3	4	5	6	7	8	9	10	x

18. Would you be more likely to purchase and install an electric car charging station if a percent of the cost was rebated?

Yes
No
Don’t know

19. What percent of the cost of a charging station would you need to be rebated for your company to purchase and install a charging station or stations on you property?

_____ %

(IF Q14 = 8, 9, or 10 OR IF Q18 = YES, ASK, ELSE SKIP TO Q29)

20. Typical charging station recharges one car at a time. How many charging stations do you think you would install on your property

One	1
Two	2
Three	3
Four	4
Other (Specify) __________	5
Would depend on number of employees driving electric vehicles	9

21. Where would you locate the spaces? **(READ LIST)**

Nearest electrical service to minimize installation cost
Next to handicapped spaces,
Next to business entrance to maximize convenience for EV drivers, to maximize visibility for the public

SECTION FOR EMPLOYERS WHO HAVE INSTALLED CHARGING FACILITY
(ALL ELSE SKIP TO Q29) IF Q4 = NO/DK SKIP TO Q29

22. How many **120** volt outlets are accessible to employers or customers within your

Surface Parking Lot ___ ___
Parking Garage ___ ___
(IF BOTH EQUAL 0 SKIP TO Q 24)

23. Is your electrical system equipped to have all of your **120** volt electrical outlets in use at the same time?

	Yes	No	DK
Surface Parking	1	2	3
Parking Lot Garage	1	2	3

24. How many charging stations did you install on your property, and what type?

Level 1 _______________
Level 2_______________

25. Where did you locate the spaces? **(READ LIST)**

Nearest electrical service to minimize installation cost
Next to handicapped spaces
Next to business entrance to maximize convenience for EV
drivers, to maximize visibility for the public

26. What is the main reason you installed charging stations for your properties? **(DO NOT READ LIST)**

Employee demand.
An employee benefit or perk.
Corporate sustainability / environmental goals.
Commuter options program.
Other (Specify)____________________

27. How often were you asked about charging electric vehicles, prior to offering charging equipment? **(READ LIST)**

Once/twice in the last 6 months
Once/twice per month
Once/twice a week
Daily

28. Do you charge employees or customers a fee to use the charging station, or is the charging service free?

Yes
No
Don't know

SECTION TO ASK ALL

29. How would you prefer to learn about plug-in electric vehicles and charging stations? (**DO NOT READ LIST)**

Phone

E-mail

Web page

Newsletter

Other (Specify)_______________

These last few questions are for statistical purposes only and will ensure that we talk with a variety of businesses.

D2. How many, if any, of your employees currently drive an electric plug-in vehicle? **(DO NOT READ LIST)**

_____ _____ _____

Don't know y

D3. What was your company's approximate revenue in dollars last year? **(READ LIST)**

Less than $100,000
$100,000 but less than $500,000 a year
$500,000 but less than $1 million a year
$1 million but less than $10 million a year
$10 million but less than $50 million a year
$50 million but less than $100 million a year
$100 million but less than $500 million a year
$500 million or more
(DO NOT READ) Don't know/refused

D4. How many locations does your company have in (MARKET IN Q1)? **(READ LIST)**

1 location
2 locations
3 to 5 locations
6 to 10 locations
More than 10 locations
(DO NOT READ) Don't know/refused

D5. What is the zip code of your primary business location?

____
Don't know (99999)

D6. Please tell me the name of your electric utility provider. **(DO NOT READ LIST.)**

Austin Energy	1
City of Austin Electric Utility Department	2
CPS/City Public Service	3
___________________________________	4
___________________________________	5
___________________________________	6
Don't know/prefer not to answer 7	

In case my supervisor would like to verify that I conducted this survey with you, I need to confirm that I'm talking to:

NAME: ____

And that I called:

COMPANY NAME:____

@ TELEPHONE: (__________)____

THAT CONCLUDES OUR SURVEY.
THANK YOU VERY MUCH FOR YOUR TIME.

INTERVIEWER:________________________________DATE:______________________

END TIME: ___________

10.6.2 Large Employers, Retailers, and Parking Lots Survey Results

Methodology

- Creative Consumer Research conducted 147 telephone interviews with managers of commercial parking properties, large employers, and retailers with large parking complexes in Austin, San Antonio, San Marcos, New Braunfels, and Georgetown, TX.
  - Interviews were conducted between May 23 and June 26, 2012.
- To participate, respondents must be decision-makers with regards to the installation or addition of property improvements such as PEV charging stations.
- Throughout these charts small base sizes (N<20) occur.
- Tables that contain small base sizes will show the number of responses rather than the percentage of the base.
- Small base sizes appearing throughout the charts occur based on skip patterns within the questionnaire.
- The survey results indicate that nine respondents in the total sample have installed a charging station. Of the 138 respondents who have not yet installed charging stations, nine have plans to do so in the future.
- Much of this report describes the nine parking facilities that have installed a charging station.
- Caution should be used if attempting to generalize the findings of these nine complexes to a greater population.

Key Findings

- Increased employee and customer demand would drive companies to install electric vehicle charging stations. However, there does not appear to be enough demand as most companies say they are not currently receiving any inquiries about charging stations for plug-in electric cars.
- While most say they are unlikely to install in the next two years, respondents do say that if a third of their employees drove plug-in electric vehicles, they would install charging stations. Respondents become even more likely to install if a rebate for half the cost of the charging station is available.
- In the end, demand for the charging stations and use of PEVs drives not only the initial installation but also the number of stations to be installed.

Executive Summary

Total Sample

- Most (88 percent) of the respondents surveyed do not charge their employees or customers for parking.
  - Premium or Valet parking is only offered by 13 percent of respondents.

- Nearly all respondents (94 percent) say their company has not installed any PEV charging stations.
  - Very few (7 percent) have any plans to install charging stations within the next 2 years.
- Web pages (37 percent) are the most preferred method to learn about PEV charging stations.
  - Other preferred methods include e-mail (25 percent) and newsletters (22 percent).

Those Who Have Not Yet Installed Electric Vehicle Charging Stations

- Twenty-three percent of those with surface parking (107 total respondents) and 31 percent of those with garage parking (26 total respondents) say they have at least one 120 volt outlet available.
  - On average, there are five outlets available in surface lots and five in garages.
- Only 4 percent of those with surface parking lots (107 total respondents) and none of those with garages (26 total respondents) say they have 220 volt outlets available.
  - Of those with 220 volt outlets available for surface lots (4 respondents), the average number available is four.
- Fifty-three percent of the 38 respondents with 120 volt outlets in surface parking and 33 percent of the 15 respondents with 120 volt outlets in garage parking say their electrical system could handle them all being used simultaneously.
- Of the 138 respondents who have not yet installed electric vehicle charging stations, 16 percent (or 22 respondents) have investigated installing plug-in electric vehicles.
  - Nine of the twenty-two respondents that have investigated charging stations say it is due to employee demand.
- Seventy-eight percent of the 138 respondents who have not installed charging stations say they have never been asked about them.
  - One in five (19 percent) say they have been asked about charging stations once or twice in the last six months.
- Ninety-three percent of 138 respondents have seen, read, or heard something about plug-in electric vehicles prior to the survey.
- Eighty percent of the 138 respondents who have not already installed charging stations are unlikely (rated likelihood 1 – 3) to install PEV charging stations within the next two years.
- On average, respondents say that if 29 percent of their customers or employees were driving PEVs, they would install charging stations.
- Respondents are mixed in their opinions on whether or not they would require employees and customers to pay for the use of charging stations.
  - While 37 percent are very likely to require payment, 30 percent say they are not at all likely.
- Seventy percent of 138 respondents say they would be more likely to purchase and install PEV charging stations if they received a rebate for a portion of the cost.

  - On average, those who would be more likely (97 respondents) would want 48 percent of the cost of the charging stations rebated.
- While 19 percent of the 97 respondents said the number of charging stations they would be likely to install would depend on the number of employees or customers driving plug-in electric vehicles, on average, respondents would install five charging stations.
- While 59 percent say they would locate the charging stations nearest to electrical service in order to minimize cost, 22 percent say they would place them to maximize convenience for EV drivers and visibility.

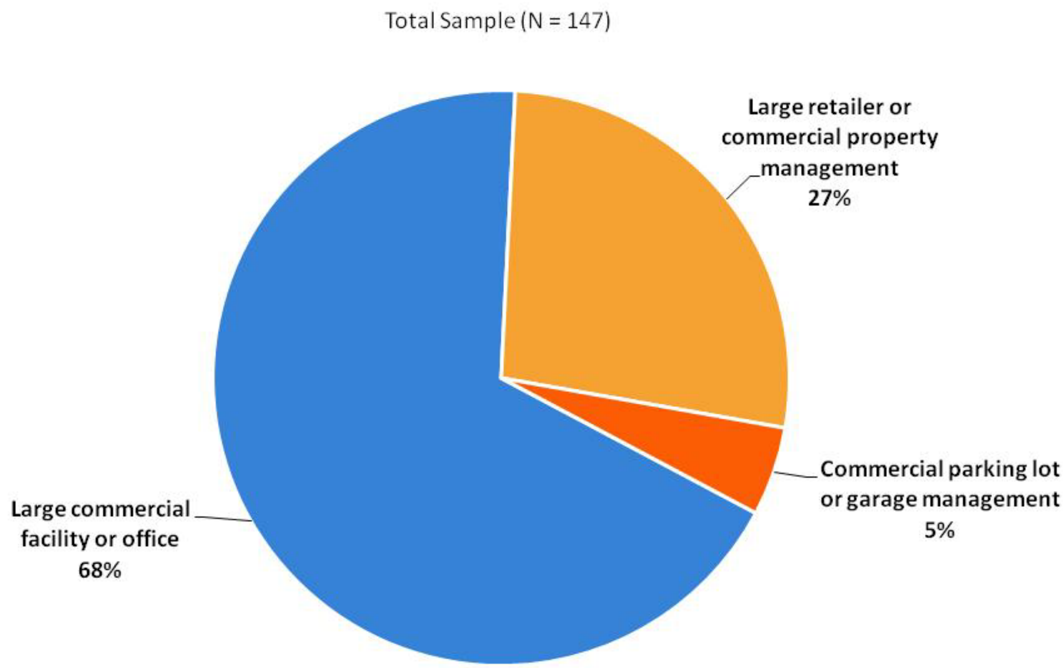
Those Who Have Installed Electric Vehicle Charging Stations

- Of the seven respondents that have installed plug-in electric vehicle charging stations and have surface parking lots, two do not have any 120 volt outlets available.
  - The other five companies average two available outlets.
  - Of the two companies that have garage parking available and have installed plug-in electric vehicles, the average number of 120 volt outlets available is five.
  - All companies that have installed charging stations and have 120 volt outlets accessible have electrical systems capable of having all outlets used at the same time.
- On average, those that have installed charging stations have 2 Level 1 charging stations and 20 Level 2 charging stations available.
- Eight out of nine respondents locate charging stations near the entrance to maximize convenience and visibility.
- Of those who have installed charging stations, five of nine say they installed them for corporate sustainability and environmental goals.
- Four of the nine installed the charging stations without being asked about them, and three installed after being asked once or twice in the last six months.
  - Two companies say they were asked daily about charging stations prior to installation.
- Of the nine respondents who have installed charging stations, four respondents charge for the use of the charging stations and four respondents say the service is free.

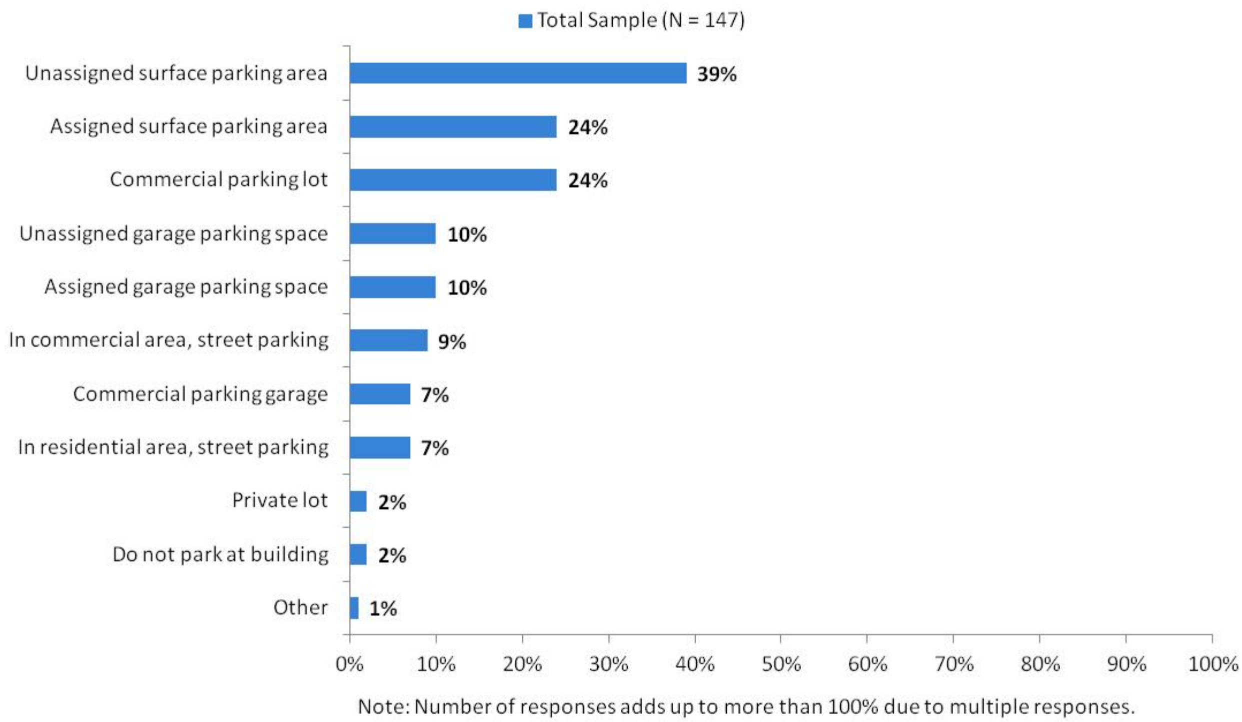
Response Details

Type of Facility

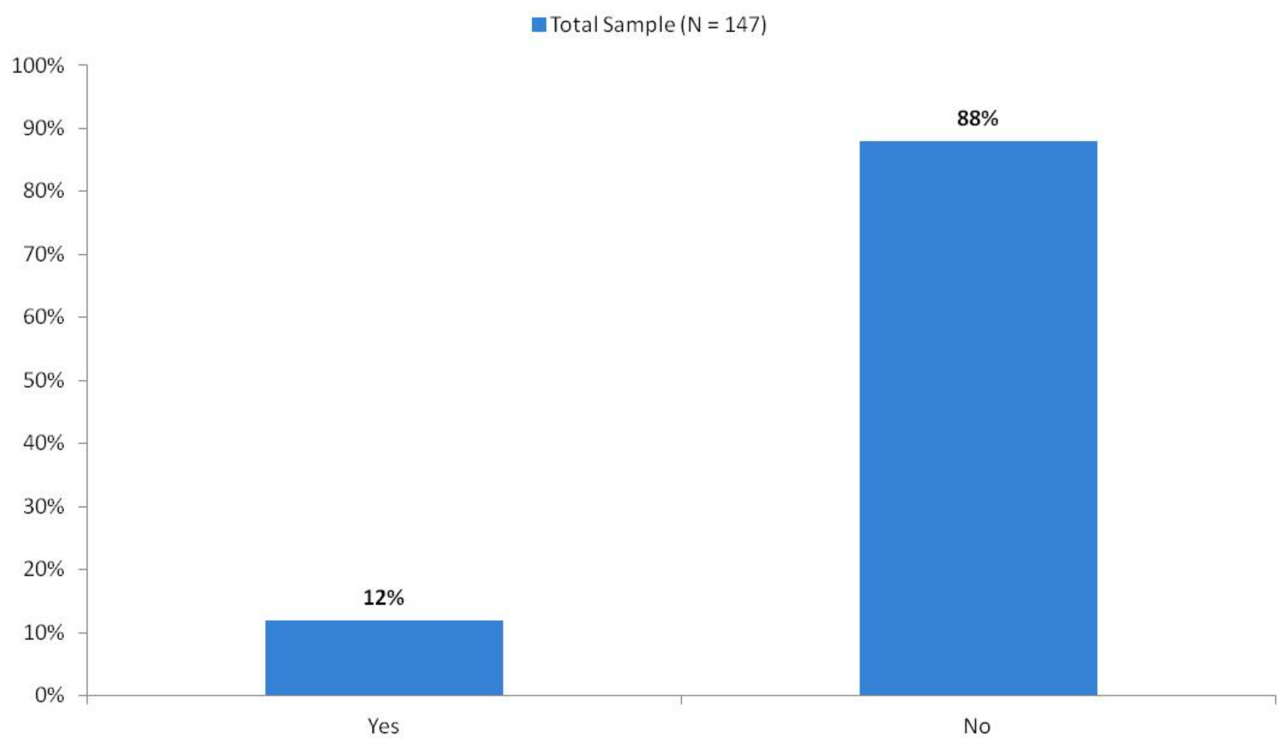
S3. To be sure that we talk to representatives from a variety of area business, which of the following best describes your company?



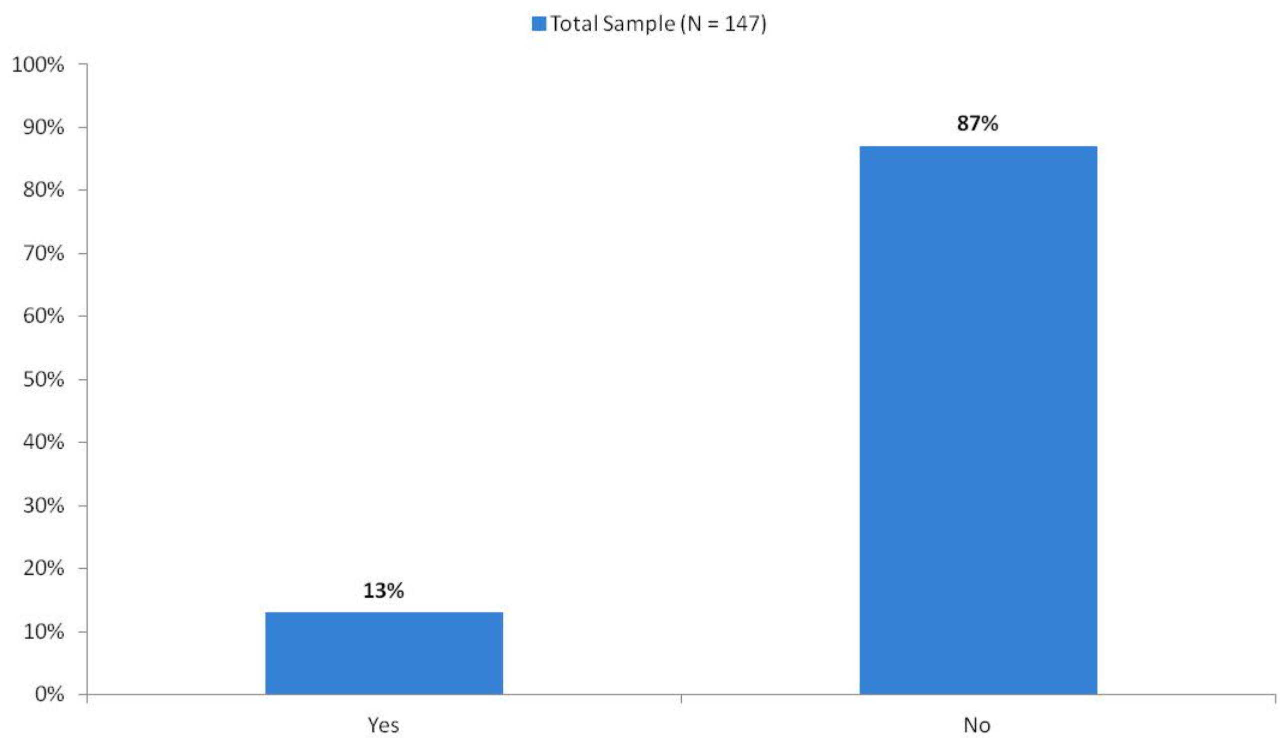
1. Where do your employees or customers park their vehicle?



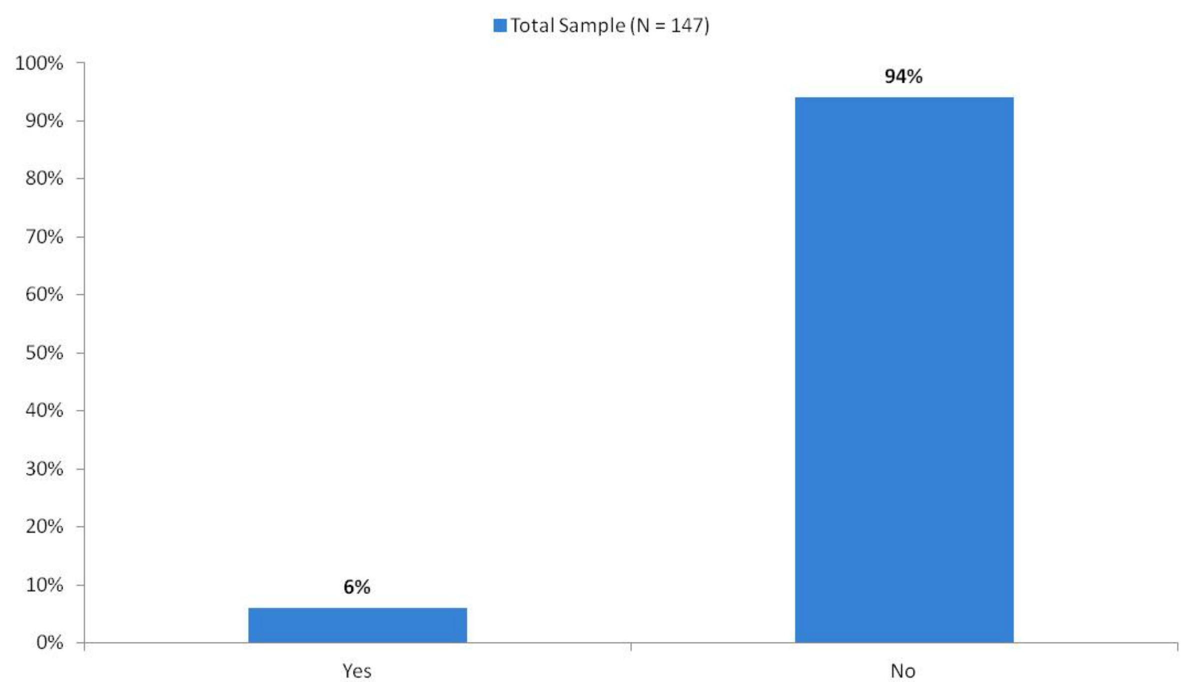
2. Does your company charge employees or customers for parking?



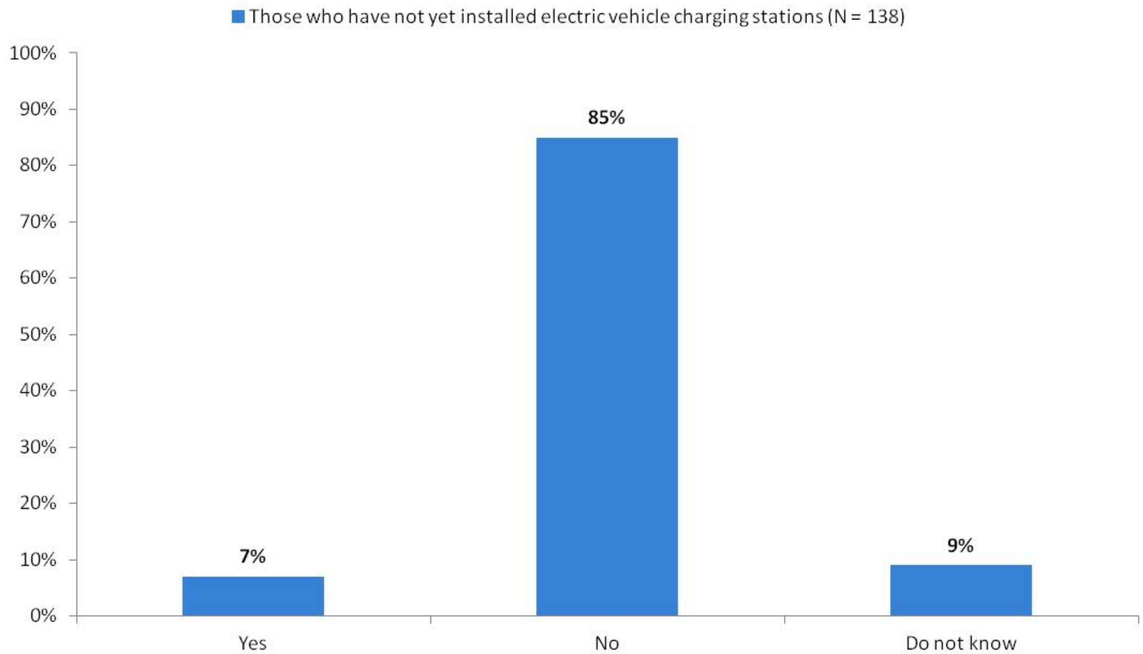
3. Does your company offer premium or valet parking spaces or garage parking spaces for an additional fee?



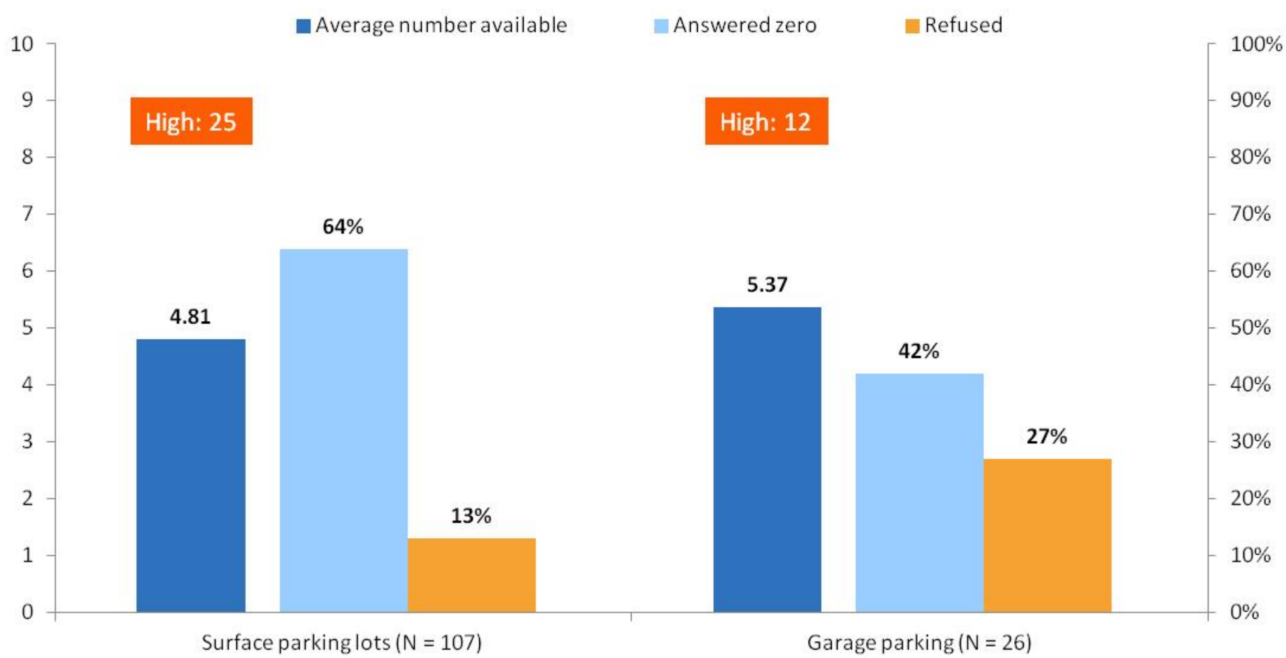
4. Has your company installed any electric vehicle, or EV, charging stations in your parking lots?



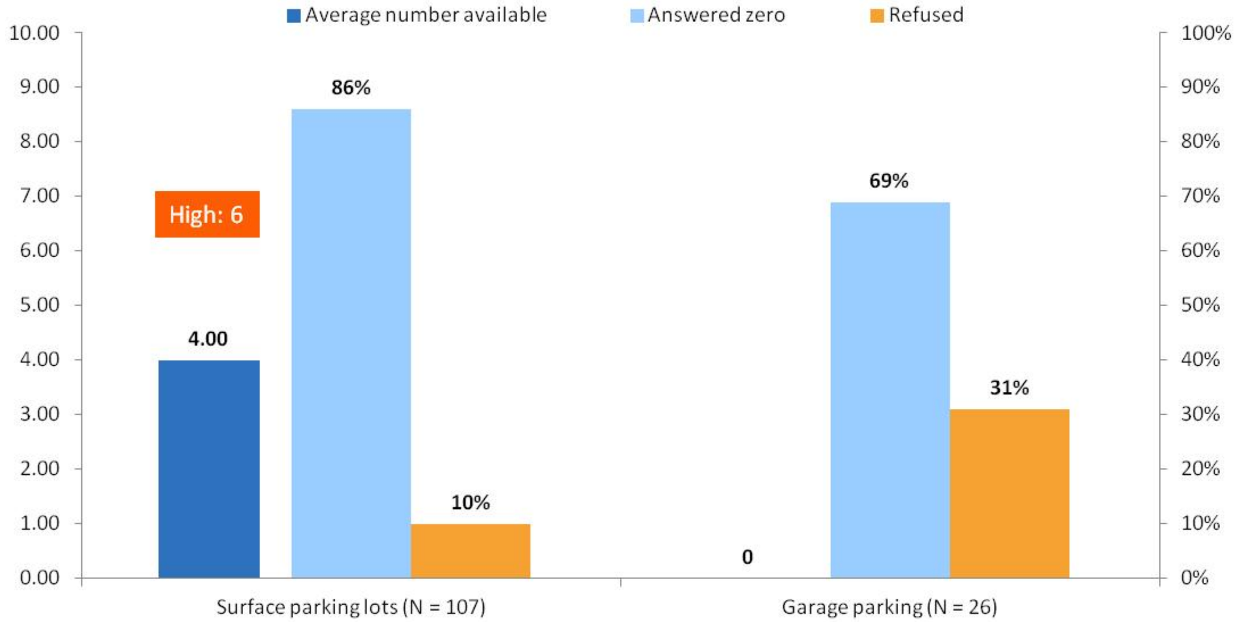
5. Does your organization have any plans to install electric vehicle charging stations, or offer access to a bank of outlets, within the next 2 years?



6. How many 120 volt outlets are accessible to employers or customers within your surface/garage parking lots?

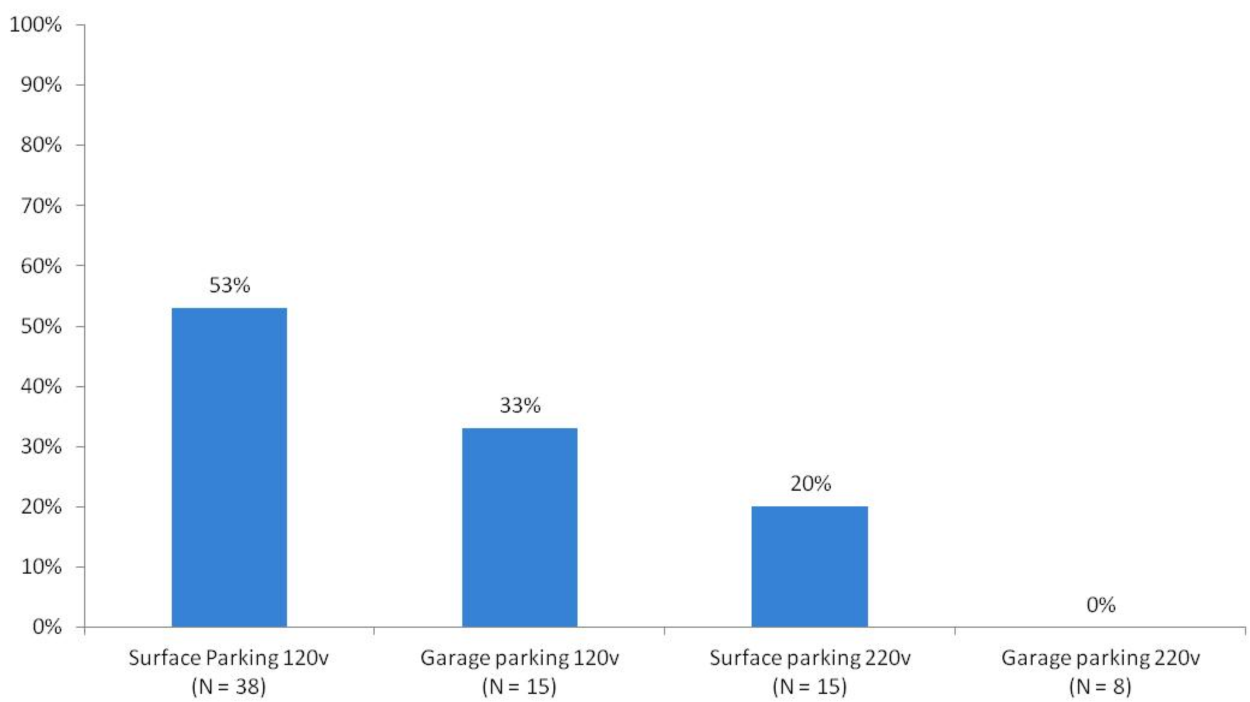


8. How many 120 volt outlets are accessible to employers or customers within your surface/garage parking lots?

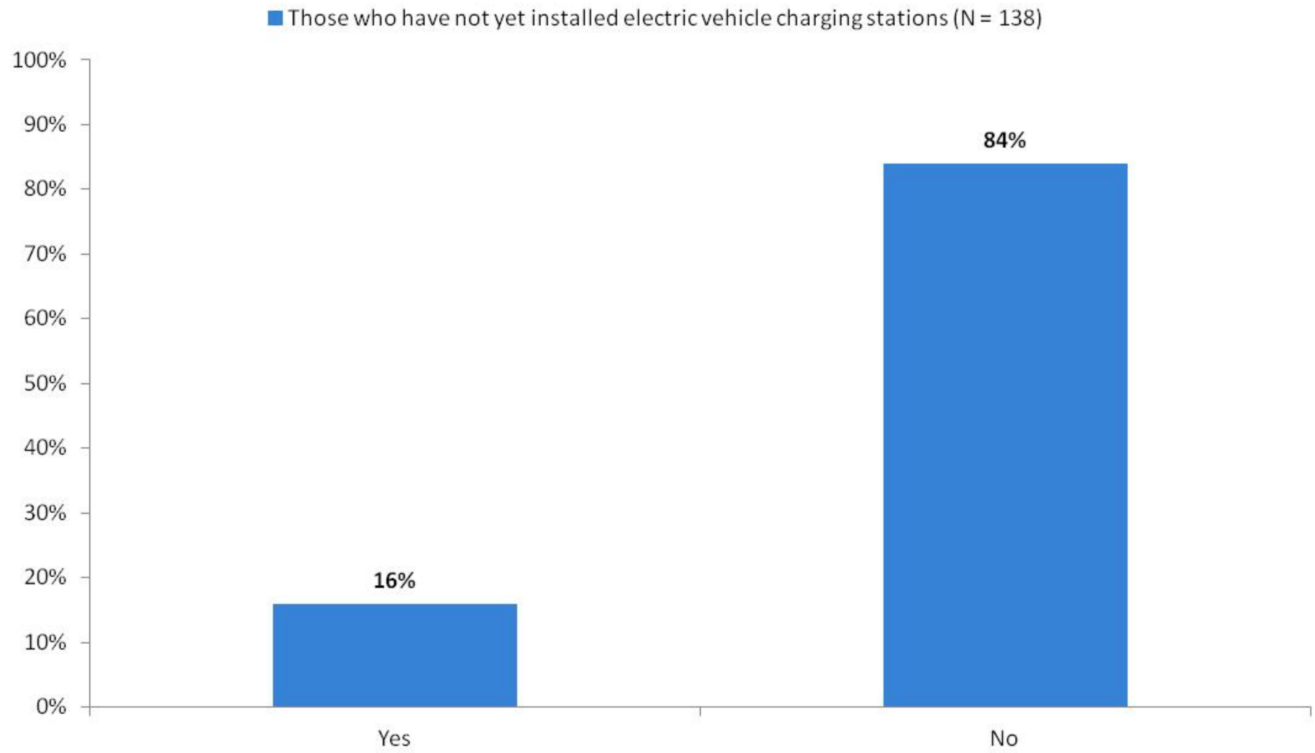


Q7/Q9. Is your surface/garage lot's electrical system equipped to have all of your 120/220 volt electrical outlets in use at the same time?

Those who have power outlets available in their parking areas 'Yes' answers shown



10. Have you investigated plug-in electric vehicles, or EV, charging stations for your properties?

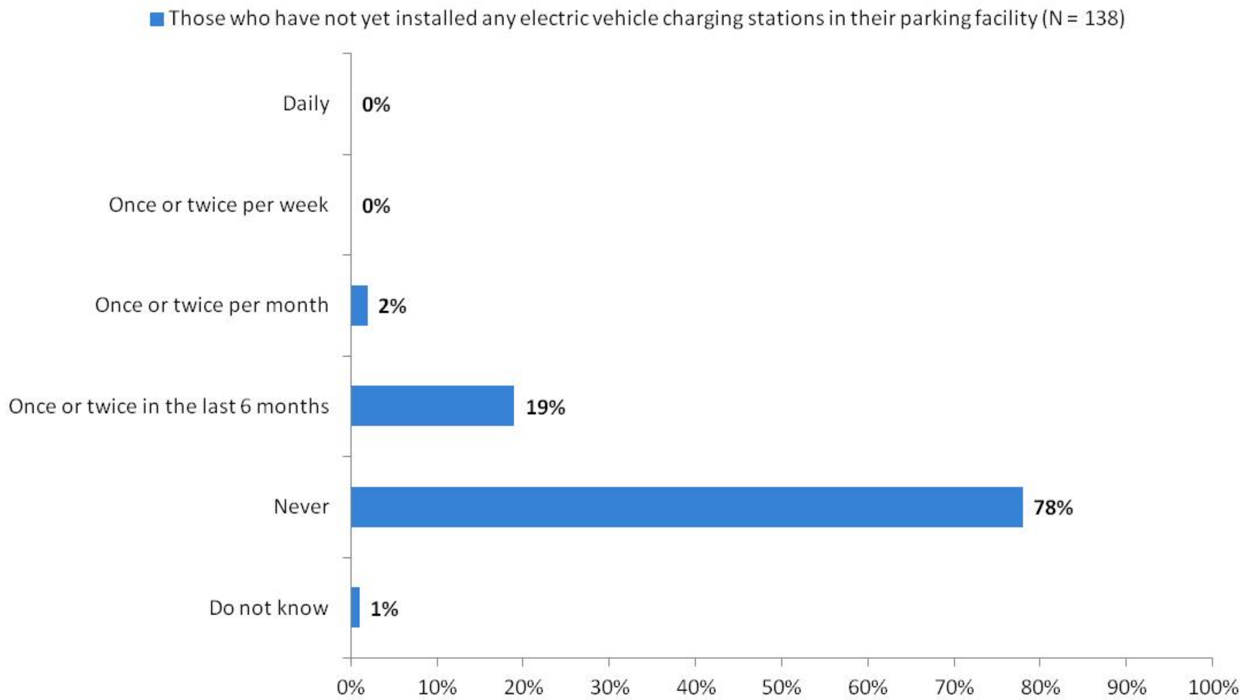


11. What is the main reason you investigated or are considering installing charging stations for your properties?

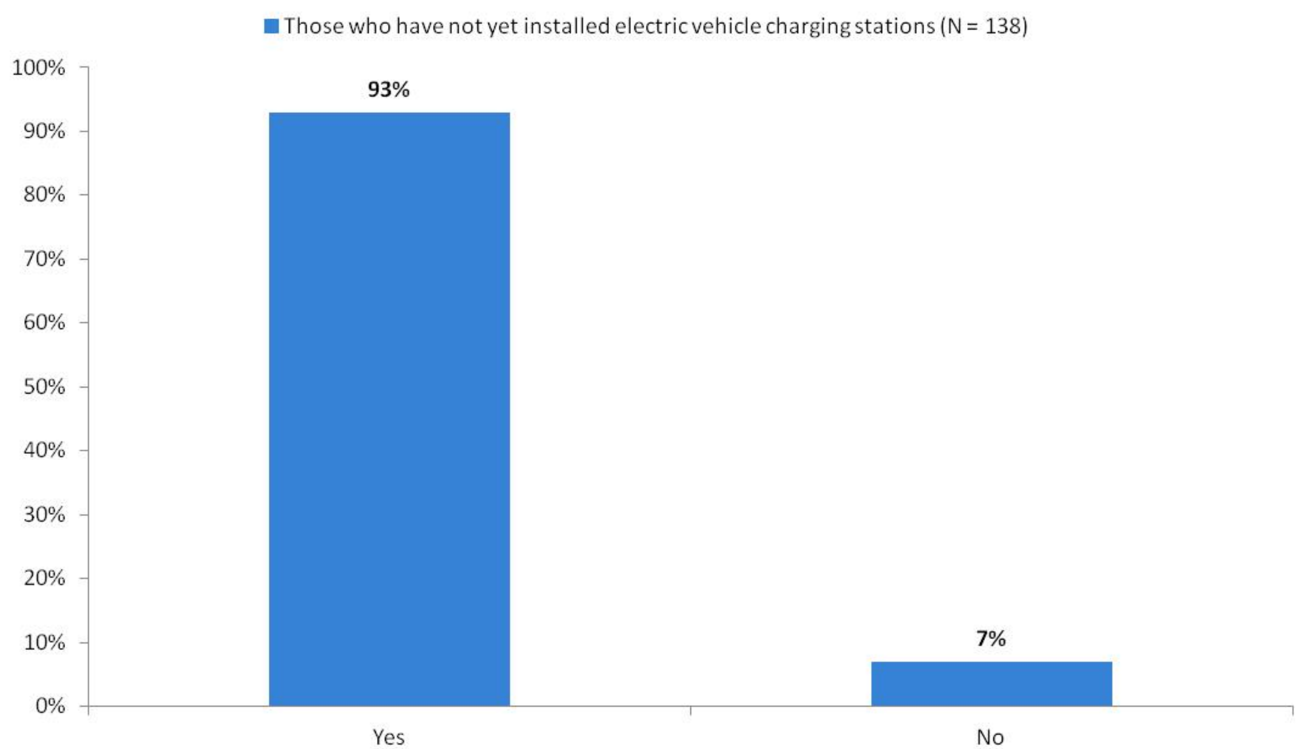
	Number of Respondents
Employee demand	9
An employee benefit or perk	3
Future demand	3
Corporate sustainability/environmental goals	2
Gain knowledge	2
Rebate program	2
Commuter options program	1
Customer need	1
Base: Those who have investigated or considered installing an EV charging station	**22**

Note: Number of responses adds up to more than base due to multiple responses.

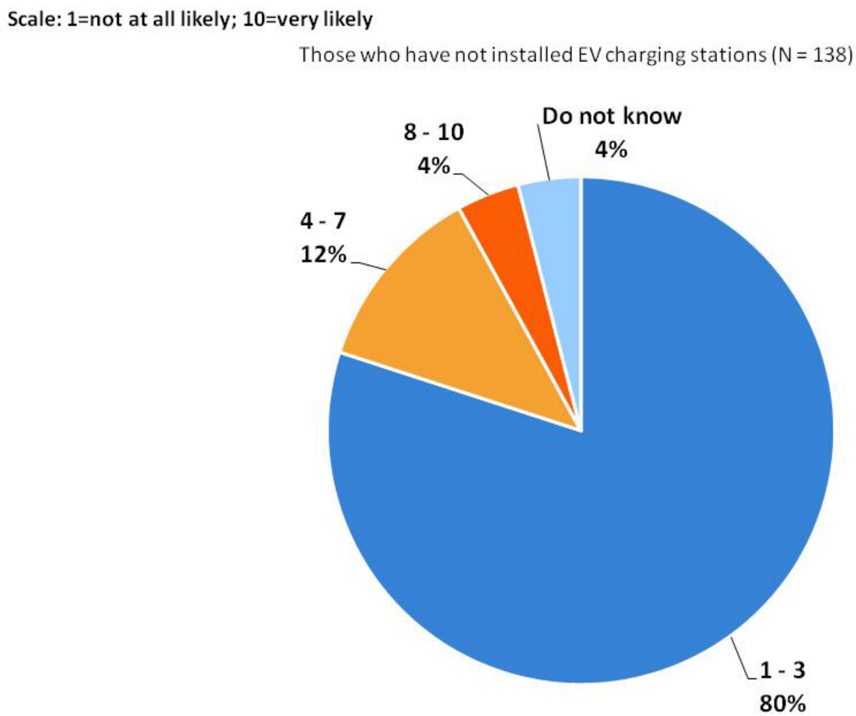
12. How often have you been asked about charging electric vehicles?

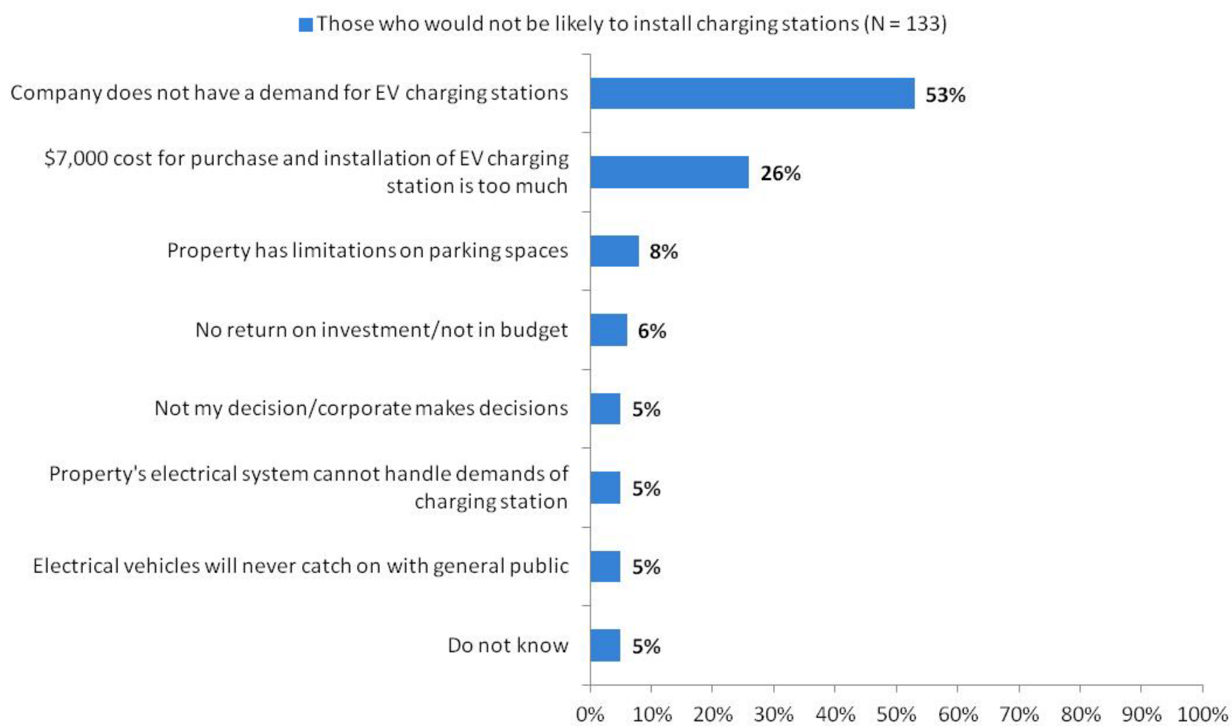


13. Prior to my call, have you seen, read, or heard anything about plug-in electric cars?



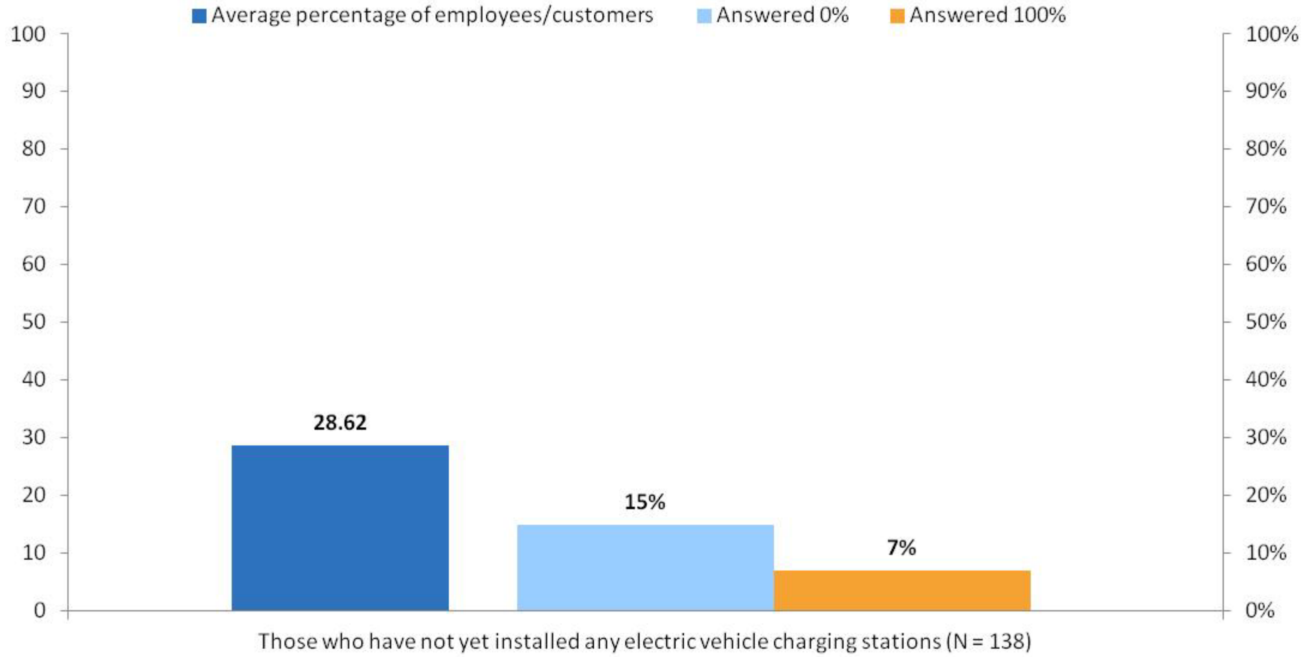
14. Using a 10-point scale where '1' is not at all likely and '10' is very likely, how likely would your company be to purchase and install an electric vehicle charging station for the use of your employees or customers in the next 2 years?



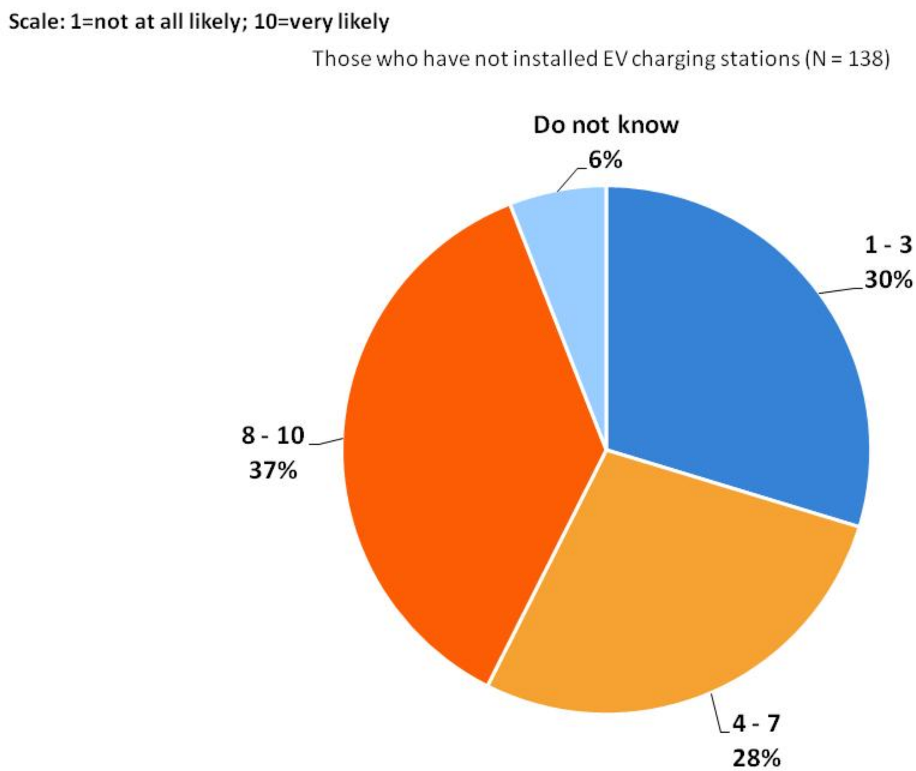


Note: All other responses mentioned by 2% or less of respondents.
Note: Number of responses adds up to more than 100% due to multiple responses.

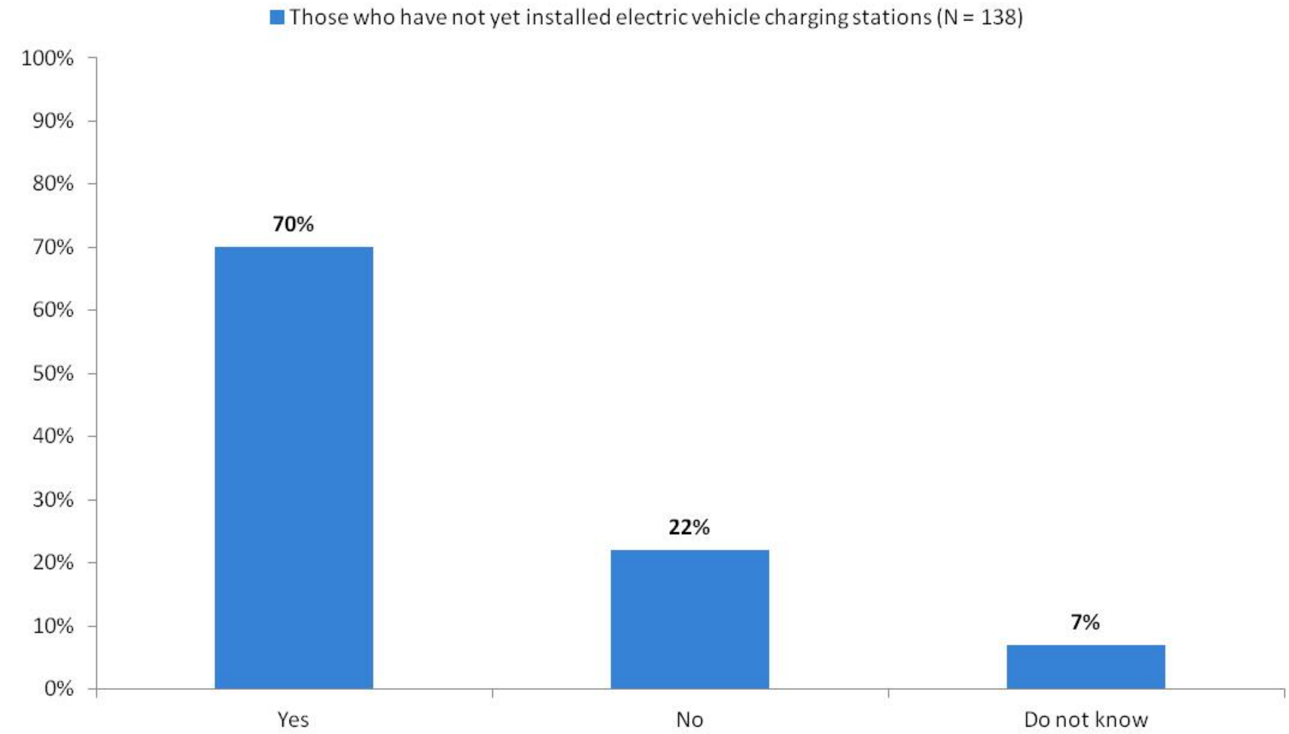
16. What percentage of your employees or customers would have to drive a plug-in electric vehicle in order for you to install outlets or an electric vehicle charging station on your property?



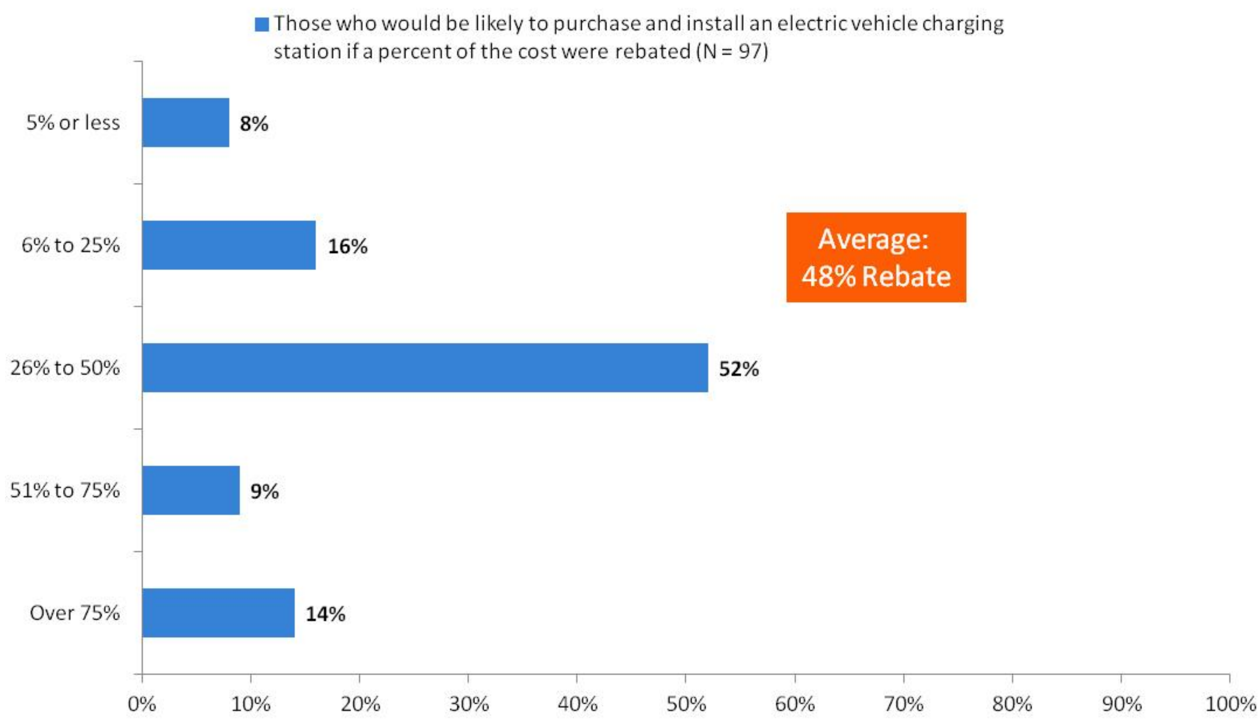
17. Using a 10-point scale where '1' is not at all likely and '10' is very likely, how likely would your company be to charge employees or customers a fee to use the charging station?



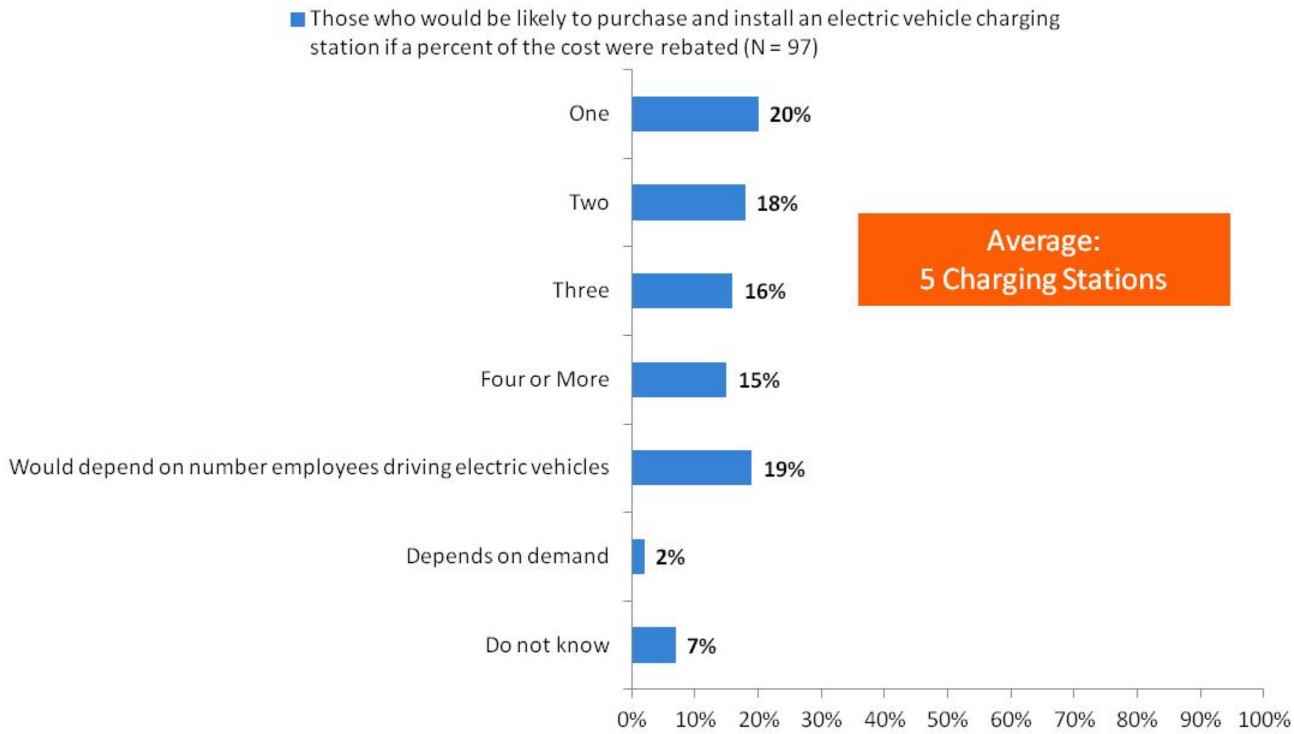
18. Would you be more likely to purchase and install an electric vehicle charging station if a percent of the cost was rebated?



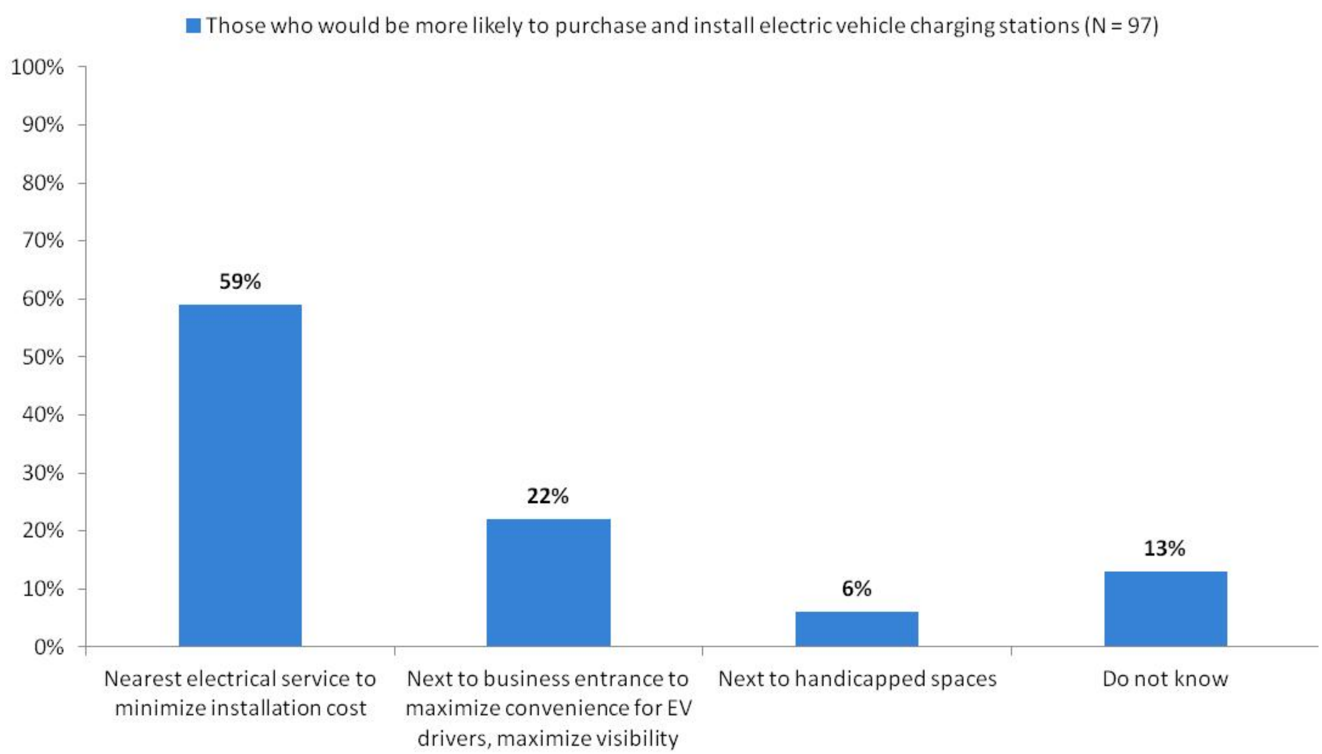
19. What percent off the cost of a charging station would you need to be rebated for your company to purchase and install a charging station or stations on your property?



20. A typical charging station recharges one car at a time. How many charging stations do you think you would install on your property?



21. Where would you locate these spaces?



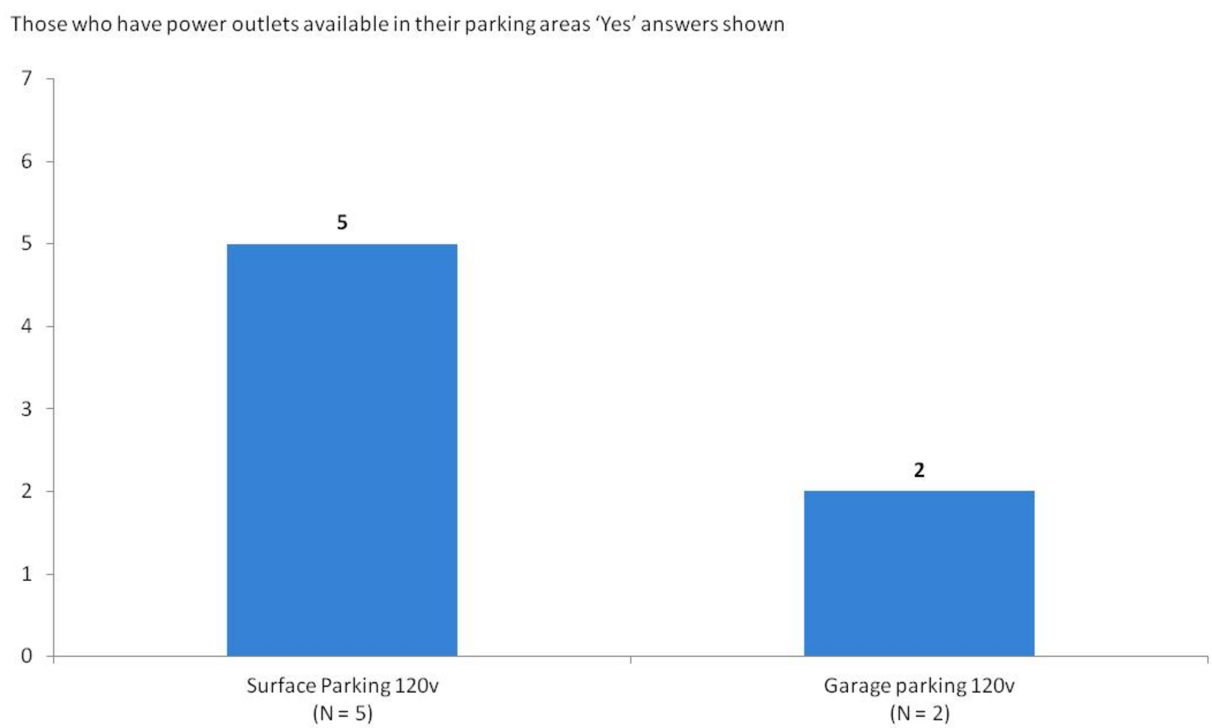
Organizations with Charging Stations

22. How many 120 volt outlets are accessible to employees or customers within your surface lot/garage?

Those who have installed electric vehicle charging stations

Number of Outlets Available	Those with surface parking lots	Those with garage parking
0	2	-
1	1	-
2	3	1
4	1	-
7	-	1
Base:	7	2

23. Is your surface/garage lot's electrical system equipped to have all of your 120 volt electrical outlets in use at the same time?

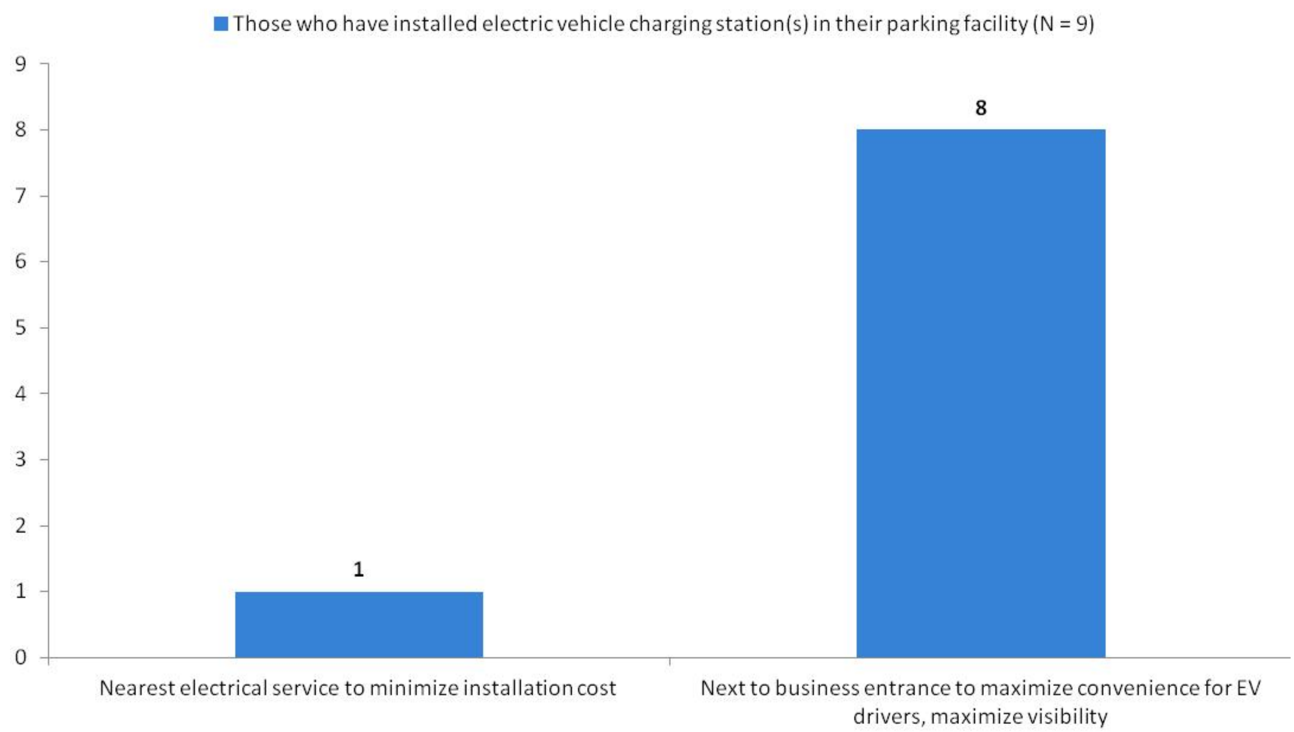


24. How many Level 1/Level 2 charging stations did you install on your property?

Number of Charging Stations Installed	Level 1 Stations	Level 2 Stations
0	1	3
1	1	-
2	1	1
3	1	-
5	1	-
100*	-	1
Refused	4	4
Those who have installed electric vehicle charging stations in their parking facility	9	9

*Note: Respondent noted that this number of charging stations was over several properties.

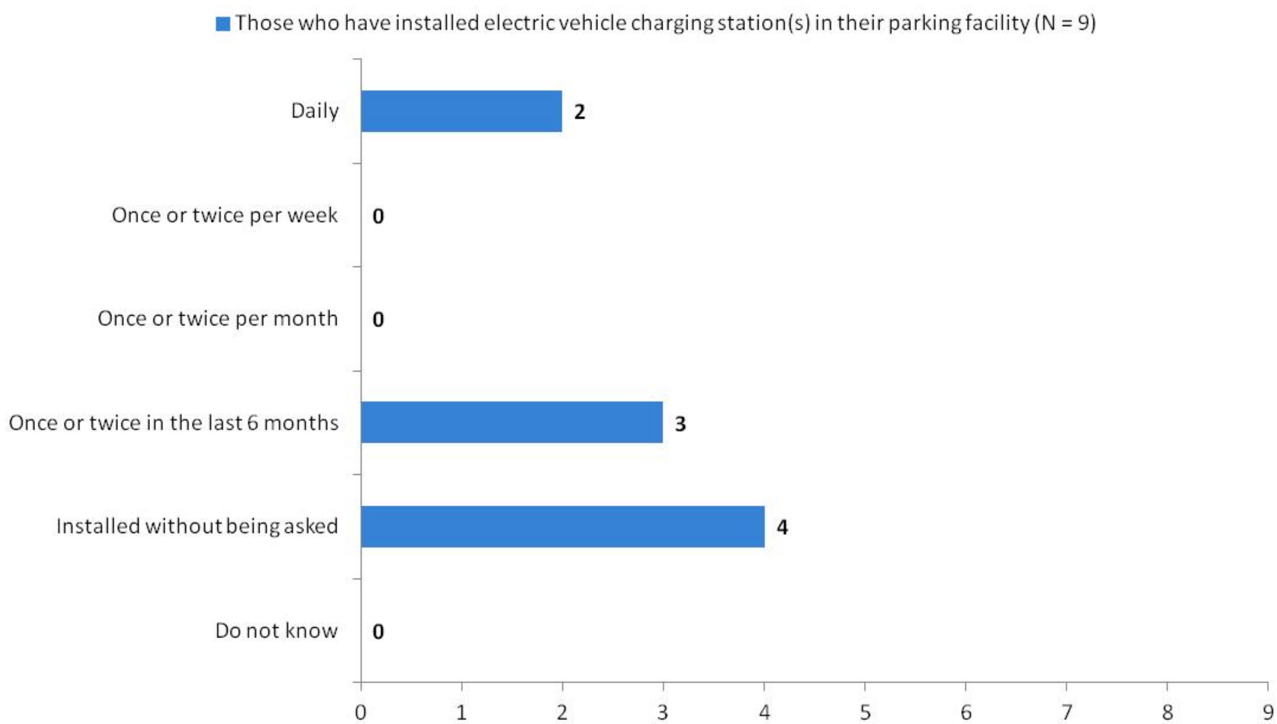
25. Where did you locate these spaces?



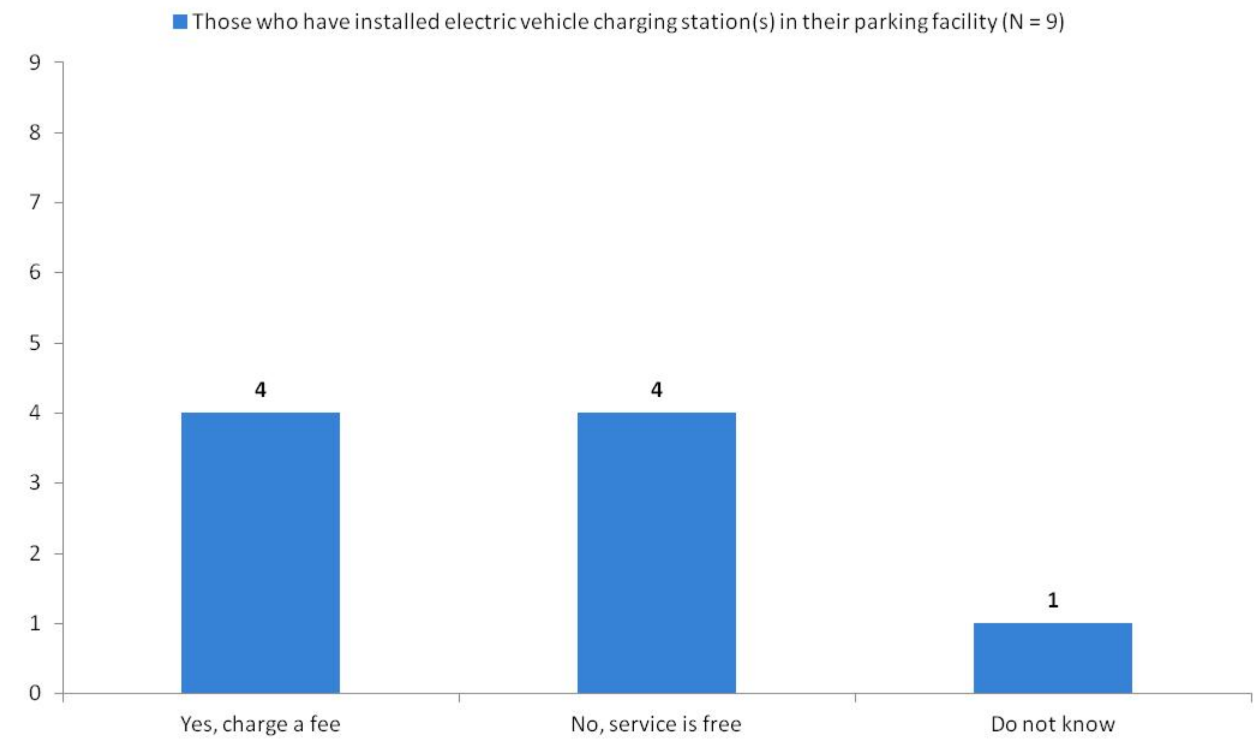
26. What is the main reason you installed charging stations for your properties?

	Number of Respondents
Corporate sustainability/environmental goals	5
Rebate program	2
Employee demand	1
An employee benefit or perk	1
Base: Those who have installed electric vehicle charging station(s) in their parking facility	9

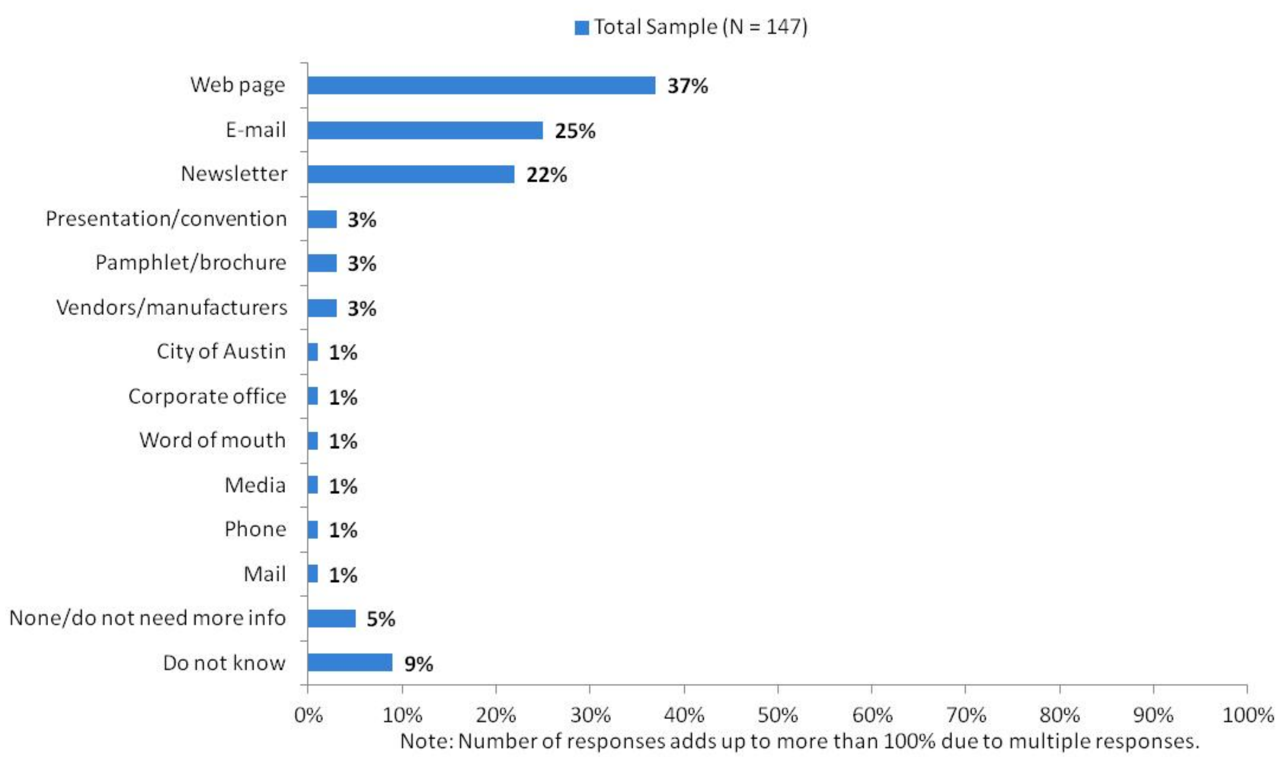
12. How often have you been asked about charging electric vehicles?



28. Do you charge employees or customers a fee to use the charging station, or is the charging service free?

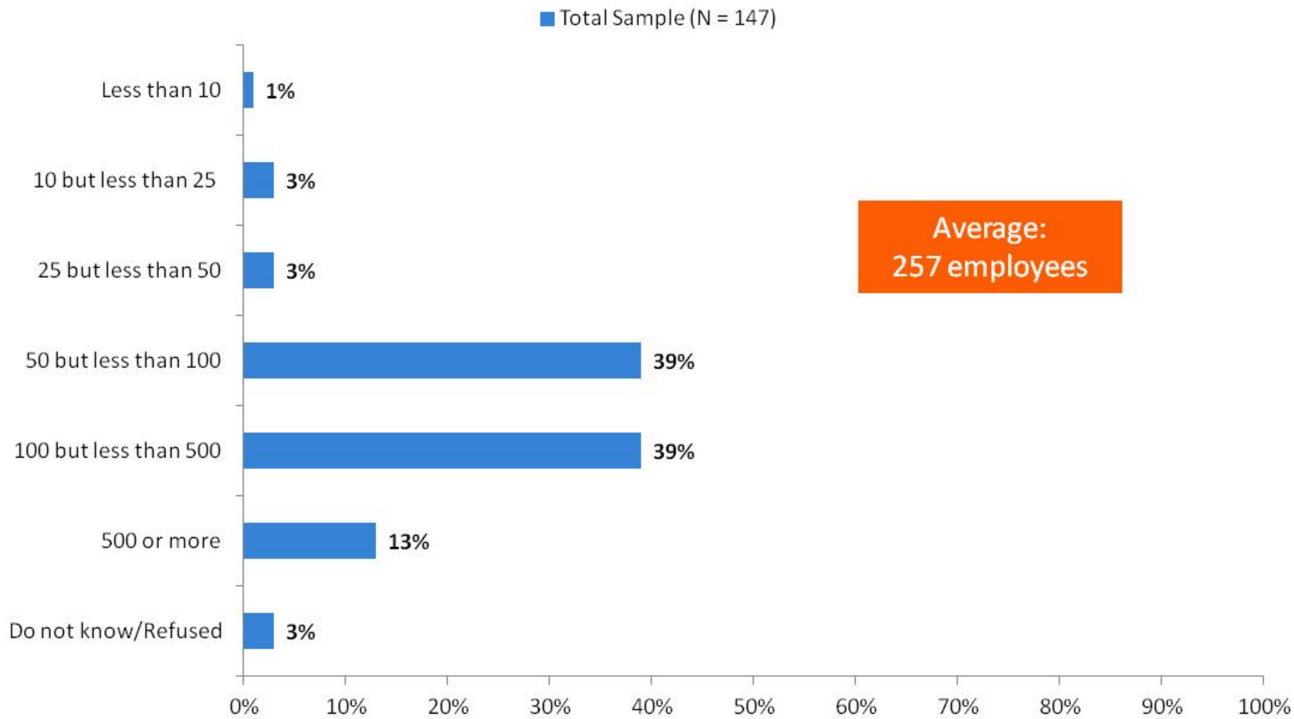


29. How would you prefer to learn about plug-in electric vehicles and charging stations?

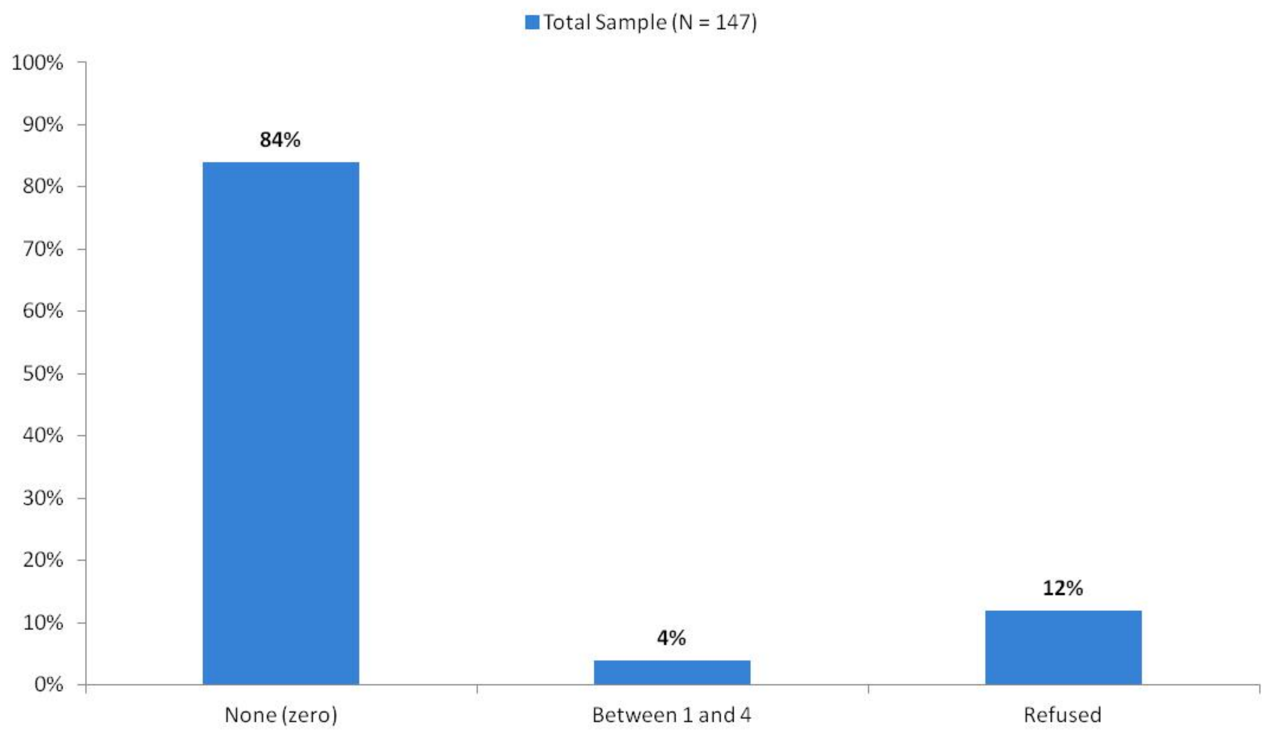


Demographics

D1. How many people does your company employ in your city?



D2. How many, if any, of your employees currently drive an electric plug-in vehicle?



	Total Sample
Number of Company Locations Within Market	
1 location	**50%**
2 locations	**10%**
3 to 5 locations	**16%**
6 to 10 locations	**12%**
More than 10 locations	**11%**
Refused	**2%**
Average	***3.85***
Annual Revenue	
Average	***$89 Million***
Base:	**147**

	Number of Respondents
78212	**1**
78233	**1**
78246	**1**
78701	**1**
78703	**1**
78736	**1**
78748	**1**
78753	**1**
78207	**1**
Base: Those who have installed electric vehicle charging station(s) in their parking facility	**9**

10.7 Texas River Cities Plug-In Electric Vehicle Business Model Survey

10.7.1 Texas River Cities Plug-In Electric Vehicle Business Model Survey Instrument

You are invited to participate in the Texas River Cities Plug-In Electric Vehicle business model survey. This survey focuses on your ideas about the future of electric vehicles and the infrastructure needed to support them. This survey includes aspects of electric vehicle technology and development.

1) Currently the Plug-In Electric Vehicle industry is just starting to develop. How long do you think it will take for the industry to fully develop?

( ) 0-5 years

( ) 6-10 years

( ) 11-15 years

( ) 16-20 years

( ) 21-25 years

( ) Greater than 25 years

( ) Never

( ) Do Not Know

2) When the Plug-In Electric Vehicle infrastructure is fully developed, what percentage of vehicle charging will take place with (Responses should add to 100%):

Level 1 Charge: _________________________

Level 2 Charge: _________________________

DC Fast Charge: _________________________

3) Please rate the following factors with regards to their ability to speed up the establishment of the Plug-In Electric Vehicle industry (5 stars= Greatest Ability).

Lower Plug-In Electric Vehicle purchase prices (through innovative leases, incentives, tax rebates, etc.)	___
Increased fuel/mileage range of Plug-In Electric Vehicles	___
Broader installed network of charging infrastructure throughout U.S.	___
More regulatory certainty (installation ordinances, sale of electricity as "fuel", Electric Vehicle Supply Equipment ownership, etc)	___

Higher gasoline prices	___
Other	___

4) If you selected "Other", please specify.

5) How many Plug-In Electric Vehicles do you think will be on the road in the United States by (please input number for each year):

2015: ___________________________

2020: ___________________________

2025: ___________________________

6) Please rate the factors with regards to impeding the growth of the Plug-In Electric Vehicle industry (5 stars = Greatest Impediment).

Technology limitations	___
Customer PEV adoption rates	___
Uncertain regulatory policies and regulation	___
No economic incentive to install and manage EVSE equipment	___
No opportunity for venture investment in industry	___
Uncertain long term future of the Plug-In Electric Vehicle industry	___
Other	___

7) If you selected "Other", please specify.

8) Please rate the following factors in relation to their importance in the evolution of Electric Vehicle Supply Equipment (EVSE) Technology (5 stars = Greatest Importance).

Time to charge Plug-In Electric Vehicles	___
Installation of EVSEs	___
Use of EVSEs	___
Remote communications with EVSEs	___
Interoperability across all Plug-In Electric Vehicles	___
Interoperability across EVSE management systems and future applications	___
Cost of EVSEs and installation	___
Other	___

9) If you selected "Other", please specify.

10) Have you or your organization ever developed a business case or evaluation for installing or selling electric vehicle charging equipment?
( ) Yes

( ) No

11) Please indicate the business case or analysis you developed. Check all that apply.
[ ] Owning and operating Electric Vehicle Supply Equipment as a business opportunity

[ ] Installing Electric Vehicle Supply Equipment as a marketing or competitive differentiator for my business

[ ] Installing Electric Vehicle Supply Equipment as an employee benefit

[ ] Installing Electric Vehicle Supply Equipment as a policy decision (lower carbon footprint, government mandate, etc)

[ ] Becoming an Electric Vehicle Supply Equipment Service Provider (operating Electric Vehicle Supply Equipment on behalf of others)

[ ] Developing applications for the industry

[ ] Other

12) Please rate the importance of the following business models based on which one you believe will help the Plug-In Electric Vehicle industry expand (5 stars = Most Helpful).

Public sector financed charging stations	___
Private sector financed charging stations	___
A mix of public and private financed charging stations	___
Other model	___

13) If you selected "Other", please specify.

14) Please rate the following payment methods for paying for PEV charging (5 stars = Most Preferred).

$ per unit of fuel	___
$ per mile charged	___
$ per hour of connectivity	___
Flat connectivity fee per use	___
Subscription fee (monthly, annually) for unlimited use	___
Subscription fee (monthly, for fixed number of hours or charges, then additional fees apply)	___
Other	___

15) If you selected "Other", please specify.

16) Please rate the following methods used to activate Electric Vehicle Supply Equipment (5 stars = Most Preferred).

Credit Card	___
"Users Card" that collects information on charging activities and bills customers periodically	___
Pre-paid cards	___
Subscription service	___
QR codes (read by smart phones)	___
Call-in numbers that provide a code	___
Other	___

17) If you selected "Other", please specify.

18) Which groups should be involved with the installation and maintenance of Electric Vehicle Supply Equipment? Select all that apply.

[ ] Utilities

[ ] Electrical contractors

[ ] Electric Vehicle Supply Equipment manufacturers

[ ] Neighborhood groups

[ ] Environmental groups

[ ] Business owners

[ ] Other

19) How should local, state or federal governments be involved in the growth and development of the infrastructure? Select all that apply.

[ ] Provide tax credits for equipment

[ ] Own/operate equipment

[ ] Provide exemptions for Electric Vehicle Supply Equipment operators to sell electricity through Electric Vehicle Supply Equipment

[ ] Have it installed at government facilities

[ ] Fund installation of public EVSE infrastructure (parking lots rest stops)

[ ] Mandate specific standards and regulations (i.e. ordinances, signage, fines illegal parking, etc)

[ ] Allow free market to dictate

[ ] Other

20) On a scale from 1-10 where 1 is Not Interested at all and 10 is Very Interested, please indicate your level of interest in the Plug-In Electric Vehicle industry.

( ) 1 Not Interested

( ) 2

( ) 3

( ) 4

( ) 5

( ) 6

( ) 7

( ) 8

( ) 9

( ) 10 Very Interested

21) Which category best describes your industry relationship?

( ) Utility

( ) Government Agency

( ) Electric Vehicle Supply Equipment Vendor

( ) Electric Vehicle Supply Equipment Service Provider

( ) Plug-In Electric Vehicle Manufacturer

( ) Hybrid Electric Vehicle Manufacturer

( ) Non Government Organization/Citizens Group

( ) PEV/EVSE Industry Expert

( ) University/Academia

( ) Private Company

( ) Other: _________________*

22) What type of utility?
( ) Investor owned

( ) Municipally owned utility

( ) Rural Electric Cooperative

( ) Municipal Utility District

23) What is your professional background?
( ) Engineer

( ) Accountant

( ) Project Management

( ) Sales

( ) Consulting

( ) Construction

( ) Other: _________________*

24) Do you currently own a Plug-In Electric Vehicle?
( ) Yes

( ) No

25) Are you planning on purchasing a Plug-In Electric Vehicle in the next 12 months?
( ) Yes

( ) No

( ) Unsure

26) What is the zip code of your residence?

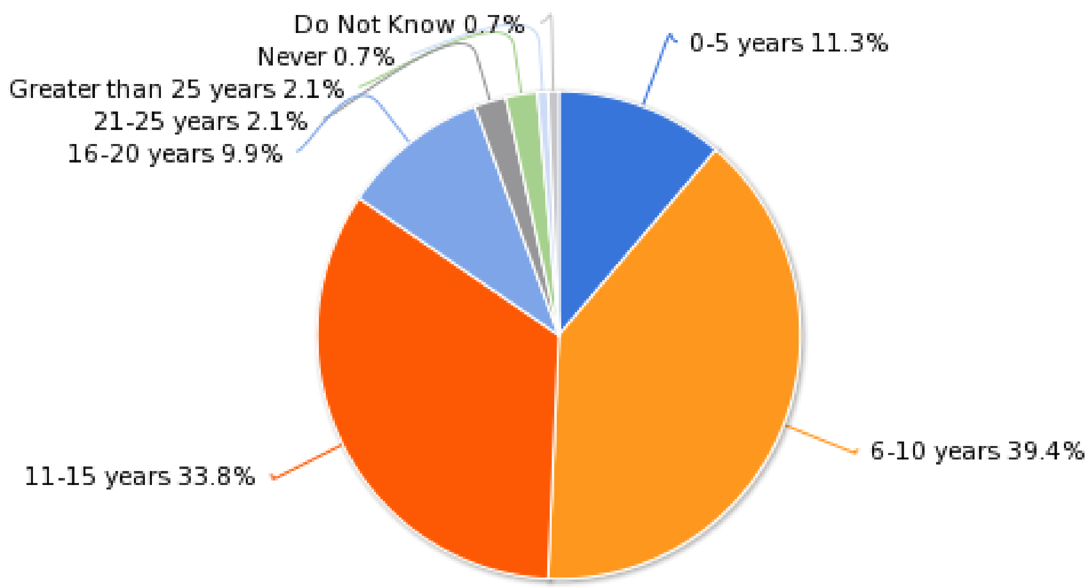
27) What is the zip code of your business?

28) What other major ideas, issues or concerns not asked here should be addressed as the industry develops?

Thank you for taking our survey. Your response is very important to us.

10.7.2 Texas River Cities Plug-In Electric Vehicle Business Model Survey Results

1) Currently the Plug-In Electric Vehicle industry is just starting to develop. How long do you think it will take for the industry to fully develop?



Value	Count	Percent
0-5 years	16	11.3%
6-10 years	56	39.4%
11-15 years	48	33.8%
16-20 years	14	9.9%
21-25 years	3	2.1%
Greater than 25 years	3	2.1%
Never	1	0.7%
Do Not Know	1	0.7%

Statistics	
Total Responses	142
Sum	1,151.0
Average	9.5
StdDev	3.84
Max	21.0

2) When the Plug-In Electric Vehicle infrastructure is fully developed, what percentage of vehicle charging will take place with a Level 1 charge? (responses should add to 100%)

Count	Response
1	don't understand this format
1	1%
6	5%
1	8%
17	10%
1	12.5%
1	13%
6	15%
1	19%
21	20%
11	25%
15	30%
1	33%
2	35%
14	40%
1	49%
12	50%
7	60%
1	70%
2	75%
6	80%
3	90

3) When the Plug-In Electric Vehicle infrastructure is fully developed, what percentage of vehicle charging will take place with a Level 2 charge? (responses should add to 100%)

Count	Response
1	5%
1	7%
1	9%
3	10%
1	12.5%
1	18%
4	20%
2	23%
4	25%
1	28%
12	30%
1	33%
5	35%
1	37%
12	40%
1	45%

Count	Response
16	50%
3	55%
1	58%
21	60%
7	65%
10	70%
13	75%
2	78%
8	80%
3	85%
2	90%

4) When the Plug-In Electric Vehicle infrastructure is fully developed, what percentage of vehicle charging will take place with a DC Fast Charge (responses should add to 100%)

Count	Response
3	1%
9	2%
2	3%
18	5%
1	<5%
35	10%
12	15%
17	20%
1	24%
10	25%
5	30%
1	34%
3	35%
7	40%
4	50%
3	60%
1	70%
2	75%

5) Please rate the following factors with regards to their ability to speed up the establishment of the Plug-In Electric Vehicle industry (5 stars= Greatest Ability).

Lower Plug-In Electric Vehicle purchase prices (through innovative leases, incentives, tax rebates, etc.)	Average Rank 4.61 • Count: 142 • Min: 2 / Max: 5 • StdDev:0.64

Increased fuel/mileage range of Plug-In Electric Vehicles	Average Rank 3.79 • Count: 141 • Min: 1 / Max: 5 • StdDev:1.04
Broader installed network of charging infrastructure throughout U.S.	Average Rank 3.14 • Count: 142 • Min: 1 / Max: 5 • StdDev:1.13
More regulatory certainty (installation ordinances, sale of electricity as "fuel", Electric Vehicle Supply Equipment ownership, etc)	Average Rank 2.42 • Count: 141 • Min: 1 / Max: 5 • StdDev:1.04
Higher gasoline prices	Average Rank 4.00 • Count: 141 • Min: 1 / Max: 5 • StdDev:1.04
Other	Average Rank 4.03 • Count: 38 • Min: 1 / Max: 5 • StdDev:1.16

6) If you selected "Other", please specify.

Count	Response
8	Public awareness/acceptance
4	Greater Range of EVs
3	Installation of DC SAE fast charging
3	Public Education
3	Vehicle to Grid capabilities More choice in types and models of PEVs
2	Greater variety of vehicles available
2	Lower EVSE prices, reduced permitting fees for EV installation, car sharing opportunities
1	A better understanding of the outstanding performance characteristics of most EVs, among the general public, will go a long way to getting folks into EVs
1	A business model like Renault in Europe where the user buys the car and leases the battery for approx $100/month. This eliminates the vehicle price premium.
1	Battery Switch capabilities and infrastructure has the highest potential to achieve EV mass adoption. See example in Israel and Denmark, where EV's are competing with Gas cars on par.
1	Direct power utility engagement in infrastructure deployment, ownership and operation as well as consumer education and outreach on the benefits of electricity as a fuel.
1	Discounted electric rates, lower cost for infrastructure installations, standardization in business models for EVSE providers - more open access, proliferation of workplace infrastructure, utility regulatory approval to own and support infrastructure implementation, more OEM PEV models for sale
1	Eliminating the oil industry's federal government subsidies
1	Mainstream vehicles (i.e. minivans, pickups, big sedans, etc.) with attractive range and cost.
1	Make PEVs sexy; popular, cool.
1	Manufacturer being able to take the tax credits at time of sale rather than the consumer
1	More level 2 charging stations in places where company employees park in large numbers.

Count	Response
1	People having the experience of driving an EV and realizing they are fun to drive.
1	Regulatory certainty again and consistent policy support over long periods of time.
1	Regulatory mandates for lower emissions
1	Solutions of charging at multifamily dwellings
1	Stop the government from funding free chargers.
1	Supply shortages in gasoline similar to those in the 70s
1	User experiences and perceived performance.

7) How many Plug-In Electric Vehicles do you think will be on the road in the United States by 2015?

Count	Response
1	?
2	2%
1	10%
1	5,000
4	1,0000
2	20,000
1	30,000
1	35,000
1	40,000
5	50,000
2	70,000
2	75,000
1	80,000
9	100,000
1	120,000
2	125,000
9	150,000
12	200,000
5	250,000
5	300,000
4	350,000
5	400,000
20	500,000
1	550,000
5	600,000
1	650000
4	700,000
4	750,000
2	800,000
7	1,000,000
1	2,000,000

8) How many Plug-In Electric Vehicles do you think will be on the road in the United States by 2020?

Count	Response
1	?
1	7%
1	30%
1	4
1	15,000
1	30,000
1	40,000
2	50,000
1	60,000
1	75,000
1	80,000
1	100,000
2	100,000
1	120,000
1	150,000
3	200,000
4	250,000
3	300,000
2	400,000
9	500,000
2	600,000
3	700,000
2	750,000
2	800,000
23	1,000,000
1	1,100,000
4	1,200,000
1	1,250,000
8	1,500,000
16	2,000,000
1	2,500,000
10	3,000,000
1	3,500,000
1	3,600,000
4	5,000,000
1	6,000,000
2	10,000,000

9) How many Plug-In Electric Vehicles do you think will be on the road in the United States by 2025?

Count	Response
1	?
1	5%
1	10%
1	40%

Count	Response
1	20,000
1	50,000
1	75,000
1	80,000
3	10,0000
1	150,000
1	200,000
1	250,000
2	300,000
2	350,000
1	400,000
1	480,000
3	500,000
2	750,000
3	800,000
9	1,000,000
1	1,200,000
6	1,500,000
1	1,800,000
5	2,000,000
10	2,000,000
1	2,100,000
1	2,500,000
3	2,500,000
1	2,800,000
4	3,000,000
4	3,000,000
5	4,000,000
5	5,000,000
8	5,000,000
2	6,000,000
1	9,000,000
12	10,000,000
1	12,000,000
1	12,000,000
4	15,000,000
3	20,000,000
1	30,000,000
1	50,000,000

10) Please rate the factors with regards to impeding the growth of the Plug-In Electric Vehicle industry (5 stars = Greatest Impediment).

Technology limitations	Average Rank 3.12 • Count: 138 • Min: 1 / Max: 5 • StdDev:1.27

Customer PEV adoption rates	Average Rank 3.90 • Count: 138 • Min: 1 / Max: 5 • StdDev:1.09
Uncertain regulatory policies and regulation	Average Rank 2.43 • Count: 136 • Min: 1 / Max: 5 • StdDev:1.15
No economic incentive to install and manage EVSE equipment	Average Rank 2.87 • Count: 135 • Min: 1 / Max: 5 • StdDev:1.25
No opportunity for venture investment in industry	Average Rank 2.30 • Count: 133 • Min: 1 / Max: 5 • StdDev:1.10
Uncertain long term future of the Plug-In Electric Vehicle industry	Average Rank 3.04 • Count: 136 • Min: 1 / Max: 5 • StdDev:1.31
Other	Average Rank 4.42 • Count: 38 • Min: 1 / Max: 5 • StdDev:1.12

11) If you selected "Other", please specify.

Count	Response
11	Consumer education/knowledge of plug in electric vehicle technologies.
3	Price of fuel
3	Cost of gas is too cheap, cost of EVs are too high (i.e. they dont "payback")
2	Poorly executed US Dept of Energy EV Infrastructure Project
1	Availability of wireless charging
1	Barriers are different in various regions or markets
1	High technology cost due to low production volumes
1	Lack of infrastructure to support Electric Charging
1	Low interest loans for private industry to install battery switch stations in the US.
1	Market fragmentation, lack of standarization, too many options, not enough focus.
1	On-board charging rate, vehicle purchase price
1	People don't like change.
1	See comment under 4.
1	The economics aren't there right now for the average owner.
1	Inconsistent policy support at State and Federal levels.
1	Prices need to be lower w/o incentives. Leases vs. purchases are not a good route to go.
1	Profit realization: we don't have the right business model yet for all pertinent players to make an adequate return on investment. When that happens, they will take off.

Count	Response
1	Availability of charging stations make current ownership of evs a nightmare and owners get stressed because of limited range and few charging stations
1	Ambiguity with infrastructure standardization - have Chademo/SAE competing std for DCFC. DC Level 1 charging and AC Level 1/2 compabitlity, wireless charging being developed, Tesla unique infrastructure, certified interoperability of EVSE with all PEV models, smart EVSEs definition, standard network communications between EVSE providers, and cost
1	Terrible business model being adopted by car manufacturers. Cars are small, funny looking and come at a very high price premium. There is also a disconnect between corporations and dealerships. An EV is only one more car for a dealer...
1	Lack of economies of scale and high battery costs combine to create an unacceptable price premium compared to ICE vehicles.
1	Volatile gas prices, when they drop significantly after a steady rise. (in Oregon they dropped nearly 50 cents a gallon in less than a week.)
1	Range of vehicles limits them to commercial fleet applications as people can't afford an electric car and a road trip car.
1	Two things: Battery Technology must improve and Initial cost of the vehicle must be more affordable.
1	Auto and EVSE manufacturers telling drivers that they "need" $1,000 - $5,000 home charging unit installations and public charging (when existing household and workplace outlets can satisfy the needs of the overwhelming majority of drivers (see 2009 FHA survey of U.S. drivers)

12) Please rate the following factors in relation to their importance in the evolution of Electric Vehicle Supply Equipment (EVSE) Technology (5 stars = Greatest Importance).

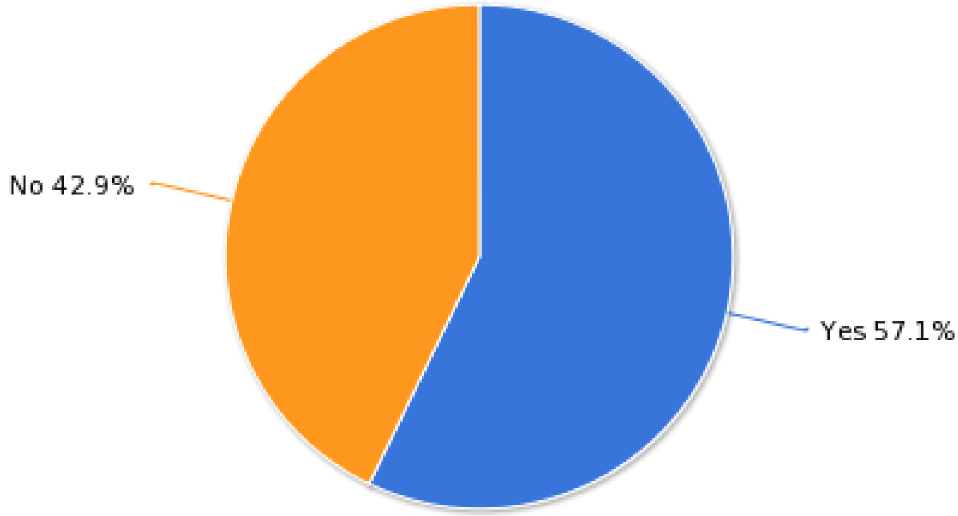
Time to charge Plug-In Electric Vehicles	Average Rank 3.74 • Count: 138 • Min: 1 / Max: 5 • StdDev:1.16
Installation of EVSEs	Average Rank 3.18 • Count: 136 • Min: 1 / Max: 5 • StdDev:1.14
Use of EVSEs	Average Rank 2.86 • Count: 133 • Min: 1 / Max: 5 • StdDev:1.09
Remote communications with EVSEs	Average Rank 2.52 • Count: 132 • Min: 1 / Max: 5 • StdDev:1.17
Interoperability across all Plug-In Electric Vehicles	Average Rank 3.80 • Count: 138 • Min: 1 / Max: 5 • StdDev:1.26

Interoperability across EVSE management systems and future applications	Average Rank 3.66 • Count: 135 • Min: 1 / Max: 5 • StdDev:1.30
Cost of EVSEs and installation	Average Rank 3.99 • Count: 139 • Min: 1 / Max: 5 • StdDev:1.07
Other	Average Rank 4.50 • Count: 12 • Min: 1 / Max: 5 • StdDev:1.12

13) If you selected "Other", please specify.

Count	Response
1	Advent of smart EVSEs without standardization and definition - proprietary networks
1	All of the back end planning and implementation - many considerations needed.
1	Business model for installation of EVSE with positive rate of return for EVSE installer
1	Evolution of Technology for Vehicle Battery Packs
1	Standard for DC fast chargers.
1	Cost of fuel
1	Educating the public
1	This survey looks like it is describing problems with pure BEV adoption; EREVs and PHEVs don't have these range and charge-time barriers. The main barriers on the EVSE side are costs and perceived costs/benefits. Subscription/membership plans are also adding a complexity that isn't really helpful
1	Mass market purchases. (Limited production of EVSEs and cost of the connectors) are resulting in prices that are really high even for a basic EVSE. the electronics and hardware are not worth $750 for the lowest price model, but once competition enters the market and prices drop to under $300, sales of EVSE will skyrocket.
1	In 20 years, the EVSE will be completely different from today's EVSE. Battery storage will be greater and many more homes will be up fitted for home charging.
1	"EVSE" must evolve to be easy and cheap. And if there's any "smart grid" features or remote control of charging (by an ISO, utility or anybody else), it had better be easy for an average American to understand and result in a check that's unambiguously higher than the cost required to participate (not clear how this will be accomplished).
1	There is almost no thought being given to non-network alternatives to Blink and ChargePoint. Also parking lot owners and operators will be buying chargers to support their customers, is there a process in place to bring them into the process?

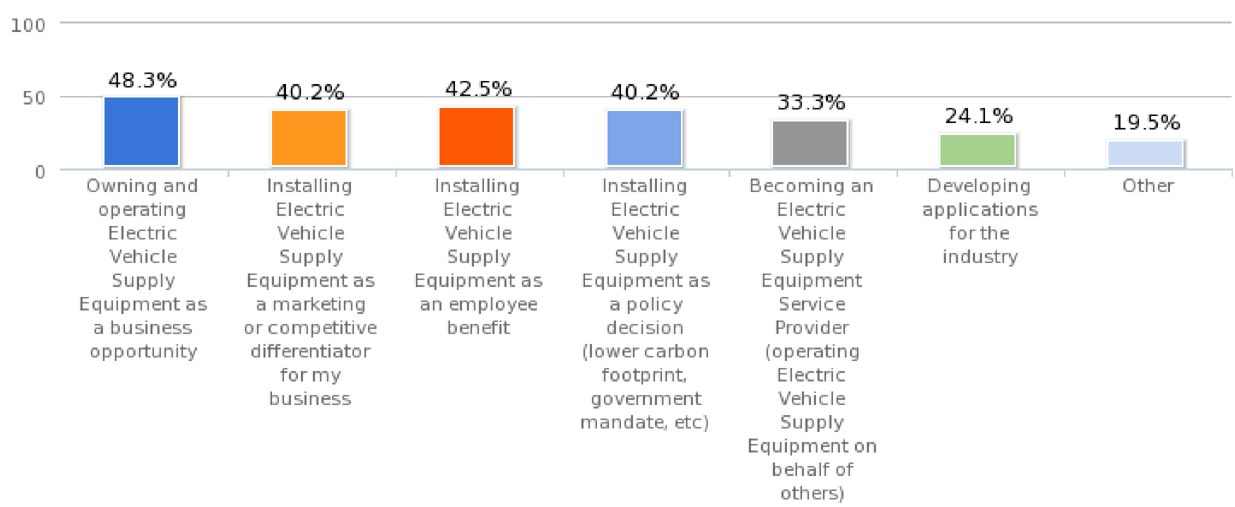
14) Have you or your organization ever developed a business case or evaluation for installing or selling electric vehicle charging equipment?



Value	Count	Percent
Yes	80	57.1%
No	60	42.9%

Statistics	
Total Responses	140

15) Please indicate the business case or analysis you developed. Check all that apply.



Value	Count	Percent
Owning and operating Electric Vehicle Supply Equipment as a business opportunity	42	48.3%
Installing Electric Vehicle Supply Equipment as a marketing or competitive differentiator for my business	35	40.2%
Installing Electric Vehicle Supply Equipment as an employee benefit	37	42.5%
Installing Electric Vehicle Supply Equipment as a policy decision (lower carbon footprint, government mandate, etc)	35	40.2%
Becoming an Electric Vehicle Supply Equipment Service Provider (operating Electric Vehicle Supply Equipment on behalf of others)	29	33.3%

Value	Count	Percent
Developing applications for the industry	21	24.1%
Other	17	19.5%

Statistics	
Total Responses	87

Open-Text Response Breakdown for "Other"	Count
Designing, manufacturing and marketing EVSEs	2
EVSE's sales	2
As a Pilot to evaluate utilization	1
Documented 96 EVSE deployment	1
Energy storage and inverters	1
EVSE Development	1
Installation Guides, workplace charging, Multifamily dwellings, public installations	1
Installing and operating battery switch stations	1
Installing EVSE in Multi Unit Dwellings	1
Making infrastructure available to the public	1
Mobile Payments for EV charging	1
N/A	1
Optimum placement of EVSE	1
Partnering to make EVSEs accessible to EV customers	1
ROI for EV Driver	1

16) Please rate the importance of the following business models based on which one you believe will help the Plug-In Electric Vehicle industry expand (5 stars = Most Helpful).

Public sector financed charging stations	Average Rank 2.77 • Count: 127 • Min: 1 / Max: 5 • StdDev:1.17
Private sector financed charging stations	Average Rank 3.60 • Count: 129 • Min: 1 / Max: 5 • StdDev:1.06
A mix of public and private financed charging stations	Average Rank 4.06 • Count: 134 • Min: 1 / Max: 5 • StdDev:1.17
Other model	Average Rank 4.00 • Count: 11 • Min: 1 / Max: 5 • StdDev:1.48

17) If you selected "Other", please specify.

Count	Response
3	Rate-based utility owned charging stations
1	Public sector financing for battery switch station networks
1	Varies as the electric market structure varies across different regions
1	The importance stressed on EVSE's is a major distraction that is killing the industry. If we spent just half the time stressing no range limitation PHEVs, infrastructure discussion would go away. As it stands EV "experts" have made a career creating a problem so they can have a career addressing the problem.
1	Return on investment requirements for private sector could cause providers to charge rates for charging that mitigate the savings for driving electric vs. gasoline.
1	The industry needs to eliminate the proprietary EVSE networked systems (such as ChargePoint and Ecotality). They are too complex, confusing, and not interchangeable. For example: An Ecotality customer must order an RFID card off the web before they can use the Blink system. That's not intuitive, and doesn't allow the casual driver to pull up and charge their EV. Let's put in basic, "plug n charge", EVSEs as public infrastructure to encourage people to purchase EVs.
1	The EVSE is an electrical appliance and should sell at a cost point less than $ 99.00 and be installed by the user. Garages and carports would be connected to 240 / 208 VAC Outlet with 30 A or 50 output.
1	Business model: make it easier and cheaper to charge; show drivers how to use existing NEMA-standard equipment to charge their cars. No special equipment...no special permits or electrical standards.. no special electric rates.
1	Public subsidies (of public and private investment) based on environmental, economic, and security benefits to public at large.

18) Please rate the following payment methods for paying for PEV charging (5 stars = Most Preferred).

$ per unit of fuel	Average Rank 3.37 • Count: 129 • Min: 1 / Max: 5 • StdDev:1.62
$ per mile charged	Average Rank 1.96 • Count: 125 • Min: 1 / Max: 5 • StdDev:1.24
$ per hour of connectivity	Average Rank 2.95 • Count: 133 • Min: 1 / Max: 5 • StdDev:1.47
Flat connectivity fee per use	Average Rank 2.73 • Count: 131 • Min: 1 / Max: 5 • StdDev:1.39
Subscription fee (monthly, annually) for unlimited use	Average Rank 3.03 • Count: 133 • Min: 1 / Max: 5 • StdDev:1.42

Subscription fee (monthly, for fixed number of hours or charges, then additional fees apply)	Average Rank 2.59 • Count: 130 • Min: 1 / Max: 5 • StdDev:1.35
Other	Average Rank 4.00 • Count: 10 • Min: 1 / Max: 5 • StdDev:1.61

19) If you selected "Other", please specify.

Count	Response
1	A complex Service level Agreement-SLA
1	Monthly per miles driven on an annualized basis.
1	People want to pay and go with no other obligations. Look at Mobile Speed Pass adoption rates
1	The subscription models are invariably proprietary networks and are short sighted foolish.
1	Minute charging increments
1	Part of a "benefit" package from an employer to encourage EV use. However the preferred method of payment depends on whether owner of the charging stations is a utility or agency wishing to make money or the EVC is provided more as a courtesy. Too many variables to answer this question meaningfully.
1	I think there will need to be a mix of choices. to predict which one is most preferred, depends on your point of view. 1- As the consumer- Lowest cost, may be by amount of fuel, or flat fee, but if there is no penalty, why not stay connected as long as you need to. 2- As the Seller- $ per hour connectivity makes the most sense,.
1	Just a comment: the only entity that likes or benefits from a subscription fee is somebody that's done the financial math on EVSE ownership & operation and has realized that they'll never recover their money, let alone a rate of return.
1	It isn't just the method of payment, but also the amount charged. In these early years we have to be reasonable and "friendly" to entice and reward early PEV technology adopters - not scare them away. Free access to electricity until we build some momentum in the market makes a lot of sense.
1	PEV Charging should be by standard kWh rates with incentives or controls to use best time and lowest rates depending on required usage time.
1	If you value public infrastructure, it looks like the subscription fee approach has the best shot of success.

20) Please rate the following methods used to activate Electric Vehicle Supply Equipment (5 stars = Most Preferred).

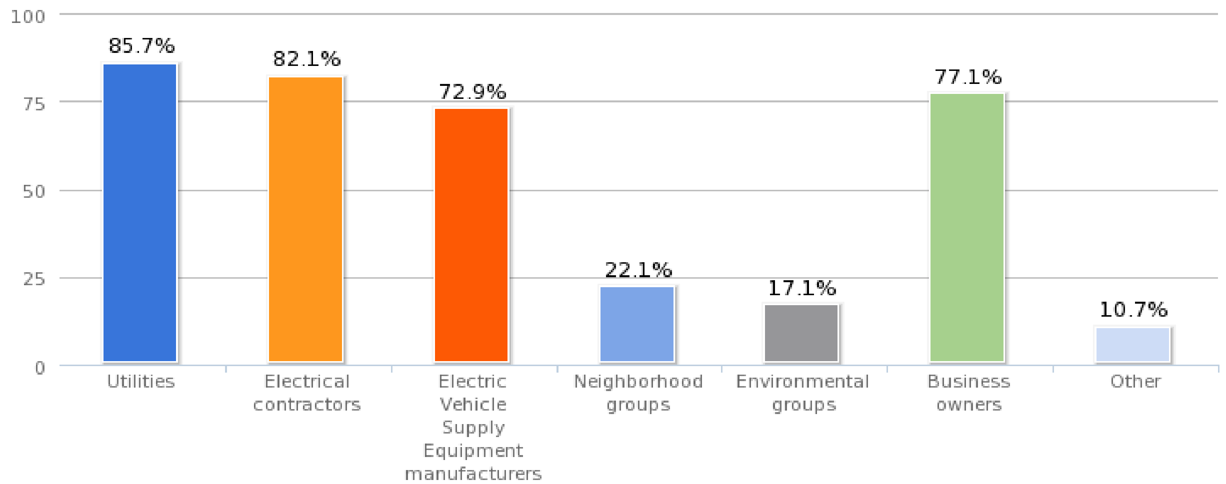
Credit Card	Average Rank 4.29 • Count: 136 • Min: 1 / Max: 5 • StdDev:1.10
"Users Card" that collects information on charging activities and bills customers periodically	Average Rank 3.14 Count: 130 Min: 1 / Max: 5 StdDev:1.42
Pre-paid cards	Average Rank 2.63 • Count: 131 • Min: 1 / Max: 5 • StdDev:1.31

Subscription service	Average Rank 2.87 • Count: 131 • Min: 1 / Max: 5 • StdDev:1.33
QR codes (read by smart phones)	Average Rank 3.17 • Count: 131 • Min: 1 / Max: 5 • StdDev:1.43
Call-in numbers that provide a code	Average Rank 1.86 • Count: 126 • Min: 1 / Max: 5 • StdDev:1.17
Other	Average Rank 4.73 • Count: 11 • Min: 2 / Max: 5 • StdDev:0.86

21) If you selected "Other", please specify.

Count	Response
1	Free
1	People want what they are familiar with.
1	Simple, simple, simple. Low-cost, low-cost, low-cost.
1	Smart PLC comunication between car and EVSE following IEC 15118 (plug an charge)
1	Wired or wireless communication with vehicle with "established" payment method
1	Smart phone application that uses web interface to start and end charging sequence, and billed back to user via monthly bills for phone.
1	Pay by phone systems (Liberty Plugins, ParkNow, ParkMobile, PayByPhone, QuickPay, PaynGo, Google wallet, PayPass, ...)
1	The car has a serial number. The charger can read it electronically. Owner plugs it in and the power consumed is automatically billed to the owner.
1	Wanted to add a commentary. Payment method is really dependent on where the EVC stations are located. If at a train station then payment needs to be quicker, more convenient than if at a shopping center or parking garage.
1	Cash, using existing vending machine standards (coin/bill acceptors). Again theme here is: easy for the driver.
1	Near Field Communications (NFC) chips added to cell phones merely replace the credit card "swipe" and require a point-of-sale (POS) system to complete the transaction. Parking lots and city streets don't have these readily available and it will be expensive to add (i.e. Blink and ChargePoint). Pay-by-phone systems where the drivers' create an account and draw from that eliminate the need to turn the EVSE into a POS system.
1	Every method currently available for fueling plus new methods being used in other retail operations.
1	Again, the responses above, As the supplier, you certainly need to provide options, and would love to collect data. As a support, having a call in as a back up makes sense as well. For a consumer, make it be easy use a credit card system.

22) Which groups should be involved with the installation and maintenance of Electric Vehicle Supply Equipment? Select all that apply.

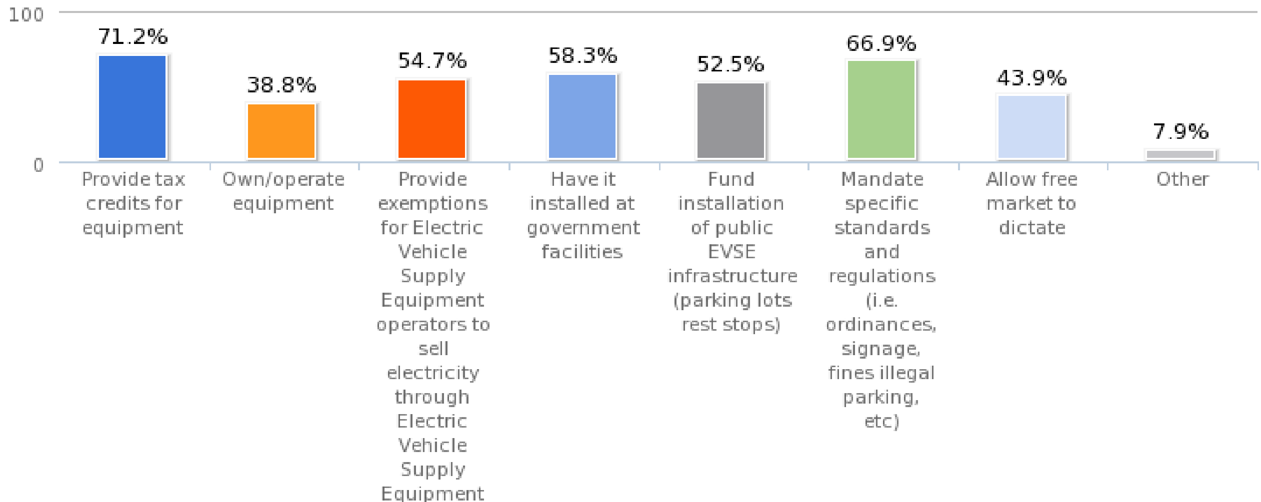


Value	Count	Percent
Utilities	120	85.7%
Electrical contractors	115	82.1%
Electric Vehicle Supply Equipment manufacturers	102	72.9%
Neighborhood groups	31	22.1%
Environmental groups	24	17.1%
Business owners	108	77.1%
Other	15	10.7%

Statistics	
Total Responses	140

Open-Text Response Breakdown for "Other"	Count
Government	3
EVSE service providers	2
"Fuel providers" that lease land from host	1
Any group that wants to promote them. The more the merrier, but the operator is the one that should ensure that they have a sound business model	1
Commercial and municipal parking operations	1
Commercial retailers Lowes, Home Depot	1
co-ops or similar orgs	1
EV owners	1
Multi-unit housing owners	1
Only entities and groups currently involved in installation of any electricity-consuming device	1
Owner of the EVSE	1
Universities	1

23) How should local, state or federal governments be involved in the growth and development of the infrastructure? Select all that apply.

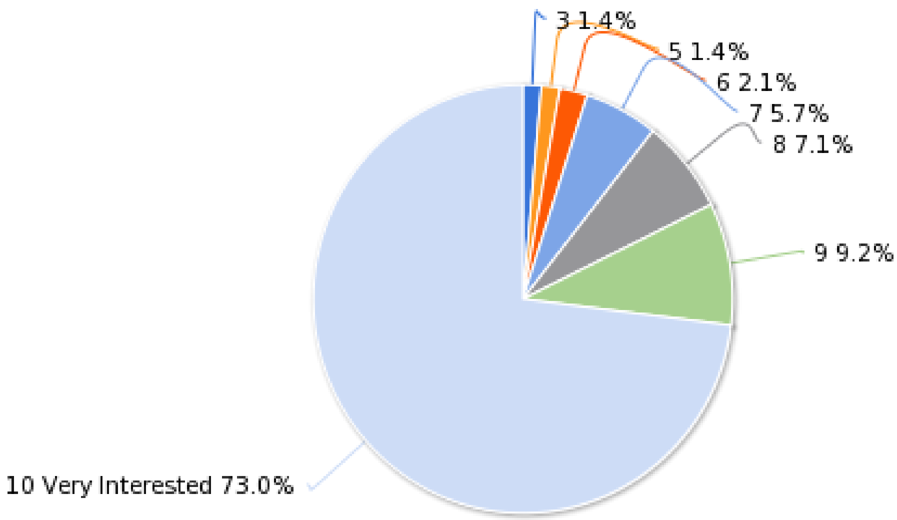


Value	Count	Percent
Provide tax credits for equipment	99	71.2%
Own/operate equipment	54	38.8%
Provide exemptions for Electric Vehicle Supply Equipment operators to sell electricity through Electric Vehicle Supply Equipment	76	54.7%
Have it installed at government facilities	81	58.3%
Fund installation of public EVSE infrastructure (parking lots rest stops)	73	52.5%
Mandate specific standards and regulations (i.e. ordinances, signage, fines illegal parking, etc)	93	66.9%
Allow free market to dictate	61	43.9%
Other	11	7.9%

Statistics	
Total Responses	139

Open-Text Response Breakdown for "Other"	Count
Accelerated depreciation on assets, allocated carbon credits	1
Building Codes requiring new construction to be EVSE wired	1
CAFE mandates + incentives to get PHEV vehicles in the market	1
Education	1
Provide loans to close upfront cost gap and let free market decide from there.	1
Provide money ONLY for vehicle purchase; no "EVSE" subsidy allowed	1
Mix of public and private efforts	1
Public private partnerships	1
Tax credits for a set period of time(ex: 10 years)	1
Governments shouldn't be needed to spend all their money. Allowing operators to have facilities at rest stops or on government facilities for either employee or for public use (with a fee) should be allowed. Signage standards and fines should be enacted.	1
Rest stops are a horrible idea for PEV charging - who will be willing to stop on a long-distance trip for at least 30 minutes (more likely a few hours) to charge? That's why EREVs and PHEVs were invented. Also, tax credits should also cover the cost to install the equipment (not just the hardware). And listen to customers - they will ask for charging locations where most needed. Be practical - the last thing we need is poor use of public funds for charge stations that won't be used. Key are high-end condos/apartments/multifamily buildings, workplaces, and some destination charging - where PEVs are parked for at least several hours.	1

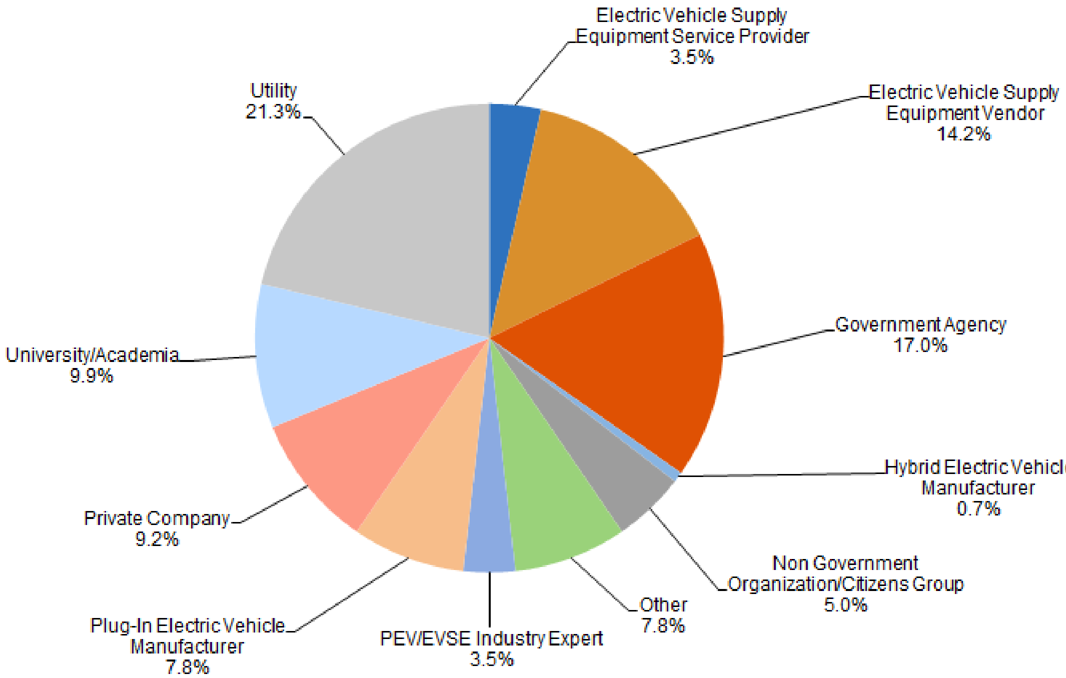
24) On a scale from 1-10 where 1 is Not Interested at all and 10 is Very Interested, please indicate your level of interest in the Plug-In Electric Vehicle industry.



Value	Count	Percent
1 Not Interested	0	0%
2	0	0%
3	2	1.4%
4	0	0%
5	2	1.4%
6	3	2.1%
7	8	5.7%
8	10	7.1%
9	13	9.2%
10 Very Interested	103	73%

Statistics	
Total Responses	141
Sum	1,317.0
Average	9.3
StdDev	1.36
Max	10.0

25) Which category best describes your industry relationship?

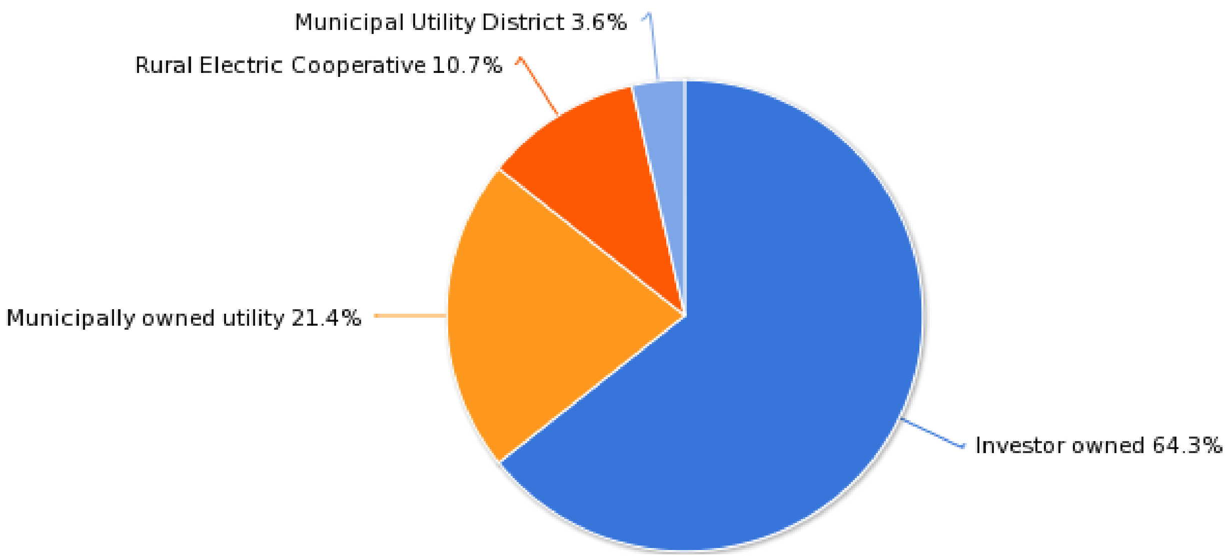


Value	Count	Percent
Utility	30	21.3%
Government Utility	0	0%
Government Agency	24	17%
Electric Vehicle Supply Equipment Vendor	20	14.2%
Electric Vehicle Supply Equipment Service Provider	5	3.5%
Plug-In Electric Vehicle Manufacturer	11	7.8%
Hybrid Electric Vehicle Manufacturer	1	0.7%
Non Government Organization/Citizens Group	7	5%
PEV/EVSE Industry Expert	5	3.5%
University/Academia	14	9.9%
Private Company	13	9.2%
Other	11	7.8%

Statistics	
Total Responses	141

Open-Text Response Breakdown for "Other"	Count
Battery Manufacturer	1
Federal Utility	1
ISO	1
Industry Consultant	1
Non-profit research (not citizen or advocacy)	2
PEV Owner (Volt)	1
e-Mobility Operator selling access to charge and customer services	1
Electrical safety	1
Planning & development consultant	1
Sales of evs	1

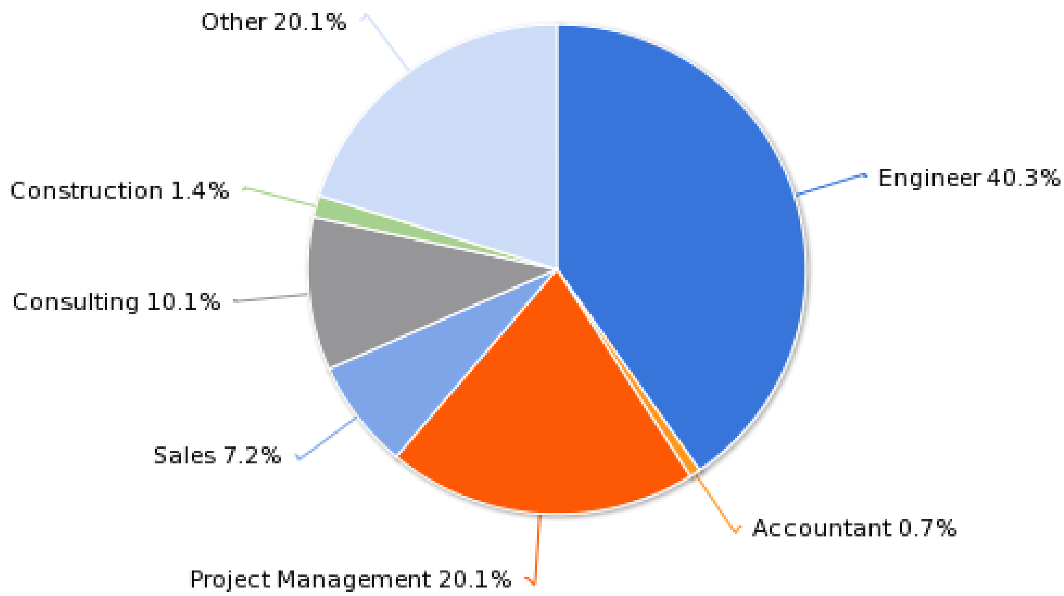
26) What type of utility?



Value	Count	Percent
Investor owned	18	64.3%
Municipally owned utility	6	21.4%
Rural Electric Cooperative	3	10.7%
Municipal Utility District	1	3.6%

Statistics	
Total Responses	28

27) What is your professional background?



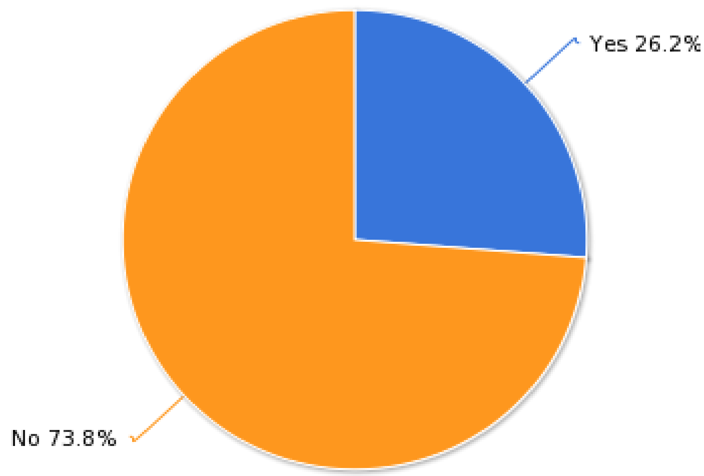
Value	Count	Percent
Engineer	56	40.3%
Accountant	1	0.7%
Project Management	28	20.1%
Sales	10	7.2%
Consulting	14	10.1%
Construction	2	1.4%
Other	28	20.1%

Statistics	
Total Responses	139

Open-Text Response Breakdown for "Other"	Count
Management	2
Airline pilot for 30 years before starting my business, Metro Plug-In.	1
Attorney/Government	1
Attorney/policy expert	1
Communication, Marketing	1
Economist	1
Education	1
Energy Analyst	1
Engineering & Economics	1
Entrepreneur	1
Executive	1
Finance, Marketing	1
General Management	1
Govt Administrator	1
Management in Generation, Distribution, Safety and Fleet	1
Management/Marketing	1
Manufacturing Management	1
Nuclear engineering background from US Navy, Electrician	1

Open-Text Response Breakdown for "Other"	Count
Policy	1
Program manager	1
Public service	1
R&D	1
Research scientist	1
Researcher	1
Teacher/Educator	1
Transportation planner	1
Transportation Planning	1

28) Do you currently own a Plug-In Electric Vehicle?



Value	Count	Percent
Yes	37	26.2%
No	104	73.8%

Statistics	
Total Responses	141

29) Are you planning on purchasing a Plug-In Electric Vehicle in the next 12 months?

Value	Count	Percent
Yes	41	29.5%
No	62	44.6%
Unsure	36	25.9%

Statistics	
Total Responses	139

30) What is the zip code of your residence?

Count	Response	Count	Response	Count	Response
1	02050	1	31558	1	78602
1	02906	1	32803	1	78640
1	06107	2	32819	1	78652
1	07677	1	32952	2	78660
1	10940	1	33186	1	78665
1	10999	1	33470	1	78681
1	12169	1	37205	1	78703
1	12309	1	37411	1	78705
1	12550	1	37416	1	78730
1	13031	1	37863	1	78731
1	17022	1	38566	1	78739
1	17078	1	42166	1	78741
1	19002	1	45230	1	78747
1	20723	1	46220	1	78749
1	21401	1	48034	1	78756
1	21403	1	48075	2	78759
1	21702	1	48178	1	78942
1	21771	1	48202	1	80031
1	21778	1	48301	1	80230
1	22959	1	48307	1	80525
1	23219	1	48309	1	83401
1	27502	1	48334	1	83642
1	27510	1	55902	1	90034
1	27517	1	60175	1	90241
1	27518	1	60194	1	90501
1	27519	1	60516	1	91202
1	27526	1	62294	1	91910
1	27529	1	66044	1	92107
1	27539	1	67207	1	92627
1	27540	1	75225	1	92648
2	27602	1	76065	1	92869
1	27606	1	77318	1	94534
1	27614	1	77345	1	95037
1	27616	1	77354	1	95616
1	28078	1	77381	1	96816
1	28209	1	77469	1	97007
1	28215	1	78006	1	97045
1	28226	1	78023	1	97068
1	28801	1	78055	1	97215
1	29492	1	78213	1	97239
1	30008	1	78228	1	98144
1	30030	1	78232	1	98362
1	30033	2	78249	1	Israel
1	30052	1	78257		
1	30189	1	78258		

31) What is the zip code of your business?

Count	Response	Count	Response	Count	Response
1	02169	1	30329	1	78249
1	02906	1	30336	1	78253
1	06103	1	32746	2	78602
1	07645	2	32801	1	78636
1	07677	1	33137	1	78681
1	12169	1	33408	4	78701
1	12203	1	35401	1	78702
1	12550	2	37075	1	78703
1	13209	1	37229	4	78704
1	17022	2	37402	1	78712
1	17111	1	37882	1	78723
1	20715	1	40508	1	78730
1	21046	1	46013	1	78744
1	21201	1	48098	1	78749
1	21704	1	48187	1	80202
2	21778	2	48202	1	80401
1	22903	1	48243	1	80524
1	23219	1	48265	1	83415
1	24540	1	48301	1	83702
1	27278	1	48307	1	90232
1	27529	1	48336	1	90501
1	27539	1	55902	1	90630
1	27560	1	60005	1	91016
1	27601	1	60439	1	91770
2	27602	2	60601	1	91914
2	27606	1	64082	1	92123
1	27607	1	66601	1	92627
1	27611	1	67201	1	92648
1	27616	1	75006	1	94303
1	27695	1	75212	1	95603
1	27699	1	76574	2	95616
1	28208	2	77002	1	96840
1	28212	1	77077	2	97201
1	28213	1	77079	2	97204
1	28285	1	77339	1	97223
1	28806	1	77381	1	98134
1	29492	1	78204	1	98362
1	30303	1	78207	1	Germany
1	30307	1	78217	1	Israel
1	30308	1	78238		

32) What other major ideas, issues or concerns not asked here should be addressed as the industry develops?

Count	Response
1	Charging options and availability in urban settings (On street parking)
1	COST! Ease of permitting, thought to the trip hazards, i.e. retractable cords,
1	Charging system fires at night
1	Consult the Town of Normal, ILL on their aggressive program for EV readiness...se EVTown.org
1	Create EV plug-in standards
1	Culture change public education energy literacy youth involvement
1	EV friendly Building Codes for existing infrastructure
1	EV-Smart Grid interaction Smart phone/tablet apps that help monitor and manage charging
1	Education about PEVs, and the infrastructure.
1	Just focus on compatibility and competition.
1	Lithium usage
1	Look to other countries for ideas on driving this industry forward in the US
1	Range placement plans "how far between stations, Interstates, tollways targeted".
1	Requiring EV charging in new construction
1	Trade-in or resale value of vehicles battery swap-outs or replacement longevity
1	Fleet use of plug-in vehicles, development of medium and heavy-duty vehicles
1	Need clearer comparison of price per mile. need to change the metric from mpg to $pm.
1	Need to make technology affordable and reliable.
1	Safety of charging public
1	Targeting specialized industry/business sectors that could potentially drive growth of PEVs
1	Utility limiting Level II charging rate to 6.6 kw/hr
1	Infrastructure does not drive PEV sales. The first priority now is to get people to test drive PEVs, get excited, and buy these vehicles. Stakeholders need to focus on events, awareness, education, outreach - and use vehicle sales as the only real metric that matters. The infrastructure can be helpful to raise some awareness, but should be driven by customers who already have PEVs. They will tell you what makes sense.
1	The cost drivers for infrastructure installation and maintenance need to be addressed - there is also the impression that faster charging at home is a necessity which will have significant implications for the grid and cost to the customer.
1	Commonality of connectors for recharging vehicles, all EVSE vendors as well as vehicle mfg.s should be providing the same connectors.
1	How will advances in battery technology over the next 15 to 20 years (e.g. a 300 mile range BEV for under $35,000) affect the demand for charging? How will garage orphans charge their vehicles? How will dependency on rare earth metals be addressed?
1	Local, state and federal entities should set a goal in terms of percentage of their new fleet acquisitions to be plug in vehicles, and also mandate a certain percentage of parking spots in all commercial buildings and government buildings be equipped with charging stations.
1	This must always be true, or people will not drive PEVs >>> ([Plug-in hybrid all-gasoline MPG] / 3) x [all-in cost/kWh] < [$/gallon of gasoline] Today, at $0.30/kWh all-in, a plug-in Prius driver is economically indifferent to electricity vs. $5/gallon of gasoline. You can't buy much "EVSE" or charge very fast when exposed to a demand charge and stay under that $0.30/kWh number. The industry and customers need to come to understand this.
1	Alternative generation of electricity so electric companies cannot adjust rates for E owners most popular myth " it will cost everyone a whole lot more for electricity when EVs become more numerous"
1	Look at the data from the EV project and provided by plug in America on public EVSE infrastructure and its low usage. Restrict committing public funds to more public infrastructure
1	Need a free market w/o government subsidies for charging infrastructure. All government subsidies should go toward purchase of PHEV and not infrastructure. The government is create a culture similar to that of the solar industry, which continues to fail as subsidies disappear.

Count	Response
1	Availability of work place charging understanding the split between PHEVs and BEVs -- likely 10:1 towards PHEVs cost effective AER ~10-20 miles
1	I think that getting vehicles out to events where people can see them and getting people to test drive or use them will make the most difference. "Range Awareness" of what people really "need" vs. what they "want" will help with Range anxiety. If someone will come out with an under $20,000 priced EV that will get close to 100 miles on a charge, that will help immensely.
1	Allowing a MSV (Middle Speed Vehicle) category for electric vehicles to operate "SAFELY" on highways 45 MPH and less.
1	Given the expense of FastDC chargers and the cost of installation and support of the 480v circuits required, it might be better to create public-private partnerships to provide the needed funds in an acceptable timeframe. This approach would spread risk and also provide new sources of revenue to strapped municipalities.
1	Need to engage with car makers to develop a completely different business model to put more vehicles on the streets, even if they do not make any money initially. Remove the dealers from the equation by giving them a flat incentive (i.e. $500 per vehicle leased). All financing should be handled by the corporations at a national scale. Pricing should be transparent. Vehicles should be leased ONLY for the first 2-3 years so manufacturers assume all the RISK.
1	DC Fast Charging is too expensive to install to be commercially viable. Focus on improving the EV on-board charger. Tesla batteries charge at 240V/80A (possibly faster). This is more than sufficient for most, if not all, PEVs.
1	Keep looking at all aspects of PEVs through the customer's eyes.. make it simple, easy, convenient, and lower cost
1	Maximize Level 1 public charging and develop models for DC Fast charging on highways to connect cities for drivers of EVs
1	How to get people to understand what EV's really are. There is a lot of misinformation and misunderstanding.
1	Need continued education to inform he public. Need the OEMs to create an AFFORDABLE option to purchase!!!!
1	Time of use rates for electricity will promote charging at off peak hours, making the transition easier for utilities and cheaper for EV owners. This is a critical step in lowering total cost of ownership for EVs.
1	It makes no sense to have the government give tax credits to citizens and provide no incentives to all governmental units smaller than the feds. They are economically streched and simply cannot justify spending $7500 more for doing the right thing.
1	Charging standards. Some groups are promoting different plug and electrical standards for the charging infrastructure. This is not a good time to argue about these standards.
1	Many potential EV customers are put off by the potential battery costs in 8 to 10 years. We need some sort of industry-wide initiative to either re-cycle, re-use, or give credit for the old batteries. Remove potential EV consumer's fears about the battery cost later.
1	Price premium prevents adoption. Adoption prevents economies of scale. Lack of economies of scale prevents widespread installation of EVSEs and keeps range anxiety a factor. The negative reinforcement cycle continues. Thus, IMHO the price premium is the critical path.
1	120 volt charging should be encouraged and charging at home. Plug-in Hybrids may be an easier bridge for consumers than Battery EVs and the requisite extensive infrastructure.
1	Public image of PEVs - it is becoming a liberal vs conservative issue with conservatives irrational opposing EVs. I have heard people refer to a Chevy Volt as an "Obamamobile."
1	How can government help spur the innovations that will make PHEV's more competitive and successful
1	Grow smart phone apps to locate EVC stations or have manufacturers incorporate in vehicle GPS. Pricing remains the big mystery with no clear cut model for how it should be done as far as I know. To gain widespread acceptance, one model for pricing should emerge.
1	Standards remaining free from proprietary definitions. Not allowing the definition of standards to become monopolized, including software and hardware of EVSE.
1	What are the drivers that make EVs a good idea? Is it an environmental issue? Is it a fuel security issue? Is it an economic issue?
1	Solar electric production at EV charging sites, such as solar parking shade canopies. EVs as mitigation in poor air quality areas.
1	Fast charging may require attendants (or valets) to ensure equipment is well utilized. Where would this be cost effective?

Appendix A
CONSOLIDATED REPORT RECOMMENDATIONS

This Appendix consolidates recommendations from the Plan. All recommendations are directed to a formalized Texas River Cities (TRC) entity unless otherwise specified. The staffing, governance structure, and legal status of the TRC entity is discussed further in Section 9: Creation, Administration, Growth of the Texas River Cities Initiative. The final scope of TRC work ultimately depends largely upon the funding available to support efforts moving forward.

Section 2: Needs Analysis, Typology, and Best Practices Guide

Companies and local governments interested in installing EVSE may utilize the best practices guides and tools provided in this report to develop plans for installing and operating EVSE.

Recommendation 1

A designated PEV charging infrastructure team with a formal project manager is essential to develop and execute project plans. TRC will serve as a consulting resource to companies and local governments to assist with project planning and execution.

Recommendation 2

TRC will periodically update the included EVSE Typology Landscape document and model. Furthermore, TRC will designate an organization or TRC subteam with technical experience to take over management of the document in the future.

Recommendation 3

TRC will cross-analyze the included EVSE Typology Landscape with the market research and lessons learned to identify new products or applications development opportunities to share with the industry.

Recommendation 4

TRC will conduct market analysis on Level 1 EVSE infrastructure and investigate it in conjunction with multifamily and workplace pilots in the region as well as business-model development to determine if there is a market for implementation.

Recommendation 5

TRC will become a regional channel for the development and dissemination of marketing outreach and education materials for the PEV/EVSE industry in the region.

Recommendation 6

TRC will work with the PEV original equipment manufacturers (OEMs) to help identify PEV location and attributes using vehicle identification numbers (VINs) or other methods to indicate features of vehicles that might impact electric system reliability.

Recommendation 7

TRC will continue to work with Pecan Street Inc. and others to collect, analyze and disseminate data to better understand when and where PEV charging occurs and how emerging technologies and new business models can mitigate PEV charging impacts.

Section 3: EVSE Codes, Ordinances and Permitting Toolkit

In order to reduce development time and costs, local governments preparing for PEV adoption may utilize the templates and tools in this section.

Recommendation 1

Local governments across the TRC region may use this toolkit to update codes or create customized local ordinances as applicable to prepare for PEVs and the electric infrastructure necessary to support them.

Recommendation 2

Local entities with an interest in creating standard PEV ordinances should find a local champion to lead the initiative.

Recommendation 3

The Plan ordinance toolkit will be maintained and updated by TRC to ensure the toolkit is up to date with changing electric vehicle definitions, regulations, standards, and technologies. Such tools will be made available through a web site and be supported by TRC outreach.

Recommendation 4

TRC will incorporate interim EVSE signage into the Plan toolkit until federal signage standards are adopted and approved.

Recommendation 5

TRC will recommend that interim EVSE parking-space markings consistent with the Texas Department of Licensing and Regulation (TDLR) will be incorporated across the TRC region until formal federal accessibility guidelines are adopted.

Recommendation 6

Publicly available EVSE will be inspected periodically by the operating entity to ensure proper operation. EVSE specifications, coordinates, and addresses will be verified to ensure they are entered accurately in mapping databases to help PEV owners locate the charging stations.

Recommendation 7

TRC will provide links on its website to regional EVSE databases that will allow PEV owners to access it on a real-time basis to view geographic and operational information on all public EVSE.

Section 4: Workplace and Multifamily Housing Issue Identification

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The role of TRC with respect to multifamily and workplace charging issues is to provide clear, concise information to employees, tenants, and property managers. The Plan also includes a sample utility pilot to include rebated charging infrastructure installed at multifamily premises. These initial recommendations apply to three audiences – multifamily property owners, residents, and large-employer workplaces.

Recommendations for the Workplace

Recommendation 1

TRC will develop education and outreach programs for business owners to understand the benefits and challenges associated with the installation and operation of EVSE units.

Recommendation 2

TRC will develop education and outreach programs for employees to understand the benefits and issues with charging their PEVs at the workplace.

Recommendation 3

TRC will encourage local governing bodies to draft or amend codes providing standards for the installation of EVSE for new construction and major renovations for businesses, parking lots, and public parking garages. At a minimum, regulations should include requirements that conduit be roughed-in and breaker-panel space allocated to accommodate future installation of EVSE electrical connections.

Recommendation 4

TRC will assist interested employers with surveying their employees to understand current and future needs for charging infrastructure. The results will be used for planning infrastructure development, site surveys, future electrical work, parking needs, sustainability policies, marketing, and corporate benefit policies.

Recommendation 5

To spur PEV adoption, utilities in the TRC region should consider incentives or rebates to businesses that install EVSE at workplace parking areas and office parking garages.

Recommendation 6

TRC will assist employers in the evaluation of Level 1 charging. This provides PEV owners with low-speed charging over many hours, and it offers a lower-cost method for businesses to gauge initial demand for PEV charging at their facilities.

Recommendation 7

Employers should consider providing charging at the workplace to encourage PEV use.

Recommendation 8

TRC will support utilities in the region conducting pilot(s) of PEV infrastructure programs for the workplace through the creation of marketing collateral and programs.

Recommendations for Multifamily Housing

Recommendation 1

TRC will develop a “PEV Ready” online property listing available to potential multifamily tenants and apartment-listing entities. This property listing will also include education and outreach programs on PEVs to help multifamily property owners understand the benefits and challenges associated with the installation and operation of EVSE units. This will include a step-by-step guide on purchasing and installing EVSE.

Recommendation 2

TRC will develop education and outreach programs to help multifamily residents understand the benefits and issues with charging PEVs at multifamily and public EVSE locations.

Recommendation 3

TRC will encourage local governing bodies to draft or amend codes providing standards for the installation of EVSE units for new construction and major renovations for multifamily housing and parking. At a minimum, regulations should include requirements for conduit to be roughed-in and breaker-panel space allocated to accommodate the future installation of EVSE electrical connections.

Recommendation 4

TRC will encourage and work with utilities in the region to provide incentives to multifamily property owners for the purchase and installation of charging stations.

Recommendation 5

TRC will assist interested property owners with surveying their residents to understand the current and future needs for charging infrastructure. The results will be used for planning infrastructure development, site surveys, future electrical work, parking needs, sustainability policies, marketing, and amenities.

Recommendation 6

TRC will assist multifamily property owners in the evaluation of Level 1 charging at multifamily parking areas. This provides PEV owners with low-speed charging over many hours, and it offers a lower-cost method for property owners to gauge initial demand for PEV charging at their facilities.

Recommendation 7

TRC will support utilities in the region conducting pilots of PEV infrastructure for multifamily housing through the creation of marketing collateral and programs.

Section 5: New Utility Business Models with Third-Party PEV Infrastructure

The business model templates developed for this project are applicable to any market structure. Recommendations in this section address the unique challenges of incorporating charging-service businesses into the unique market structure and laws governing public power entities, the prevailing market structure throughout the majority of the TRC region.

Recommendation 1

TRC will perform scenario analyses on key variables in the utility and private business models to understand what issues, policies, regulations, products, and/or technology advancements may affect the EVSE industry in the TRC region.

Recommendation 2

TRC will form an Industry Advisory Council to engage private industry participants directly in TRC implementation activities.

Recommendation 3

TRC will continue analysis of business model survey data to gain deeper insights into the key industry drivers, challenges, and barriers to overcome for the growth of PEV and EVSE industries.

Recommendation 4

TRC will conduct a business-model scenario workshop to vet the templates, and train interested TRC stakeholders on how to use the business-model templates to create and run scenarios. The workshop will result in the development of comprehensive documentation and training manuals for users, provide company business-model templates, and provide examples and demonstrations of how to develop and run scenarios.

Recommendation 5

TRC will support ERCOT efforts to explore the viability of strategies to allow aggregation of PEVs and EVSE to be bid into future market programs, such as ancillary services and emergency load curtailment.

Recommendation 6

Assist entities looking to install large public EVSE networks in pursuing federal grants and incentives as a source for PEV infrastructure funding.

Recommendation 7

Utilize the findings and tools included in this plan to assist entities looking to enter the EVSE market with developing EVSE deployment strategies, goals, and objectives.

Recommendation 8

Private companies interested in participating in the PEV industry should meet with utilities to comply with utility regulation.

Section 6 – EVSE Technology Interoperability Roadmap

Interoperability of EVSE infrastructure results from the integration of systems, devices, and applications, allowing for a seamless customer experience. Many of these components have yet to be developed, or can only operate independently of other components. Key findings from the section identify various components that must be integrated to provide an interoperable ecosystem for PEVs, EVSE, utilities, and other important ecosystem components.

Recommendation 1

Convene a subteam to develop and execute a plan for addressing the highest priority integration/interoperability issues outlined in Section 6 – those addressable at the regional level, and identified as critical needs within the next two years.

Recommendation 2

Develop a set of general functional and technical requirements for TRC to recommend utilities within the TRC region formally adopt for use. These requirements will be the foundation for selecting technologies, systems, and applications that could be installed in the TRC area as part of the regional infrastructure interoperability plan.

Recommendation 3

Identify "integration clusters", groups of integration points that may all be simultaneously addressed with the adoption of a specification or interoperability standard.

Recommendation 4

Periodically update the included roadmap matrices to reflect new devices, systems, and applications that would create new integration points.

Recommendation 5

TRC will facilitate the investigation of a utility PEV infrastructure reciprocity agreement across the TRC region, allowing customers of one utility's network program in the region seamless access to other utilities' networks without an additional fee associated with it.

Section 7 – Communications Plan

This section contains the goals, objectives, timeline, and budget for the TRC Communications Plan.

Recommendation 1

TRC will promote the use of the communications plan outlined in Section 7 as the foundation for its marketing communications plan moving forward. The plan will serve to inform and educate those interested in the deployment of electric vehicles and charging-station infrastructure in the TRC region.

Section 8 – Projection of PEV Market Penetration for the TRC Region

University of Texas San Antonio developed a multivariate model that projects PEV market penetration for Bexar County (including San Antonio). Based on its findings, PEV adoption is hampered by several factors, the most significant being the price premium between PEVs and conventional vehicles.

Recommendation 1

Report on alternative pricing models for PEVs in an effort to reduce or mitigate the current price premium versus internal combustion engine (ICE) vehicles.

Recommendation 2

TRC will work with the University of Texas at San Antonio (UTSA) to expand its model to incorporate the entire TRC region to predict adoption rates. Currently, the model looks at Bexar County only.

Section 9 – Creation, Administration, and Growth of the Texas River Cities Initiative

Stakeholders in this project recognize the need for an entity to execute the proposed plan. This section contains the goals, objectives, and alternatives for formalizing the TRC organizational structure.

Recommendation 1

Create a formalized entity to carry out TRC implementation efforts.

Recommendation 2

Establish a governance structure for the organization.

Recommendation 3

TRC will pursue the recommended implementation efforts of the adopted elements of the plan, and will continue to facilitate ongoing deployment and increased adoption of PEVs and PEV charging infrastructure.

Recommendation 4

TRC will create subject-matter working/advisory groups within the overall alliance to include interoperability, marketing/communications, and business models.

Appendix B
ACRONYMS

AACOG	Alamo Area Council of Governments
AC	alternating current
ADA	Americans with Disabilities Act
AMI	advanced metering infrastructure
Amp	amperage
B2B	business-to-business
BEV	battery electric vehicle
CAMPO	Capital Area Metropolitan Planning Organization
CAPCOG	Capital Area Planning Council of Governments
CCET	Center for the Commercialization of Electric Technologies
CCL	Communication Certification Laboratory, Inc.
CFR	Code of Federal Regulations
CIS	customer information system
CSA	Canadian Standards Association
CSL	Curtis-Straus, LLC
DC	direct current
DLC	direct load control
DMS	distribution management system
DOE	U.S. Department of Energy
DR	demand response
DSM	demand-side management
EDF	Environmental Defense Fund
EDTA	Electric Drive Transportation Association
EMS	emergency medical services
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ERCOT	Electric Reliability Council of Texas
EREV	extended-range electric vehicle
EV	electric vehicle
EVSE	electric vehicle supply equipment
FHWA	Federal Highway Administration
FIP	Federal Implementation Plan
FM	FM Approvals LLC
FOA	funding opportunity announcement
GE	General Electric
GFCI	ground fault circuit interrupt
GFI	ground fault interrupter
GHG	greenhouse gas
GM	General Motors
GPS	global positioning system
HAN	home area network

HEM	home energy management
HEV	hybrid electric vehicle
HOA	homeowners association
HVAC	heating, ventilation, and air-conditioning
IAEI	International Association of Electrical Inspectors
IATA	International Air Transportation Association
ICE	internal combustion engine
IRR	internal rate of return
ISO	independent system operator
ITSNA	Intertek Testing Services NA, Inc.
kWh	kilowatt hours
LAN	local area network
MDMS	meter data management system
MET	MET Laboratories
MF	multifamily
Mph	miles per hour
MUTCD	Manual on Uniform Traffic Control Devices
MW	megawatt
NEC®	National Electrical Code®
NEMA	National Electrical Manufacturers Association
NEV	neighborhood electric vehicle
NFPA	National Fire Protection Agency
NHTSA	National Highway Traffic Safety Administration
NMS	network management system
NOx	Nitrogen Oxide
NPV	net present value
NRTL	nationally recognized testing laboratory
NSF	NSF International
NTS	National Technical Systems, Inc.
O&M	Operations & Maintenance
OEM	original equipment manufacturer
OEP	Office of Environmental Policy, City of San Antonio
OHSA	Occupational Health and Safety Administration
PEV	plug-in electric vehicle
PHEV	plug-in hybrid electric vehicle
PV	present value
QR	quick reference
REEV	range extended electric vehicle
RFID	radio frequency identification
RoHS	Restriction of Hazardous Substances Directive
SAE	Society of Automotive Engineers
SDGE	San Diego Gas and Electric Company
SGSUS	SGS U.S. Testing Company, Inc.
SLA	service-level agreement
SLN	straight line
SwRI	Southwest Research Institute

SWOT	strengths, weaknesses, opportunities, and threats
SXSW®	South by Southwest®
T&D	transmission and distribution
TCEQ	Texas Commission on Environmental Quality
TDLR	Texas Department of Licensing and Regulation
TRC	Texas River Cities; also Texas River Cities Plug-In Electric Vehicle Initiative
TSAT	smart thermostat
TUV	TUV Reinland of North America
TUVAM	TUV SUD America, Inc.
TxDOT	Texas Department of Transportation
UL	Underwriters Laboratories, Inc.
USGBC	U.S. Green Building Council
UTSA	University of Texas-San Antonio
VAC	volts, alternating current
VAR	volt-ampere reactive
VIN	vehicle identification number
WAN	wide-area network
WL	Wyle Laboratories, Inc.

Appendix C
BIBLIOGRAPHY

Following is the TRC bibliography of resources reviewed as part of the project.

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Appendix D
UTSA REPORT ON PROJECTION OF PEV MARKET PENETRATION FOR THE TRC REGION

DRIVING THE FUTURE: AN ADOPTION MODEL FOR ELECTRIC VEHICLES IN SAN ANTONIO

UTSA | Texas Sustainable Energy Research Institute

2012 SUMMARY

DRIVING THE FUTURE:
AN ADOPTION MODEL FOR ELECTRIC VEHICLES
IN SAN ANTONIO

Key Contributors:

UTSA | Texas Sustainable Energy Research Institute

August 2012

This project and the preparation of this report were funded in part by monies provided by CPS Energy through an agreement with The University of Texas at San Antonio.

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EXECUTIVE SUMMARY

The team was tasked with investigating existing electric vehicle adoption models as well as adoption models developed for other technologies such as residential central air conditioning, hybrid vehicles, diesel vehicle adoption in Europe, personal computers and many others. Researchers identified key variables, collected and analyzed data for each variable and developed a series of customized technology adoption models that included the unique socio-economic characteristics of the San Antonio area.

In 1999, hybrid vehicles debuted in the North American market. They represented the newest breed of innovation in the automobile industry and a considerable step forward towards significantly increasing vehicle mileage while maintaining performance and reducing emissions. In December of 2010, the Chevrolet Volt, a plug-in hybrid electric vehicle was released. Soon after, Nissan released the Leaf, a 100% plug-in electric vehicle. As of summer of 2012, many of the top-selling carmakers have started selling electric vehicles in the U.S. market. Those include, Honda, Mitsubishi, Tesla, Ford, BMW, Mini Cooper and Coda. Many other vehicles are available in the European and global markets.

This report summarizes the findings of the investigation including previous adoption forecasting models, market incentives, market barriers and a series of key economic and social variables that may affect the way electric vehicles are adopted.

At the present time, there is a considerable body of literature discussing and analyzing the intricacies of the electric vehicle industry, from their design, complexity and cost to their place in the market as well as their ability to effectively compete with and replace their gasoline and diesel driven counterparts. Other topics covered in the literature include development plans, future R&D needs, public policy analyses, infrastructure development strategies, consumer perception and availability and access to reliable charging infrastructure.

A variety of forecasting models were evaluated for use as tools for predicting adoption of EVs in the San Antonio market. A number of key studies have been published and are publicly available. The Michigan study and the Berkeley study are two great examples. In the Michigan study, researchers projected adoption of electric vehicles using the same Michigan-Bass (Combined) model. Other studies reviewed included the Pure Innovation Model, the Pure Imitative Model, the EPRI study, and the market saturation model. The team developed its own predictive model using a multi-variate adoption approach that used a combination of socio-economic and industry indicators and their respective coefficients to predict adoption.

The Michigan and EPRI studies appeared to be too optimistic of the adoption rate as compared to recent data for the San Antonio area. Given the results of the team's model, we believe that adoption of electric vehicles in the San Antonio market will lag behind national averages.

The Bass Algorithm uses two main parameters, namely innovation and imitation. The innovation parameter is concerned with the technology and financial matters of the issue. The imitation parameter is concerned with the awareness and news one hears about a particular issue, as well as recommendations one gets from family and friends.

The UTSA model takes into account the same factors as the Bass model, plus replacement (a minor factor at this stage), fuel pricing (gasoline and electricity), income and educational attainment levels of the population under study. It is based on the assumption that all factors are multiplicative, and that each factor can be seen as a subset of the next, and so on. For example, automobile owners in the San Antonio area with advanced degrees, exceeding a certain income level, sensitive to fuel prices, and sensitive to news stories relating to electric vehicles may be influenced to purchase an EV. In other words, current and future automobile owners meeting several criteria are likely buyers.

In marketing theory, the early adopting group of new technology is also known as the "Innovators." Persons falling under this category are venturesome, daring, more educated and are willing to try new ideas at some risk. Why is this important? Electric vehicles are not only competing with standard gasoline and diesel driven vehicles. EVs compete with hybrids as well as smaller and more efficient vehicles that flooded the market after the latest round of economic uncertainty (2007-2008). Today, after 13 years in the market, sales of hybrid vehicles represent only about 2% of total vehicle sales in the United States, which would indicate that the adoption of hybrids has not transitioned into the next stage of consumer adoption represented by the "Early Adopters."

Based on preliminary findings, adoption of electric vehicles is being hampered by the following factors:

- Significant price premium between EVs and equivalent size vehicles (about $20,000), even within the same car manufacturer;
- Costs associated with operation and maintenance of an EV are mostly uncertain, given the short track record (since 2010);
- Current federal tax incentives ($7,500) are not high enough to overcome the price premium paid by consumers;
- Costs associated with purchase and installation of the necessary charging infrastructure can be significant and are commonly not rolled into the financing of the vehicle;
- EVs represent a significant paradigm shift in the mind of consumers, one for which the American public may not be ready;
- Cost of the battery pack, essential for an EV, is high and its replacement frequency is uncertain (cars have been in operation for the last couple of years while car manufacturers guarantee the battery pack for a period of 7 to 8 years);
- Lack of clear policies at the local, state and federal level incentivizing adoption of EVs; and
- Suspect marketing practices from car manufacturers (prices advertised on corporate websites are not available at local dealerships).

Models studied only indicate purchases if economic incentives are present, or said another way; purchases are only likely to occur if there is a net neutral financial advantage for the new EV over the old gasoline driven vehicle at the very least. New technology-based products only "take-off" when there is a distinct financial advantage of the new technology over the old. In summary, the Institute's electric vehicle adoption model predicts that adoption of EVs in Bexar County will proceed slowly, with a projected total ranging from 1,800 to 30,000 vehicles in service in the region by 2030.

Our public policy analysis indicates that a series of federal government policy moves, such as improved vehicle efficiency, reduced emissions, more stringent air quality standards, attempts to force gas prices upward, rebates and tax incentives, and incentives or pressures placed upon auto manufacturers to offer new transportation alternatives, all have the affect of either forcing the auto industry to innovate or attempting to incentivize EV adoption by the general public. Significant work remains to be done in the area of public policy at the local, state and federal levels.

Additional research is required to further refine the proposed adoption models. It is recommended that the team continues to collect EV sales data for the San Antonio area as well as other meaningful consumer related data as to evaluate the likelihood of area residents of purchasing an EV the next time they are faced with replacing their existing vehicle.

SECTION 1:
LITERATURE REVIEW

Introduction

The motivation behind this study is geared towards the adoption of Electrical Vehicles (EV) to be implemented for the 2013 San Antonio emissions reduction plan. While tactical steps to meet the grand target may take many forms, improvements made in the transportation sector by the deployment of Electrical Vehicles is a clever tactic for mitigating inner city and highway emissions.

As it becomes more important to “change the way we drive and commute”, the potential complexities of forecasting models and factors such as price, policy, gas prices, and electricity prices, need to be evaluated as to their impact on the rate of adoption of EVs. The position taken and roles played by energy companies as energy supplier and provider of charging stations to consumers cannot be overstated: as consumer concerns revolved around *convenience*- A “critical feeling” which may enhance or retard adoption rates of EVs. Meade and Islam (2009) asserted “Potential customers for a new market would only buy into the market at the point where their risk adjusted price is below their reservation price”.

Socio-economic factors such as income, educational achievement, and occupation, amongst others, provide insight on how potential adopters would behave and, as such, behavioral changes as related to coefficients may accelerate or decelerate the rate of adoption and path to market saturation of EVs. By using parallel extrapolation derived from studies of the Hybrid and Plug-in hybrid automobiles (an analogous market) as templates, new adoption model(s) can be derived and tailored for EVs with their own parameters and market variables.

Through analysis of articles highlighting adoption trends across the green transportation sector and current forecasting models, an EV adoption model can be developed for the San Antonio areas, including definitions of trending analogous markets: HEV and PHEV markets. Adoption models would be highlighted thereafter in an attempt to predict potential problems that may plague early EV adoption rates in the San Antonio area, given the inferences from the analogous markets highlighted above. A “break-even” cost scenario for the EV market, as compared to conventional vehicles, can be produced using information from the forecasting models, providing insight to increased EV adoption rates.

HEV

The Hybrid Electric Vehicle is defined as an automobile powered by both a gasoline engine and a standby battery, which captures mechanical energy (e.g., regenerative, when the vehicle brakes), which kicks in at intervals. These vehicles do not have re-charging capabilities.

PHEV

The Plug-In Hybrid Electric Vehicle can be defined as an HEV with a larger battery package, which allows for re-charging. The gasoline engine powers the motor when the battery is depleted. This extended range capability completely eliminates consumers’ range anxiety.

EV

Electric Vehicles can also be defined as Full Electric Vehicles or Battery Electric Vehicles (BEVs). These vehicles do not have a gasoline-powered engine but have an even bigger battery package than both the HEV and PHEVs counterparts. EVs need to be recharged when depleted in order to be operational again. Currently available vehicles have a range of about 70 to 160 miles or more. Tesla sells versions of the Model S with larger battery packs to extend the vehicle’s range to 300 miles.

Electric Vehicle Supply Equipment (EVSE)

Electric vehicle supply equipment also known as charging stations can be classified based on their intended use as residential or commercial. Charging stations are equipped to harness the grid electric energy either as AC or DC supplying current for recharging depleted EV battery packs. Charging stations are also graded according to outlet/output of electric current they discharge, namely Level 1, Level 2 and Level 3 which supply 100 Volts, 208-240 Volts (220V Nominal) and 480 Volts, respectively. Current prices range from $1,000-$5,000 for Level 2 charging stations, while Level 3 stations cost upwards of $25,000-$50,000, not including installation. Most U.S. cities do not currently have a network of public charging infrastructure to support integration of electric vehicles.

CPS Energy installed over 120 publicly available charging stations throughout San Antonio in 2011. The utility plans to add 20-30 more stations in 2012 to complete its network. The city of San Antonio is at the forefront of the industry related to providing adequate access to EV infrastructure and will accommodate EV adoption well into the future.

Policy Review

Across the United States numerous city governments are beginning to plan and implement electric vehicle (EV) transportation infrastructure with each city working at its own pace of development and with varying degrees of success. In "Bringing the Electric Vehicle to the Mass Market" (2012), RAND Europe, an independent research institute, suggests that local governments make the decision to embark on EV development for a variety of reasons. Various governments are motivated by economics and the need to bolster their local economy and therefore consider the rising demand for electric vehicles as a way to create jobs and attract capital investment. Others may be attracted to the technology and see the electrification of transportation as an opportunity to create a name for the city in a competitive environment where cities are vying to be known as leaders in the area of sustainable and "green" energy and improve their image. Finally, and possibly the strongest motivation of all, comes from the emissions mandates of the Clean Air Act (1990) which requires regions impacted by the U.S. Environmental Protection Agency's air quality nonattainment standards to reduce "emissions of toxic air pollutants that are known to, or are suspected of, causing cancer or other serious health effects". Outlined in the EPA's National Ambient Air Quality Standards (NAAQS), cities and states must work to reduce certain air pollutants and concentrations levels that are constantly measured by a network of air monitors throughout the state. Failure to meet attainment opens city and state governments to penalties and a formal federal process whereby the local government within that area must submit a strategic plan for getting emissions in that region back down to suitable levels of air pollution or attainment (Ohio EPA, 2010).

Whatever the motivation or the combination thereof, the decision to invest time, money, and resources into an emerging technology and market is not without risks. Two of the most frequently mentioned challenges from a public policy perspective are a lack of consumer demand for EVs and insufficient EV charging infrastructure. By using appropriate public policies, city governments and electric utilities can mitigate some of the risks associated with implementing an electric vehicle infrastructure (RAND, 2012; Stewart et al., 2010; Dubin et al., 2011; Wiederer et al., 2010; EPRI, 201; Brown et al., 2010; Lindquist et al., 2011).

Many local governments and electric utility companies consider investing money and resources into EV infrastructure development as a risk due to the uncertainty of consumer demand. Despite the fact that national energy security, energy independence, and rising fuel prices continue to be areas of concern for most Americans, the majority of consumers are still ambivalent about making the jump from driving a fossil fuel propelled vehicle to a fully electric vehicle, also known as Battery Electric Vehicle (BEV), which is propelled by electricity stored in the vehicles batteries. In a study published by the University of California, Los Angeles titled *"Realizing the Potential of the Los Angeles Electric Vehicle Market"* (2011), one of the most common obstacles to EV adoption is the higher up-front costs consumers face when purchasing an electric vehicle. Mostly due to the cost of the battery, BEVs are much more expensive than the equivalent Internal Combustion Engine (ICE) vehicle. Additional expenses include the cost of the home charging unit, permitting, and installation, all of which carry highly variable costs and appear to lower the budget conscious public's enthusiasm for BEVs. Ultimately, the overall Total Cost of Ownership (TCO) of purchasing an EV currently far exceeds the budget of the average consumer (Stewart et al., 2010 and Dubin et al., 2011)

There are several other consumer related adoption barriers that appear frequently in existing research regarding EV adoption and infrastructure development. Lack of confidence and knowledge of EV technology and capability prevents many consumers from entering the electric vehicle market. The lack of consumer education with regard to EV capabilities results in what researchers are calling "Range Anxiety", the industry term used to explain the fear people have of being stranded, believing the range of electric vehicles are insufficient to reach a destination. Other consumer-associated concerns deal with the availability and access to residential, work, commercial, and public charging options (Wiederer et al., 2010, Dubin et al., 2011; Perdiguero and Jimenez, 2012).

The idea of implementing a network of publically accessible Electric Vehicle Service Equipment (EVSE), the industry term for EV charging stations throughout a city, seems simple enough on the surface. However, executing a city wide EVSE infrastructure project becomes an extremely complex matter when it comes to private homes, multifamily dwellings, commercial parking, publically owned parking, and determining appropriate EVSE infrastructure ownership and operation models (Dubin et al., 2011, Wiederer et al., 2010, Stewart et al., 2010, EPRI et al., 2011). There is no shortage of public policy recommendations and options associated with availability of EV charging, promotion of consumer demand, providing incentives that draw private enterprise into the market, rebates, subsidies, and tax credits, et cetera (RAND, 2012; Stewart et al., 2010; Dubin et al., 2011; Wiederer et al., 2010; EPRI, 201; Brown et al., 2010; Lindquist et al., 2011; Perdiguero and Jimenez, 2012).

Despite the obstacles associated with developing publically accessible EV infrastructure A study conducted by the Metropolitan Washington Council of Governments titled *"Charged up: Making Metropolitan Washington Electric Vehicle Ready"* (2010) identifies various opportunities that electric utilities, municipal governments, private enterprise, and other stakeholders could take advantage of, given the appropriate policy tools, in an effort to help grow EV adoption rate in their city. See Table 1.1 below:

Table 1: Charging Opportunities by Location

Location	Opportunities	Barriers/Limitations
Single Family Home (w/ driveway or garage)	Highest Charging Demand	Many potential owners may not live in SFHs or have private driveways/garages Knowledge Permitting process
Multifamily Dwelling	Potentially high demand Many contain parking facilities Opportunities for car-sharing	May have limited parking spaces Metering for shared parking or common areas Property owners lack information Permitting process Technical capabilities Turnover of management Parking lot management
Workplace	Second highest charging demand behind residential	Knowledge Permitting process Technical capabilities Charging turnover management Parking lot management

		Public perceptions that charging provided to EV owners is an unfair benefit; possible tax implications of that benefit.
Amenities and Recreation	Third highest charging demand	Knowledge Permitting process Technical capabilities Charging turnover management Parking lot management
Rentals	Capitalize on tourism market Stepping stone to ownership	Need network w/ rental companies, hotels, and destination parking
EV car sharing	The model for car-sharing already exists Zipcar planning to offer a few EVs	Permitting process Technical capabilities Knowledge
Public facilities	Help grow EV market Demonstrate environmental responsibility Improve air quality	Permitting process Charging turnover management Parking lot management On-street charging

According to *Indiana University's "Plug-in Electric Vehicles: A Practical Plan for Success"* (2011), policy makers should consider the unforeseen consequences when creating policy to bolster EV adoption and develop an EV infrastructure. The report identifies five major impact areas: technology, governmental budgets, consumer budgets, behavioral change, and incentives. In the area of technology, policy makers should be cautious of implementing policies that "pick winners," i.e. policies that promote a specific alternative fuel driven vehicle or technology over another. Most economists would suggest a technology-neutral policy for the purposes of economic efficiency. Ideally, private or public organizations that operate large fleets of vehicles should have the opportunity to convert their fleets to a cleaner, more sustainable fuel based on their particular economic needs, and the most efficient solution(s) will come to prominence through operation of market forces. (Indiana University, 2011).

On the topic of governmental budgets, policy makers should be especially aware of the strain that subsidies, rebates, and other monetary instruments may have on a government's limited budget. A useful and common policy option implemented to enhance EV adoption is consumer tax subsidies for PEV purchasers. Although subsidies and tax credits are effective methods to influence EV adoption, they also have drawbacks. As traditional gasoline-powered vehicles continue to become more fuel-efficient and electricity becomes a popular economical alternative fuel source, governmental highway budgets will to shrink due loss of gasoline tax revenue, which is assessed on a per gallon basis at the pump. (Indiana University, 2011).

Consumer budgets are also sensitive to policy tools used to promote EVs. "Command and control regulations may be cheaper to implement for the government but costs automakers incur in complying with regulations may be passed on to the consumers" (Indiana University, 2011). Moreover, while subsidies and tax credits positively impact consumers by putting money in their pockets, the same subsidies and tax credits negatively impact governmental budgets as mentioned above (Indiana University, 2011).

When considering policy options to create behavioral changes, such as production subsidies and vehicle mileage standards aimed at manufacturers or increased gasoline taxes aimed at altering the behavior of consumers that drive low fuel efficiency vehicles, it is necessary for policy makers to keep in mind that manufacturers will usually respond accordingly to changes in consumer preferences (Indiana University, 2011). Even though monetary based incentives work well to create behavioral changes, non-monetary options have been shown to work just as well to alter behavior, and carry fewer risks. Examples of non-monetary incentives include allowing eligible alternative fuel vehicles access to High Occupancy Vehicle lanes (HOV), preferential parking at publically owned locations, and reduced parking fees. Essentially, policy makers should be cautious of inadvertently creating disincentive mechanisms that make it difficult for interested consumers to enter the EV market.

Determining ownership of, and areas of operational responsibilities with respect to, electric vehicle infrastructure is a key issue that city governments, municipal and investor-owned utilities, EV/EVSE infrastructure developers, commercial businesses, and the public will need to navigate before executing any EV infrastructure development plan. As previously mentioned, many U.S. cities are at various stages of EV infrastructure development with a mixture of outcomes and no clear models for success. However, industry reports and academic articles do not provide insight into many of the roles and responsibilities that local governments and municipal and investor-owned utility companies play in the areas of EV adoption and infrastructure development (Dubin et al., 2011).

The Electric Power Research Institute (EPRI) (2011) provides several examples of EVSE ownership models. The first option is to create the infrastructure as a benefit to the public, owned by the region's municipality, and supported through the municipal budget. This model is thus similar to traffic signals, roads, and other publically owned infrastructure elements (EPRI, 2011). The second option is for electric utilities to develop an EV infrastructure within their service area as a service to their customers, as well as a public benefit. Ownership and responsibility of the infrastructure would belong to the utility and would be supported through usage rates and fees (EPRI, 2011). As a third option, business owners and employers can install EVSEs on their property as a benefit to their employees. Depending on the business model, employers may pay for the electricity consumed by charging EVs as part of their standard billing statement or the employees may get billed for charging their EV based on subscriptions they may have with the local utility (EPRI, 2011). Similar to the third option, commercial businesses may install EVSEs for the purpose of attracting customers. Again, the business model would determine whether the commercial enterprise or the patron would pay for the electricity consumed through charging (EPRI, 2011).

Ultimately, local governments, utilities, and other stakeholders would have to conduct an economic impact analysis to determine which ownership and business models would best suit their city. Decisions regarding infrastructure ownership and business models may be effected by the regulatory structure of utilities, i.e., investor owned, publically owned, or cooperative. CPS Energy, a publically owned utility in San Antonio, Texas is an example of an electric utility that is constrained by federal and state regulations that prevent the sale, access, and oversight of electricity use by any entity other than CPS Energy in the utility's service area. Although the EPRI study does not provide details on the costs and benefits of each model, the Silver Springs Network did a similar study on EVSE ownership models. In "The Dollars and Sense of EV Smart Charging" (2010), the Silver Spring Network researchers provide four different EVSE ownership models along with the drivers and benefits of each. See Table 1.2:

Table 2: EVSE Ownership Drivers and Benefits

Driver	Benefit	Utility Owned	Privately Owned	Privately Owned w/ Utility Metering
Peak control	Reduces cost of peak generation	Yes	Yes	Yes
	Reduces cost of transmission and distribution expansion	Yes	Yes	Yes
	Lowers energy cost due to shifting EV charging	Yes	Yes	Yes

	to non-peak times (set number of peak days per year)			
Load scheduling or time-of-use rates	Lowers energy costs by shifting loads to non-peak times (ongoing as needed)	Yes	Depends on customer engagement	Depends on customer engagement
Load scheduling	Maintains local distribution network reliability	Yes	No	No
	Supports integration of more renewable energy	Yes	No	No
EVSE ownership	Greenhouse gas abatement credits	Yes	No	No

Under the utility owned EVSE model, the utility is solely responsible for all costs associated with installation, maintenance, and electric power management. The customer is provided with several charging options and different rates depending on their charging schedule. As it stands, the utility owned EVSE model carries the highest cost since the utility would be entirely responsible for all costs associated with EVSE ownership and management (Silver Springs Network). As explained by the Silver Springs Network there are two variations to the privately owned EVSE model. In the first scenario the EVSE is owned by the utility customer, who incurs all cost associated with installation and maintenance. In exchange for charging management capabilities the utility provides the customer with EVSE related subsidies and various rate plans (Silver Springs Network, 2010). Under second iteration of the privately owned EVSE model the customer is still responsible for all costs associated with owning the EVSE, however, the utility installs a separated EVSE metering system for billing purposes. The utility would also provide the customer with incentives and maintain control of charge management, as well as bear the cost of the subsidy and installation for the metering system (Silver Springs Network, 2010).

The last EVSE ownership model is for the utility to treat the EV as another household appliance. In this scenario the customer owns the EVSE and is responsible for all cost associated with ownership, installation, and maintenance. The utility would not offer any EVSE/EV related subsidies or specific EV charging rate plans and have no charge management control (Silver Springs Network, 2010). Instead, the utility company would consider the EV to be another appliance, thus, charging the customer at the regular household rate whenever the vehicle is charging. Of all scenarios, treating the EV as an appliance carries the smallest cost to the utility. However, Michael J. Kearney suggests in *"Electric Vehicle Charging Infrastructure Deployment: Policy Analysis Using a Dynamic Behavioral Spatial Model"* (2011), that utilities may see greater costs down the road due to upgrades to the distribution system if EVs become popular in residential areas. Known as clustering, residential neighborhoods with unusually high numbers of EV owners may create considerable stress on local transformers if EV charging is not properly managed (Kearney, 2011; Silver Springs Network, 2010).

Research indicates that electric utility companies play a unique role in the EV industry. In the area of adoption, the utility is positioned to take a lead role in promoting the commercial introduction of electric vehicles by converting its fleets to illustrate confidence in the technology and educate the public. More so than any other actor in the industry, utility companies have access to customers and can leverage these relationships to educate and raise awareness of the benefits associated with BEVs (EPRI, 2011). Usually serving as the sole providers of electric power in a particular service area, the utility is also the entity best able to develop the "critical EVSE infrastructure and services to support the safe and secure operation of electric vehicles" (EPRI, 2011).

Additionally, EPRI (2011) also suggests that utility companies play an essential function in "facilitating the implementation of residential, commercial, and public charging throughout a utility service territory". This capability can then be augmented, as suggested in *"Realizing the Potential of the Los Angeles Electric Vehicle Market"* (2011) by Dubin et al., with a web-based interactive tool that EV drivers and those interested in EVs can access. Most importantly, utilities must be sure to "understand" the potential impact of adding electric vehicles to the grid and take steps to mitigate any system disruptions exacerbated by clustering (EPRI, 2011; Dubin et al., 2011). Kearney (2011) suggests that utilities seem to be less concerned about their capability to generate and transmit electricity than with potential issues that may arise from the strain produced on "local distribution systems, made up of a network of neighborhood transformers" (Kearney, 2011) when many EV owners simultaneously plug into the grid after arriving home from work in the evenings.

Most of the literature on public policy as it relates to electrification of transportation is heavily concentrated on policy levers that bolster adoption rates of EVs/EVSEs. In contrast, there is little to no literature that focuses on the roles and responsibilities of city governments and public utilities in the day-to-day operations of EV infrastructure. There is a dearth in the literature that speaks to infrastructural spans of control, areas of oversight, organizational structure, and management and regulatory bodies. Based on current research, one can derive that the roles and responsibilities for each entity involved in the process of EV infrastructure deployment are highly dependent on the partnerships that are established during planning and development process, as well as by federal and state regulatory constraints and the requirements of applicable statutes. (RAND, 2012; Stewart et al., 2010; Dubin et al., 2011; Wiederer et al., 2010; EPRI, 201; Brown et al., 2010; Lindquist et al., 2011; Perdiguero and Jimenez, 2012; Kearney, 2011). It is assumed that the lack of information in the areas mentioned above is due to the EV market being in its infancy, and due to the unique regulatory and statutory framework that controls utility operations in local jurisdictions.

As mentioned above the scarcity of information can be attributed to the market being in its infancy, therefore, organizations are still experimenting with revenue models. However, in *" Advancing the Use of Electric Vehicles in Silicon Valley: Policy Options for City Governments"* (2010), Stewart, A., Carlisle, A., and Brendal, J. discuss a business model where utilities would receive a percentage of the revenue earned from the EVSE owner/host on top of the revenue the utility earns from the sale of electricity. Whereas Dubin et al. (2011), discusses several pricing options that can be used by utility companies to support the operational costs of the EV infrastructure. The "anytime plan" allows EV drivers to charge their vehicles at a fixed rate. It is expected that drivers who sign up for the anytime plan will have to pay a premium for the opportunity to charge at anytime of the day regardless of on/off peaks hours.

In an effort to get drivers to charge their vehicles during off peak hours (9pm-8am) utilities can offer a "night-time only" plan, where drivers are rewarded with discounted rates for agreeing to charge during off peak times, reducing strain on the grid. Although the literature does not mention it, the assumption may be, if a "night-time only" subscriber charges at a peak time, they would face penalty charges or restrictions on the operation of their EVSE during times of constrained electricity supply. Similar to the "night-time only" plan, is the option of a "flat-rate/night-time only" plan where EV owners pay a flat monthly fee regardless of their power consumption provided they only charge during off peak hours (Dubin et al., 2011). Depending on infrastructure ownership dynamics EVSE owners and utility companies have a stake in gaining access to different market segments. According to Kearney (2011) one of the most prominent business models used is the battery-swap model popular in Denmark and Israel, which requires a network of EV battery swap stations where EV drivers can exchange their energy depleted battery for a fully charged battery. A second model, known as charge-point, is popular in the United States. The charge-point model requires a network of charging stations through out a service area that would be accessible to EV drivers. Drivers looking to charge their EV would pay a rate based on the amount of time spent charging and for the electricity consumed (Kearney, 2011). Both models provide consumers with several payment options for utilizing the charge unit.

In an effort to manage the strain that charging EVs may have on the grid the Electric Transportation Engineering Corporation (ETEC) suggested in their report a study "Electric Vehicle Charging Infrastructure Deployment Guidelines for the Oregon I-5 Metro Areas of Portland, Salem, Corvallis and Eugene" (2010), that there are three options that can be implemented. First is the Time of Use option, which provides an incentive-based rate where EV drivers can save money to charge their vehicles during off-peak hours. Second, the Demand Response model is described as a voluntary program that compensates commercial customers for cutting back on electricity use when the utility is experiencing high levels of strain on their grid (ETEC, 2010). Third, the Real-Time Pricing model suggests that utilities make customers aware of “pricing signals” through the use of communication devices. This would allow customers to charge their vehicle during the most cost-effective time (ETEC, 2010). Additionally, depending on the ownership model in a particular service area, EV owners will have the opportunity to subscribe for services from EVSE vendors or utility companies. Payment subscriptions are similar to something one might see from their cell phone service providers or when joining a gym. The types of services that accompany the customer’s subscription vary widely from online services that can be accessed with smart devices or boutique style options that allow the customer to reserve specific charging units for an allotted amount of time (Kearney, 2011). The logistics of how the deal with complex issues, such as charging outside of electric utility service area boundaries and enforcement of EVSE reservations, is not addressed in the current studies of EV infrastructure business models.

Recommendations for Further Research

The body of industry reports and academic research on the public policy challenges associated with developing an electric transportation infrastructure provides a variety of policy tools that can be utilized by local governments and utilities alike to bolster EV adoption and open the market for the commercial introduction of electric vehicles. Even though researchers have studied ownership and business models of EV charging infrastructures, the information provided is minimal and fails to mention strategies that address the logistical issues that may and most likely will arise during implementation.

Based on existing literature more research needs to be conducted on current ownership models that provide EV infrastructure developers with an understanding of the extent of control different actors may have in the day-to-day operations, such as oversight, regulation, organizational structure, standardization, and operational management. Furthermore, research also needs to continue specifically in the area of publically owned utilities. Studies have only focused on the general roles that utilities play in the areas of public education, outreach, infrastructure development, and promoting EV adoption. Public and investor-owned utilities are fundamentally different in their organizational structure; to whom they are accountable; areas of responsibility; and are bound by different regulatory and governmental constraints. There also need to be further research detailing the pricing model and other load management options that can be implemented at the consumer level.

Thus, it is necessary to do research that delineates the roles and responsibilities of public and investor-owned utilities in relation to EV infrastructure development either separately or comparatively. Ideally, future research would focus on actual strategies of implementation to complement the current studies that have focused on the topical issues of EV adoption. Additionally, new research projects should look into infrastructure ownership and business models to clearly outline the organizational structure currently in use by organization involved in planning and developing any EV infrastructure.

Summary of Current Research

Thus far the research related to the public policy challenges associated with implementing an EV infrastructure in San Antonio and what the role is for CPS Energy is being done in two stages.

Stage one (secondary research):

Consists of researching current public policies levers being utilized by federal, state, and city policies, including grants, rebates, programs, laws, and ordinances related to electric vehicles (EV) and electric vehicle service equipment (EVSE). We have also compiled data of existing EV infrastructure ownership and business models to include the development process and policy drivers. Additionally, research is also being conducted on the barriers associated with EV infrastructure development and which policies are used to overcome development obstacles for operation and electric grid load management. Since this project involves researching transportation development strategies of an emerging technology and market, it has been a challenge to find business models that are being used by public utility companies. Ideally, the research would identify opportunities for partnerships, roles and responsibilities, revenue streams, and the extent of control the public utility has over EV infrastructure. The second stage of research will yield information that could not be obtained through currently available industry literature and reports.

Further details of the secondary type of research conducted to date are summarized below:

- Compiled and analyzed public policies levers being utilized by federal, state, and city policies, including grants, rebates, programs, laws, and ordinances related to electric vehicles (EV) and electric vehicle service equipment (EVSE).
- Gathered data on 40 U.S. cities that are leading the way in sustainable and green energy, such as ECOtality EV Project cities, U.S. C40 cities, Solar cities, and cities involved in EV infrastructure deployment. The data will be used to identify trends and common drivers, which will then be cross-referenced with San Antonio. Through comparing the collected data we expect to get an idea of where San Antonio stands among the leading sustainable and green energy cities. As well as, identify best practices and policies that can be adopted by the city of San Antonio and/or CPS Energy in an effort to develop an EV infrastructure plan.
- Collected information on current and suggested public policy practices for cities involved in EV infrastructure development. Which will be used to create a public policy strategy suited for the city of San Antonio.
- Investigated and analyzed the political environment surrounding EV/EVSE infrastructure.
- See Appendix B for public policy examples.

Stage two (primary research):

Involves surveying and interviewing key public utility personnel, mayoral offices, city managers, OEMs of electric vehicles and EVSEs, metropolitan planning organizations, EV infrastructure developers, lobby and advocacy groups, and any other identifiable stakeholders. The purpose of the survey is to gather information and data that was not obtained in stage one. The survey will be conducted electronically via a web-based tool and will begin after Institutional Review Board approval for research involving human subjects and/or information generated by the use of surveys and other data collection methods. A foreseeable challenge may be the sample size of public utilities since many may not be involved in EV infrastructure development. To overcome this challenge, survey participants will fall under two tiers. *Tier One* will be designed for cities/utilities not involved in EV infrastructure development with questions as to why they have not gotten involved, whereas *Tier Two* will be designed for cities/utilities that have begun or plan to develop an EV infrastructure. The target rate of return for all the surveys that are sent out is 40%. The team will follow-up via email and/or phone calls to boost the number of respondents. Following the survey, a series of in-depth interviews will be conducted with key officials in leading EV enabled public utilities to explore the policy factors and ordinances in more detail.

Further details of the primary type of research to be conducted are summarized below:

- The survey element will cover five key policy areas: business models, benefits, challenges, policy drivers, rebates and incentives, and city/utility and demographic information of respondents.
- For non-adopters, the survey will cover the primary policy inhibitors for non-adoption.
- Need to obtain contact information (names, email address, phone number) for survey respondents, particularly for public utility companies. Discuss with CPS Energy the possibility of gaining access to the American Public Utility Association's directory of public utilities.

SECTION 2:
ADOPTION MODELS

Everett Rogers in his book Innovation of Diffusion (1962) explains the adoption process of a new technology or a product thru time as:

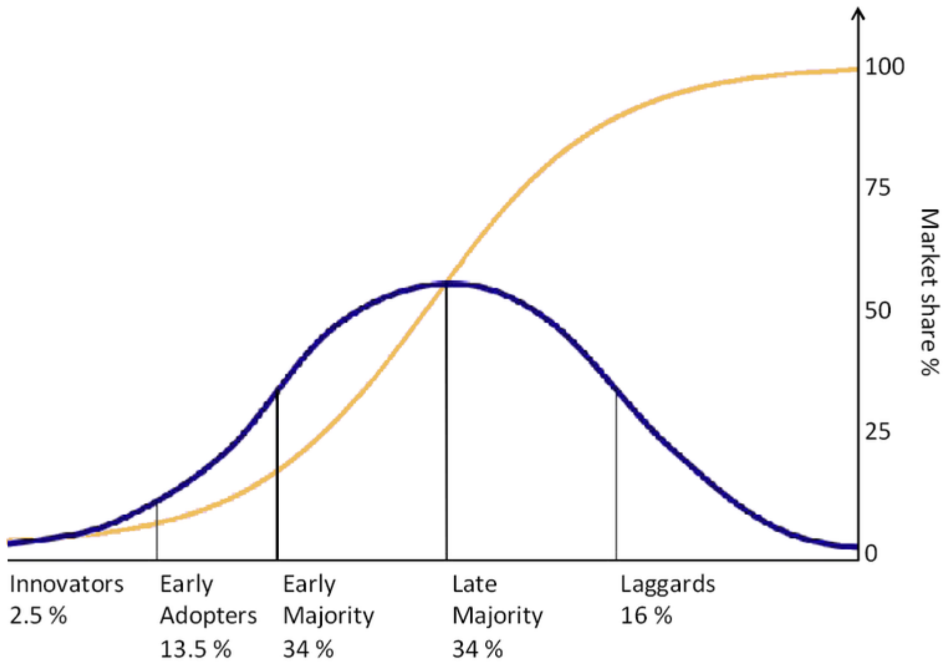

Figure 1: Rogers Model of Adoption
Source: Roger's Diffusion of Innovations, 1983

These five categories are defined as (Smart Marketing and Research Techniques, 2012):

- *Innovators* interact with other innovators, are venturesome, daring, more educated and are willing to try new ideas at some risk (Wright, 1995; Rogers, 1962, 1976, 1983).
- *Early Adopters* are guided by respect, are opinion leaders, and adopt new ideas early, but carefully.
- *Early Majority* group members are deliberate and adopt new ideas before the average person — although they rarely are leaders.
- *Late Majority* individuals are skeptical. They adopt an innovation only after a majority of people has tried it.
- *Laggards* are tradition bound. They are suspicious of changes, mix with other tradition-bound people, and adopt the innovation only because it has now taken on a measure of tradition itself.

As it can be seen, the diagram shows the cumulative sales over time (t) and the different categories of customers at each period. This diagram is known as the Rogers model. He describes five factors that affect an individual's decision to adopt the innovation: relative advantage, compatibility, complexity or simplicity, trialability, observability.

The Rutgers University study, "Overview of New Product Diffusion Sales Forecasting Models" by Michelfelder and Morin (2006), highlighted three main models: Pure Innovation Model, Pure Imitative Model, and the Combined Model.

Pure Innovation Model

The pure innovation model was developed by Fourt and Woodlock in 1960, and it depicted a penetration curve upon the analysis of market penetration curves of new products. The innovation model involves adoptions based on individual's exposure to external mass media and marketing advertising schemes. The result is an exponentially shaped curve. This model excludes all word-of-mouth communicative effects. It is represented by the coefficient (p) (McManus and Senter, 2009). The model is described by the formula:

$$ft= rM(1-r)t-1$$

Where, f_t = (change in cumulative sales at time t) / (potential sales)
r = rate of penetration of potential sales
M = (total potential sales) / (all buyers), or market saturation percentage

Pure Imitative Model

The pure Imitative model was developed by Fisher and Pry (1971), contrary to the pure innovative model, this solely imitative approach of product sales forecasting emphasized on "word-of-mouth" for diffusion to spread rather than media and marketing strategies. It is represented by coefficient (q) (McManus and Senter, 2009)

$$f= 11+ e-b(t- t0)$$

Where, f = percentage of market that adopted new product
b = growth to potential constant
t = time since introduction
t_0 = time of introduction

The Combined Model

The combined model is extracted from both the imitative and innovative models respectively forming a *generalized combined* model. Combined coefficients p and q are instrumental in adjusting the slope of the combined model (Bass model). While this hybrid model can take the form of either model as highlighted above, (i.e. the Pure innovative model-where coefficient q is zero or Pure innovative model-where coefficient p is zero), the Bass model's complete form shows both coefficients at play. The model describes a process based on relaying on information between consumers and potential consumers while laying more emphasis on the imitative factor coefficient as being the major determinant for product adoption. Customers tend to react more internally to "word-of-mouth" rather than to the external marketing mix-tools used by producers or Four P's -Promotion (media advertisement), Product, Price, and Place all of which are peripheral to the central social market system of consumers. The formula shows the pressures exerted on new market customers (potential adopters) as a result of the pre-existing adopters, the innovators (i.e. those who have already experienced the new product in question). Thus, paving the way for "word-of-mouth" spread, represented by the imitative effect acting directly on the given potential market base (m) over time. Frank M. Bass introduced the Bass Diffusion model in 1969. It defines the function L(t), the probability that an individual adopts the innovation at time t as:

$$Lt= p+qmNt$$

Where, L(t) = probability that an individual adopts the innovation at time (t)
m = the total potential market
p = the coefficient of innovation
q the coefficient of imitation
N(t) is the cumulative number of customers who have already adopted

We can also estimate n(t), the number of adopters in each period t, as:

$$nt=p+qNtm[m-N(t)]$$

Where, n(t) = the number of adoptions occurring in period t

The first parameter p indicates the propensity to adopt the product independent to how many customers have already done that. This parameter is also known as the “innovation” component of the model (Lilien, et al., 2007). The product with higher p has more rapid adoption rate so its diagram would be steeper at first periods. It is usually the first phases of a product’s adoption.

On the other hand, the parameter q shows the represents the propensity to adopt as a function of the number of existing adopters, also referred to as the “imitation” component of the model. This parameter indicates the word-of-mouth communication effect among innovators and imitators (Lilien, et al., 2007).

There are some extensions for the Bass model developed during time and diverse experiences on forecasting different products with it. The Generalized Bass model is one of these extensions that Bass, Krishnan, and Jain proposed in 1994. This model just has one extra function x(t) added for influencing the market advertisement and price changes into account (Bass, et al., 1994):

$$ft= p+ qNNtm-Ntxt$$

Where, x(t) is a function of the marketing-mix variables in time period t (e.g., advertisement, price), calculated through the formula:

$$xt= 1+ \alpha[Pt-Pt-1]P(t-1)+ \beta Max0, At-A(t-1)A(t-1)$$

Where, α = coefficient capturing the percentage increase in diffusion speed resulting from a 1% decrease in price
P(t) = price in period t
β = coefficient capturing the percentage increase in diffusion speed resulting from a 1% increase in advertising
A(t) = advertising in period t

Predicting the Bass Model Variables

The existing data for the product sales in past years can be used or estimated with the help of analogous products. In despite of which approach is chosen, it is recommended to determine the value of “m” via managerial judgment (e.g., doing a survey) instead of relying on formulas on previous sales or using analogous analysis. However, p and q coefficients can be calculated by one of the illustrated procedures below (Lilien and Rangaswamy, 1999).

According to Lilien, et al., 2007, it is possible to use historical EV sales data to calculate the Bass model variables p, q, and m via regression analysis. For example, the variables can be estimated using ordinary least square method to solve the following linear function:

$$n(t) = a + bN(t-1) + cN^2(t-1)$$

Where: m = −b−b2−4ac2c
p = a/m
q = p + b

For this approach, at least 4 to 5 periods of data are necessary. According to previous research, nonlinear regression has the most accurate outcome for p and q values.

Analogous Product:
For this approach, researchers choose a product for which there are published values for p, q, and M and used those values for our adoption model, using the p and q values from the analogous product with an "m" calculated for the product in question. Lilien, et al., (2007) suggest following five bases for finding similar products: Environmental Context, Market Structure, Buyer Behavior, Marketing-Mix Strategies of the Firm, and Characteristics of the Innovation.

While the simple Bass Model is used in most contexts, the Michigan University study on "Predicting Plug-In Hybrid Electric Vehicles (PHEV) Adoption and Diffusion", McManus and Senter (2009), expanded on the formula creating the Generalized Bass Model (GBASS) which includes behavioral changes on the probability of adoption over time brought about by relative price changes of PHEV/ conventional Vehicle and gasoline prices. The GBASS made for a better forecasting model than the simple Bass model.

Other Models covered were the Gompertz and Logistics including the Bass and GBASS share fixed market saturation levels, where M, the potential market is independent of the model and is derived from past data on demographics of HEVs, an analogous market to the PHEVs. This causes the results to be applied to one-time purchases of new durable products only, excluding returns on products and repeat purchases. As such, these benchmark models lacked the ability to exhibit the reality of sales and purchases when dissatisfied customers may default on purchases with returns or may repeat purchases of same product given improvements with better technology.

The Centrone Model determines market potential (M) as a function of time by the sum of customers who have already adopted the product in question plus the not-yet (potential) adopters. The model also allows for varying market potential M as a function of time by employing a net growth exponential to potential (M) determining customer entry and exit by using difference between birth rates (b) and death rates (d) respectively within a population. This inclusion of demographic factors (difference between birth rates and death rates represented as differences between customer entry into and exit from a market) allowed for the divergence of incremental adoptions (gross adoption) and sales, which the benchmark models (GBass, Bass, Logistic and Gompertz) failed to depict as they tended to group incremental adoptions and sales together as annual sales.

While the Centrone model addressed the issue of fixed saturation levels (market potential, M) by the benchmark models, it failed to address the true market activities such as possibility of repeat purchases by previous adopters (i.e. replacement of an outdated or earlier. Despite its approach of subtracting the death of adopters (or exit customers from M) from sales to give "gross adoptions", and net adoptions, the study highlighted that the model overstated gross adoptions by directly equating them to sales. The Centrone model also failed to show economic analysis for consumer choice brought on by "behavioral factors".

Based on results of the Bass model and observations of analogous predecessor PHEV/HEV markets respectively, this study attempted to highlight the role "Quality" (an equally important factor, often ignored) may play in adoption. Though exogenous to the models contained in this report, we highlight 'quality' is deeply intrinsic to the consumer, and as such is an important element. In addition to the socio-economic indicators (such as income distribution and education level) and vehicle price as driving factors affecting the potential market size and adoption of EVs in the San Antonio area, the proposed models highlight the learning consumer-producer approach based on quality. A prospective EV buyer observes a range of available vehicles (choices) and from there on, updates (adjusts) preferences. Given the choices the potential consumer is exposed to by the manufacturer, we note that every potential EV buyer seeks to maximize the benefits received from a particular EV brand and as such chooses the vehicle that provides the highest Utility. The approach is described by the formula:

$$U_{ij} = X_j \cdot \theta + \acute{\eta}_j + \varepsilon_{ij}$$

Where, X_j: Vector of Vehicle Attributes

$ή_j$: Assumed consumer Quality assessment of j EV(say Tesla),normalizing quality of other brands to zero($ή_j = \eta_0$)

η_j: The Actual Quality of j EV unbeknownst to consumer

ε_{ij}: Mean Zero Error

$ή_j$, the consumer preconceived perception of EV j quality, is balanced against a set of choices (each independent) presented to the consumer by the market (EVs, Hybrids and small conventional vehicles) and thus is a function on the collection of N choices $\{\omega_{ib}\ldots\omega_{iv}\}$.

Each independent choice gives signals to consumer on brand model/vehicle quality: If the k-th signal is about the model/vehicle j then the information passed by such signal can be represented by:

$$\omega_{ik} = \eta_j + v$$

where, v is the $v \sim N(0,\delta^2_j)$.

The observations highlighted above should be seen as actual (real life) EVs amongst other cars that catch the consumer's eye. The assessment for quality (a learning phase) based on the collection of signals given by $\Omega_i = \{\omega_{ib}\ldots\omega_{iv}\}$ then follows the innovation-imitation phase.

Considering that the above signals vary in strength, the consumer may build his perception on quality in the following ways:

- First, the consumer may build his notion about η_j Actual Quality of EV model j (e.g., the Tesla Model S) based on the signals he receives exclusively from EV model j and as such he has an unbiased estimation of what his perception of EV quality is thus, excluding all other choices. The mean estimation value can be seen as $ή_j = \Sigma_{nj}\, \omega\eta$ with a variance of $\delta 2/\eta$.
- Secondly, the consumer may receive signals from small conventional vehicles and as such gets no feedback on assessing EV quality, his perceived notion of EV quality remains unchanged, $ή_j = \eta_0$.
- Thirdly, based on the choices presented in the market, the consumer can receive imperfect signals of quality when confronted by different EV models than originally experienced. Using the car manufacturer Tesla as an example, the imperfect signals are stronger if the EV vehicle(s) observed are from the *same* manufacturer converse to other manufacturers (thus the term brand loyalty can be used). The full effect of the learning model is observed at play with the sold-out Tesla Roadster, the Model S, and the rising demand for upcoming Model X slated for a 2014 release.

Quality induced loyalty and the compounded learning effects brought about by strong 'signals' previously experienced by the consumer, given a particular EV model brand (e.g., the Tesla Roadster), goes a long way to further establish the brand-manufacturer in question above all other brand-manufacturers in the same market. See below:

$$ή_j = \alpha\Sigma_{nk}\, \omega\eta + (1-\alpha)\eta_0$$

where, α is an exogenous weighting parameter

Mean value of customer's perception on the EV model-brands by the *same* manufacturer is expressed by,

$$ή_j = \beta\Sigma_{nk}\, \omega\eta + (1-\beta)\eta_0$$

where, β is an exogenous weighting parameter

Mean value of customer's perception on the EV model-brands by *different* manufacturers.

The consumer bases his brand loyalty on the manufacturer who affected him most profoundly with the "best" quality over the other manufacturers presenting similar products, as such weighs his signals accordingly: $\alpha > \beta$. Heutel and Muehlegger (2010) state that "If a consumer does not receive any signals about hybrid *j* but receives *at least one signal* about hybrid *k* made by the *same* manufacturer as *j*, then he forms his assessment of η_j based on those signals only along with his prior belief about hybrid quality."

What drives the consumers purchasing decision that accompanies the need to purchase a vehicle, while also addressing repeat purchases of similar brands? Given all market choices ranging from HEV to EVs, the overwhelmed consumer is tasked with finding his/her niche thus, narrowing down choices presented by the market by using a scale of preference. Upon, finding their personal niche preference, then the consumer proceeds to attempt trials, depending on the consumer type: Innovators as highlighted in Rogers' model are more experimental in nature relative to the laggards-who wait on diffusion of information to eliminate imperfect information. With the product signals obtained from the innovators via firsthand experience, the strong signals received (good or bad) remains with the consumer (in his now "adjusted" scale of preference) and may come in handy in his next market choice-dilemma encounter-where there would be less noise than his first encounter.

This process goes a step further by social interaction of the innovative consumer with other potential consumers types (early adopters, early adopter, majority, late majority and laggards), via peer interaction and communication of their 'experienced signals'. The compounding effect caused by the innovators experienced communicated signals, causes reduced noise in the choice-dilemma market encounter for other *potential consumer types* who may be trying to buy into the same vehicle market. Given the myriad of choices, the imitative consumer is bound to eliminate all other brands so as to settle with the innovators prescribed choice of quality thus, the "word-of-mouth" and the "monkey-see-monkey-do" effect. Though it is not always certain that 'new' potential consumers would make exactly the same purchase choices as their 'innovator predecessor', early adopters may influence their decision or the two groups may share similar values and perceptions. This holistic interaction of Rogers's diffusion process and quality intersects and peaks off at a point where brand loyalty is established.

SECTION 3:
PROPOSED MODEL FOR SAN ANTONIO

Overview

After a review of different forecasting tools, the team chose to utilize the dynamic Generalized Bass model. The Bass model consists of three major parameters: p, q and M (coefficients of innovation, imitation and potential market, respectively). Careful consideration of the appropriate coefficients and the potential market are critical to obtaining good results from the Bass model. This section will detail the process used to arrive at the UTSA model's p, q and M, including the assumptions made and data sets used in developing the model.

Data Sources

The team obtained historical sales figures for HEVs in the United States from the period of inception of the Toyota Prius in 1999 through 2012 and national sales figures for EVs in the US market (2010-2012) from the Ward's Automotive Group (WardsAuto.com). Local data was obtained from R.L. Polk & Co. (Polk) for vehicles in service in Bexar County in 2012 (all makes and models). Polk also provided the team with historical tax, title and license data for all vehicle makes and models in Bexar County for the years 2002 – 2012. This data set effectively tracked vehicle sales in Bexar County for each of the referenced years.

Demographic data for Bexar County, including income and educational achievement, was collected from the U.S. Census for 2010. CPS Energy provided current cost of electricity. Current local average gasoline prices for the San Antonio area were obtained from the U.S. Energy Information Administration. The vehicle replacement rate is defined as +4% based on information from the American Manufacturers Association. The replacement rate is expected to have a small impact this early in the product life cycle for EVs.

In addition to the raw data described above, review of prior literature provided p and q coefficients for a variety of analogous products that were used to inform the UTSA model. In particular, the team reviewed the coefficients suggested by the Michigan Study (McManus and Santer, 2009) and Berkeley Study (Brown et al., 2010). Coefficients derived from historical adoption rates of HEVs and diesel vehicles were also utilized as suggested from research conducted by Lilien and Rangaswamy (2007).

Assumptions

The following is a summary of key assumptions made during the development of the proposed adoption models for electric vehicles in the San Antonio area.

- Gasoline prices will remain relatively stable (e.g., current prices) and will follow a slightly upward trend;
- Electricity prices will remain relatively stable (e.g., current prices) and will follow a slightly upward trend;
- Adoption of electric vehicles will follow a similar trend to that observed for hybrid vehicles;
- The level of consumer awareness and comfort with electric vehicles will continue to increase over time;
- Price premium for EVs will remain at current levels ($20,000) in the near future;
- Currently available tax incentives for electric vehicles will remain and current levels and most likely will be phased out as they were for hybrid vehicles (12/31/10);
- Households owning multiple vehicles are more likely to purchase an electric vehicle;
- Educated persons with higher levels of disposable income (higher income overall) are more likely to purchase an electric vehicle; and
- Electric vehicles will be adopted at a slower pace than hybrids.

SECTION 4:
MODEL COMPARISON AND ANALYSIS

This section summarizes the findings of the study. It reviews historical data and trends at the global, national and local levels for both HEVs and EVs. A subsection explaining the rationale the team utilized for estimating the market potential for the San Antonio area is also covered. Finally, the four models developed for this study are presented and analyzed to draw conclusions and recommendations for future research.

Global Vehicle Sales Data

Historical global vehicle sales, excluding the U.S. market, are presented in Figure 2. Annual sales ranged from about 6.0 million vehicles in 2012 (partial year) to as many as 15.0 million in 2005. Vehicle sales experienced a downward trend overall. Hybrid vehicles represent a very small portion of the global market.

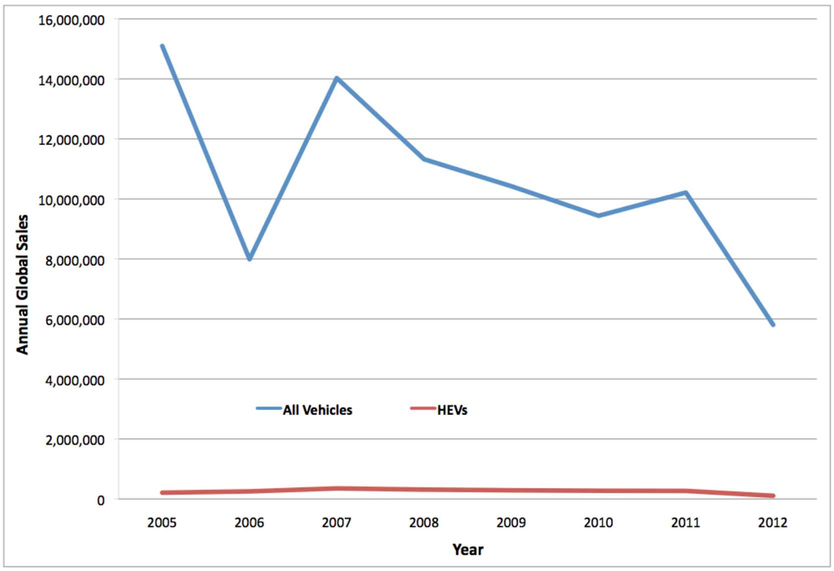

Figure 2: Global Historical Vehicle Sales (Excluding the United States)

Figure 3 presents global cumulative vehicle sales, excluding the U.S. market for the same time period (2005 - 2012).

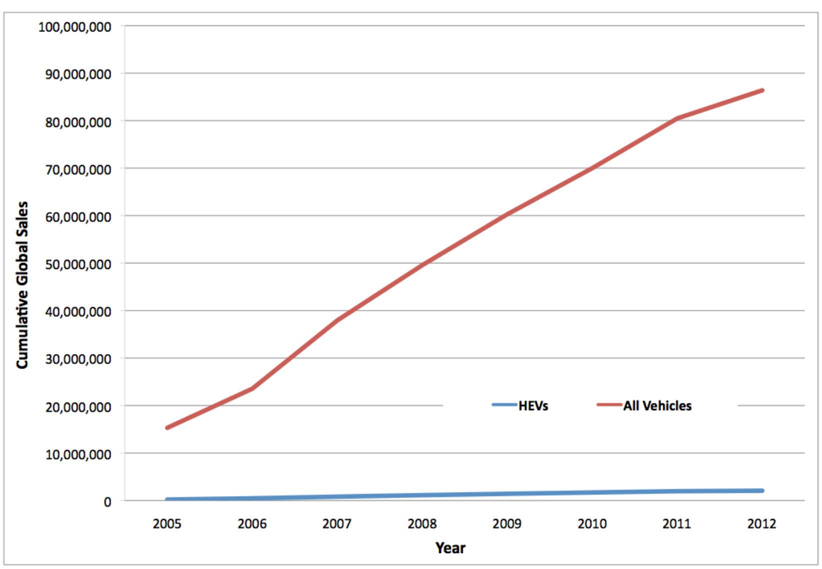

Figure 3: Global Cumulative Vehicle Sales (Excluding the United States)

National Vehicle Sales Data

Historical U.S. (national) vehicle sales are presented in Figure 4. Annual sales ranged from about 7.0 million vehicles in 2012 (partial year) to as many as 15.0 million in 2002. Vehicle sales experienced a downward trend overall. 2009 was a "bad" year for the automotive industry. Hybrid vehicles represent a very small portion of the global market.

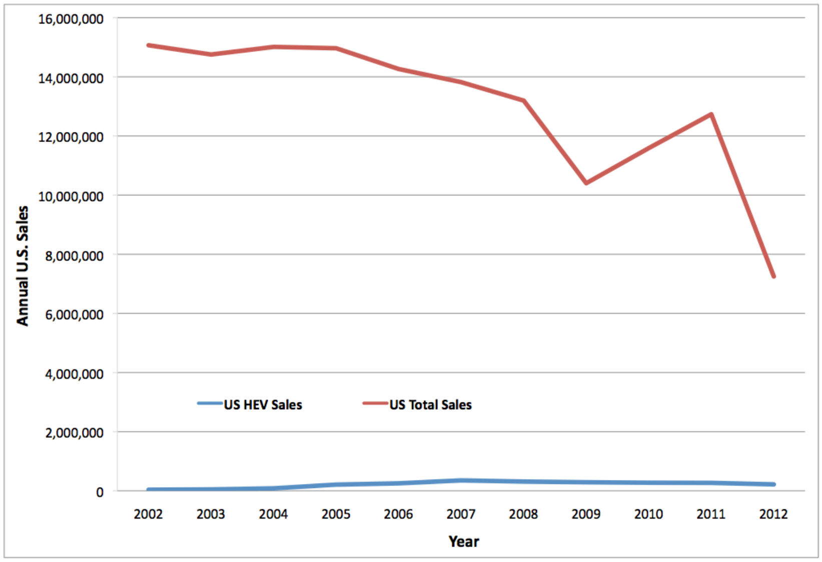

Figure 4: National Historical Vehicle Sales

Figure 5 presents national cumulative vehicle sales for the same time period (2002 - 2012).

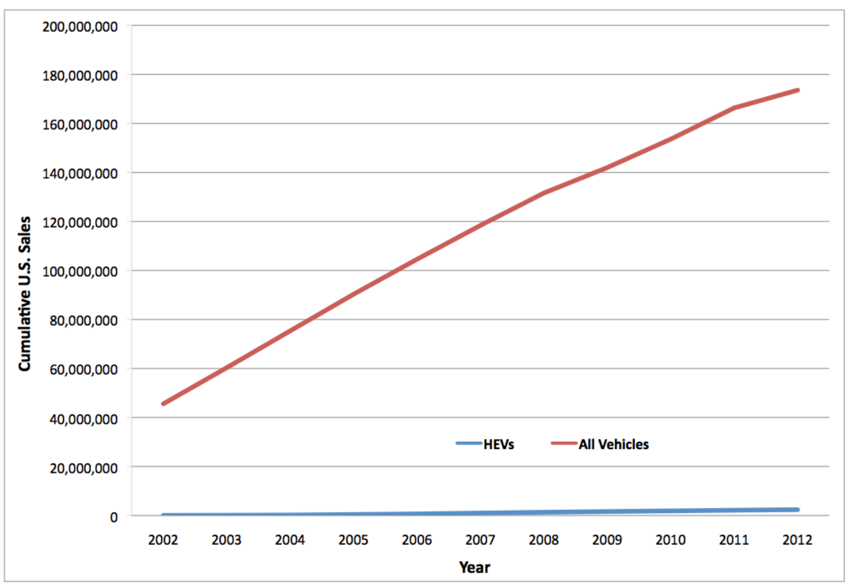

Figure 5: National Historical Cumulative Vehicle Sales

Local Vehicle Sales Data

Figure 6 shows local historical vehicle sales. Total annual vehicle sales (both conventional and alternative) for Bexar County have decreased from a high of 100,000 vehicles in 2002 to a low of about 60,000 vehicles in 2009.

Figure 6: Local Historical Vehicle Sales

A closer look at figures for hybrid and electric vehicles, as seen in Figure 7, evidences the relatively low level of adoption of these vehicles in the San Antonio area. Hybrids represent roughly 2% of the market. The trend is similar to that of the national market.

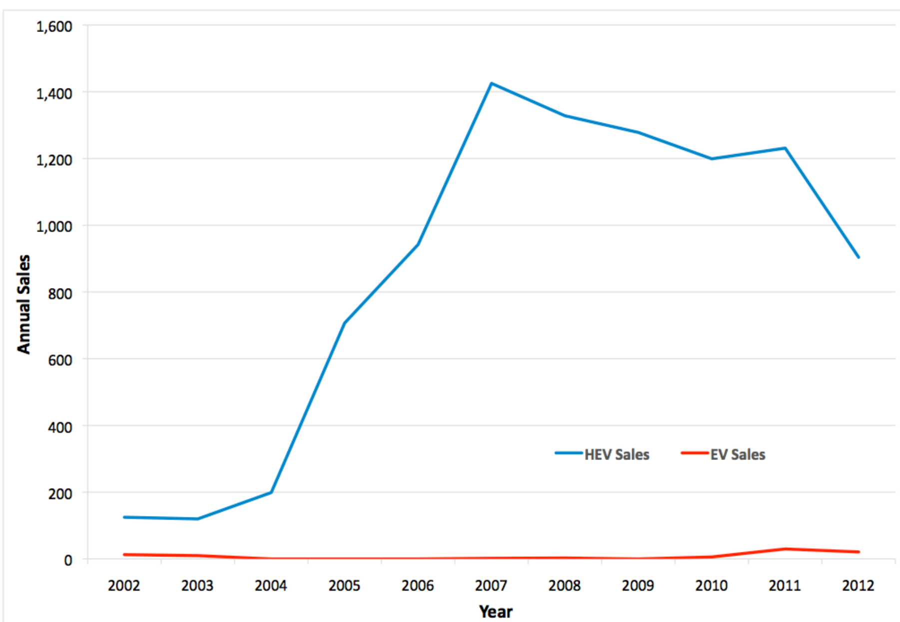

Figure 7: Local Historical Hybrid and Electric Vehicle Sales

Figure 8 presents local cumulative vehicle sales for the same time period (2002 - 2012).

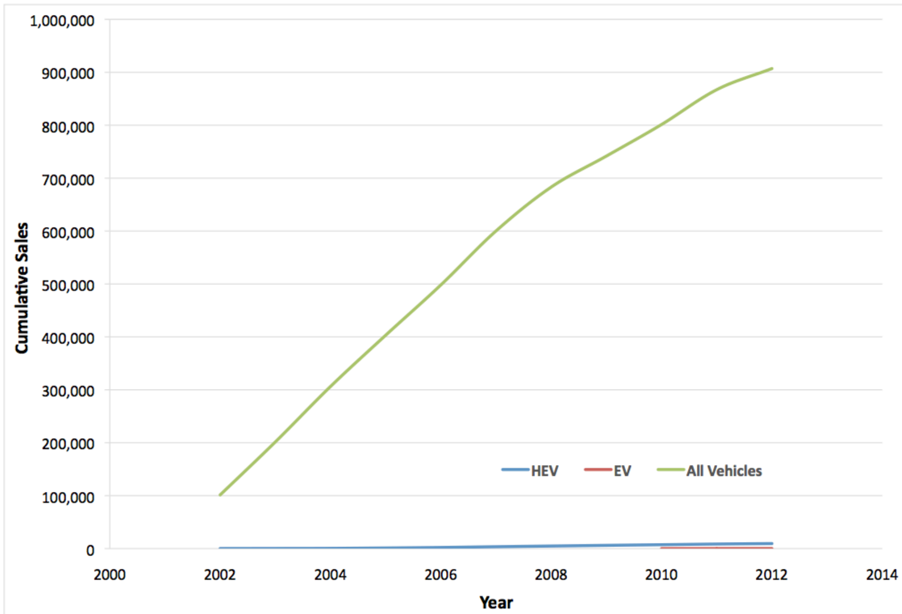

Figure 8: Local Historical Cumulative Vehicle Sales

Figure 9 presents local cumulative hybrid and electric vehicle sales. Alternative fuel vehicles represent a very small portion of the local market.

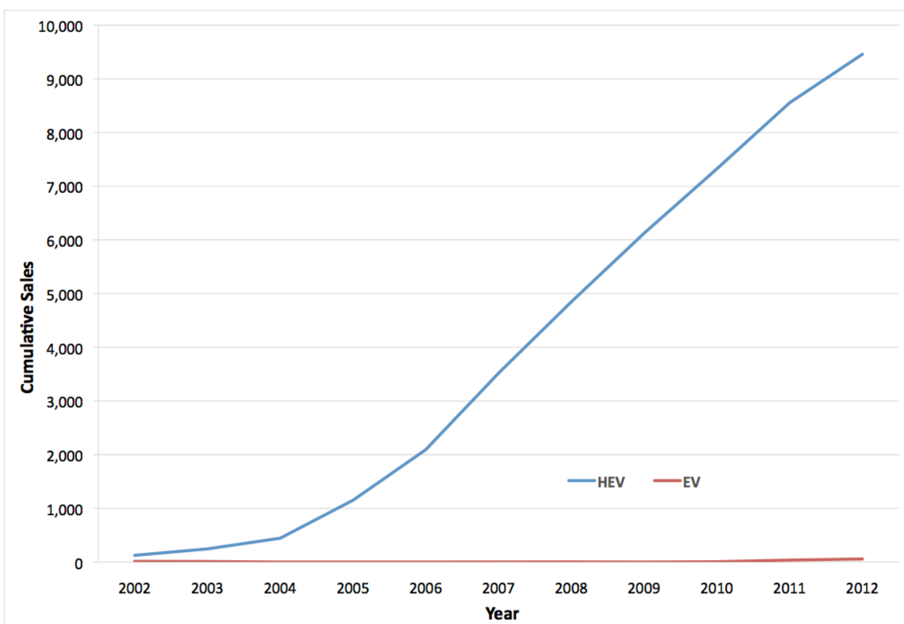

Figure 9: Local Historical Cumulative Hybrid and Electric Vehicle Sales

A comparison of global, national and local trends demonstrates that hybrids and electric vehicles represent a small percentage of the automotive industry market. There are geographic variations based on cultural, political and economic preferences. However, as a whole there needs to be a significant shift in consumers' minds paired with economic incentives to transform the industry and realize its potential. We are in the early stages of diversifying fleets across all sectors of society and looking into cost-effective alternatives for mobilizing millions of people living in more urbanized environments.

Table 3 summarizes historical hybrid and electric vehicle sales when compared to total vehicle sales (See also Figure 7). Partial figures for 2012 indicate that this year more hybrid vehicles will be registered (purchased) in the San Antonio area than ever before. It is a significant step in the direction of improving the efficiency of our fleet and reducing emissions citywide.

Table 3: Bexar County Car Sales (2002-2012)

Year	EV Total Sales	HEV Total Sales	Other Cars Sales	Total Sales	% Hybrids
2002	13	125	101,261	101,399	0.12%
2003	10	120	99,961	100,091	0.12%
2004	0	199	104,570	104,769	0.12%
2005	0	707	96,163	96,870	0.73%
2006	0	942	94,071	95,013	1.00%
2007	2	1425	100,601	102,028	1.39%
2008	3	1328	81,557	82,888	1.60%
2009	0	1278	57,301	58,579	2.18%
2010	6	1199	58,445	59,650	2.01%
2011	30	1231	64,526	65,787	1.87%
2012	21	904	38,952	39,877	2.27%

Substitutive effects brought on by fluctuating gasoline prices caused vehicle buyers to become more cost-conscious and rethink their driving preferences and habits, moving away from large conventional and less efficient gasoline vehicles (e.g., trucks and sport utility vehicles) to hybrids or smaller, more efficient ones.

Calculating Potential Market Size (M)

Estimating the potential market size (M) for a given product in a given geography is part art and part science. For the purposes of this study, the market size was calculated based on observed trends for the local hybrid vehicle market. Figure 10 presents cumulative sales of hybrid vehicles in the San Antonio area. There are only 13 years of historical data for hybrid vehicles. Two regression models (polynomial and linear) were applied to the data to identify the best fit and project future cumulative sales of hybrid vehicles. The two models resulted in relatively high R-squared (correlation coefficient or coefficient of determination) values, 0.988 and 0.967 respectively. Based on the two models, cumulative sales of hybrid vehicles by 2022 are predicted to range between 19,000 and 30,000.

Adoption of electric vehicles is expected to take place at lower levels and slower pace than hybrid vehicles have over the past 13 years. Price premium (about $20,000), current gasoline prices, and the paradigm shift represented by the purchase of an EV are all key variables limiting the adoption of electric vehicles.

A potential market size "M" of 20,000 was selected to run three of the four proposed models based on the Generalized Bass model. The fourth model is not dependent on "M". Adoption of vehicles is calculated based on a series of coefficients representing the unique socio-economic characteristics of consumers within the San Antonio area.

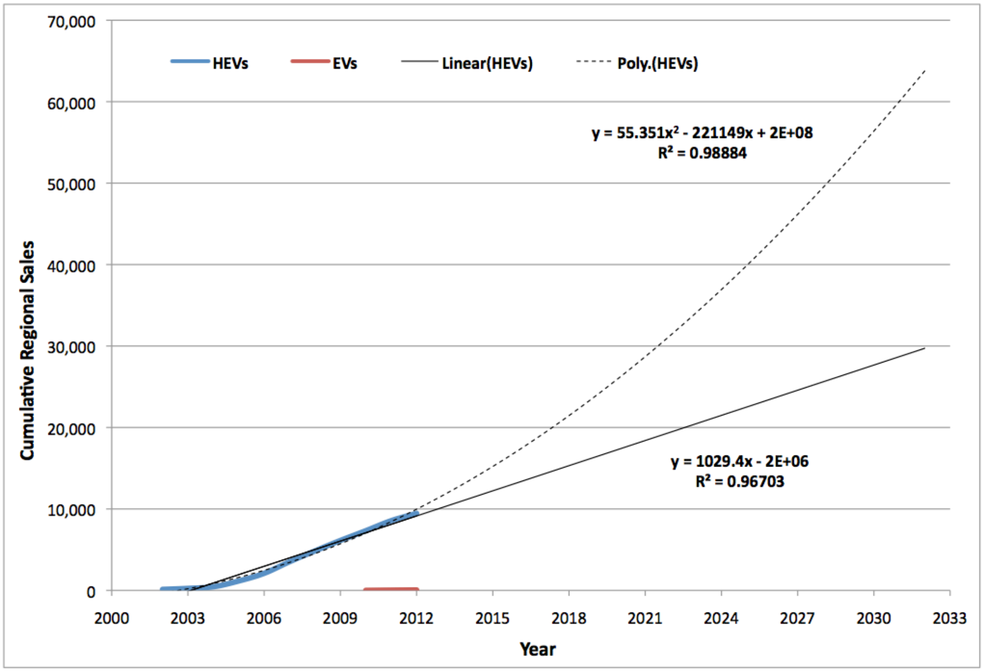

Figure 10: Projecting Local Hybrid Sales into the Future

Proposed Models for the San Antonio Area

EV Adoption Forecast using p and q from Michigan Study

The first model presented in Figure 11 was developed using the p and q for hybrid vehicles from the Michigan Study in combination with the potential market size "M" as calculated in the previous section of the report (M = 20,000). EVBass model parameters would then be p = 0.002, q = 0.779 and M = 20,000.

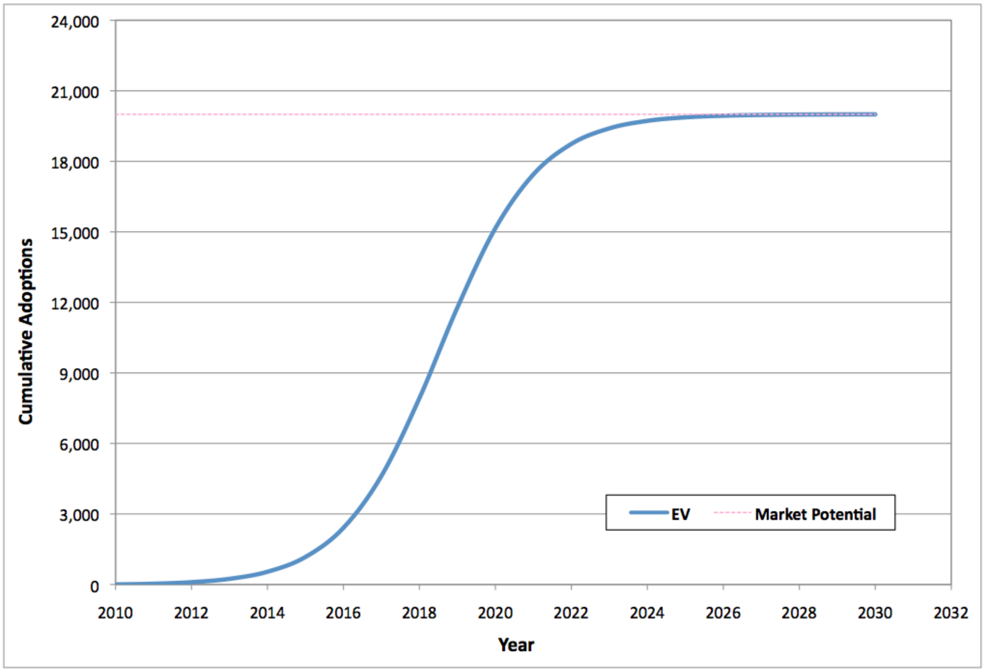

Figure 11: EV Model Forecast with Parameters from Michigan Study

EV Adoption Forecast using the Analogous Product Model

The second proposed model, based on the Analogous Product theory, resulted in two version of the model, depending on which analogous product was selected. The models were developed using: a) the p and q describing adoption of diesel vehicles, and b) based on p and q for adoption of hybrid vehicles. Potential market size "M" was kept at 20,000 as calculated in this study.

Figure 12 shows the results of the model run based on diesel vehicles. The figure shows a significantly lower and slower level of adoption for electric vehicles when compared with adoption of hybrid vehicles.

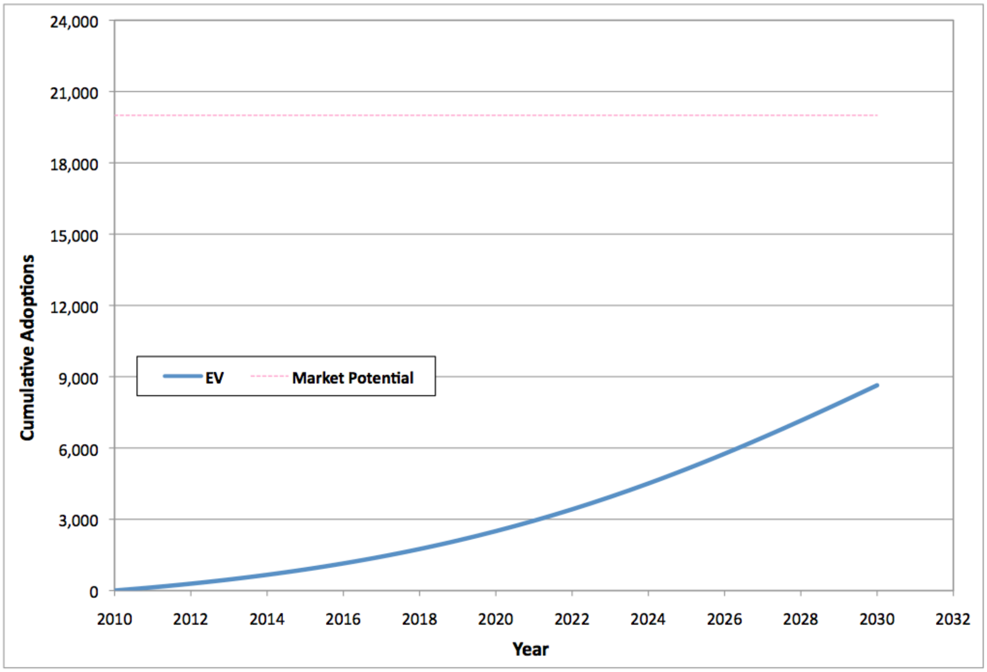

Figure 12: EV Model Forecast using Parameters from an Analogous Product (Diesel Adoption)

EV Adoption Forecast using the Weighted Average of Analogous Products

The third proposed model was developed using a weighted average p and q values from analogous products (e.g., hybrid vehicles, diesel engines and plug-in hybrid vehicles). Resulting p (p = 0.00188) and q (q = 0.698) values were combined with the potential market size "M" of 20,000 as calculated earlier in this study.

The desire to arrive at precise figures for the Bexar County area prompted a weighting of the analogous p and q parameter figures for the Hybrid (HEV) according to product characteristic and market structure. The resulting p and q generated are then used as EV parameters. This critical step taken to arrive at EV parameters highlights any correlation between the market in question and the HEV market.

Table 4 summarizes the parameters utilized to estimate the weighted average p and q coefficients for the proposed model.

Table 4: Innovation and Imitation Coefficients for Analogous Products

Product	p	q
Diesel Engines	0.0063	0.14
Hybrid Vehicles	0.00124	0.77922
Plug-In Hybrid Vehicles	0.00124	0.77922

Table 5 shows the calculation of the weighted average parameters.

Table 5: Calculating Weighted Average Coefficients

Product	Market Structure	Product Characteristics	Weighted Score	
	Weight = 0.4	Weight = 0.6	Intermediate	Weighted
Diesel Engines	2.0	1.0	1.4	0.127273
Hybrid Vehicles	4.0	3.0	3.4	0.309091
Plug-In Hybrid Vehicles	8.0	5.0	6.2	0.563636

Figure 13 shows the results of the model run based on weighted average coefficients estimated from analogous products. The figure shows a slower level of adoption for electric vehicles when compared with adoption of hybrid vehicles.

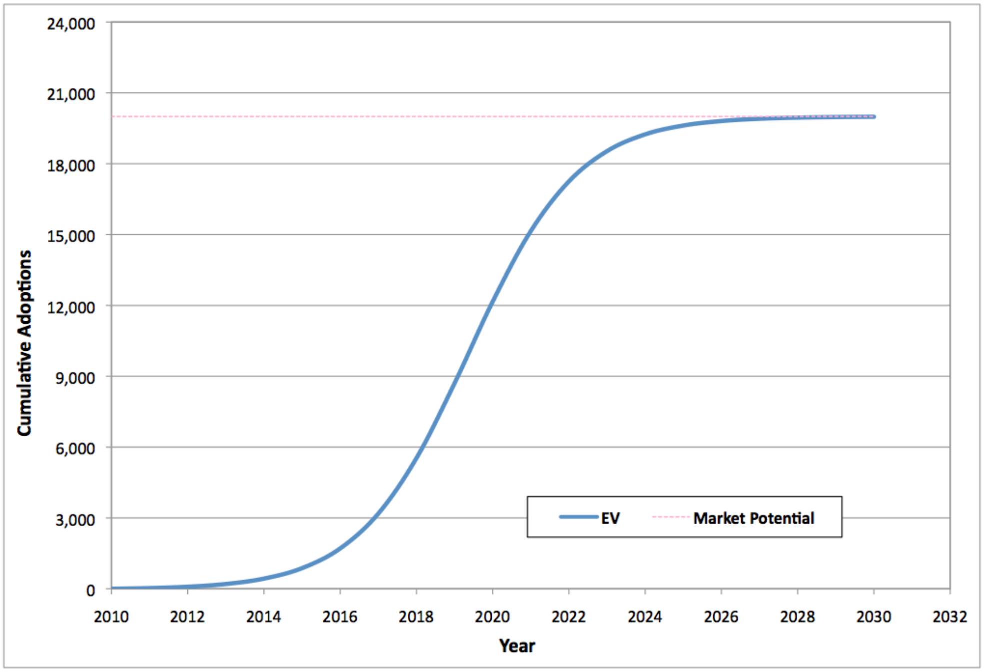

Figure 13: EV Model Forecast using Weighted Average Parameters

EV Adoption Forecast using a Multivariate Model

The fourth proposed model is a multivariate model, which differs from the Bass model approach. The proposed multivariate model used a series of socio-economic indicators (income levels, educational achievement, population of drivers) coupled with fuel prices, vehicle replacement and consumers' awareness of the EV market to predict EV adoption over a 20-year period (2011-2030).

The basic hypothesis of this approach is that all variables are dependent upon each other; in other words, the total value is a nesting of all variables as if they were part of a series on Venn diagrams. Consumers; awareness is the level of advertisement, news, and articles that appear in the local newspapers, magazines, on TV and on the radio.

The model can be described by the formula below,

$$\textit{Total Number of EVs}_{(t)} = VD \times a_i \times b_i \times c_i \times d_i \times e_i$$

Where, VD is the number of drivers within the target population;

- a_i represents the vehicle replacement ratio;
- b_i represents the income level ratio;
- c_i corresponds to the educational achievement ratio;
- d_i represents the fuel cost ratio; and
- e_i is the awareness level coefficient

Replacement is the rate at which vehicles are replaced in the market based on wear and tear, accidents, and the caprices of the owner. It is usually a constant, which for the purposes of this study, has been defined as +4% based on information obtained from the American Manufacturers Association. The replacement rate was kept at 1.0 (no replacement) for the first five years of the projection, and 1.04 thereafter.

Income level is a fraction that represents the number of families earning over $150,000 per year divided by the total number of families in the target area. The initial value is 5.6% with an annual growth rate of 1.4%.

Educational achievement is a ratio defined as the number of people who hold a bachelors degree or higher divided by the total number of adults in the target area. The initial value is 15% with an annual growth rate of 1.2%.

Fuel cost is a ratio of the gasoline cost to electricity cost in the target area. The initial value for this coefficient is calculated by determining the energy content for one gallon of gasoline (114,100 BTU) and one kWh of electricity (3,412 BTU). The initial value is 1.12 based on $3.65/gal of gasoline and $3.24 equivalent for electricity.

Calculations of each variable are determined from data obtained from the 2010 Census. The initial number of drivers in the target area is estimated to be 400,000.

Figure 14 presents the results of the model. Estimated adoption follows a similar trend to that exhibited by diesel vehicles but represents a lower level of adoption.

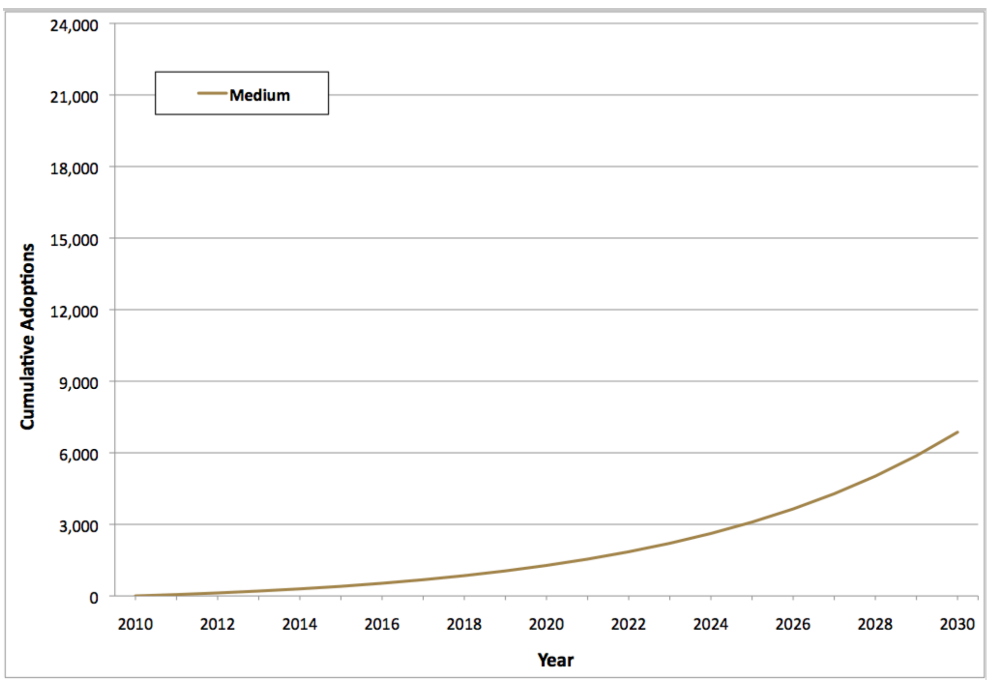

Figure 14: EV Multivariate Model Forecast

Two other scenarios were explored by adjusting the income level and educational achievement of the target population. Those resulted in higher and lower estimates than the ones shown in Figure 14. The higher estimate, labeled “High” in Figure 15, was obtained by reducing the income level to $100,000 combined with an educational achievement of at least a high school diploma. The lower estimate, labeled “Low” in Figure 15, was obtained by increasing the income level to $200,000 and an educational achievement of at least a master’s degree or higher.

Figure 15 shows the results of the three scenarios. Predicted adoption of electric vehicles in the area could range from as low as 1,800 vehicles to as high as 30,000 vehicles over a 20-year period. Previous estimates developed by EPRI seemed to indicate a slightly higher level of adoption over the same time period.

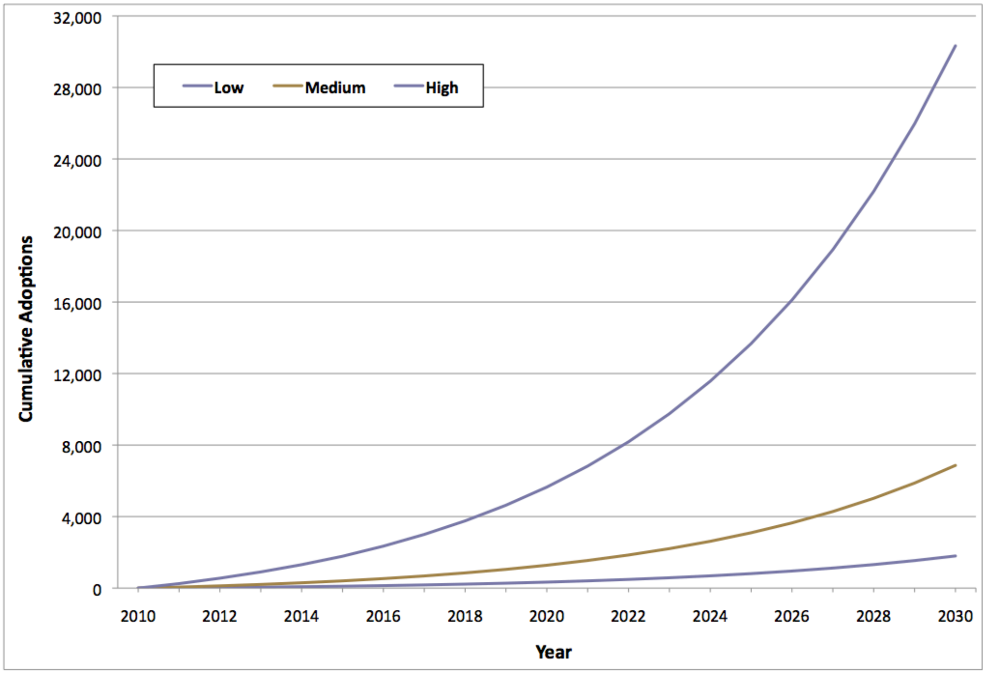

Figure 15: EV Multivariate Model Forecast Scenarios

Discussion/Analysis

The Michigan and EPRI studies appeared to be too optimistic of the adoption rate as compared to recent data for the San Antonio area. Based on preliminary results of our study, adoption of electric vehicles in the San Antonio market will lag behind national averages, even though the city is well ahead of the curve with regards to providing adequate access to publicly available electric vehicle charging infrastructure.

The Bass Algorithm, as developed by Bass in the 1960s and utilized in this study, uses two main parameters, namely innovation (p) and imitation (q). The innovation parameter is concerned with the technology and financial matters of the issue. The imitation parameter is concerned with the awareness and news one hears about a particular issue, as well as recommendations one gets from family and friends. The EV market faces steep competition. It is a relatively new technology and as such unproven in the eyes of the consumer. New technology appeals to a small percentage of the population, the Innovators! The price premium (about $20,000) combined with the newness of the technology utilized by these vehicles further complicates the challenge. There are relatively few EVs on the road, thus limiting the potential impact of the imitation parameter.

After 13 years, hybrid vehicles still represent a very small percentage of the automobile market. The Toyota Prius continues to dominate the sector, but faces growing competition from other brands. Today, most car manufacturers have at least one hybrid model. Most car companies also have a variety of “smaller” and more efficient vehicles, which directly compete with their hybrid and electric counterparts. The price premium for consumers seeking to enter the hybrid market remains about the same (approximately $5,000). However, most incentives have been removed. Sales of hybrid vehicles represent about 2% of total vehicle sales in the U.S., which would indicate that the hybrid vehicles market has not transitioned into the next stage of adoption represented by the “Early Adopters.” Hybrids seem to be stuck in the “Innovator”phase of the continuum.

The proposed multivariate model takes into account the same factors as the Bass model, plus replacement (a minor factor at this stage), plus fuel (gasoline and electricity) pricing, income and educational achievement levels of the population under study. It is based on the assumption that all factors are multiplicative, and that each factor can be seen as a subset of the next, and so on. For example, automobile owners in the San Antonio area with advanced degrees, exceeding a certain income level, sensitive to fuel prices, and sensitive to news stories relating to electric vehicles may be influenced to purchase an EV. In other words, automobile owners meeting several criteria are likely buyers.

The purpose of the proposed multivariate model was to capture the unique socio-economic characteristics of the city of San Antonio. San Antonio is a big city with a small community mindset. It is a more traditional and conservative market. It is also very diverse demographically and economically. A small percentage (5.6%) of the population has an estimated income level of over $150,000 per year. The city is growing rapidly, but growth is higher in the under-represented, less educated and less wealthy sectors of the community. Members of these groups cannot afford to purchase an electric vehicle. They struggle to make ends meet on a daily basis.

Based on preliminary findings, adoption of electric vehicles is being hampered by the following factors:

- Significant price premium between EVs and equivalent size vehicles, even within the same car manufacturer
- Costs associated with operation of maintenance of an EV are mostly uncertain, given the short track record (since 2010)
- Current federal tax incentives ($7,500) are not high enough to overcome the price premium paid by consumers
- Costs associated with purchase and installation of the necessary charging infrastructure can be significant and are commonly not rolled into the financing of the vehicle
- EVs represent a significant paradigm shift in the mind of consumers, one for which the American public may not be ready
- Cost of battery pack are high and its replacement frequency is uncertain (cars have been in operation for the last couple of years while car manufacturers guarantee the battery pack for a period of 7 to 8 years)
- Lack of clear policies at the local, state and federal level incentivizing adoption of EVs
- Suspect marketing practices from car manufacturers (prices advertised on corporate sites are not available at local dealerships)

SECTION 5:
COMPARISON OF CONVENTIONAL AND ELECTRIC VEHICLES

With current gas prices and federal tax incentives (e.g., $7,500 for electric vehicles), it will take nearly a decade to breakeven on the total cost of ownership of an electric vehicle versus a comparable size gasoline driven vehicle.

For this analysis, it was assumed that cars are driven 15,000 miles annually, with 60% city and 40% highway miles. The loan terms are 4.5% for 60 months, with an average car ownership of 7 years. Fuel prices were set at $3.65 per gallon for regular gasoline and $0.10 per kWh for electricity, the current average for the San Antonio region. A federal tax rebate of $7,500 was assessed for the first year, and no local tax incentive was utilized. Specific vehicle information including vehicle MSRP, fuel efficiency (miles/gal, miles/kWh), and destination fees was compiled from www.edmunds.com, a commonly consulted automotive industry consumer website. The information found at this website matches information provided by car manufacturers on their own corporate websites. Maintenance costs are determined based on engine type (gas versus electric) with oil changes every 3,000 miles ($40 per oil change) and tire rotations every 7,500 miles ($40 per tire rotation). Tire rotation costs were applied to all vehicles while oil change costs were applied to the vehicles running primarily on gasoline. Supplemental maintenance fees of $300 for gas vehicles and $250 for electric vehicles were applied after year two when drivers often see an increase in maintenance. Automotive insurance was not included in the calculations as the cost varies based on driver's driving record, age and gender as well as type of car being insured and other specific regional characteristics. Replacement costs of electric vehicle batteries were not included because car ownership is typically shorter than battery life.

Cars with similar specifications were compared from four different automakers: Chevrolet, Ford, Honda, and Nissan. The Chevrolet Cruze Eco was compared to the Chevrolet Volt, a plug-in hybrid. The Ford Focus was compared to its equivalent, the Ford Focus Electric, as was the Honda Fit and Honda Fit Electric. The Nissan Versa was compared to the Nissan Leaf, a plug-in electric. The cars were compared in five different scenarios:

1. Electric Vehicles and Gas Powered Vehicles with gas at $3.65/gallon and no tax incentive to purchase an alternative fuel vehicle
2. Gas vehicles if gas were $5/gallon, a price that may not be far off in the future for many drivers across the United States
3. Gas vehicles if gas were $7.60/gallon, the equivalent of the average gas prices in the European Union (assuming an Unleaded Fuel Average price of €1.602/liter and $1 US dollar equivalent to €0.7983)
4. Electric Vehicles with a $7,500 federal tax incentive, the current incentive in the United States
5. Electric Vehicles with an increased federal tax incentive of $15,000

The Chevrolet Case

The Chevrolet Volt runs on electricity for 36 miles, then shifts over to gasoline to generate electricity and power the vehicle. It was assumed that the Volt would run for the full 36 miles and then an additional 5.1 miles on gas each day (15,000/yr / 365 days = 41.1 miles/day). Figure 1 shows the results of a breakeven analysis for the two Chevrolet vehicles. Based on the minimal amount of gasoline used by the Volt, it is clear that gasoline prices do not affect the total cost of ownership greatly. Based on current market conditions, it would take 13 years for a future Volt owner to break even when compared to the cost of ownership of the Cruze Eco. A second scenario was run assuming gas prices reached $5/gallon. Under this scenario, it would take 9 years to break even. If gas prices reached $7.60/gallon, it would take 5 years to break even. A final scenario evaluated the impact of a $15,000 tax incentive for electric cars. In this case, the Volt owner would break even at 7 years, after which it would have a lower cost of ownership.

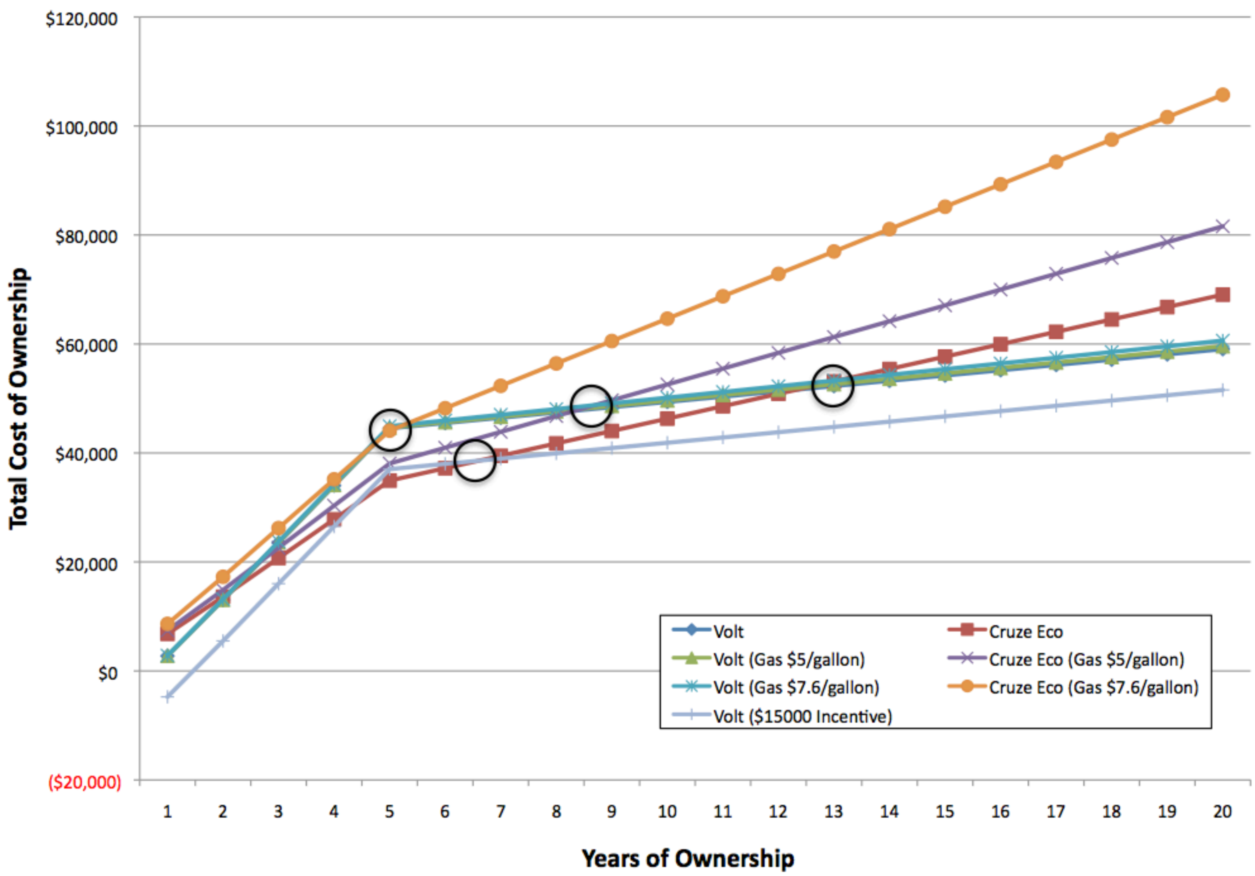

Figure 16: Chevrolet Breakeven Calculation

The Ford Case

The Ford Focus Electric has an estimated range of 76 miles, sufficient for most consumers' daily commute (based on 15,000 total annual miles driven).

Figure 2 shows the results of the analysis. Based on current market conditions, it would take 12 years for the Focus Electric to break even compared with the standard Focus vehicle. If gas prices were to reach $5/gallon, it would take 8 years to break even. If gas prices reached $7.60/gallon, it would take 5 years to break even. With a $15,000 tax incentive on electric cars, the Focus Electric would break even at about 7 years, after which it would have a lower cost of ownership.

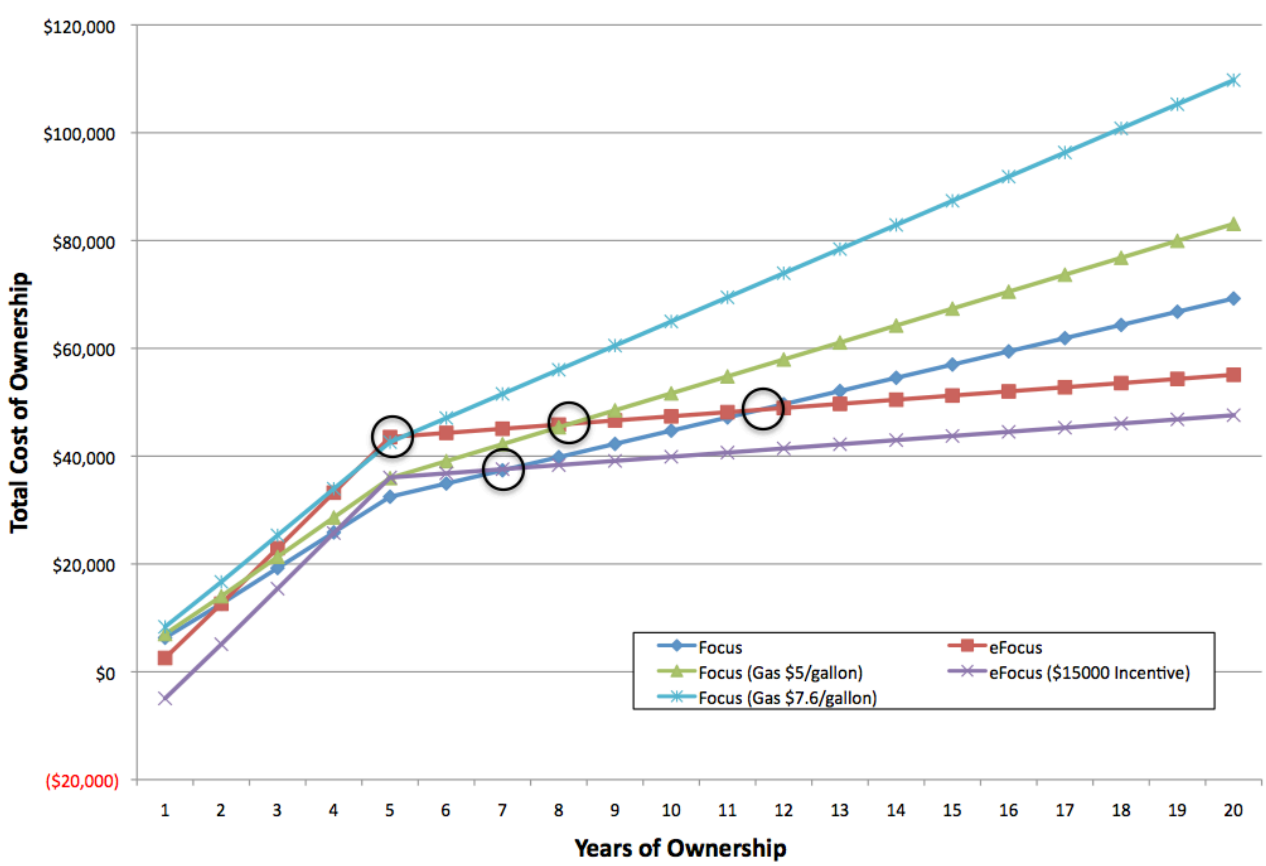

Figure 17: Ford Breakeven Calculation

The Honda Case

The Honda Fit Electric has an estimated range of 76 miles, sufficient for most consumers' daily commute (based on 15,000 total annual miles driven).

Figure 3 shows the results of the analysis. Based on current market conditions, it would take 11 years for the Honda Fit Electric to break even compared with the standard Fit. If gas prices were to reach $5/gallon, it would take 8 years to break even. If gas prices reached $7.60/gallon, it would take 5 years to break even. With a $15,000 tax incentive on electric cars, the Fit Electric would break even just after 7 years, after which it would have a lower cost of ownership.

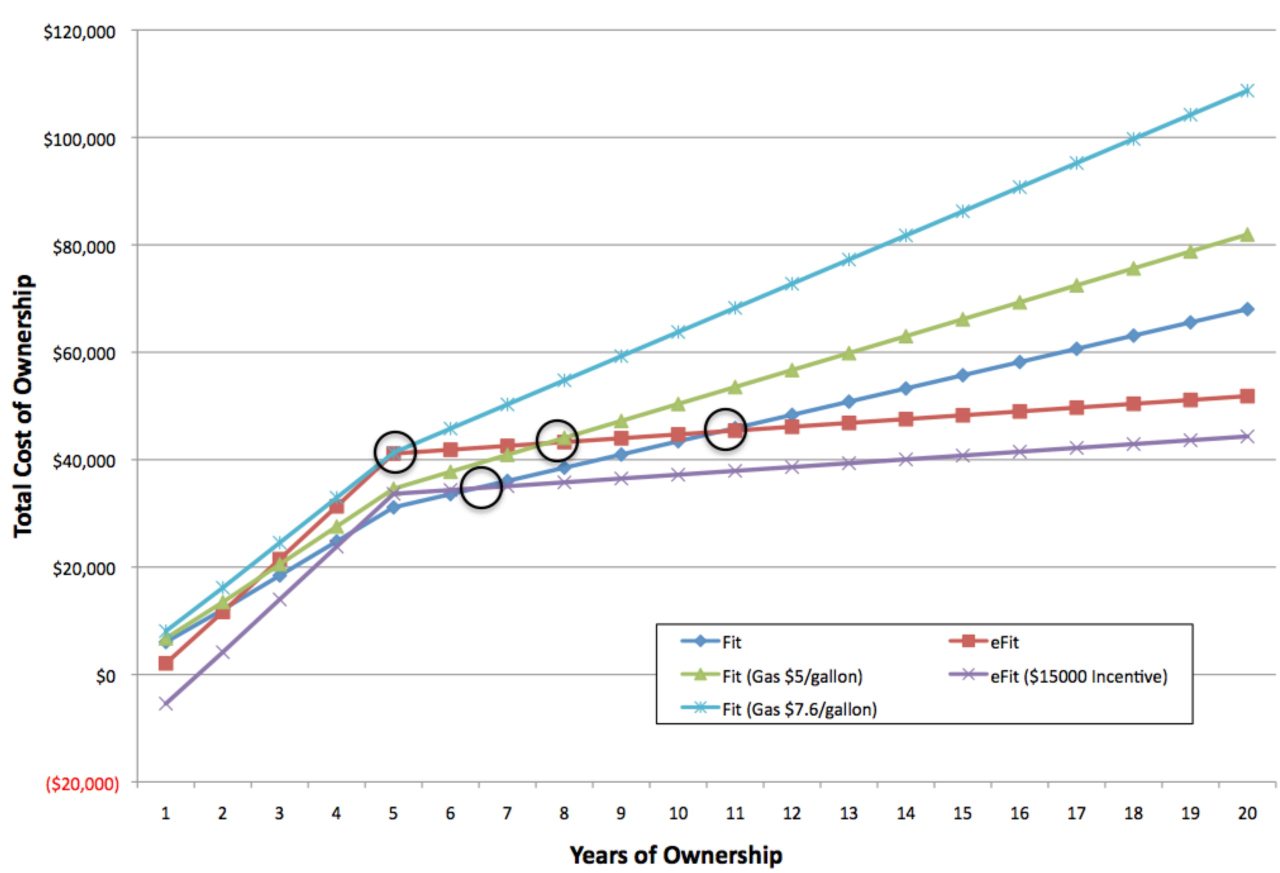

Figure 18: Honda Breakeven Calculation

The Nissan Case

The Nissan Leaf has an estimated range of 100 miles, sufficient for most consumers' daily commute (based on 15,000 total annual miles driven).

Figure 4 shows the results of the analysis. Based on current market conditions, it would take 9 years for the Nissan Leaf to break even compared with the standard Versa. If gas prices were to reach $5/gallon, it would take 7 years to break even. If gas prices reached $7.60/gallon, it would be consistently cheaper to drive the Leaf in comparison to the Versa. With a $15,000 tax incentive on electric cars, the Leaf would be consistently cheaper than the Versa, with increasingly lower costs of ownership after 5 years of ownership.

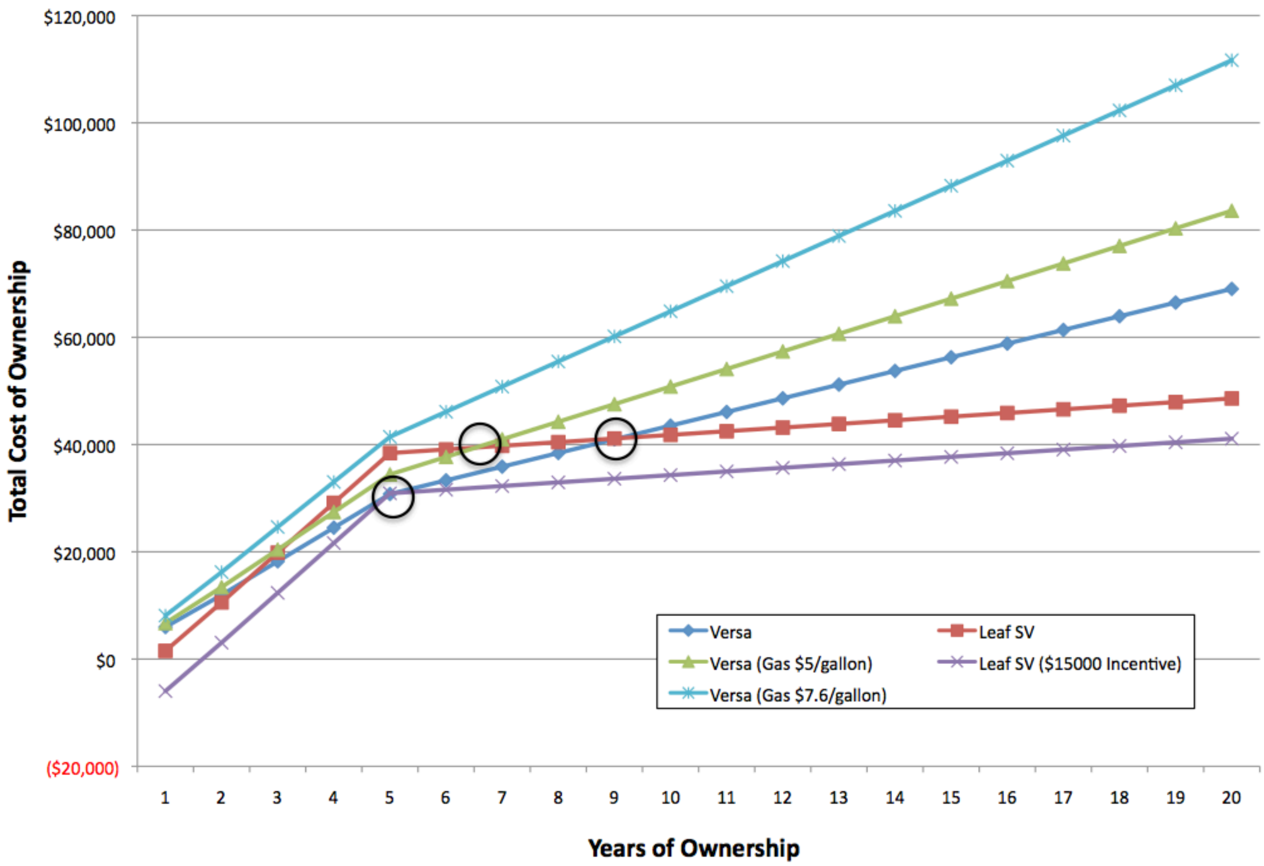

Figure 19: Nissan Breakeven Calculation

SECTION 6: CONCLUSIONS

In summary, the Institute's electric vehicle adoption model predicts that adoption of EVs in Bexar County will proceed slowly, with a projected total ranging from 1,800 to 30,000 vehicles in service in the region by 2030. The high upfront costs of EVs (price premium of about $20,000) generally trump the fuel savings of EVs from a total cost of ownership perspective. Current incentives, while significant ($7,500), are not sufficient to overcome upfront costs and truly incentivize consumer adoption. Furthermore, uncertainty related to battery life and replacement cost forces consumers to assume undue risk when purchasing a new electric vehicle, not because current technology is flawed but because car companies are not willing to assume the risk and promote innovation.

The Institute's modeling indicates that the typical EV on the market today will not reach a break even point with comparable conventional vehicles for an average of 10 – 12 years of ownership, assuming that the current federal incentives remain in place and that gasoline prices remain similar to today's levels. Predicted adoption rates of EVs are unlikely to increase unless gasoline prices and/or incentives substantially increase in the coming years.

Despite these findings, many personal and societal benefits arise from adoption of EVs. Emissions reductions from deployment of EVs could potentially assist with Clean Air Act compliance, which in turn is likely to have a significant impact on the San Antonio region in the near future in terms of environmental quality and highway funding. In addition, EVs will help auto manufacturers to meet enhanced federal Corporate Average Fuel Efficiency (CAFE) standards requiring improved fuel efficiency. The electricity used to power EVs is produced locally, while gasoline is often imported from foreign sources, and a portion of the proceeds from the sale of this electricity helps fund municipal services in San Antonio. Although range anxiety is commonly cited as a consumer concern, American driving patterns are generally consistent with EV ranges, and range anxiety is not an issue for PHEVs such as the Chevrolet Volt. While most cities have not developed publicly available EV charging infrastructure, San Antonio is ready with over 120 publicly available charging stations and range anxiety should not be an issue for local consumers.

Last month, Chevrolet unveiled a program targeted at incentivizing car dealerships with the objective of significantly increasing the number of Chevy Volts on the road. The program included very aggressive leasing terms in select market, as low as $199/month. This is a significant step in the right direction and a clear deviation from marketing strategies implemented by all car companies.

Recommendations for Future Research

Additional research is required to refine this adoption model and to allow for modeling of alternative policy and economic scenarios, to determine the local economic impacts of adoption rates of alternative vehicles, and to continue tracking consumer, vehicle and fuel price data, as material changes to these and other factors will continue to impact the likelihood that area residents will opt to purchase an EV when they are next in the market to replace their existing vehicle. Additional research into potential EV business models, including battery swap and battery leasing models that reduce the price premium may also be of value.

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APPENDIX A:
CHARTS AND TABLES

Table A 1: Electric Vehicles (EVs)

Manufacturer	Model	MSRP	Seating Capacity	Battery Type	Battery Capacity (kWh)	Electric Range (miles)	Miles per Gallon Equivalent (MPGe)	Battery Maker
Chevrolet	Volt	$39,145	4	Lithium Ion	16	36	93	
Honda	Fit	$37,415	5	Lithium Ion	20	76	132/105	
Mitsubishi	i-MiEV SE	$31,125	4	Lithium Ion	16	62	126/99	GS Yuas
	i-MiEV ES	$2,125	4	Lithium Ion	16	62	126/99	GS Yuas
Nissan	Nissan Leaf SL	$37,250	5	Lithium Ion	24	100	106/92	
	Nissan Leaf SV	$35,200	5	Lithium Ion	24	100	106/92	
Coda Electric	Coda	$37,250	5	Lithium Iron Phosphate	31	125	77/68	
Ford	Focus Electric	$39,200	5	Lithium ion	23	76	110/99	Compac Power Ir
Tesla	Model S	$57,400 $67,400 $77,400	5	Lithium Ion	40 60 85	160 230 300	88/90	
Toyota	Prius Plug-In Hybrid	$32,000	5	Lithium Ion		11	95	

SOURCE: www.edmunds.com

Table A 2: Hybrid Vehicles

Manufacturer	Model	MSRP	Seating Capacity	Engine	Battery Type	Battery Capacity (kWh)	Range (miles)	Miles per Gallon Equivalent (MPGe) by City/Highway	Sales to Date
BMW	ActiveHybrid 5	$60,950	5	3L 6-Cyl ActiveHybrid	Lithium Ion			21/30	
	ActiveHybrid 750i	$97,000	5	4.4L 8-Cyl ActiveHybrid	Lithium Ion			17/26	102
Buick	LaCrosse	$30,170	5	2.4L 6-Cyl				25/36	
Cadillac	Escalade Hybrid	$73,850	8	6L 8-Cyl				20/23	3,969
Chevrolet	Tahoe Hybrid	$51,970	8	6L 8-Cyl				20/23	8,471
	Silverado Hybrid	$38,725	4	6L 8-Cyl				20/23	
Ford	Fusion	$28,775	5	2.5L Atkinson-Cycl I4	Ni-Metal Hydride	26		41/36	36,370
	Escape Hybrid	$21,440	5	2.5L Atkinson-Cycl I5				34/31	106,467
GMC	Yukon	$52,470	8	6L 8-Cyl Hybrid Vortec	Ni-Metal Hydride			20/23	4,764
	Yukon Denali	$60,285	8	6L 8-Cyl Hybrid Vortec	Ni-Metal Hydride			20/23	
	Sierra 1500 Hybrid	$40,010	5	6L 8-Cyl Hybrid Vortec	Ni-Metal Hydride			20/23	3,991
Honda	Insight	$18,500	5	1.3L 4-Cyl	Ni-Metal Hydride			41/44	55,452
	Civic Hybrid	$24,200	5	1.5L 4-Cyl	Lithium Ion	20		44/44	204,513
	CR-Z	$19,695	4	2.7-L 4-Cyl	Ni-Metal Hydride			35/39	5,249
Hyundai	SonataHybrid	$25,850	5	2.7L 4-Cyl MPITheta II Atkinson	Lithium Polymer			35/40	

Manufacturer	Model	MSRP	Seating Capacity	Engine	Battery Type	Battery Capacity (kWh)	Range (miles)	Miles per Gallon Equivalent (MPGe) by City/Highway	Sales to Date
Kia	Optima Hybrid	$25,700	5	2.7L 4-Cyl Full Parallel Hybrid System	Lithium Polymer			35/40	
Lexus	CT Hybrid	$29,120	5	1.8L 4-Cyl Atkinson				43/40	
	HS Hybrid	$37,030	5	2.4L 4-Cyl Atkinson				35/34	17,362
	RX Hybrid	$45,910	5	3.5L 6-Cyl Atkinson				32/28	102,909
	GS Hybrid	$58,950	5	3.5L 6-Cyl Atkinson				22/25	4,881
	LS Hybrid	$112,750	5	5L 8-Cyl Atkinson				19/23	2,231
Lincoln	MKZ Hybrid	$34,755	5	2.5L 4-Cyl Atkinson	Ni-Metal Hydride			41/36	1,192
Mercedes-Benz	S400 Hybrid	$91,850	5	3.5L 6-Cyl	Lithium Ion			19/25	801
Porsche	Cayenne Hybrid	$69,850	6	3L 6-Cyl	Ni-Metal Hydride	1.7		20/24	206
	Panamera Hybrid	$96,150	5	3L 6-Cyl	Ni-Metal Hydride			22/30	
Toyota	Prius c	$18,950	5	1.5L 4-Cyl Hybrid	Ni-Metal Hydride		150K (life)	53/46	
	Prius	$24,000	5	1.8L 4-Cyl Hybrid	Ni-Metal Hydride		150K (life)	51/48	955,101
	Prius v	$26,550	5	1.8L 4-Cyl Hybrid	Ni-Metal Hydride		150K (life)	44/40	

Manufacturer	Model	MSRP	Seating Capacity	Engine	Battery Type	Battery Capacity (kWh)	Range (miles)	Miles per Gallon Equivalent (MPGe) by City/Highway	Sales to Date
	Camary L	$22,055	5	2.5L 4-Cyl	Ni-Metal Hydride		150K (life)	43/39	169,564
	Highlander		6	2.7L 4-Cyl	Ni-Metal Hydride			28/28	109,509
Volkswagen	Touareg Hybrid	$61,995	6	3L 6-Cyl Paralle Hybrid	Ni-Metal Hydride			20/24	

SOURCE: www.edmunds.com

Table A 3: Small Vehicles

Manufacturer	Model	MSRP	Seating Capacity	Engine
CHEVROLET	AVEO5 LS	$12,115	5	1.6L 4-cyl.
	AVEO5 1LT	$14,250	5	1.6L 4-cyl.
	AVEO5 2LT	$15,365	5	1.6L 4-cyl.
	CRUZE LS	$16,800	5	1.8L 4-cyl.
	CRUZE 1LT	$18,555	5	1.4L 4-cyl. Turbo
	CRUZE ECO	$19,325	5	1.4L 4-cyl. Turbo
	CRUZE 2LT	$20,685	5	1.4L 4-cyl. Turbo
	CRUZE LTZ	$23,190	5	1.4L 4-cyl. Turbo
	SONIC HATCHBACK LS	$14,765	5	1.8L 4-cyl.
	SONIC HATCHBACK LT	$15,865	5	1.8L 4-cyl.
	SONIC HATCHBACK LTZ	$17,365	5	1.8L 4-cyl.
FORD	FIESTA HATCHBACK S	$14,100	5	1.6L 4-cyl.
	FIESTA HATCHBACK SE	$15,670	5	1.6L 4-cyl.
	FIESTA HATCHBACK SES	$17,500	5	1.6L 4-cyl.
HYUNDAI	ACCENT HATCHBACK GS	$14,695	5	1.6L 4-cyl.
	ACCENT HATCHBACK GS	$17,300	5	1.6L 4-cyl.
	ACCENT HATCHBACK GS	$15,895	5	1.6L 4-cyl.
KIA	RIO HATCHBACK LX	$13,600	5	1.6L 4-cyl.
	RIO HATCHBACK EX	$16,500	5	1.6L 4-cyl.
	RIO HATCHBACK SX	$19,600	5	2.4L 4-cyl.
	FORTE HATCHBACK EX	$18,100	5	2.0L 4-cyl.
	RIO HATCHBACK SX	$17,700	5	1.6L 4-cyl.
MAZDA	MAZDA2 HATCHBACK Touring	$16,020	5	1.5L 4-cyl.
	MAZDA2 HATCHBACK Sporting	$14,530	5	1.5L 4-cyl.
	MAZDA3 HATCHBACK i-touring	$19,300	5	2.0L 4-cyl.
	MAZDA3 HATCHBACK s-touring	$21,800	5	2.5L 4-cyl.
	MAZDA3 HATCHBACK i-grand touring	$23,150	5	2.0L 4-cyl.
	MAZDA3 HATCHBACK s-grand touring	$23,400	5	2.5L 4-cyl.
NISSAN	JUKE HATCHBACK S	$19,990	5	1.6L 4-cyl.
	JUKE HATCHBACK SV	$21,610	5	1.6L 4-cyl.
	JUKE HATCHBACK SL	$23,930	5	1.6L 4-cyl.
	VERSA HATCHBACK 1.8S	$14,570	5	1.8L 4-cyl.
	VERSA HATCHBACK 1.8SL	$18,490	5	1.8L 4-cyl.
TOYOTA	YARIS L	$14,115	5	1.5L 4-cyl.

Manufacturer	Model	MSRP	Seating Capacity	Engine
	YARIS LE	$15,625	5	1.5L 4-cyl.
	YARIS SE	$16,400	5	1.5L 4-cyl.
MINI COOPER	WORKS	$31,400	4	1.6L 4-cyl.
	BASE	$21,200	4	1.6L 4-cyl.
	S	$24,900	4	1.6L 4-cyl.
FIAT	500 ABARTH	$22,000	4	1.4L 4-cyl.
	POP	$15,500	4	1.4L 4-cyl.
	SPORT	$17,500	4	1.4L 4-cyl.
	LOUNGE	$19,500	4	1.4L 4-cyl.
MITSUBISHI	ECLIPSE HATCHBACK GS	$19,499	4	2.4L 4-cyl.
	ECLIPSE HATCHBACK GS SPORT	$24,699	4	2.4L 4-cyl.
	ECLIPSE HATCHBACK SE	$24,699	4	2.4L 4-cyl.
	ECLIPSE HATCHBACK GT	$29,089	4	3.8L V6
	LANCER GT	$21,345	5	2.4L 4-cyl.
	LANCER ES	$18,395	5	2.0L 4-cyl.
SCION	iQ	$15,265	4	1.3L 4-cyl.
	tC	$18,575	4	2.5L 4-cyl.
	tC Release Series 7.0	$20,905	4	2.5L 4-cyl.
	xD	$15,345	4	1.8L 4-cyl.
	tC Release Series 4.0	$16,250	4	1.8L 4-cyl.
SUBARU	IMPREZA HATCHBACK 2.0i	$17,995	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i PZEV	$18,295	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Premium	$19,295	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Premium PZEV	$19,595	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Sport Premium	$20,295	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Sport Premium PZEV	$20,595	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Limited	$22,095	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Limited PZEV	$22,395	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Sport Limited	$22,595	5	2.0L 4-cyl.
	IMPREZA HATCHBACK 2.0i Sport Limited PZEV	$22,895	5	2.0L 4-cyl.
SUZUKI	SX4 HATCHBACK SportBack	$16,799	5	2.0L 4-cyl.
	Crossover	$16,999	5	2.0L 4-cyl.
	SportBack Techonology	$18,499	5	2.0L 4-cyl.
	Crossover Premium	$18,875	5	2.0L 4-cyl.
TOYOTA	Matrix Hatchback L	$18,845	5	1.8L 4-cyl.
	Matrix Hatchback S	$19,565	5	2.4L 4-cyl.
VOLKSWAGON	Beetle Hatchback PZEV	$18,995	4	2.5L 4-cyl.
	Beetle Hatchback Base	$18,995	4	2.5L 4-cyl.
	Beetle Hatchback 2.5L	$19,795	4	2.5L 4-cyl.
	Beetle Hatchback 2.5L PZEV	$19,795	4	2.5L 4-cyl.

Manufacturer	Model	MSRP	Seating Capacity	Engine
	Beetle Turbo 2.0T PZEV	$23,395	4	2.0L 4-cyl.
	Beetle Turbo 2.0T	$23,395	4	2.0L 4-cyl.
	Beetle Hatchback 2.0T Turbo Launch Edition PZEV	$24,950	4	2.0L 4-cyl.
	Golf Diesel 2.0L TDI	$24,235	4	2.0L 4-cyl.
	2.5L PZEV	$17,995	4	2.5L 4-cyl.
	GTI Hatchback	$23,995	4	2.0L 4-cyl.
	PZEV	$23,995	4	2.0L 4-cyl.
	Autobahn PZEV	$29,995	5	2.0L 4-cyl.
VOLVO	C30 Hatchback T5	$24,950	5	2.5L 4-cyl.
	C30 Hatchback T5 R-Design	$27,450	5	2.5L 4-cyl.

SOURCE: www.edmunds.com

Table A 4: Electric Vehicle Charging Stations

Company	Coulomb Technologies	ECOtality	Elektromotive	AeroVironment	General Electric	Siemens	Eaton	Levito
Model No.	CT503	Blink	Elektrobay	EVSE-RS	WattsStation	VersiCharge - 30A	Charging Station	Evr-Gre
Residential	x	x		x	x	x	x	x
Mounting	Wall	Wall	Ground/Wall	Wall	Wall	Wall	Wall/Pedestal	Wall
Cost	$2,295.00			$999 - $1070	$999.00			$1395 $1,04 $1495
Level 1							x	
Level 2	x	x	x	x	x	x	x	x
Power	7.2 kW		7 kW		7.2 kW	7.2 kW	3.6kW (Level 1) 7.2kW (Level 2)	3.8 or 7 kW
Voltage	208/240 VAC	240 VAC	240 VAC	208/240 VAC	208/240 VAC	208/240 VAC	110/120 VAC | 208/240 VAC	240 VA
Amps	30 A		32 A	30 A	30 A	30 A	16 A or 30 A (both)	16 A or 3
Size (HxWxD)	12.1" x 17.2" x 4"		1400 mm x 415mm x 257 mm (wall mount)	12" x 12" x 8"	23.9" x 16" x 6.1"	16.5" x 16.5" x 6.5"	10.07" x 15.20" x 5.34" (both)	
Region	North America / Australia		Fitted for any region	North America	North America	North America	North America	North Americ
No. of Outputs	1		1 (plug in)	1	1	1	1	1
Vehicle Plug	SAE J1772			SAE-J1772	SAE J1772		SAE J1772	SAE J17

Table A 5: Electric Vehicle Battery Types

Company	Tesla	A123		AESC	BYD	Lithium Energy Japan (GS-Yuasa)	Hitachi	Primearth EV (Panasonic EV)
Battery Type	Lithium Ion	Lithium Ion	Lithium Ion		Lithium Iron Phosphate	Lithium Ion	Lithium Ion	Nickel Metal-Hydride
Model		AMP20*M1*HD-A	AHR32113*M1*Ultra-B		Fe Battery	LEV50-4	173V	
Region	North America	US		Japan	China	Japan	Japan	Japan
Replacement Cost	$13,760.00							
Life-Span	7-10 yrs				>10 yrs			
Charge-Cycles		~3200			~2000			
Specific Energy		131 Wh/kg	71 Wh/kg		90-110 Wh/Kg			41 Wh/kg
Specific Power		2400 W/kg	2700 W/kg		>300 W/kg			
Range/Capacity		19.6 Ah	4.5 Ah			50 Ah	5.5 Ah	6.5 Ah
Weight		496 g	205 g			7.5 kg	24 Kg	1510 g
Notes	Replacement expected after 30% of battery charge capacity is lost	Partner with GE and Think Automotive		Partner with Nissan	Check if in US	Partner with Mitsubishi Motors	Partner with GM	

Table A 6: Weekly Gas Prices in Texas

Date	Weekly Gasoline Prices in Texas All Grades All Formulations ($/gal)
Jun 05, 2000	1.516
Jun 12, 2000	1.516
Jun 19, 2000	1.56
Jun 26, 2000	1.567
Jul 03, 2000	1.572
Jul 10, 2000	1.575
Jul 17, 2000	1.558
Jul 24, 2000	1.535
Jul 31, 2000	1.507
Aug 07, 2000	1.466
Aug 14, 2000	1.454
Aug 21, 2000	1.459
Aug 28, 2000	1.461
Sep 04, 2000	1.468
Sep 11, 2000	1.498
Sep 18, 2000	1.499
Sep 25, 2000	1.499
Oct 02, 2000	1.478
Oct 09, 2000	1.448
Oct 16, 2000	1.468
Oct 23, 2000	1.469
Oct 30, 2000	1.475
Nov 06, 2000	1.462
Nov 13, 2000	1.458
Nov 20, 2000	1.447
Nov 27, 2000	1.451
Dec 04, 2000	1.433
Dec 11, 2000	1.402
Dec 18, 2000	1.374
Dec 25, 2000	1.355
Jan 01, 2001	1.349
Jan 08, 2001	1.362
Jan 15, 2001	1.423
Jan 22, 2001	1.451
Jan 29, 2001	1.442
Feb 05, 2001	1.424
Feb 12, 2001	1.435
Feb 19, 2001	1.427
Feb 26, 2001	1.401
Mar 05, 2001	1.371
Mar 12, 2001	1.36
Mar 19, 2001	1.354
Mar 26, 2001	1.359
Apr 02, 2001	1.393
Apr 09, 2001	1.459
Apr 16, 2001	1.565
Apr 23, 2001	1.593
Apr 30, 2001	1.601
May 07, 2001	1.634
May 14, 2001	1.644
May 21, 2001	1.623
May 28, 2001	1.631
Jun 04, 2001	1.613
Jun 11, 2001	1.577
Jun 18, 2001	1.561
Jun 25, 2001	1.511
Jul 02, 2001	1.445
Jul 09, 2001	1.373
Jul 16, 2001	1.337
Jul 23, 2001	1.32
Jul 30, 2001	1.311
Aug 06, 2001	1.308
Aug 13, 2001	1.318
Aug 20, 2001	1.352
Aug 27, 2001	1.365
Sep 03, 2001	1.412
Sep 10, 2001	1.423
Sep 17, 2001	1.441
Sep 24, 2001	1.411
Oct 01, 2001	1.356
Oct 08, 2001	1.308
Oct 15, 2001	1.274
Oct 22, 2001	1.214
Oct 29, 2001	1.191
Nov 05, 2001	1.155
Nov 12, 2001	1.123
Nov 19, 2001	1.11
Nov 26, 2001	1.077
Dec 03, 2001	1.064
Dec 10, 2001	1.053
Dec 17, 2001	1.04
Dec 24, 2001	1.037
Dec 31, 2001	1.067
Jan 07, 2002	1.083
Jan 14, 2002	1.092
Jan 21, 2002	1.079
Jan 28, 2002	1.073
Feb 04, 2002	1.074
Feb 11, 2002	1.079
Feb 18, 2002	1.094
Feb 25, 2002	1.097
Mar 04, 2002	1.103
Mar 11, 2002	1.206
Mar 18, 2002	1.264
Mar 25, 2002	1.321
Apr 01, 2002	1.342
Apr 08, 2002	1.381
Apr 15, 2002	1.392
Apr 22, 2002	1.383
Apr 29, 2002	1.379
May 06, 2002	1.378
May 13, 2002	1.373
May 20, 2002	1.371
May 27, 2002	1.367
Jun 03, 2002	1.369
Jun 10, 2002	1.353
Jun 17, 2002	1.343
Jun 24, 2002	1.336
Jul 01, 2002	1.335
Jul 08, 2002	1.332
Jul 15, 2002	1.335
Jul 22, 2002	1.36
Jul 29, 2002	1.354
Aug 05, 2002	1.36
Aug 12, 2002	1.349
Aug 19, 2002	1.35
Aug 26, 2002	1.355
Sep 02, 2002	1.356
Sep 09, 2002	1.354
Sep 16, 2002	1.363
Sep 23, 2002	1.371
Sep 30, 2002	1.391
Oct 07, 2002	1.415
Oct 14, 2002	1.426
Oct 21, 2002	1.449
Oct 28, 2002	1.441
Nov 04, 2002	1.428
Nov 11, 2002	1.409
Nov 18, 2002	1.383
Nov 25, 2002	1.36
Dec 02, 2002	1.349
Dec 09, 2002	1.341
Dec 16, 2002	1.332
Dec 23, 2002	1.377
Dec 30, 2002	1.428
Jan 06, 2003	1.447

Jan 13, 2003	1.442
Jan 20, 2003	1.45
Jan 27, 2003	1.461
Feb 03, 2003	1.515
Feb 10, 2003	1.601
Feb 17, 2003	1.621
Feb 24, 2003	1.617
Mar 03, 2003	1.613
Mar 10, 2003	1.626
Mar 17, 2003	1.65
Mar 24, 2003	1.632
Mar 31, 2003	1.603
Apr 07, 2003	1.568
Apr 14, 2003	1.53
Apr 21, 2003	1.496
Apr 28, 2003	1.475
May 05, 2003	1.438
May 12, 2003	1.405
May 19, 2003	1.406
May 26, 2003	1.405
Jun 02, 2003	1.399
Jun 09, 2003	1.41
Jun 16, 2003	1.434
Jun 23, 2003	1.425
Jun 30, 2003	1.411
Jul 07, 2003	1.42
Jul 14, 2003	1.464
Jul 21, 2003	1.477
Jul 28, 2003	1.472
Aug 04, 2003	1.481
Aug 11, 2003	1.513
Aug 18, 2003	1.543
Aug 25, 2003	1.621
Sep 01, 2003	1.616
Sep 08, 2003	1.589
Sep 15, 2003	1.555
Sep 22, 2003	1.515
Sep 29, 2003	1.47
Oct 06, 2003	1.446
Oct 13, 2003	1.449
Oct 20, 2003	1.453
Oct 27, 2003	1.438
Nov 03, 2003	1.431
Nov 10, 2003	1.412
Nov 17, 2003	1.418
Nov 24, 2003	1.436
Dec 01, 2003	1.425
Dec 08, 2003	1.413

Dec 15, 2003	1.408
Dec 22, 2003	1.434
Dec 29, 2003	1.431
Jan 05, 2004	1.462
Jan 12, 2004	1.513
Jan 19, 2004	1.555
Jan 26, 2004	1.566
Feb 02, 2004	1.571
Feb 09, 2004	1.574
Feb 16, 2004	1.576
Feb 23, 2004	1.596
Mar 01, 2004	1.604
Mar 08, 2004	1.633
Mar 15, 2004	1.627
Mar 22, 2004	1.648
Mar 29, 2004	1.663
Apr 05, 2004	1.688
Apr 12, 2004	1.685
Apr 19, 2004	1.72
Apr 26, 2004	1.713
May 03, 2004	1.746
May 10, 2004	1.841
May 17, 2004	1.904
May 24, 2004	1.956
May 31, 2004	1.95
Jun 07, 2004	1.94
Jun 14, 2004	1.909
Jun 21, 2004	1.868
Jun 28, 2004	1.837
Jul 05, 2004	1.811
Jul 12, 2004	1.833
Jul 19, 2004	1.843
Jul 26, 2004	1.83
Aug 02, 2004	1.814
Aug 09, 2004	1.805
Aug 16, 2004	1.811
Aug 23, 2004	1.824
Aug 30, 2004	1.806
Sep 06, 2004	1.782
Sep 13, 2004	1.771
Sep 20, 2004	1.784
Sep 27, 2004	1.849
Oct 04, 2004	1.862
Oct 11, 2004	1.905
Oct 18, 2004	1.935
Oct 25, 2004	1.936
Nov 01, 2004	1.935
Nov 08, 2004	1.915

Nov 15, 2004	1.889
Nov 22, 2004	1.863
Nov 29, 2004	1.859
Dec 06, 2004	1.824
Dec 13, 2004	1.778
Dec 20, 2004	1.73
Dec 27, 2004	1.716
Jan 03, 2005	1.689
Jan 10, 2005	1.719
Jan 17, 2005	1.769
Jan 24, 2005	1.818
Jan 31, 2005	1.871
Feb 07, 2005	1.859
Feb 14, 2005	1.837
Feb 21, 2005	1.826
Feb 28, 2005	1.84
Mar 07, 2005	1.918
Mar 14, 2005	1.985
Mar 21, 2005	2.035
Mar 28, 2005	2.093
Apr 04, 2005	2.153
Apr 11, 2005	2.195
Apr 18, 2005	2.17
Apr 25, 2005	2.158
May 02, 2005	2.153
May 09, 2005	2.12
May 16, 2005	2.09
May 23, 2005	2.052
May 30, 2005	2.025
Jun 06, 2005	2.069
Jun 13, 2005	2.074
Jun 20, 2005	2.114
Jun 27, 2005	2.145
Jul 04, 2005	2.147
Jul 11, 2005	2.264
Jul 18, 2005	2.257
Jul 25, 2005	2.24
Aug 01, 2005	2.213
Aug 08, 2005	2.324
Aug 15, 2005	2.528
Aug 22, 2005	2.596
Aug 29, 2005	2.57
Sep 05, 2005	2.997
Sep 12, 2005	2.884
Sep 19, 2005	2.712
Sep 26, 2005	2.778
Oct 03, 2005	2.939
Oct 10, 2005	2.873

Oct 17, 2005	2.744
Oct 24, 2005	2.597
Oct 31, 2005	2.446
Nov 07, 2005	2.336
Nov 14, 2005	2.242
Nov 21, 2005	2.142
Nov 28, 2005	2.098
Dec 05, 2005	2.088
Dec 12, 2005	2.176
Dec 19, 2005	2.199
Dec 26, 2005	2.18
Jan 02, 2006	2.216
Jan 09, 2006	2.314
Jan 16, 2006	2.302
Jan 23, 2006	2.313
Jan 30, 2006	2.3
Feb 06, 2006	2.286
Feb 13, 2006	2.229
Feb 20, 2006	2.178
Feb 27, 2006	2.165
Mar 06, 2006	2.262
Mar 13, 2006	2.324
Mar 20, 2006	2.504
Mar 27, 2006	2.483
Apr 03, 2006	2.606
Apr 10, 2006	2.736
Apr 17, 2006	2.828
Apr 24, 2006	2.926
May 01, 2006	2.904
May 08, 2006	2.868
May 15, 2006	2.897
May 22, 2006	2.84
May 29, 2006	2.789
Jun 05, 2006	2.819
Jun 12, 2006	2.857
Jun 19, 2006	2.823
Jun 26, 2006	2.8
Jul 03, 2006	2.868
Jul 10, 2006	2.892
Jul 17, 2006	2.905
Jul 24, 2006	2.929
Jul 31, 2006	2.937
Aug 07, 2006	2.966
Aug 14, 2006	2.912
Aug 21, 2006	2.843
Aug 28, 2006	2.751
Sep 04, 2006	2.616
Sep 11, 2006	2.502

Sep 18, 2006	2.382
Sep 25, 2006	2.271
Oct 02, 2006	2.203
Oct 09, 2006	2.165
Oct 16, 2006	2.137
Oct 23, 2006	2.114
Oct 30, 2006	2.125
Nov 06, 2006	2.115
Nov 13, 2006	2.133
Nov 20, 2006	2.146
Nov 27, 2006	2.152
Dec 04, 2006	2.209
Dec 11, 2006	2.232
Dec 18, 2006	2.233
Dec 25, 2006	2.248
Jan 01, 2007	2.236
Jan 08, 2007	2.198
Jan 15, 2007	2.14
Jan 22, 2007	2.086
Jan 29, 2007	2.057
Feb 05, 2007	2.083
Feb 12, 2007	2.125
Feb 19, 2007	2.168
Feb 26, 2007	2.265
Mar 05, 2007	2.393
Mar 12, 2007	2.43
Mar 19, 2007	2.44
Mar 26, 2007	2.474
Apr 02, 2007	2.609
Apr 09, 2007	2.716
Apr 16, 2007	2.797
Apr 23, 2007	2.792
Apr 30, 2007	2.891
May 07, 2007	2.907
May 14, 2007	2.949
May 21, 2007	3.113
May 28, 2007	3.096
Jun 04, 2007	3.045
Jun 11, 2007	2.993
Jun 18, 2007	2.938
Jun 25, 2007	2.915
Jul 02, 2007	2.886
Jul 09, 2007	2.893
Jul 16, 2007	2.961
Jul 23, 2007	2.908
Jul 30, 2007	2.837
Aug 06, 2007	2.798
Aug 13, 2007	2.73

Aug 20, 2007	2.725
Aug 27, 2007	2.703
Sep 03, 2007	2.692
Sep 10, 2007	2.731
Sep 17, 2007	2.717
Sep 24, 2007	2.741
Oct 01, 2007	2.738
Oct 08, 2007	2.702
Oct 15, 2007	2.681
Oct 22, 2007	2.742
Oct 29, 2007	2.765
Nov 05, 2007	2.926
Nov 12, 2007	3.015
Nov 19, 2007	3.003
Nov 26, 2007	3.000
Dec 03, 2007	2.975
Dec 10, 2007	2.916
Dec 17, 2007	2.893
Dec 24, 2007	2.88
Dec 31, 2007	2.959
Jan 07, 2008	3.013
Jan 14, 2008	2.995
Jan 21, 2008	2.947
Jan 28, 2008	2.922
Feb 04, 2008	2.914
Feb 11, 2008	2.895
Feb 18, 2008	2.974
Feb 25, 2008	3.086
Mar 03, 2008	3.124
Mar 10, 2008	3.168
Mar 17, 2008	3.218
Mar 24, 2008	3.209
Mar 31, 2008	3.256
Apr 07, 2008	3.303
Apr 14, 2008	3.337
Apr 21, 2008	3.462
Apr 28, 2008	3.556
May 05, 2008	3.558
May 12, 2008	3.665
May 19, 2008	3.744
May 26, 2008	3.881
Jun 02, 2008	3.897
Jun 09, 2008	3.957
Jun 16, 2008	3.997
Jun 23, 2008	3.976
Jun 30, 2008	3.98
Jul 07, 2008	4.004
Jul 14, 2008	4.016

Jul 21, 2008	3.993
Jul 28, 2008	3.899
Aug 04, 2008	3.811
Aug 11, 2008	3.727
Aug 18, 2008	3.638
Aug 25, 2008	3.547
Sep 01, 2008	3.597
Sep 08, 2008	3.57
Sep 15, 2008	3.757
Sep 22, 2008	3.695
Sep 29, 2008	3.617
Oct 06, 2008	3.431
Oct 13, 2008	3.001
Oct 20, 2008	2.74
Oct 27, 2008	2.449
Nov 03, 2008	2.215
Nov 10, 2008	2.082
Nov 17, 2008	1.966
Nov 24, 2008	1.829
Dec 01, 2008	1.766
Dec 08, 2008	1.678
Dec 15, 2008	1.599
Dec 22, 2008	1.598
Dec 29, 2008	1.542
Jan 05, 2009	1.589
Jan 12, 2009	1.674
Jan 19, 2009	1.762
Jan 26, 2009	1.764
Feb 02, 2009	1.838
Feb 09, 2009	1.865
Feb 16, 2009	1.866
Feb 23, 2009	1.812
Mar 02, 2009	1.852
Mar 09, 2009	1.848
Mar 16, 2009	1.842
Mar 23, 2009	1.917
Mar 30, 2009	2.013
Apr 06, 2009	2.007
Apr 13, 2009	2.016
Apr 20, 2009	2.02
Apr 27, 2009	2
May 04, 2009	2.009
May 11, 2009	2.186
May 18, 2009	2.259
May 25, 2009	2.367
Jun 01, 2009	2.435
Jun 08, 2009	2.521
Jun 15, 2009	2.572

Jun 22, 2009	2.596
Jun 29, 2009	2.553
Jul 06, 2009	2.493
Jul 13, 2009	2.414
Jul 20, 2009	2.358
Jul 27, 2009	2.422
Aug 03, 2009	2.486
Aug 10, 2009	2.582
Aug 17, 2009	2.58
Aug 24, 2009	2.557
Aug 31, 2009	2.519
Sep 07, 2009	2.46
Sep 14, 2009	2.436
Sep 21, 2009	2.409
Sep 28, 2009	2.358
Oct 05, 2009	2.343
Oct 12, 2009	2.37
Oct 19, 2009	2.482
Oct 26, 2009	2.59
Nov 02, 2009	2.607
Nov 09, 2009	2.569
Nov 16, 2009	2.539
Nov 23, 2009	2.552
Nov 30, 2009	2.536
Dec 07, 2009	2.552
Dec 14, 2009	2.516
Dec 21, 2009	2.488
Dec 28, 2009	2.512
Jan 04, 2010	2.564
Jan 11, 2010	2.65
Jan 18, 2010	2.653
Jan 25, 2010	2.619
Feb 01, 2010	2.572
Feb 08, 2010	2.548
Feb 15, 2010	2.514
Feb 22, 2010	2.561
Mar 01, 2010	2.625
Mar 08, 2010	2.667
Mar 15, 2010	2.72
Mar 22, 2010	2.732
Mar 29, 2010	2.719
Apr 05, 2010	2.77
Apr 12, 2010	2.808
Apr 19, 2010	2.795
Apr 26, 2010	2.78
May 03, 2010	2.835
May 10, 2010	2.854
May 17, 2010	2.826

May 24, 2010	2.759
May 31, 2010	2.705
Jun 07, 2010	2.668
Jun 14, 2010	2.637
Jun 21, 2010	2.653
Jun 28, 2010	2.669
Jul 05, 2010	2.642
Jul 12, 2010	2.623
Jul 19, 2010	2.608
Jul 26, 2010	2.64
Aug 02, 2010	2.627
Aug 09, 2010	2.692
Aug 16, 2010	2.664
Aug 23, 2010	2.619
Aug 30, 2010	2.577
Sep 06, 2010	2.565
Sep 13, 2010	2.582
Sep 20, 2010	2.624
Sep 27, 2010	2.603
Oct 04, 2010	2.633
Oct 11, 2010	2.72
Oct 18, 2010	2.725
Oct 25, 2010	2.716
Nov 01, 2010	2.689
Nov 08, 2010	2.728
Nov 15, 2010	2.771
Nov 22, 2010	2.735
Nov 29, 2010	2.708
Dec 06, 2010	2.843
Dec 13, 2010	2.869
Dec 20, 2010	2.886
Dec 27, 2010	2.943
Jan 03, 2011	2.976
Jan 10, 2011	2.983
Jan 17, 2011	3.016
Jan 24, 2011	3.01
Jan 31, 2011	2.989
Feb 07, 2011	3.022
Feb 14, 2011	3.045
Feb 21, 2011	3.065
Feb 28, 2011	3.288
Mar 07, 2011	3.459
Mar 14, 2011	3.488
Mar 21, 2011	3.473
Mar 28, 2011	3.524
Apr 04, 2011	3.622
Apr 11, 2011	3.743
Apr 18, 2011	3.807

Apr 25, 2011	3.81
May 02, 2011	3.906
May 09, 2011	3.899
May 16, 2011	3.907
May 23, 2011	3.786
May 30, 2011	3.699
Jun 06, 2011	3.648
Jun 13, 2011	3.637
Jun 20, 2011	3.594
Jun 27, 2011	3.524
Jul 04, 2011	3.48
Jul 11, 2011	3.575
Jul 18, 2011	3.651
Jul 25, 2011	3.682
Aug 01, 2011	3.684
Aug 08, 2011	3.638
Aug 15, 2011	3.554
Aug 22, 2011	3.523
Aug 29, 2011	3.533
Sep 05, 2011	3.546

Sep 12, 2011	3.526
Sep 19, 2011	3.467
Sep 26, 2011	3.355
Oct 03, 2011	3.285
Oct 10, 2011	3.274
Oct 17, 2011	3.353
Oct 24, 2011	3.372
Oct 31, 2011	3.332
Nov 07, 2011	3.297
Nov 14, 2011	3.308
Nov 21, 2011	3.236
Nov 28, 2011	3.172
Dec 05, 2011	3.158
Dec 12, 2011	3.159
Dec 19, 2011	3.112
Dec 26, 2011	3.129
Jan 02, 2012	3.157
Jan 09, 2012	3.261
Jan 16, 2012	3.268
Jan 23, 2012	3.29

Jan 30, 2012	3.36
Feb 06, 2012	3.409
Feb 13, 2012	3.51
Feb 20, 2012	3.555
Feb 27, 2012	3.63
Mar 05, 2012	3.669
Mar 12, 2012	3.734
Mar 19, 2012	3.787
Mar 26, 2012	3.845
Apr 02, 2012	3.891
Apr 09, 2012	3.891
Apr 16, 2012	3.877
Apr 23, 2012	3.814

Table A 7: Monthly Gas Prices in Texas

Date	Gasoline Prices in Texas All Grades All Formulations ($/gal)
Jun-2000	1.54
Jul-2000	1.549
Aug-2000	1.46
Sep-2000	1.491
Oct-2000	1.468
Nov-2000	1.455
Dec-2000	1.391
Jan-2001	1.405
Feb-2001	1.422
Mar-2001	1.361
Apr-2001	1.522
May-2001	1.633
Jun-2001	1.566
Jul-2001	1.357
Aug-2001	1.336
Sep-2001	1.422
Oct-2001	1.269
Nov-2001	1.116
Dec-2001	1.052
Jan-2002	1.082
Feb-2002	1.086
Mar-2002	1.224
Apr-2002	1.375
May-2002	1.372
Jun-2002	1.35
Jul-2002	1.343
Aug-2002	1.354
Sep-2002	1.367
Oct-2002	1.433
Nov-2002	1.395
Dec-2002	1.365
Jan-2003	1.45
Feb-2003	1.589
Mar-2003	1.625
Apr-2003	1.517
May-2003	1.414
Jun-2003	1.416
Jul-2003	1.458
Aug-2003	1.54
Sep-2003	1.549
Oct-2003	1.447
Nov-2003	1.424
Dec-2003	1.422
Jan-2004	1.524
Feb-2004	1.579
Mar-2004	1.635
Apr-2004	1.702
May-2004	1.879
Jun-2004	1.889
Jul-2004	1.829
Aug-2004	1.812
Sep-2004	1.797
Oct-2004	1.91
Nov-2004	1.892
Dec-2004	1.762
Jan-2005	1.773
Feb-2005	1.841
Mar-2005	2.008
Apr-2005	2.169
May-2005	2.088
Jun-2005	2.101
Jul-2005	2.227
Aug-2005	2.446
Sep-2005	2.843
Oct-2005	2.72
Nov-2005	2.205
Dec-2005	2.161
Jan-2006	2.289
Feb-2006	2.215
Mar-2006	2.393
Apr-2006	2.774
May-2006	2.86
Jun-2006	2.825
Jul-2006	2.906
Aug-2006	2.868
Sep-2006	2.443
Oct-2006	2.149
Nov-2006	2.137
Dec-2006	2.231
Jan-2007	2.143
Feb-2007	2.16
Mar-2007	2.434
Apr-2007	2.761
May-2007	3.016
Jun-2007	2.973
Jul-2007	2.897
Aug-2007	2.739
Sep-2007	2.72
Oct-2007	2.726
Nov-2007	2.986
Dec-2007	2.925
Jan-2008	2.969
Feb-2008	2.967
Mar-2008	3.195
Apr-2008	3.415
May-2008	3.712
Jun-2008	3.961
Jul-2008	3.978
Aug-2008	3.681
Sep-2008	3.647
Oct-2008	2.905
Nov-2008	2.023
Dec-2008	1.637
Jan-2009	1.697
Feb-2009	1.845
Mar-2009	1.894
Apr-2009	2.011
May-2009	2.205
Jun-2009	2.535
Jul-2009	2.422
Aug-2009	2.545
Sep-2009	2.416
Oct-2009	2.446
Nov-2009	2.561
Dec-2009	2.517
Jan-2010	2.622
Feb-2010	2.549
Mar-2010	2.693
Apr-2010	2.788
May-2010	2.796
Jun-2010	2.657
Jul-2010	2.628
Aug-2010	2.636
Sep-2010	2.594
Oct-2010	2.699
Nov-2010	2.726
Dec-2010	2.885
Jan-2011	2.995
Feb-2011	3.105
Mar-2011	3.486
Apr-2011	3.746
May-2011	3.839

Jun-2011	3.601
Jul-2011	3.597
Aug-2011	3.586
Sep-2011	3.474
Oct-2011	3.323
Nov-2011	3.253
Dec-2011	3.14
Jan-2012	3.267
Feb-2012	3.526
Mar-2012	3.759

Table A 8: Annual Gas Prices in Texas

Date	Gasoline Prices in Texas All Grades All Formulations ($/gal)
2000	1.481
2001	1.367
2002	1.316
2003	1.489
2004	1.77
2005	2.218
2006	2.511
2007	2.705
2008	3.169
2009	2.268
2010	2.691
2011	3.429

Table A 9: Hybrid Electric Vehicle Sales by Model

Hybrid Electric Vehicle (HEV) Sales by Model													
Vehicle	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**Total**
Honda Insight	17	3,788	4,726	2,216	1200	583	666	722	0	0	20,572	20,962	55,452
Toyota Prius		5,562	15,556	20,119	24,600	53,991	107,897	106,971	181,221	158,574	139,682	140,928	955,101
Honda Civic				13,700	21,800	25,571	25,864	31,251	32,575	31,297	15,119	7,336	204,513
Ford Escape						2,993	18,797	20,149	21,386	17,173	14,787	11,182	106,467
Honda Accord						1,061	16,826	5,598	3,405	196	-	-	27,086
Lexus RX400h							20,674	20,161	17,291	15,200	14,464	15,119	102,909
Toyota Highlander							17,989	31,485	22,052	19,441	11,086	7,456	109,509
Mercury Mariner							998	3,174	3,722	2,329	1,693	890	12,806
Lexus GS 450h								1,784	1,645	678	469	305	4,881
Toyota Camry								31,341	54,477	46,272	22,887	14,587	169,564
Nissan Altima									8,388	8,819	9,357	6,710	33,274
Saturn Vue									4,403	2,920	2,656	50	10,029
Lexus LS600hL									937	907	258	129	2,231
Saturn Aura									772	285	527	54	1,638
Chevy Tahoe										3,745	3,300	1,426	8,471
GMC Yukon										1,610	1,933	1,221	4,764
Chevy Malibu										2,093	4,162	405	6,660
Cadillac Escalade										801	1,958	1,210	3,969
Chrysler Aspen										46	33	-	79
Dodge Durango											9	-	9

Ford Fusion											15,554	20,816	36,370
Mercury Milan											1,468	1,416	2,884
Lexus HS 250h											6,699	10,663	17,362
Sierra/Silverado											1,598	2,393	3,991
BMW ActiveHybrid 7												102	102
BMW X6												205	205
Ford Lincoln MKZ												1,192	1,192
Honda CR-Z												5,249	5,249
Mazda Tribute												570	570
Mercedes ML450												627	627
Mercedes S400												801	801
Porsche Cayenne												206	206
Total	17	9,350	20,282	36,035	47,600	84,199	209,711	252,636	352,274	312,386	290,271	274,210	1,888,971
www.insightcentral.net/KB/sales.html (Accessed 7/18/2007)													
www.toyoland.com/prius/chronology.html (Accessed 7/18/2007)													
www1.eere.energy.gov/vehiclesandfuels/facts/2007_fcvt_fotw462.html (Accessed 4/3/2007)													
Hybrid Vehicles Report (Dec 2005 volume 7, Issue 6)													
www.greencarcongress.com/2005/01/us_hybrid_sales.html (Accesed 7/18/2007)													
www.electricdrive.org/index.php?tg=articles&idx=Print&topics=7&article=692 (Accessed 7/18/2007)													
Hybrid Vehicles Report (Feb 2007 volume 9, Issue 1) - 2006 Ford and GM data not included													
Manufacturer-reported numbers, as posted on www.hybridcars.com/market-dashboard.html (Accessed 1/27/2010)													

Table A 10: Car Totals (2006)

2006	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	2006 Totals
Insight	59	72	79	110	92	77	91	109	19	9	2	3	722
Prius	7,654	6,547	7,922	8,234	8,103	9,696	11,114	11,177	10,492	8,733	8,008	9,291	106,971
Civic	3,165	1,780	2,232	3,087	2,890	2,601	2,673	3,411	2,508	2,288	2,208	2,408	31,251
Accord	351	783	581	614	520	396	504	499	389	287	311	363	5,598
Camry	n/a	n/a	n/a	86	3,032	4,268	5,023	4,977	4,044	2,806	3,100	4,005	31,341
Highlander	2,263	2,631	2,987	3,768	3,755	2,705	2,784	2,581	2,347	1,643	1,667	2,354	31,485
RX400h	1,477	1,803	2,470	2,247	2,006	1,190	1,220	1,514	1,687	1,239	1,327	1,981	20,161
GS450h	n/a	n/a	n/a	141	294	231	157	192	164	177	176	252	1,784
Escape	801	1,233	1,441	3,039	2,434	1,569	2,060	1,789	1,369	1,343	1,323	1,748	20,149
Mariner	97	108	149	381	428	315	423	351	282	259	161	220	3,174
Total	15,867	14,957	17,861	21,707	23,554	23,048	26,049	26,600	23,301	18,784	18,283	22,625	252,636

Table A 11: Car Sales (2004-2005)

Month-Year	Honda Accord	Honda Civic	Honda Insight	Toyota Prius	Toyota Highlander	Lexus RX 400h	Ford Escape	Mercury Mariner
1/2004		1282	45	2925				
2/2004		1975	59	3215				
3/2004		2725	83	3778				
4/2004		3041	107	3684				
5/2004		3183	130	3962				
6/2004		1802	61	4219				
7/2004		1963	34	5230				
8/2004		1816	23	4393				
9/2004		1535	12	4039				
10/2004		2266	11	6123			1130	
11/2004		1867	35	5866			864	
12/2004	1061	2116	8	6287			969	
1/2005	805	1169	7	5566			908	
2/2005	855	1353	22	7078			1092	
3/2005	1862	2896	56	10236			1569	
4/2005	2023	3466	90	11345		2345	1705	
5/2005	1314	1895	52	9461		2931	1234	
6/2005	1080	1852	69	9622	2869	2605	1126	
7/2005	1376	2329	68	9691	2564	2262	1138	
8/2005	2336	4146	80	9850	2925	2607	1363	
9/2005	2352	1916	83	8193	2715	2113	1808	
10/2005	1266	231	37	9939	2330	1904	1227	
11/2005	837	2083	60	7889	2353	1722	998	161
12/2005	720	2528	42	9027	2198	2172	1403	148
9,500 in 2000								
20,300 in 2001								
35,000 in 2002								
48,000 in 2003								
88,000 in 2004								
200,000 in 2005								

Table A 12: Hybrid Vehicle Sales[a] in the United States (1999 - 2010)[c]

Year	Domestic Hybrid[b]	Import Hybrid	Total Hybrid
1999	0	17	17
2000	0	9,350	9,350
2001	0	20,282	20,282
2002	0	22,335	22,335
2003	0	47,566	47,566
2004	2,993	81,206	84,199
2005	15,960	189,868	205,828
2006	24,198	229,320	253,518
2007	77,629	275,233	352,862
2008	86,082	229,606	315,688
2009	81,882	208,858	290,740
2010	64,893	209,528	274,421

[a]Sales include leased vehicles and fleet sales.

[b]Includes vehicles produced in Canada and Mexico.[c] Colander year vehicle sales.

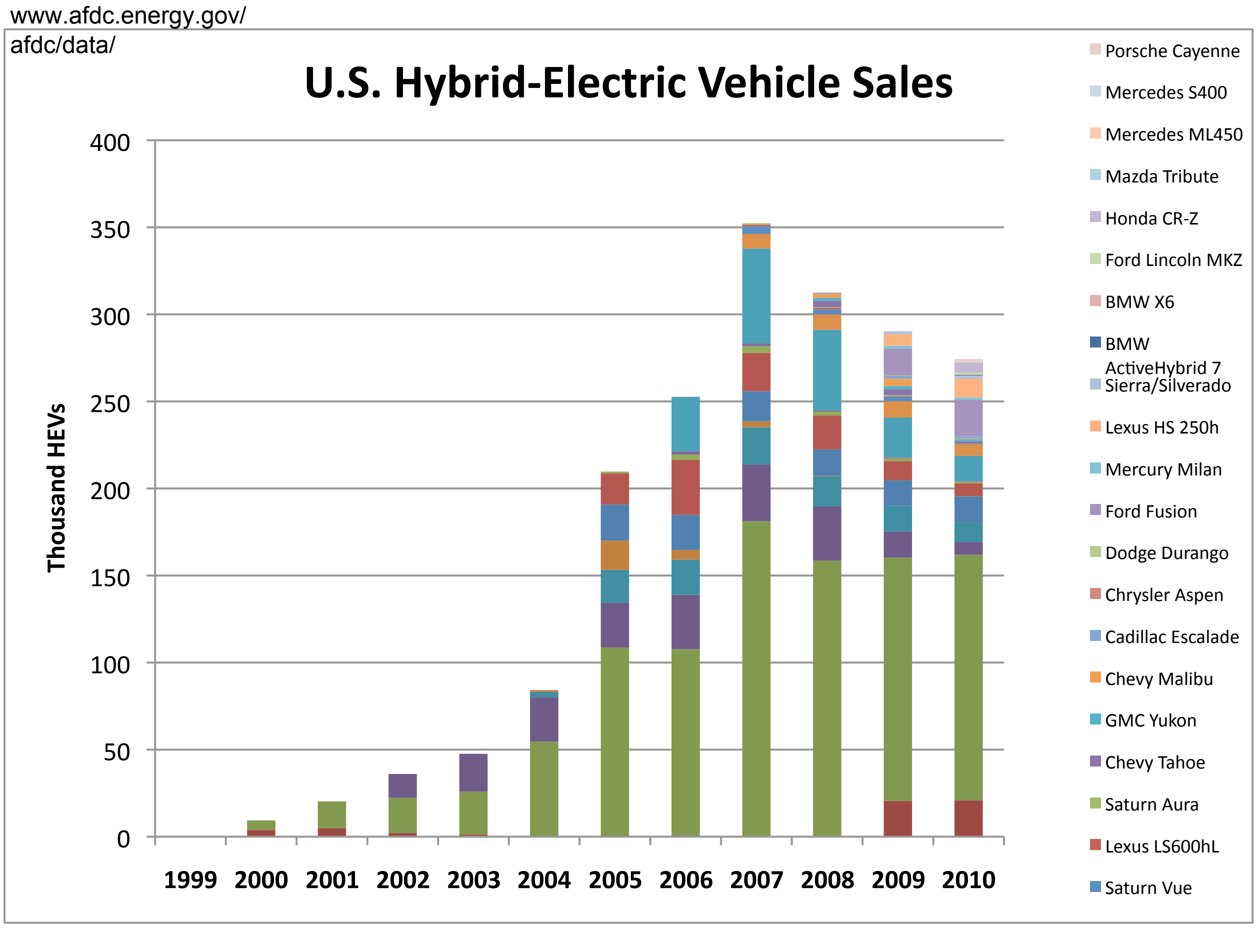
Notes: Data for 2009 are revised. The first domestic hybrid vehicle was not introduced in the U.S. market until 2004. A hybrid vehicle is a vehicle powered by a combination of battery-electric motor(s) and an internal combustion engine.

Source: Ward's Automotive Group, WardsAuto.com, personal communication, March 2011.
http://www.bts.gov/publications/pocket_guide_to_transportation/2012/html/table_05_04.html

Table A 13: Forecasting Scenarios

Period / Forecasting Scenarios	EV	Market Potential
Total Market Potential	**9458**	
Parameter p	**0.002**	
Parameter q	**0.698**	
2010	0.00	9458.00
2011	19.29	9647.16
2012	52.38	9840.10
2013	108.71	10036.91
2014	204.05	10237.64
2015	364.17	10442.40
2016	630.24	10651.24
2017	1065.10	10864.27
2018	1757.12	11081.55
2019	2812.02	11303.19
2020	4313.51	11529.25
2021	6234.86	11759.83
2022	8336.24	11995.03
2023	10198.18	12234.93
2024	11504.07	12479.63
2025	12279.37	12729.22

Figure A 1: United States Hybrid Electric Vehicle Sales



Worksheet available at www.afdc.energy.gov/afdc/data/
See "Data" tab for supporting data, sources, and notes
Last updated 3/7/11

APPENDIX B:
EV RELATED POLICIES

Federal EV Programs

Clean Cities

The mission of Clean Cities is to advance the energy, economic, and environmental security of the United States by supporting local initiatives to adopt practices that reduce the use of petroleum in the transportation sector. Clean Cities carries out this mission through a network of more than 80 volunteer coalitions, which develop public/private partnerships to promote alternative fuels and advanced vehicles, fuel blends, fuel economy, hybrid vehicles, and idle reduction. Clean Cities provides information about financial opportunities, coordinates technical assistance projects; updates and maintains databases and websites, and publishes fact sheets, newsletters, and related technical and informational materials.

State Energy Program (SEP) Funding

The SEP provides grants to states to assist in designing, developing, and implementing renewable energy and energy efficiency programs. Each state's energy office receives SEP funding and manages all SEP-funded projects. States may also receive project funding from technology programs in the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) for SEP Special Projects. EERE distributes the funding through an annual competitive solicitation to state energy offices.

Clean Ports USA

Clean Ports USA is an incentive-based program designed to reduce emissions by encouraging port authorities and terminal operators to retrofit and replace older diesel engines with new technologies and use cleaner fuels. The U.S. Environmental Protection Agency's National Clean Diesel Campaign offers funding to port authorities and public entities to help them overcome barriers that impede the adoption of cleaner diesel technologies and strategies.

Clean Construction USA

Clean Construction USA is a voluntary program that promotes the reduction of diesel exhaust emissions from construction equipment and vehicles by encouraging proper operations and maintenance, use of emissions-reducing technologies, and use of cleaner fuels. Clean Construction USA is part of the U.S. Environmental Protection Agency's National Clean Diesel Campaign, which offers funding for clean diesel construction equipment projects.

Clean Agriculture USA

Clean Agriculture USA is a voluntary program that promotes the reduction of diesel exhaust emissions from agricultural equipment and vehicles by encouraging proper operations and maintenance by farmers, ranchers, and agribusinesses, use of emissions-reducing technologies, and use of cleaner fuels. Clean

Agriculture USA is part of the U.S. Environmental Protection Agency's National Clean Diesel Campaign, which offers funding for clean diesel agricultural equipment projects.

Air Pollution Control Program

The Air Pollution Control Program assists state, local, and tribal agencies in planning, developing, establishing, improving, and maintaining adequate programs for prevention and control of air pollution or implementation of national air quality standards. Plans may emphasize alternative fuels, vehicle maintenance, and transportation choices to reduce vehicle miles traveled. Eligible applicants may receive federal funding for up to 60% of project costs to implement their plans.

Congestion Mitigation and Air Quality (CMAQ) Improvement Program

The CMAQ Improvement Program provides funding to state departments of transportation (DOTs), municipal planning organizations (MPOs), and transit agencies for projects and programs in air quality nonattainment and maintenance areas that reduce transportation-related emissions. Eligible activities include transit improvements, travel demand management strategies, traffic flow improvements, purchasing idle reduction equipment, development of alternative fueling infrastructure, conversion of public fleet vehicles to operate on cleaner fuels, and outreach activities that provide assistance to diesel equipment and vehicle owners and operators regarding the purchase and installation of diesel retrofits. State DOTs and MPOs must give priority to projects and programs to include diesel retrofits and other cost-effective emissions reduction activities, and cost-effective congestion mitigation activities that provide air quality benefits.

Voluntary Airport Low Emission (VALE) Program

The goal of the VALE Program is to reduce ground level emissions at commercial service airports located in designated ozone and carbon monoxide air quality nonattainment and maintenance areas. The VALE Program provides funding through the Airport Improvement Program and the Passenger Facility Charges program for the purchase of low-emission vehicles, development of fueling and recharging stations, implementing gate electrification, and other airport air quality improvements.

Texas State Incentives for EVs

Alternative Fueling Infrastructure Grants

Effective September 1, 2011, the Texas Commission on Environmental Quality will establish and administer the Alternative Fueling Facilities Program, part of the Texas Emissions Reduction Plan, which provides grants for 50% of eligible costs, up to $500,000, to construct, reconstruct, or acquire a facility to store, compress, or dispense alternative fuels in Texas air quality nonattainment areas. Qualified alternative fuels include electricity, natural gas, hydrogen, propane, and fuel mixtures containing at least 85% methanol (M85). The entity receiving the grant must agree to make the fueling station available to people and organizations not associated with the grantee during certain times. Additional terms and conditions apply. This program ends

August 31, 2018.

Clean Vehicle and Infrastructure Grants

The Texas Commission on Environmental Quality administers the Emissions Reduction Incentive Grants (ERIG) Program, part of the Texas Emissions Reduction Plan, which provides grants for various types of clean air projects to improve air quality in the state's nonattainment areas. Eligible projects include those that involve heavy-duty vehicle replacement, retrofit, or repower; alternative fuel dispensing infrastructure; idle reduction and electrification infrastructure; and alternative fuel use.

Alternative Fuel and Advanced Vehicle Research and Development Grants

The Texas Council on Environmental Quality administers the New Technology Research and Development (NTRD) Program, part of the Texas Emissions Reduction Plan, which provides grants for alternative fuel and advanced technology demonstration and infrastructure projects to encourage and support research, development, and commercialization of technologies that reduce pollution.

Clean Fleet Grants

The Texas Commission on Environmental Quality (TCEQ) administers the Texas Clean Fleet Program, part of the Texas Emissions Reduction Plan, which encourages owners of fleets containing diesel vehicles to permanently remove the vehicles from the road and replace them with alternative fuel vehicles (AFVs) or hybrid electric vehicles (HEVs). Grants are available to fleets to offset the incremental cost of such replacement projects. An entity that operates a fleet of at least 100 vehicles and places 25 or more qualifying vehicles in service for use entirely in Texas during a given calendar year may be eligible for grant. Qualifying AFV or HEV replacements must reduce emissions of nitrogen oxides or other pollutants by at least 25% as compared to baseline levels and must replace vehicles that meet operational and fuel usage requirements. Neighborhood electric vehicles do not qualify.

Clean Vehicle Replacement Vouchers

The Texas Commission on Environmental Quality administers the AirCheckTexas Drive a Clean Machine program, which provides vehicle replacement assistance for qualified individuals owning vehicles registered in participating counties. Vouchers in the amount of $3,500 are available toward the purchase of a hybrid electric, battery electric, or natural gas vehicle that is up to three model years old.

Texas Utility and Private Business Incentives EVs Purchasers

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Dallas, Fort Worth, and Houston metropolitan areas. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation. Additional restrictions may apply.

Electric Vehicle Supply Equipment (EVSE) Incentive - Austin Energy

Plug-in electric vehicle owners in the Austin Energy service area may be eligible for a rebate of 50% of the cost to purchase and install a qualified Level 2 charging station. The maximum rebate amount is $1,500.

Texas State Laws and Regulations Concerning EVs

Alternative Fuel Use and Vehicle Acquisition Requirements

State agency fleets with more than 15 vehicles, excluding emergency and law enforcement vehicles, may not purchase or lease a motor vehicle unless the vehicle uses compressed or liquefied natural gas, propane, ethanol or fuel blends of at least 85% ethanol (E85), methanol or fuel blends of at least 85% methanol (M85), biodiesel or fuel blends of at least 20% biodiesel (B20), or electricity including plug-in hybrid electric vehicles. Waivers may be granted for fleets under the following circumstances: 1) the fleet will operate primarily in areas where neither the state agency or a supplier can reasonably be expected to establish adequate fueling infrastructure for these fuels, or 2) the agency is unable to obtain equipment or fueling facilities necessary to operate alternative fuel vehicles at a cost that is no greater than the net costs of using conventional fuels.

Covered state agency fleets must consist of at least 50% of vehicles that are able to operate on alternative fuels and use these fuels at least 80% of the time the vehicles are driven. Covered state agencies may meet these requirements through the purchase of new vehicles or the conversion of existing vehicles. State agencies that purchase passenger vehicles or other ground transportation vehicles for general use must ensure that at least 25% of the vehicles purchased during any state fiscal biennium, other than exempted vehicles, meet or exceed federal Tier II, Bin 3 emissions standards.

California State Incentives for EVs

Plug-In Hybrid and Zero Emission Light-Duty Vehicle Rebates

Rebates are available through the Clean Vehicle Rebate Project (CVRP) for the purchase or lease of qualified vehicles. The rebates offer up to $2,500 for light-duty zero emission and plug-in hybrid vehicles that the California Air

Resources Board (ARB) has approved or certified. The rebates are available on a first-come, first-served basis to individuals, business owners, and government entities in California that purchase or lease new eligible vehicles on or after March 15, 2010. Manufacturers must apply to ARB to have their vehicles included in CVRP. Refer to the CVRP website for a list of eligible vehicles and other requirements. ARB determines annual funding amounts for CVRP, which is expected to be effective through 2015.

Alternative Fuel and Vehicle Incentives

The California Energy Commission (CEC) administers the Alternative and Renewable Fuel and Vehicle Technology Program (Program) to provide financial incentives for businesses, vehicle and technology manufacturers, workforce training partners, fleet owners, consumers, and academic institutions with the goal of developing and deploying alternative and renewable fuels and advanced transportation technologies. The CEC must prepare and adopt an annual Investment Plan for the Program to establish funding priorities and opportunities that reflect program goals and to describe how program funding will be used to complement other public and private investments. Funded projects include:

- Commercial alternative fuel vehicle (AFV) demonstrations and deployment;
- Alternative and renewable fuel production;
- Research and development of alternative and renewable fuels and innovative technologies;
- AFV manufacturing;
- Workforce training; and
- Public education, outreach, and promotion.

High Occupancy Vehicle (HOV) Lane Exemption

Compressed natural gas (CNG), hydrogen, electric, and plug-in hybrid electric vehicles (PHEVs) meeting specified California and federal emissions standards and affixed with a California Department of Motor Vehicles Clean Air Vehicle sticker may use HOV lanes regardless of the number of occupants in the vehicle. White Clean Air Vehicle Stickers, expiring January 1, 2015, are available to an unlimited number of qualifying CNG, hydrogen, and electric vehicles. Beginning January 1, 2012, a new Clean Air Vehicle Sticker will be available for a limited number of qualified PHEVs. This sticker will expire January 1, 2015.

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants

The Motor Vehicle Registration Fee Program provides funding for projects that reduce air pollution from on- and off-road vehicles. Eligible projects include purchasing AFVs and developing alternative fueling infrastructure.

Low Emissions School Bus Grants

The Lower-Emission School Bus Program provides grant funding for the replacement of older school buses and for the purchase of air pollution control equipment for in-use buses. The California Air Resources Board must verify that the air pollution control devices reduce particulate matter emissions by at least 85% for each retrofitted school bus. Public school districts in California that own their buses are eligible to receive funding. Private school transportation providers that contract with public school districts in California to provide transportation services are also eligible to receive funding for the retrofit of in-use buses. New buses purchased to replace older buses may be fueled with diesel or an alternative fuel, provided that the required emissions standards specified in the current guidelines for the Lower-Emission School Bus Program are met. Funds are also available for replacing on-board natural gas tanks on older school buses and for updating deteriorating natural gas fueling infrastructure. Commercially available hybrid electric school buses may be eligible for partial funding.

Alternative Fuel and Advanced Technology Research and Development

The Innovative Clean Air Technologies (ICAT) Program co-funds innovative technology demonstration projects that will improve emissions prevention or control while promoting new industries and jobs in California. Proposals related to current California Air Resources Board programs, such as developing alternatives to diesel fuel and diesel engines, increasing zero emission vehicle efficiency, and developing fuel cells and hydrogen technology, are of particular interest. As of October 2011, the ICAT Program is on hold but is expected to resume for future solicitations.

Advanced Transportation Financing

The California Alternative Energy and Advanced Transportation Financing Authority (CAEATFA) provides financing for property used to develop and commercialize advanced transportation technologies that reduce pollution and energy use and promote economic development. Eligible advanced transportation technologies include electric vehicles, fuel cells, and ultra low emission vehicles. CAEATFA may provide financial incentives in the form of sales and use tax exclusions on qualified property.

Electric Vehicle Supply Equipment (EVSE) Incentive - Bay Area

The Bay Area Air Quality Management District (BAAQMD) provides incentives for up to 2,750 residents who purchase new plug-in electric vehicles and install Level 2 EVSE from qualifying vendors after December 1, 2010. Incentive amounts vary and the funds are administered through BAAQMD partner vendors on a first-come, first-served basis.

Employer Invested Emissions Reduction Funding - South Coast

The South Coast Air Quality Management District (SCAQMD) administers the Air Quality Investment Program (AQIP). The AQIP provides funding to allow employers within SCAQMD's jurisdiction to make annual investments into an administered fund to meet employers' emissions reduction targets. The revenues collected are used to fund alternative mobile source emissions/trip reduction programs, including alternative fuel vehicle projects, on an on-going basis. Programs such as low emission, alternative fuel, or zero emission vehicle procurement, and old vehicle scrapping may be considered for funding. Current requests for proposals and funding opportunities are listed on the AQIP website.

Technology Advancement Funding - South Coast

The South Coast Air Quality Management District's Clean Fuels Program provides funding for research, development, demonstration, and deployment projects that are expected to help accelerate the commercialization of advanced low emission transportation technologies. Eligible projects include powertrains and energy storage/conversion devices (e.g., fuel cells and batteries), and implementation of clean fuels (e.g., natural gas, propane, and hydrogen), including the necessary infrastructure. Projects are selected via specific requests for proposals on an as-needed basis or through unsolicited proposals. Approximately $10 million in funding is available annually with expected cost-share from other project partners and stakeholders.

Alternative Fuel and Advanced Vehicle Rebate - San Joaquin Valley

The San Joaquin Valley Air Pollution Control District (SJVAPCD) administers the Drive Clean! Rebate Program, which provides rebates for the purchase or lease of eligible new vehicles, including qualified natural gas and plug-in electric vehicles. The program offers rebates of up to $3,000, which are available on a first-come, first-served basis for residents and businesses located in the SJVAPCD on or after March 15, 2012.

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Incentives - San Joaquin Valley

The San Joaquin Valley Air Pollution Control District administers the Public Benefit Grant Program, which provides funding to cities, counties, special districts (such as water districts and irrigation districts) and public educational institutions for the purchase of new AFVs, including electric, natural gas, and propane vehicles, as well as hybrid electric vehicles; electric vehicle supply equipment and alternative fueling infrastructure projects; and advanced transportation and transit projects. Projects are considered on a first-come, first-serve basis.

Low Emission Vehicle Incentives and Technical Training - San Joaquin Valley

The San Joaquin Valley Air Pollution Control District administers the REMOVE II program, which provides incentives for the purchase of low emission passenger vehicles, light-duty trucks, small buses, and trucks with gross vehicle weight ratings of 14,000 pounds or less. The purpose of REMOVE II is to encourage the early introduction of low emission vehicles in the San Joaquin Valley. Funding in the amount of $1,000 to $3,000 is available per vehicle according to the emissions certification level and size of the vehicle. Vehicles must be powered by alternative fuel or electric or hybrid electric engines/motors. REMOVE II also includes an Alternative Fuel Vehicle (AFV) Mechanic Training Component that provides incentives to educate personnel on the mechanics, operation safety, and maintenance of AFVs, fueling stations, and tools involved in the implementation of alternative fuel technologies.

California Utility and Private Business Incentives EVs Purchasers

Electric Vehicle Supply Equipment (EVSE) Rebate – Las Angeles Department of Water and Power (public utility)

The Los Angeles Department of Water and Power (LADWP) provides rebates of up to $2,000 to residential customers who purchase or lease a new electric vehicle and install Level 2 EVSE with a separate time-of-use meter at their home. Customers living in apartment buildings or condominiums may also qualify for the rebate so long as they have received permission from the property owner and/or homeowner association. The rebate is available to the first 1,000 customers that submit a completed application. The program will expire on June 30, 2013, when the program goals are met, or when the funds are exhausted, whichever occurs first.

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Los Angeles and San Diego metropolitan areas. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation. Additional restrictions may apply.

Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (AFV) Insurance Discount

Farmers Insurance provides a discount of up to 10% on all major insurance coverage for HEV and AFV owners. To qualify, the automobile must be designed to use a dedicated alternative fuel as defined in the Energy Policy Act of 1992, or a HEV. A complete Vehicle Identification Number is required to validate vehicle eligibility.

Plug-In Electric Vehicle Charging Rate Reduction – Sacramento Municipal Utility District (public utility)

The Sacramento Municipal Utility District (SMUD) offers a reduced time-of-use rate option to residential customers who own a licensed passenger plug-in electric vehicle (PEV).

Plug-In Electric Vehicle Charging Rate Reduction – Las Angeles Department of Water and Power (public utility)

The Los Angeles Department of Water and Power (LADWP) offers a $0.025 per kilowatt discount for electricity used to charge plug-in electric vehicles (PEVs) during off-peak times. Proof of vehicle registration is required. LADWP also provides guidance on PEV charging infrastructure to help customers determine applications for PEVs in their fleet operations, PEV maintenance services, and training.

Plug-In Electric Vehicle Charging Rate Reduction – Southern California Edison (private utility)

Southern California Edison (SCE) offers a discounted rate to customers for electricity used to charge plug-in electric vehicle (PEVs). Two rate schedules are available for PEV charging during on- and off-peak hours. For more information, see the SCE Electric Vehicle Residential Rates website.

<u>Clean Vehicle Electricity and Natural Gas Rate Reduction – Pacific Gas & Electric (public utility)</u>

Pacific Gas & Electric (PG&E) offers a discounted Experimental Residential Time-of-Use rate for electricity used to charge battery electric vehicles (EVs), plug-in hybrid electric vehicles, and natural gas vehicle (NGV) home fueling appliances. Special rates are also available for natural gas that residential customers compress using home fueling appliances.

<u>Plug-In Electric Vehicle and Natural Gas Infrastructure Charging Rate Reduction – San Diego Gas & Electric (private subsidiary of Sempra Energy)</u>

San Diego Gas & Electric (SDG&E) offers lower rates to customers for electricity used to charge plug-in electric vehicles (PEVs). SDG&E's PEV Time-of-Use rates are available in two variations: EV-TOU-2 bills home and vehicle electricity use on a single meter; and EV-TOU bills vehicle electricity use separately, requiring the installation of a second meter. Lower rates are also available to customers who own a natural gas vehicle and use a qualified compressed natural gas fueling appliance at home.

California State Laws and Regulations Concerning EVs

<u>Plug-In Electric Vehicle Parking Regulation</u>

An individual may not stop, stand, or park a motor vehicle, or otherwise block access to parking, in a stall or space designated for the exclusive purpose of charging a plug-in electric vehicle unless the vehicle displays a valid state-issued zero emission vehicle (ZEV) decal and is connected for electric charging purposes.

<u>Electricity Provider Definition</u>

A corporation or individual that owns, controls, operates, or manages a facility that supplies electricity to the public exclusively to charge light-duty battery electric and plug-in hybrid electric vehicles is not defined as a public utility.

<u>Electric Vehicle Supply Equipment (EVSE) Policies for Multi-Unit Dwellings</u>

A common interest development, including a community apartment, condominium, and cooperative development, may not prohibit or restrict the installation or use of EVSE. These entities may put reasonable restrictions on EVSE, but the policies may not significantly increase the cost of the EVSE or significantly decrease its efficiency or performance. If the EVSE is placed in a common area, the homeowner must obtain appropriate approvals from the common interest development association and agree in writing to comply with applicable architectural standards, engage a licensed installation contractor, provide a certificate of insurance, and pay for the electricity usage associated with the EVSE.

Any application for approval should be processed by the common interest development association without willful avoidance or delay. The homeowner and each successive homeowner of the parking space equipped with EVSE is responsible for the cost of the installation, maintenance, repair, removal, or replacement of the station, as well as any resulting damage to the EVSE or surrounding area. The homeowner must also maintain a $1 million umbrella liability coverage policy and name the common interest development as an additional insured entity under the policy.

Access to Plug-In Electric Vehicle Registration Records

The California Department of Motor Vehicles may disclose to an electrical corporation or local publicly owned utility a plug-in electric vehicle (PEV) owner's address and vehicle type if the information is used exclusively to identify where the PEV is registered.

Plug-In Electric Vehicle Infrastructure Information Resource

The California Energy Commission, in consultation with the Public Utilities Commission, must develop and maintain a website containing specific links to electrical corporations, local publicly owned electric utilities, and other websites that contain information specific to plug-in electric vehicles (PEVs), including the following:

- Resources to help consumers determine if their residences will require utility service upgrades to accommodate PEVs;
- Basic charging circuit requirements;
- Utility rate options; and
- Load management techniques.

Plug-In Electric Vehicle Infrastructure Evaluation

The California Public Utilities Commission, in consultation with the California Energy Commission, California Air Resources Board, electrical corporations, and the motor vehicle industry, must evaluate policies to develop infrastructure sufficient to overcome barriers to the widespread deployment and use of plug-in electric vehicles (PEVs). By July 1, 2011, the Commission must adopt rules to address the following:

- The impacts on electrical infrastructure and any infrastructure upgrades necessary for widespread use of PEVs, including the role and development of public charging infrastructure;
- The impact of PEVs on grid stability and the integration of renewable energy resources;
- The technological advances necessary to ensure the widespread use of PEVs and what role the state should take to support the development of this technology;
- The existing code and permit requirements that will impact the widespread use of PEVs and any

recommended changes to existing policies that may be barriers to the widespread use of PEVs;
- The role the state should take to ensure that technologies employed in PEVs work harmoniously and across service territories; and
- The impact of widespread use of PEVs on achieving the state's greenhouse gas emissions reductions goals and renewables portfolio standard program, and what steps should be taken to address the possibility of shifting emissions reductions responsibilities from the transportation sector to the electrical industry.

Zero Emission Vehicle (ZEV) Promotion Plan

All state agencies must support and facilitate the rapid commercialization of ZEVs in California. In particular, the California Air Resources Board, California Energy Commission, Public Utilities Commission, and other relevant state agencies must work with the Plug-in Electric Vehicle Collaborative and the California Fuel Cell Partnership to establish benchmarks to achieve targets for ZEV commercialization. These targets include:

- By 2015, all major metropolitan areas in California will be able to accommodate ZEVs and have infrastructure plans and streamlined permitting in place;
- By 2020, the state will have established adequate infrastructure to support one million ZEVs;
- By 2025, there will be 1.5 million ZEVs on the road in California and clean, efficient vehicles will displace 1.5 billion gallons of petroleum fuels annually; and
- By 2050, greenhouse gas emissions from the transportation sector will be 80% less than 1990 levels.
- The ZEV promotion plan also directs the state fleet to increase the number of ZEVs in the fleet through gradual vehicle replacement. By 2015, ZEVs should make up at least 10% of fleet light-duty vehicle (LDV) purchases and by 2020, at least 25% percent of fleet LDV purchases should be ZEVs. Vehicles with special performance requirements necessary for public safety and welfare are exempt from this requirement.

Plug-In Electric Vehicle Charging Requirements

New plug-in electric vehicles (PEVs) must be equipped with a conductive charger inlet port that meets the specifications contained in Society of Automotive Engineers (SAE) standard J1772. PEVs must be equipped with an on-board charger with a minimum output of 3.3 kilovolt amps. These requirements do not apply to PEVs that are only capable of Level 1 charging, which has a maximum power of 12 amperes (amps), a branch circuit rating of 15 amps, and continuous power of 1.44 kilowatts.

State Transportation Plan

The California Department of Transportation (Caltrans) must update the California Transportation Plan (Plan) by December 31, 2015, and every five years thereafter. The Plan must address how the state will achieve maximum feasible emissions reductions, taking into consideration the use of alternative fuels, new vehicle technology, and tailpipe emissions reductions. Caltrans must prepare and submit an interim report to the California Transportation Commission and to the Senate and Assembly committees related to transportation, environmental quality, natural resources, and local government by December 31, 2012. Caltrans must consult and coordinate with related state agencies, air quality management districts, public transit operators, and regional transportation planning agencies. Caltrans must also provide an opportunity for general public input. Caltrans must submit a final draft of the Plan to the legislature and governor.

Low Emission Vehicle (LEV) Standards

California's LEV II exhaust emissions standards apply to Model Year (MY) 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty passenger vehicles meeting specified exhaust standards. The LEV II standards represent the maximum exhaust emissions for LEVs, Ultra Low Emission Vehicles, and Super Ultra Low Emission Vehicles, including flexible fuel, bi-fuel, and dual-fuel vehicles when operating on an alternative fuel. New MY 2009 and subsequent model year passenger cars, light-duty trucks, and medium-duty passenger vehicles must meet specified fleet average greenhouse gas (GHG) exhaust emissions requirements. Each manufacturer must comply with these fleet average GHG requirements, which are based on California Air Resources Board calculations. Bi-fuel, flexible fuel, dual-fuel, and grid-connected hybrid electric vehicles may be eligible for an alternative compliance method. Manufacturers may earn credits for fleet average GHG values lower than the fleet average GHG requirement applicable to MY 2012.

As of October 2011, the California Air Resources Board is considering changes to the regulations, referred to as LEV III, which would control smog-causing pollutants and GHG emissions and include efforts to accelerate the production and use of plug-in hybrid electric and zero emission vehicles in the state. See the LEV III Program website for more information.

Zero Emission Vehicle (ZEV) Production Requirements

New passenger cars, light-duty trucks, and medium-duty passenger vehicles are certified as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. Manufacturers with annual sales greater than 60,000 vehicles must produce and deliver for sale in California a minimum percentage of ZEVs for each model year as follows:

Model Year	Minimum ZEV Requirement
2010-2011	11%
2012-2014	12%
2015-2017	14%
2018 and on	16%

Manufacturers with annual sales between 4,501 and 60,000 vehicles may comply with the ZEV requirements through multiple alternative compliance options that include producing low emission vehicles and obtaining ZEV credits. Manufacturers with annual sales of 4,500 vehicles or less are not subject to this regulation.

As of October 2011, the California Air Resources Board is considering changes to the ZEV regulations that focus on plug-in hybrid electric vehicles and ZEVs to encourage commercial market penetration of these vehicles.

Alternative Fuel and Plug-in Hybrid Electric Vehicle Retrofit Regulations

Converting a vehicle to operate on an alternative fuel in lieu of the original gasoline or diesel fuel is prohibited unless the California Air Resources Board (ARB) has evaluated and certified the retrofit system. ARB will issue certification to the manufacturer of the system in the form of an Executive Order once the manufacturer demonstrates compliance with the emissions, warranty, and durability requirements. A manufacturer is defined as a person or company who manufactures or assembles an alternative fuel retrofit system for sale in California; this definition does not include individuals wishing to convert vehicles for personal use. Individuals interested in converting their vehicles to operate on an alternative fuel must ensure that the alternative fuel retrofit systems used for their vehicles have been ARB certified.

A hybrid electric vehicle that is Model Year 2000 or newer and is a passenger car, light-duty truck, or medium-duty vehicle may be converted to incorporate off-vehicle charging capability if the manufacturer demonstrates compliance with emissions, warranty, and durability requirements. ARB issues certification to the manufacturer and the vehicle must meet California emissions standards for the model year of the original vehicle.

Fleet Vehicle Procurement Requirements

When awarding a vehicle procurement contract, every city, county, and special district, including school and community college districts, may require that 75% of the passenger cars and/or light-duty trucks acquired be energy-efficient vehicles. By definition, this includes hybrid electric vehicles and alternative fuel vehicles that meet California's advanced technology partial zero emission vehicle (AT PZEV) standards. Vehicle procurement contract evaluations may consider fuel economy and lifecycle factors for scoring purposes.

Vehicle Acquisition and Petroleum Reduction Requirements

The California Department of General Services (DGS) is responsible for maintaining specifications and standards for passenger cars and light-duty trucks that are purchased or leased for state office, agency, and department use. These specifications include minimum vehicle emissions standards and encourage the purchase or lease of fuel-efficient and alternative fuel vehicles (AFVs). On an annual basis, DGS must compile information including, but not limited to, the number of AFVs and hybrid electric vehicles acquired, the locations of the alternative fuel pumps available for those vehicles, and the total amount of alternative fuels used.

Vehicles the state owns or leases that are capable of operating on alternative fuel must operate on that fuel unless the alternative fuel is not available. Additionally, the California State and Consumer Services Agency, in consultation with DGS and other appropriate state agencies, must develop, implement, and submit to the California Legislature and governor a plan to increase the state fleet's use of alternative fuels, synthetic lubricants, and fuel-efficient vehicles. This must be done by reducing or displacing the fleet's consumption of petroleum products by 10% by January 1, 2012, and 20% by January 1, 2020, as compared to the 2003 consumption level. DGS must also take steps to transfer vehicles between agencies and departments to ensure that the most fuel-efficient vehicles are used and to eliminate the least fuel-efficient vehicles from the state's motor vehicle fleet. DGS must submit annual progress reports to the California Department of Finance, related legislative committees, and the general public via the DGS website.

Alternative Fuel and Vehicle Policy Development

The California Energy Commission must prepare and submit an Integrated Energy Policy Report (IEPR) to the governor on a biannual basis. The IEPR provides an overview of major energy trends and issues facing the state, including those related to transportation fuels, technologies, and infrastructure. The IEPR also examines potential effects of alternative fuels use, vehicle efficiency improvements, and shifts in transportation modes on public health and safety, the economy, resources, the environment, and energy security. The IEPR's primary purpose is to develop energy policies that conserve resources, protect the environment, ensure energy reliability, enhance the state's economy, and protect public health and safety.

Mobile Source Emissions Reduction Requirements

Through its Mobile Sources Program, the California Air Resources Board has developed programs and policies to reduce emissions from on-road heavy-duty diesel vehicles through the installation of verified diesel emission control strategies (VDECS) and vehicle replacements.

An on-road heavy-duty diesel vehicle rule requires the retrofit and replacement of nearly all privately owned vehicles operated in California with a gross vehicle weight rating (GVWR) greater than 14,000 pounds. School buses owned by private and public entities and federal government owned vehicles are also included in the scope of the rule. The requirements phase in the installation of VDECS on certain heavier in-use vehicles beginning January 1, 2012, and require the replacement of older vehicles starting January 1, 2015. By January 1, 2023, nearly all vehicles must have engines certified to the 2010 engine standard or equivalent. A drayage/port truck rule regulates heavy-duty diesel-fueled vehicles that transport cargo to and from California's ports and intermodal rail facilities.

The rule requires that certain drayage trucks be equipped with VDECS and that all applicable vehicles have engines certified to the 2007 emissions standards by January 1, 2014. A public transit agency fleet rule regulates public transit fleets and sets emissions reduction standards for new transit vehicles. A solid waste collection vehicle rule regulates solid waste collection vehicles with a gross vehicle weight rating of 14,000 pounds or more that operate on diesel fuel, have 1960 through 2006 engine models, and collect waste for a fee. The fleet rule for public agencies and utilities requires fleets to install VDECS on vehicles or purchase vehicles that run on alternative fuels or use advanced technologies to achieve emissions requirements by specified implementation dates.

New York State Incentives for EVs

Alternative Fuel Bus and Infrastructure Funding

The New York State Energy Research and Development Authority (NYSERDA) administers the Clean Fueled Bus Program, which provides funds to state and local transit agencies, municipalities, and schools for up to 100% of the incremental cost of purchasing new alternative fuel buses and associated infrastructure. For the purposes of this program, an alternative fuel bus is any motor vehicle with a seating capacity of at least 15 passengers used to transport passengers on public highways that is powered by compressed natural gas (CNG) (including dual-fuel technology that is factory built and certified or a new diesel engine with a minimum of 75% use of CNG during typical operation), propane, methanol, hydrogen, biodiesel, or ethanol, or uses electricity as a primary fuel source (e.g., hybrid electric). Eligible infrastructure projects include fueling equipment installations including, but not limited to, electric vehicle battery charging stations and natural gas fueling stations and depots. A qualified infrastructure project must be necessary to introduce or expand an alternative fuel bus fleet and the funding only covers the cost for items directly associated with making the facility capable of dispensing the fuel.

Alternative Fuel Vehicle (AFV) Technical Assistance

The New York State Energy Research and Development Authority (NYSERDA) manages the New York State Clean Cities Sharing Network (Network), which provides technical, policy, and program information about AFVs. Membership is open to all organizations, businesses, and individuals interested in AFVs and members are notified about upcoming funding opportunities and events. The Network publishes information about tax incentives, fueling stations, case studies, and contact information for the Clean Cities program and other industry leaders. The Network also organizes and sponsors technical workshops.

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Technical Assistance

The New York State Energy Research and Development Authority's (NYSERDA) Flexible Technical (FlexTech) Assistance Program provides assistance to public, private, and not-for-profit organization fleet managers who want to evaluate the feasibility and cost of adding AFVs and fueling facilities to their operations. Low-cost training for vehicle mechanics is also available through certified institutions.

Alternative Fuel Product Development Funding

The New York State Energy Research and Development Authority's (NYSERDA) Transportation Research Program sponsors a wide variety of product development efforts aimed at improving efficiency and increasing the use of alternative fuels. Program Opportunity Notices are issued periodically to solicit proposals for cost-share development efforts leading to the manufacture and sale of innovative products that provide energy, environmental and economic development benefits.

New York Utility and Private Business Incentives Related to EVs

Plug-In Electric Vehicle Rebate - Long Island Power Authority (public utility)

Long Island Power Authority offers residential customers a one-time $500 mail-in rebate for qualifying plug-in hybrid electric or all-electric vehicles. Vehicles must be purchased, registered, and owned by the LIPA customer during the period beginning January 1, 2012, and ending December 31, 2012.

New York State Laws and Regulations Concerning EVs

Alternative Fuel Vehicle (AFV) Acquisition Requirements

All new light-duty vehicles that state agencies and other affected entities procure must be AFVs, with the exception of designated specialty, police, or emergency vehicles. Hybrid electric vehicles qualify under these requirements. State agencies and other affected entities that operate medium- and heavy-duty vehicles must implement strategies to reduce petroleum consumption and emissions by using alternative fuels and improving vehicle fleet fuel efficiency. State agencies and other affected entities may substitute the use of 450 gallons of 100% biodiesl (B100) for the acquisition of one AFV. Alternatively, using 2,250 gallons of biodiesel blends of 20% (B20) or 9,000 gallons of biodiesel blends of 5% (B5) may also be substituted in place of purchasing one AFV. No more than 50% of a given state agency fleet's AFV purchase requirement may be met by substituting B100, B20, or B5.

Illinois State Incentives for EVs

Smart Grid Infrastructure Development and Support

The Illinois Science and Energy Innovation Trust will provide financial and technical support and assistance to public or private entities within the state for programs and projects that support, encourage, or utilize innovative technologies and methods to modernize the state's electric grid. Technologies may include advanced electricity storage and peak-shaving technologies such as plug-in electric vehicles (PEVs), devices that allow PEVs to engage in smart grid functions, or standards development for communication and interoperability of appliances and equipment connected to the electric grid. Electric utilities may voluntarily commit to investments in smart grid advanced metering infrastructure deployment. Participating utilities must consult with the Smart Grid Advisory Council and file a Smart Grid Advanced Metering Infrastructure Deployment Plan with the Illinois Commerce Commission.

Plug-in Electric Vehicle and Infrastructure Grants

Car sharing organizations located and operating in Illinois may be eligible for grants of up to 25% of qualifying project costs, including the cost of purchasing new electric vehicles and building charging infrastructure. Vehicles must be predominately powered by electricity, be purchased from an Illinois dealership, and remain registered and in service with the grantee in Illinois for at least five years after purchase. Vehicles purchased with grant funds are not eligible for rebates under the Illinois Alternate Fuels Rebate Program. Grant application and reporting requirements apply. The Illinois Environmental Protection Agency will administer the grant program through Fiscal Year 2013.

Alternative Fuel Vehicle (AFV) and Alternative Fuel Rebates

The Illinois Alternate Fuels Rebate Program (Program) provides a rebate for 80% of the incremental cost of purchasing an AFV (up to $4,000), 80% of the cost of converting a conventional vehicle or a hybrid electric vehicle to an AFV using a federally certified conversion (up to $4,000), and for the incremental cost of purchasing alternative fuels. Eligible fuels for the program include E85, fuel blends containing at least 20% biodiesel (B20), natural gas, propane, electricity, and hydrogen. A vehicle may receive one rebate in its lifetime. Only AFVs or conversion systems purchased from an Illinois-based company or vendor are eligible, except if the vehicle is a heavy-duty specialty vehicle that is not sold in Illinois, but the conversion does have to take place in Illinois.

Only hybrid electric vehicles fueled with alternative fuels are eligible. To be eligible for a fuel rebate, the entity or individual must purchase the majority of E85 or biodiesel fuel from Illinois retail stations or fuel suppliers. The E85 fuel rebate is up to $450 per year (depending on vehicle miles traveled) for up to three years for each flexible fuel vehicle that uses E85 at least half the time. The biodiesel fuel rebate (for B20 and higher blends) is for 80% of the incremental cost of the biodiesel fuel, as compared to conventional diesel. The Program is part of the Illinois Green Fleets Program and is open to all Illinois residents, businesses, government units (except federal government), and organizations located in Illinois.

Alternative Fuel Vehicle (AFV) Fleet Incentives

The Illinois Green Fleets Program recognizes and provides additional marketing opportunities for fleets in Illinois that have a significant number of AFVs and use clean, domestically produced fuels.

Electric Vehicle (EV) Registration Fee Reduction

Individuals may register an EV at a discounted registration fee of no more than $18 per year. To qualify for the reduced fee, the EV must be designed to carry 10 or fewer passengers or be designed to carry more than 10 passengers but must weigh 8,000 pounds or less.

School Bus Retrofit Reimbursement

The Illinois Department of Education will reimburse any qualifying school district for the cost of converting gasoline buses to more fuel-efficient engines or to engines using alternative fuels.

Fleet User Fee Exemption

Fleets with 10 or more vehicles located in defined areas must pay an annual user fee of $20 per vehicle. Owners of state, county, or local government vehicles or electric vehicles are exempt from this fee. Fees are collected into the Alternate Fuels Fund.

Illinois Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Chicago metropolitan area. To be eligible for free home charging stations, individuals living within the specified area must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Illinois State Laws and Regulations Concerning Evs

Electric Vehicle Supply Equipment (EVSE) Installation Requirements

The Illinois Commerce Commission must establish certification requirements for vendors that install EVSE by April 29, 2012.

Plug-in Electric Vehicle Promotion and Coordination

The Illinois Electric Vehicle Advisory Council is established to investigate and recommend strategies that the governor and the general assembly may implement to promote the use of plug-in electric vehicles, including potential infrastructure improvements. The governor may appoint an Electric Vehicle Coordinator to act as the point of contact for related policies and activities in the state.

Fuel-Efficient Vehicle Acquisition Goals

To help achieve the statewide goal of reducing petroleum use by 20% by July 1, 2012, as compared to 2008 petroleum use, Illinois state agencies must work towards meeting the following goals:

- By July 1, 2015, at least 20% of new passenger vehicles purchased must be hybrid electric vehicles (HEVs) and 5% must be battery electric vehicles (EVs);
- By July 1, 2025, at least 60% of new passenger vehicles purchased must be HEVs and 15% must be EVs;

Agencies that operate medium- and heavy-duty vehicles must implement strategies to reduce fuel consumption through diesel emission control devices, HEV and EVs technologies, alternative fuel use, and fuel-efficient technologies. Agencies must also implement strategies to promote the use of biofuels in state vehicles; reduce the environmental impacts of employee travel; and encourage employees to adopt alternative travel methods, such as carpooling.

Alternative Fuel Promotion

The Illinois General Assembly established the Alternate Fuels Commission (Commission) within the Illinois Department of Commerce and Economic Opportunity to identify and recommend strategies to the governor and General Assembly for implementing and promoting the use of alternative fuels and alternative fuel vehicles. The Commission will identify ways to improve stakeholder communication and coordination regarding the research and promotion of alternative fuels. The Commission must issue written reports on their activities and findings on at least an annual basis.

State Government Energy Initiative

The Green Governments Illinois Act (Act) demonstrates the state's commitment to reduce negative environmental impacts, reduce greenhouse gases, and preserve resources for current and future generations. The Act also aims to strengthen the capacity of local governments and educational institutions to enable a more environmentally sustainable future. The Act established the Green Governments Coordinating Council (Council) to fully integrate cost-effective environmental sustainability measures into the ongoing management systems, long-range planning, and daily operations of state agencies. Initially, the Council will focus on initiatives that include those related to energy efficiency, renewable energy, and alternative fuel vehicles. Local governments and educational institutes are not required to participate in the provisions of the Act.

Pennsylvania State Incentives for EVs

Alternative Fuel Production Tax Credits

The Alternative Energy Production Tax Credit Program provides a credit of 15%, up to $1 million per taxpayer, of the net cost of projects related to the production of alternative fuels and the research and development of technology to provide alternative fuels. An eligible applicant must develop or construct an alternative energy production project located in Pennsylvania that has a minimum useful life of four years. Funding is contingent upon annual legislative appropriations. As of October 2011, the program is closed but may reopen in the future.

Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Funding

The Alternative Fuels Incentive Grant (AFIG) Program provides financial assistance programs; information on alternative fuels, AFVs, HEVs, plug-in hybrid electric vehicles, and anti-idling technologies that use alternatives to diesel fuel for heavy-duty trucks; and advanced vehicle technology research, development, and demonstration. Projects that result in product commercialization and the expansion of Pennsylvania companies are favored in the selection process.

The AFIG Program also offers Alternative Fuel Vehicle Rebates to assist eligible residents with the incremental cost of the purchase of new AFVs, including electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), natural gas vehicles (NGVs), and propane vehicles. As of October 2011, rebates of $3,500 are available for qualified EVs and PHEVs, and rebates of $1,000 are available for NGVs and propane vehicles.

Alternative Fuel Development and Deployment Grants

Pennsylvania Energy Development Authority (PEDA) provides grants of up to $1,000,000 for alternative energy projects and research related to deployment projects or manufacturing. PEDA funding is available for projects involving biomass, fuel cells, and clean and alternative fuels for transportation, and may be used for equipment purchases, construction, contractor expenses, and engineering design necessary for construction or installation. Pure research is not eligible for funding.

Alternative Fuel Project Grants

Pennsylvania Energy Harvest Grant seeks to deploy cleaner energy sources by providing funding for alternative energy projects, including those involving clean, alternative fuels for transportation. Projects must address both energy and environmental concerns; projects that are primarily education, outreach, feasibility, assessment, planning, or research and developments are not eligible. Eligible applicants include an incorporated 501(c)(3) non-profit organizations that is also registered with the Pennsylvania Bureau of Charitable Organizations; county or municipal government; county conservation district; Council of Governments; a school, school district, college or university; or an incorporated watershed organization recognized by the Pennsylvania Department of Environmental Protection.

Pennsylvania Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Philadelphia metropolitan area. To be eligible for free home charging stations, individuals living within the specified area must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Plug-In Electric Vehicle (PEV) Rebate – PECO (private utility)

PECO provides rebates of $50 to residential customers who purchase a new, qualified PEV.

Pennsylvania State Laws and Regulations Concerning Evs

Alternative Fuels Tax

Alternative fuels used to propel vehicles of any kind on public highways are taxed at a rate determined on a gasoline gallon equivalent basis. The tax rates are posted in the Pennsylvania Bulletin. (Reference Title 75 Pennsylvania Statutes, Chapter 90, Section 9004)

Arizona State Incentives for EVs

Alternative Fuel Vehicle (AFV) High Occupancy Vehicle (HOV) Lane Exemption

Dedicated AFVs are permitted to use HOV lanes, regardless of the number of passengers. Qualified vehicles must display AFV special plates or stickers, which are available from the Arizona Department of Transportation Motor Vehicle Division. Recognized alternative fuels are propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas. HOV lane use may become restricted if certain speed criteria are met.

Plug-In Electric Vehicle (PEV) Charging Equipment Tax Credit

A tax credit of up to $75 is available to individuals for the installation of a PEV charging outlet in a house or housing unit that they have built. To qualify, the outlet must meet certain codes and standards.

Alternative Fuel Vehicle (AFV) Parking Incentive

An individual driving an AFV may park without penalty in parking areas that are designated for carpool operators provided the vehicle is using alternative fuel. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas.

Reduced Alternative Fuel Vehicle (AFV) License Tax

The initial annual vehicle license tax on an AFV is lower than the license tax on a conventional vehicle. The vehicle license tax on an AFV is $4 for every $100 in assessed value. The assessed value of the AFV is determined as follows: during the first year after initial registration, the value of the AFV is 1% of the manufacturer's base retail price (as compared to 60% for conventional vehicles); during each succeeding year, the value of the AFV is reduced by 15%. The minimum amount of the license tax is $5 per year for each motor vehicle subject to the tax. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas.

Alternative Fuel and Alternative Fuel Vehicle (AFV) Tax Exemption

The Arizona use tax does not apply to the following: natural gas or liquefied petroleum gas (propane) used to propel a motor vehicle; AFVs, if the AFV was manufactured as a diesel fuel vehicle and converted to operate on an alternative fuel; and equipment that is installed on a conventional diesel fuel motor vehicle to convert the vehicle to operate on an alternative fuel. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas.

Arizona Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Phoenix and Tucson metropolitan areas. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Plug-In Electric Vehicle (PEV) Charging Discount – Glendale Water and Power (public utility)

Glendale Water and Power (GWP) offers an electricity bill discount of $0.33 per day to residential and commercial customers who own qualified PEVs. To be eligible, customers must submit a copy of their PEV registration and install a second sub-meter. GWP provides the second meter and socket at no charge.

Plug-In Electric Vehicle (PEV) Charging Rate – Arizona Public Service Co. (private utility)

The Arizona Public Service Company (APS) offers an electricity rate option to residential customers who own a qualified PEV. To be eligible, customers must have an Advanced Metering Infrastructure meter in place. Additional restrictions apply. The rate will be available through December 31, 2014. For more information, see the APS Electric Vehicle Rate Impact website.

Arizona State Laws and Regulations Concerning EVs

Alternative Fuel Vehicle (AFV) Special License Plate

A registered AFV must display an AFV license plate. State or agency directors who conduct activities of a confidential nature and use AFVs are exempt from the requirement to display an AFV special license plate. The Arizona Department of Transportation has the authority to issue regular plates to AFVs used by law enforcement agencies and the federal government. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas.

Electric Vehicle (EV) Parking Space Regulation

An individual is not allowed to stop, stand, or park a motor vehicle within any parking space specifically designated for parking and charging EVs unless the motor vehicle is an EV and has been issued an alternative fuel vehicle special plate or sticker. A person who is found responsible for a violation may be subject to a civil penalty of at least $350.

Joint Use of Government Fueling Infrastructure

To the extent practical, an Arizona state agency or political subdivision that operates an alternative fueling station must allow vehicles other state agencies or political subdivisions own or operate to fuel at the station. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas.

State Vehicle Acquisition and Fuel Use Requirements

Arizona state agencies, boards, and commissions must purchase hybrid electric vehicles (HEVs), alternative fuel vehicles (AFVs), or vehicles that meet greenhouse gas emissions standards; or use alternative fuels; with the goal that all state vehicles be HEVs, meet low emissions standards, or be AFVs by January 2012. At least 75% of light-duty state fleet vehicles operating in counties with a population of more than 250,000 people must be capable of operating on alternative fuels. If the AFVs operate in counties with populations of more than 1.2 million people, those vehicles must meet U.S. Environmental Protection Agency emissions standards for Low Emission Vehicles. Alternatively, the state fleet may meet AFV acquisition requirements through biodiesel or alternative fuel use or apply for waivers. For the purpose of these requirements, alternative fuels include propane, natural gas, electricity, hydrogen, qualified diesel fuel substitutes, E85, and a blend of hydrogen with propane or natural gas.

Municipal Alternative Fuel Vehicle (AFV) Acquisition Requirements

Local governments in defined areas of Maricopa, Pinal, and Yavapai counties that have a population of more than 1.2 million people must develop and implement vehicle fleet plans for the purpose of encouraging and increasing the use of alternative fuels in vehicles the city or town owns. At least 75% of the total local government fleet must operate on alternative fuels. Alternatively, local government fleets may meet AFV acquisition requirements through biodiesel or alternative fuel use or apply for waivers. Any local governments that purchase buses for use in counties with populations of more than 500,000 people must purchase or convert buses to operate on alternative fuels. For the purpose of these requirements, alternative fuels include propane, natural gas, electricity, hydrogen, qualified diesel fuel substitutes, E85, and a blend of hydrogen with propane or natural gas.

School District Alternative Fuel Vehicle Acquisition Requirements

Within defined areas of Maricopa, Pinal, and Yavapai counties, school districts with an average student population of more than 3,000 students must ensure that 50% of the portion of the fleet with a gross vehicle weight rating of at least 17,500 pounds per vehicle operates on alternative fuels, ultra low sulfur diesel, or meets specified emissions standards. Alternatively, school districts may meet acquisition requirements through alternative fuel use. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, qualified diesel fuel substitutes, E85, and a blend of hydrogen with propane or natural gas.

Federal Fleet Operation Regulations

Federal fleets based in Arizona that operate primarily in counties with a population of more than 1.2 million people must be comprised of at least 90% alternative fuel vehicles. Alternatively, federal fleets may meet acquisition requirements through alternative fuel use or apply for waivers. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, qualified diesel fuel substitutes, E85, and a blend of hydrogen with propane or natural gas.

Alternative Fuel Vehicle (AFV) Dealers Information Dissemination Requirement

New motor vehicle dealers must make information about AFVs and Arizona-based incentives for purchasing or leasing AFVs available to the public. Recognized alternative fuels include propane, natural gas, electricity, hydrogen, and a blend of hydrogen with propane or natural gas.

Indiana State Incentives for EVs

Alternative Fuel Vehicle (AFV) Grant Program

The Alternative Fuel Vehicle Grant Program offers grants to counties, cities, towns, townships, or school corporations to purchase original equipment manufacturer (OEM) AFVs and for the cost of AFV conversions. Qualified entities may receive $2,000 for each OEM AFV purchased, and up to $2,000 for each AFV conversion. Eligible AFVs include dedicated and bi-fuel liquefied petroleum gas (propane) and compressed natural gas vehicles. The Indiana Office of Energy Development must review and approve applications for the grant program, and the grant funding awarded for all fiscal years may not exceed $1 million.

Alternative Fuel Vehicle (AFV) Manufacturer Tax Credit

The Indiana Economic Development Corporation (IEDC) may award tax credits under the Hoosier AFV Manufacturer Tax Credit to foster job creation, reduce dependence on imported energy sources, and reduce air pollution resulting from the manufacture or assembly of light-duty AFVs in Indiana. AFV manufacturers are eligible for tax credits of up to 15% of qualified investments, which include expenditures in the state that are reasonable and necessary for the manufacture or assembly of AFVs. To be eligible, the manufacturer must compensate its employees at least 150% of the state's hourly minimum wage and agree to maintain operations for at least 10 years. Additional restrictions apply.

ultra low sulfur diesel fuel, natural gas, liquefied petroleum gas (propane), hydrogen, methanol, coal-derived liquid fuels, non-alcohol fuels derived from biological material, P-Series fuels, or electricity. IEDC must review and approved applications for this incentive. The credit applies to taxable years beginning after December 31, 2006, and before December 31, 2016. Unused credits may be carried forward for up to nine consecutive taxable years.

Vehicle Research and Development Grants

The Indiana Economic Development Corporation administers the Indiana 21st Century Research and Technology Fund, which provides grants and loans to support proposals for economic development in high technology industry clusters. Incentives are available for qualified alternative fuel technologies and fuel-efficient vehicle production.

Indiana Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - Duke Energy (public utility)

As part of Indiana's Project Plug-IN initiative, Duke Energy is conducting a two-year pilot program that provides qualified residential and commercial customers with Level 2 EVSE. Duke Energy will install the EVSE at the home (covering up to $1,000 in installation costs) or business (covering up to $1,500 in installation costs) and service the equipment for the duration of the pilot program. Duke Energy will remotely access the EVSE to collect information in an effort to better understand charging habits and the impact on the power grid. At the end of the pilot program, participants will be able to keep the EVSE at no additional cost.

Plug-In Electric Vehicle Charging Rates and Infrastructure Incentive - Indianapolis Power & Light (private utility)

The Indianapolis Power & Light Company (IPL) offers special plug-in electric vehicle charging rates, including year-round time-of-use based options, for residential and fleet customers who own a licensed electric or plug-in electric vehicle. IPL will provide Level 2 electric vehicle supply equipment (EVSE) and the associated metering equipment for the first 150 eligible customers to take advantage of the special rate. IPL will also cover the cost of a standard installation of the equipment. Indianapolis residents and visitors may also use public EVSE by paying a flat fee of $2.50 per charging session.

Electric Vehicle Supply Equipment (EVSE) Credit and Charging Incentive – NIPSCO (public utility)

NIPSCO's IN-Charge Electric Vehicle Program (Program) offers a credit of up to $1,650 to purchase and install residential EVSE, as well as free plug-in electric vehicle (PEV) charging during off-peak hours for those enrolled in the Program. Customers will also receive a free meter specifically dedicated to the EVSE. The Program is in effect until January 31, 2015, and is limited to 250 customers, or until funding is exhausted.

Indiana State Laws and Regulations Concerning EVs

Clean Vehicle Acquisition Requirements

Each state entity must purchase or lease a clean energy vehicle, unless the Indiana Department of Administration determines that the purchase or lease of the vehicle is inappropriate for its intended use, or the purchase or lease would cost 10% more than a comparable non-clean energy vehicle. Additional exemptions apply. A clean energy vehicle is defined as a vehicle that operates on one or more of the following energy sources: a rechargeable energy storage system; hydrogen; compressed natural gas; or liquefied natural gas.

Certified Technology Park Designation

The Indiana Economic Development Corporation may designate an area as a certified technology park if certain criteria are met, including a commitment from at least one business engaged in a high technology activity that creates a significant number of jobs. The establishment of high technology activities and public facilities within a technology park serves a public purpose and benefits the public's general welfare by encouraging investment, job creation and retention, and economic growth and diversity. High technology activities include advanced vehicles technology, which is any technology that involves electric vehicles, hybrid electric vehicles, or alternative fuel vehicles, or components used in the construction of these vehicles.

North Carolina State Incentives for EVs

Alternative Fuel and Idle Reduction Grants

Diesel Emission Reduction Grants are available from the North Carolina Department of Environment and Natural Resources Division of Air Quality for the incremental cost of purchasing original equipment manufacturer alternative fuel vehicles, vehicle conversions, implementing idle reduction programs, and constructing or installing public alternative fueling facilities. As of September 2011, funding availability for the 2012 grant cycle is unknown.

High Occupancy Vehicle (HOV) Lane Exemption

Qualified plug-in electric vehicles, dedicated natural gas vehicles, and fuel cell electric vehicles may use North Carolina HOV lanes, regardless of the number of occupants.

Plug-In Electric Vehicle Emissions Inspection Exemption

Qualified plug-in electric vehicles are exempt from state emissions inspection requirements. Other restrictions may apply.

Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Support

The Clean Fuel Advanced Technology project focuses on reducing transportation related emissions in non-attainment and maintenance counties for National Ambient Air Quality Standards. Projects that are adjacent to areas may also be eligible if the project will reduce emissions in eligible counties. The North Carolina Department of Transportation funds the CFAT project, which covers three broad areas: education and outreach; project funding; and recognition of exemplary activities. As of September 2011, funding is not available. Future financial support is anticipated to be available in 2013 for AFVs, fueling infrastructure, idle reduction technologies, heavy-duty HEVs, heavy-duty buses, and diesel retrofits.

Alternative Fuel and Alternative Fuel Vehicle (AFV) Fund

The North Carolina State Energy Office administers the Energy Policy Act (EPAct) Credit Banking and Selling Program, which enables the state to generate funds from the sale of EPAct 1992 credits. The funds EPAct credit sales generate are deposited into the Alternative Fuel Revolving Fund (Fund) for state agencies to offset the incremental costs of purchasing biodiesel blends of at least 20% (B20) or ethanol blends of at least 85% (E85), developing alternative fueling infrastructure, and purchasing AFVs and hybrid electric vehicles. Funds are distributed to state departments, institutions, and agencies in proportion to the number of EPAct credits generated by each. For the purposes of this program, the definition of alternative fuel includes 100% biodiesel (B100), biodiesel blends of at least B20, ethanol blends of at least E85, compressed natural gas, propane, and electricity. The Fund also covers additional projects approved by the Energy Policy Council.

Alternative Fuel Tax Exemption

The retail sale, use, storage, and consumption of alternative fuels are exempt from the state retail sales and use tax.

North Carolina Utility and Private Business Incentives Related to EVs

Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Loans

The State Employees' Credit Union and the Local Government Federal Credit Union offer green vehicle loans to purchase qualified new and used fuel-efficient vehicles. Vehicles with a combined fuel economy rating of at least 28 miles per gallon, according to revised fuel economy ratings posted on www.fueleconomy.gov, qualify. The loan interest rates are 0.5% lower than traditional new or used vehicle loan rates.

Plug-In Electric Vehicle Rebates - Advanced Energy (public utility)

Advanced Energy is offering a $7,500 rebate to 40 qualified Nissan LEAF SL owners in the Greater Triangle, North Carolina area on a first come, first served basis. To qualify for the rebate, residents must purchase or lease the vehicles by December 30, 2011, and allow Advanced Energy to monitor their vehicle usage and charging activity to document fuel savings over a two-year period.

North Carolina State Laws and Regulations Concerning EVs

Alternative Fuel Vehicle (AFV) Acquisition Requirements

At least 75% of new or replacement state government light-duty cars and trucks with a gross vehicle weight rating of 8,500 pounds or less must be AFVs or low emission vehicles.

Plug-In Electric Vehicle Definition

- A plug-in electric vehicle is defined as a vehicle that:
- Draws electricity from a battery with a capacity of at least four kilowatt hours and that is capable of being charged from an external source;
- Has not been modified from the original equipment manufacturer power train specifications;
- Has a gross vehicle weight rating of 8,500 pounds or less;
- Has a maximum speed capacity of at least 65 miles per hour; and
- Meets applicable requirements in Title 49 of the Code of Federal Regulations, section 571.

Michigan State Incentives for EVs

Advanced Vehicle Battery Manufacturer Tax Credits

Manufacturers of traction battery packs for use in vehicles may qualify for a tax credit from the Michigan Economic Development Corporation for tax years beginning on or after January 1, 2010 and ending before January 1, 2015. The amount of the credit is based on kilowatt hours (kWh) of battery capacity. Qualified batteries must have a traction battery capacity of at least 4 kWh, be equipped with an electrical plug for charging purposes, and be installed in a new, qualified plug-in electric drive motor vehicle that qualifies for the federal tax credit specified in 26 U.S. Code 30D.

Beginning January 1, 2012, a manufacturer may claim a tax credit of up to 75% of the qualified expenses for vehicle engineering to support battery integration, prototyping, and launching, so long as the expenses are incurred between January 1, 2009, and January 1, 2014. The same credit is available to a manufacturer that increases its engineering activities for advanced automotive battery technologies.

Taxpayers also may claim a tax credit equal to 50% of the capital investment expenses for the construction of an integrative cell manufacturing facility that includes anode and cathode manufacturing and cell assembly if the project creates at least 300 new jobs in the state. Taxpayers that have received federal loan guarantees may claim a credit equal to 25% of the capital investment expenses for the construction of a facility that will produce large-scale batteries and manufacture integrated power management, smart control, and storage systems if the project creates at least 500 new jobs in the state.

Alternative Fuel and Vehicle Research, Development, and Manufacturing Tax Credits

Qualified taxpayers may claim a non-refundable credit for tax liability attributable to research, development, or manufacturing of qualified alternative fuel vehicles (AFVs), and renewable fuel. For the purpose of this incentive, AFVs include fuel cell, electric, hybrid electric, natural gas, E85, liquefied petroleum gas or propane, and hydrogen vehicles. Renewable fuels include biodiesel blends of at least 20%. The Michigan NextEnergy Authority must certify eligible taxpayers. Additionally, businesses located within the designated Alternative Energy Zone that are engaged in qualified activities may claim a credit for the qualified payroll amount.

Alternative Fuel and Vehicle Research, Development, and Manufacturing Tax Credits

Qualified taxpayers may claim a non-refundable credit for tax liability attributable to research, development, or manufacturing of qualified alternative fuel vehicles (AFVs) and renewable fuel. For the purpose of this incentive, AFVs include fuel cell, electric, hybrid electric, natural gas, E85, liquefied petroleum gas or propane, and hydrogen vehicles. Renewable fuels include biodiesel blends of at least 20%. The Michigan NextEnergy Authority must certify eligible taxpayers. Additionally, businesses located within the designated Alternative Energy Zone that are engaged in qualified activities may claim a credit for the qualified payroll amount.

Alternative Fuel Development Property Tax Exemption

A tax exemption may apply to industrial property that is used for, among other purposes, and high-technology activities or the creation or synthesis of biodiesel fuel. High-technology activities include those related to advanced vehicle technologies such as electric, hybrid electric, or alternative fuel vehicles and their components. To qualify for the tax exemption, an industrial facility must obtain an exemption certificate for the property from the Michigan State Tax Commission.

Alternative Fuel Vehicle (AFV) Tax Exemption

Qualified AFVs are exempt from personal property taxes. The exemption only applies to personal property that is new to Michigan. To be eligible, the vehicle must not have been previously taxed or exempted from taxation under another law. Eligible vehicles must also:

- Be produced by an original equipment manufacturer;
- Meet the Federal Motor Vehicle Safety Standards;
- Meet local emissions standards; and
- Be propelled by natural gas, fuel blends containing at least 85% ethanol), liquefied petroleum gas (LPG, or propane), or fuel blends containing at least 85% methanol), or be a fuel cell vehicle, electric vehicle, or hybrid electric vehicle.

The Michigan NextEnergy Authority must certify the vehicle in order for it to be eligible. The exemption expires on December 31, 2012.

Alternative Fuel Vehicle (AFV) Emissions Inspection Exemption

Dedicated AFVs powered by compressed natural gas, propane, electricity, or any other source as defined by the Michigan Department of Transportation are exempt from emissions inspection requirements.

Michigan Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Rebate - Indiana Michigan Power (public utility)

Indiana Michigan Power provides rebates of up to $2,500 to residential customers who purchase or lease a new plug-in electric vehicle (PEV) and install a Level 2 EVSE with a separate meter. Customers must also sign up for the Indiana Michigan Power PEV time-of-use rate. The rebate is available to the first 250 qualified customers who submit a completed application.

Plug-In Electric Vehicle (PEV) Charging Rate Reduction - Indiana Michigan Power (public utility)

Indiana Michigan Power offers a special time-of-use rate option to residential customers who own a qualified PEV.

Plug-In Electric Vehicle Charging Rate Reduction and Rebate - Consumers Energy (public utility)

Consumers Energy offers three different rate structures for plug-in electric vehicle (PEV) owners, including two time-of-use rates and one monthly flat rate. For more information, see the Consumers Energy PEV Rate Options website. Consumers Energy also offers qualified customers a reimbursement of up to $2,500 to cover the purchase, installation, and wiring for qualified Level 2 electric vehicle supply equipment (EVSE). For more information, see the Consumers Energy PEVs Incentive Program website.

Plug-In Electric Vehicle Charging Rate Reduction - DTE Energy (public utility)

DTE Energy offers a reduced electricity rate to qualified residential customers for charging all-electric and plug-in hybrid electric vehicles during off-peak hours. A flat rate option is also available.

Electric Vehicle Supply Equipment (EVSE) Rebate - DTE Energy (public utility)

DTE Energy will provide a $2,500 rebate for the purchase and installation of separately metered EVSE to the first 2,500 qualified customers who purchase all-electric or plug-in hybrid electric vehicles and enroll in the DTE plug-in electric vehicle rate.

Michigan State Laws and Regulations Concerning EVs

As of July 30th, 2012 there are no laws or regulation specific to EVs/EVSEs

Maryland State Incentives for EVs

Electric Vehicle Supply Equipment (EVSE) Tax Credit

The Maryland Energy Administration (MEA) offers an income tax credit equal to 20% of the cost of qualified EVSE that meets the definition of qualified alternative fuel vehicle refueling property as set forth in the Internal Revenue Code. The credit may not exceed the lesser of $400 or the state income tax imposed for that tax year. The tax credit is limited to one EVSE system per individual and 30 EVSE systems per business entity. Individuals and businesses must apply to MEA for the credit. Unused credits may not be carried over. MEA may adopt regulations to limit the credit amounts. Total funds currently available for the tax credit are $500,000 for the 2012 tax year and $600,000 for the 2013 tax year.

Plug-In Electric Vehicle (PEV) Tax Credit

Purchasers of qualified PEVs may apply for a tax credit of up to $2,000 against the imposed excise tax. The tax credit is limited to one vehicle per individual and 10 vehicles per business entity. Vehicles must be registered in Maryland, unless the vehicle manufacturer conforms to applicable state or federal laws or regulations governing clean fuel vehicles or PEVs during the year in which the vehicle was purchased, or the vehicle was originally registered in another state. A qualified vehicle must meet the following criteria:

- Has a gross vehicle weight rating not to exceed 8,500 pounds;
- Can achieve a maximum speed of at least 55 miles per hour;
- Is a two-, three-, or four-wheeled vehicle;
- Is propelled to a significant extent by an electric motor that draws electricity from a battery with a capacity of at least four kilowatt hours in the case of a four-wheeled motor vehicle, or at least 2.5 kilowatt hours in the case of a two- or three-wheeled motor vehicle;
- Has not been modified from original manufacturer specifications; and
- Is purchased between October 1, 2010, and July 1, 2013.

Electric Truck Purchase Vouchers

The Maryland Energy Administration provides vouchers for the purchase of new all-electric trucks. Eligible vehicles must have a gross vehicle weight rating over 10,000 pounds and be registered for on-road use in the state of Maryland. Vouchers of $20,000 are available for qualified vehicles purchased from a dealership in Maryland or directly from a manufacturer located outside of Maryland. Vouchers of $15,000 are available for qualified vehicles purchased through a dealership located outside of Maryland. All applicants must submit their application for funding by June 15, 2013, limited to five vouchers per motor carrier. The voucher program will end December 31, 2013.

Plug-in Electric Vehicle (PEV) High Occupancy Vehicle (HOV) Lane Exemption

Permitted PEVs may operate in Maryland HOV lanes regardless of the number of occupants. Qualified PEVs must be propelled to a significant extent by an electric motor that draws electricity from a battery with a capacity of at least four kilowatt hours. To operate in HOV lanes, PEV owners must obtain a permit from the Maryland Motor Vehicle Administration (MVA). The MVA may charge a permit fee of up to $20 and may issue a limited number of permits. Each year the MVA and the State Highway Administration must report PEV use in HOV lanes to the governor. This exemption expires September 30, 2013.

Maryland Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Washington, DC metropolitan area. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Maryland State Laws and Regulations Concerning EVs

Electric Vehicle Supply Equipment (EVSE) Regulation Exemption

Effective October 1, 2012, owners and operators of EVSE are not subject to state regulation as electricity suppliers or public service companies. For the purpose of this regulation, owners and operators of EVSE are considered retail electric customers.

Plug-in Electric Vehicle (PEV) Information Disclosure

The Maryland Motor Vehicle Administration is allowed to provide the address of a registered PEV owner and information about the vehicle to electric companies for their use.

Plug-in Electric Vehicle (PEV) Infrastructure Promotion

The Maryland Electric Vehicle Infrastructure Council (Council) promotes the use of PEVs in the state. Specific responsibilities of the Council include the following:

- Develop an action plan to facilitate successful integration of PEVs into the Maryland transportation network;

- Assist in developing and coordinating statewide standards for streamlined permitting and installation of electric vehicle supply equipment;
- Recommend a statewide charging infrastructure plan and incentives to support investment in PEVs;
- Develop targeted policies to support fleet purchases of PEVs; and
- Encourage local and regional efforts to promote the use of PEVs.

The Maryland Department of Transportation must provide staff support to the Council with the assistance of the Maryland Energy Administration and the Maryland Public Service Commission. The Council submitted an interim report and recommendations to the governor, and must submit a final report and recommendations by December 1, 2012. The Council will remain in place through June 2013.

Provision for Plug-In Electric Vehicle (PEV) Charging Incentives

By June 30, 2013, the Maryland Public Service Commission (PSC) must establish a pilot program for electric customers to charge PEVs during off-peak hours. The pilot program must include at least two electric companies and provide incentives for residential, commercial, and governmental customers to charge PEVs. The incentives should increase the efficiency and reliability of the electric distribution system and lower electricity use at times of high demand. The incentives may include time-of-use pricing, credits on distribution charges, rebates on the cost of charging systems, demand response programs, or other incentives approved by PSC.

Massachusetts State Incentives for EVs

Electric Vehicle Supply Equipment (EVSE) Grants

The Green Communities Division of the Massachusetts Department of Energy Resources (DOER) has funding available to local governments to fund the installation of publically available EVSE. All Massachusetts cities and towns are eligible and encouraged to apply; preference will be given to the 74 designated Green Communities and communities predicted to have the largest volume of potential plug-in electric vehicles. DOER will award grants based on funding availability; as of December 2011, funding is not available.

Massachusetts Utility and Private Business Incentives Related to EVs

As of July 30th, 2012 there are no electric utilities or private businesses that offer EV related incentives.

Massachusetts State Laws and Regulations Concerning EVs

Hybrid Electric (HEV) Alternative Fuel Vehicle (AFV) Acquisition Requirements

When purchasing new motor vehicles, the Commonwealth of Massachusetts must purchase HEVs or AFVs to the maximum extent feasible and consistent with the ability of such vehicles to perform their intended functions. HEVs and AFVs must be acquired at a rate of at least 5% annually for all new motor vehicle purchases so that not less than 50% of the motor vehicles the Commonwealth owns and operates will be HEVs or AFVs by 2018.

State Agency Alternative Fuel Vehicle (AFV) Acquisition Requirement

State fleets must acquire AFVs according to the requirements of the Energy Policy Act (EPAct) of 1992 and the Massachusetts Office of Vehicle Management (OVM) must approve any light-duty vehicle acquisition. All agencies must purchase the most economical, fuel-efficient, and low emission vehicles appropriate to their mission. OVM, in collaboration with the Massachusetts Department of Energy Resources, will set new minimum standards for vehicle mileage and work with agencies to acquire vehicles that provide the best value for the Commonwealth on a total cost of ownership basis.

Washington State Incentives for EVs

Alternative Fuel Vehicle (AFV) Tax Exemption

New passenger cars, light-duty trucks, and medium-duty passenger vehicles that are dedicated AFVs are exempt from the state motor vehicle sales and use taxes. Qualified vehicles must operate exclusively on natural gas, propane, hydrogen, or electricity; meet the California motor vehicle emissions standards; and comply with the rules of the Washington Department of Ecology. This exemption also applies to qualified used vehicles that are modified with a U.S. Environmental Protection Agency certified aftermarket conversion, as long as the vehicle is being sold for the first time after modification. The converted vehicle must be part of a fleet of at least five vehicles owned by the same person and have an odometer reading of less than 30,000 miles. This tax exemption expires July 1, 2015.

Electric Vehicle (EV) Infrastructure and Battery Tax Exemptions

Public lands used for installing, maintaining, and operating EV infrastructure are exempt from leasehold excise taxes until January 1, 2020. Additionally, the state sales and use taxes do not apply to EV batteries; labor and services for installing, repairing, altering, or improving EV batteries and EV infrastructure; and the sale of property used for EV infrastructure.

Alternative Fuel Loans and Grants

The Washington Department of Commerce administers the Energy Freedom Program (Program) in consultation with other state agencies. The Program includes the Energy Freedom Account, which provides financial and technical assistance for bioenergy production, research, and market development, primarily in the form of loans used to convert farm products, organic wastes, cellulose and biogas into electricity, biofuel, and related co-products. The Program also includes the Green Energy Incentive Account, which provides financial assistance for alternative fueling infrastructure along interstate corridors.

Plug-In Electric Vehicle (PEV) Demonstration Grants

The Washington Department of Commerce administers the Vehicle Electrification Demonstration Grant Program, part of the Energy Freedom Program. Eligible applicants are state agencies, public school districts, public utility districts, or political subdivisions of the state. Grants may be awarded for projects involving the purchase or conversion of existing vehicles to PEVs for use in an applicant's fleet or operations; additional eligibility requirements apply. As of April 2012, funding is not available.

Electric Vehicle Supply Equipment (EVSE) Project Funding

The Washington Departments of Commerce and Transportation are partnering to fund the installation of qualified EVSE along the I-5 and US-2 corridors. Competitive funding is available to businesses wishing to host EVSE.

Alternative Fuel Vehicle (AFV) and Hybrid Electric Vehicle (HEV) Emissions Inspection Exemption

Dedicated electric, compressed natural gas, and propane vehicles are exempt from state emissions control inspections. HEVs that obtain a U.S. Environmental Protection Agency fuel economy rating of at least 50 miles per gallon during city driving are also exempt from these inspections.

Washington Utility and Private Business Incentives Related to EVs

Clean and Efficient Fleet Assistance

The Western Washington Clean Cities Coalition, in partnership with the Puget Sound Clean Air Agency, offers the Evergreen Fleets program, a comprehensive greening plan and certification system for fleets. Evergreen Fleets provides fleet managers with tools to help "green" public and private fleets, reduce pollution, and save money. Evergreen Fleets provides a step-by-step guide to identify the most effective way for fleet managers to green their fleets, including buying greener vehicles, switching to cleaner fuels, or improving fleet efficiency.

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Seattle metropolitan area. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Washington State Laws and Regulations Concerning EVs

Electric Vehicle (EV) Promotion and Infrastructure Development

Any regional transportation planning organization containing a county with a population greater than one million must collaborate with state and local governments to promote EV use, invest in EV infrastructure, and seek federal or private funding for these efforts. Collaborative planning efforts may include: 1) developing short- and long-term plans outlining how state, regional, and local governments may construct EV charging locations and ensure that the infrastructure can be electrically supported; 2) supporting public education and training programs on EVs; 3) developing an implementation plan for counties with a population greater than 500,000 to have 10% of public and private parking spaces ready for EV charging by December 31, 2018; and 4) developing model ordinances and guidance for local governments for site assessment and installing EV infrastructure.

Electric Vehicle (EV) Charging Infrastructure Availability

Publicly and privately owned EVs may be charged at state office locations where the vehicles are used for state business, conducting business with the state, or as commuter vehicles. Additionally, contingent upon funding, the state must install electrical outlets suitable for charging EVs in each of the state's fleet parking and maintenance facilities as well as every state-operated highway rest stop by December 31, 2015.

Electric Vehicle (EV) Fee

Effective February 1, 2013, EV operators must pay an annual vehicle registration renewal fee of $100. This fee expires if the legislature imposes a vehicle miles traveled fee or tax in the state.

Local Government Electric Vehicle (EV) Infrastructure Requirements

Jurisdictions must develop regulations to allow the use of EV infrastructure and battery charging stations in all areas except critical areas or areas zoned for residential or resource use. This regulation applies to jurisdictions that meet specific location criteria. The Washington Department of Commerce included a model ordinance, development regulations, and guidance for local governments for site assessment and installing EV infrastructure in "Electric Vehicle Infrastructure: A Guide for Local Governments in Washington State." This requirement is contingent upon federal funding. Additionally, cities or municipalities may adopt incentive programs to encourage retrofitting of existing structures capable of charging EVs.

Electric Vehicle Supply Equipment (EVSE) and Battery Exchange Station Regulations

State and local governments may lease land for installing, maintaining, and operating EVSE or electric vehicle battery exchange stations for up to 50 years. Additionally, the installation of battery charging and exchange stations is categorically exempt from the Washington Environmental Policy Act.

Electric Vehicle (EV) Road User Assessment System Pilot

The Washington Transportation Commission must establish a steering committee to determine the feasibility of transitioning from a fuel tax to a road user assessment system in the state. Under the guidance of this steering committee, the Department of Transportation may conduct a limited scope pilot project to test the feasibility of this new system as it applies to EVs.

Electric Vehicle (EV) Infrastructure Definitions

EV infrastructure is defined as structures, machinery, and equipment necessary and integral to support an EV, including battery charging stations, rapid charging stations, and battery exchange stations. A battery charging station is defined as an electrical component assembly or cluster of component assemblies designed specifically to charge batteries within an EV. A rapid charging station is defined as an industrial grade electrical outlet that allows for faster recharging of EV batteries through higher power levels. A battery exchange station is defined as a fully automated facility that will enable an EV with a swappable battery to enter a drive lane and exchange the depleted battery with a fully charged battery through a fully automated process. Infrastructure must meet or exceed any applicable state building standards, codes, and regulations.

Provision for Alternative Fuels Corridor Pilot Projects

The Washington Department of Transportation may enter into partnership agreements with other public and private entities to use land for alternative fuel corridor pilot projects. Minimum requirements apply and these agreements are subject to funding availability.

State Agency Coordination to Address Climate Change

The Washington Department of Ecology worked with the Washington Departments of Commerce and Transportation to assess whether California's low carbon fuel standard (LCFS) or other state standards would help Washington meet its greenhouse gas emissions reduction target of 1990 levels by 2020. See the Department of Ecology's LCFS website for information about the assessment.

The Department of Transportation must work in consultation with the Departments of Ecology and Commerce and other interest groups to address low or zero emission vehicles. Additionally, the Office of the Governor will work with state agencies to seek funding to implement a project for the electrification of the West Coast interstate highway and associated metropolitan centers and to purchase electric vehicles and install public fueling and/or charging infrastructure for electric and other high-efficiency, zero, or low carbon vehicles.

Alternative Fuel Use Requirement

Effective June 1, 2015, all state agencies must use 100% biofuels or electricity to operate all publicly owned vehicles. To phase in this requirement, all state agencies must achieve 40% biofuel or electricity use by June 1, 2013. In addition, effective June 1, 2018, all local government agencies must use 100% biofuels or electricity to operate all publically owned vehicles. Transit agencies using compressed natural gas (CNG) are exempt from this requirement. To allow the motor vehicle fuel needs of state and local government to be satisfied by Washington-produced biofuels, the Washington Department of Enterprise Services and local governments may contract in advance and execute contracts with public or private producers and suppliers for the purchase of appropriate biofuels. Government agencies may substitute CNG, liquefied natural gas, or propane in vehicles if the Washington Department of Commerce determines that biofuels and electricity are not reasonably available.

State Vehicle Purchasing Guidance

The Washington Department of Enterprise Services must develop guidelines and criteria for the purchase of high mileage gasoline vehicles, as well as alternative fuel vehicles and systems that reduce the overall costs and energy use in the state. The guidance should include investigations into all opportunities to aggregate the purchasing of clean technologies with state and local governments, as well as federal fuel economy standards.

Low Carbon Fuel and Fuel-Efficient Vehicle Acquisition Requirement

Washington state agencies must consider purchasing ultra low carbon fuel vehicles or converting conventional vehicles to use ultra low carbon fuels when financially comparable over the vehicle's useful life. Ultra low carbon fuels include hydrogen, biomethane, electricity, or at least 90% natural gas. State agencies must phase in fuel economy standards for motor pools and leased conventional vehicles to achieve an average fuel economy of 36 miles per gallon for passenger vehicle fleets by 2015. State agencies must purchase ultra low carbon fuel vehicles or, when purchasing new conventional vehicles, achieve an average fuel economy of 40 miles per gallon (mpg) for light-duty passenger vehicles and 27 mpg for light-duty vans and sport utility vehicles. When calculating average fuel economy, emergency response vehicles, passenger vans with a gross vehicle weight rating of 8,500 pounds or greater, off-road vehicles, ultra low carbon fuel vehicles, and vehicles driven less than 2,000 miles per year are excluded.

District of Columbia Incentives for EVs

Alternative Fuel and Fuel-Efficient Vehicle Title Tax Exemption

Qualified alternative fuel vehicles (AFVs) and motor vehicles with a U.S. Environmental Protection Agency estimated average city fuel economy of at least 40 miles per gallon are exempt from the excise tax imposed on an original certificate of title. The District of Columbia Department of Motor Vehicles determines which AFVs qualify for this exemption.

Alternative Fuel Vehicle Exemption from Driving Restrictions

Certified clean fuel vehicles are exempt from time-of-day and day-of-week restrictions and commercial vehicle bans, if these vehicles are part of a fleet that operates at least 10 vehicles in an ozone nonattainment area, as defined by the Clean Air Act. This exemption does not permit unrestricted access to High Occupancy Vehicle lanes, except for covered fleet vehicles that have been certified by the U.S. Environmental Protection Agency as Inherently Low Emission Vehicles (ILEV) and continue to be in compliance with applicable ILEV emission standards.

District of Columbia Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the District of Columbia metropolitan area. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

District of Columbia Laws and Regulations Concerning EVs

Alternative Fuel Vehicle Acquisition Requirements

Fleets that operate at least 10 vehicles in an ozone nonattainment area, as defined by the Clean Air Act, must ensure that 70% of newly purchased vehicles with a gross vehicle weight rating (GVWR) of 8,500 pounds (lbs.) or less and 50% of vehicles with a GVWR between 8,500 lbs. and 26,000 lbs. are clean fuel vehicles. For these purposes, a clean fuel is any fuel, including diesel, ethanol (including E85), hydrogen, liquefied petroleum gas, natural gas, reformulated gasoline, or other power source (including electricity) used in a clean fuel vehicle that complies with standards and requirements applicable to such vehicles

Tennessee State Incentives for EVs

Plug-in Electric Vehicle (PEV) Rebate

Through the state's participation in the EV Project, the Tennessee Department of Revenue (Department) offers a rebate of $2,500 on the first 1,000 qualified PEVs purchased in Tennessee. The Department will administer the rebate program in cooperation with Nissan's automotive dealerships in the state. Customers will receive the rebate at the time they purchase their vehicle.

Alternative Fuel Infrastructure Development Program

The Tennessee Department of Environment and Conservation provides funding for alternative fueling infrastructure improvements through the FastTrack Infrastructure Development Program. Private sector businesses may use funds to locate or expand fueling infrastructure in the state and to create or retain jobs for Tennesseans.

High Occupancy Vehicle (HOV) Lane Exemption

Vehicles that the U.S. Environmental Protection Agency defines as Inherently Low Emission Vehicles or Low Emission and Energy-Efficient Vehicles and have gross vehicle weight ratings of 26,000 pounds or less are permitted use of HOV lanes regardless of the number of occupants. Such vehicles must display a Tennessee Department of Revenue decal.

Tennessee Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Nashville, Knoxville, Memphis, and Chattanooga metropolitan areas. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Tennessee State Laws and Regulations Concerning EVs

Alternative Fuel and Fuel-Efficient Vehicle Acquisition and Use Requirements

The Tennessee Department of General Services must ensure that at least 25% of newly purchased passenger motor vehicles procured for use in areas designated as ozone nonattainment areas are hybrid electric vehicles (HEVs), provided that such vehicles are available at the time of procurement. If HEVs are not available, conventional gasoline vehicles achieving an average fuel economy of at least 25 miles per gallon (mpg) may satisfy the requirement. In areas not designated as ozone nonattainment areas, at least 25% of newly purchased passenger motor vehicles must be either HEVs or conventional gasoline vehicles achieving an average fuel economy of at least 25 mpg.

State fleets must make every effort to ensure that 100% of newly purchased motor vehicles are energy-efficient vehicles. Energy-efficient vehicles are defined as passenger vehicles that are alternative fuel vehicles using alternative fuels, as defined by the Energy Policy Act of 1992; HEVs; conventional gasoline vehicles achieving an average fuel economy of at least 25 mpg; or vehicles powered by ultra-low sulfur diesel achieving an average fuel economy of at least 30 mpg. Additionally, state agencies should strive to use ethanol and biodiesel in appropriate state-owned vehicles whenever possible and should support the development of biofuels fueling infrastructure.

Energy Task Force

The Governor's Task Force on Energy Policy is developing a state energy plan to facilitate energy efficiency and the use of alternative and renewable fuels in Tennessee. The energy plan will include a summary of opportunities for the state government to use an energy-efficient approach in purchasing and managing the state vehicle fleet; prospective policies, legislation, and incentives to encourage energy efficiency; possible public-private partnerships to encourage research and development of clean energy technologies; and strategies for expanding the use of alternative and renewable fuels.

Colorado State Incentives for EVs

Alternative Fuel, Advanced Vehicle, and Idle Reduction Equipment Tax Credit

An income tax credit is available from the Colorado Department of Revenue for a motor vehicle titled and registered in Colorado that uses or is converted to use an alternative fuel, is a hybrid electric vehicle (HEV), or has its power source replaced with one that uses an alternative fuel. Qualified idle reduction technologies are also eligible for the tax credit. Credits are based on defined vehicle and technology categories.

The credit is capped at $6,000 for the following: alternative fuel vehicles (AFVs), AFV conversions, HEVs, plug-in hybrid electric vehicles (PHEVs), idle reduction technologies, and power source replacements. The credit for PHEV conversions is capped at $7,500. Individuals who claimed a tax credit in previous years for the purchase of a Model Year 2004 or newer HEV may be eligible to claim an additional credit for the conversion of the same vehicle to a PHEV. Credits generated after January 1, 2010, that exceeds the tax due are refundable but cannot be carried forward. Used vehicles may qualify with proof that the prior owners did not claim the tax credit.

Electric Vehicle Supply Equipment (EVSE) Grants

The Electric Vehicle Grant Fund provides grants to local governments for the installation of qualified EVSE. Grants are prioritized based on the local government's commitment to energy efficiency. As of July 2012, no grant funding is available.

Alternative Fuel Vehicle (AFV) Weight Limit Exemption

Gross vehicle weight rating limits for AFVs are 1,000 pounds greater than those for comparable conventional vehicles, as long as the AFVs operate using an alternative fuel or both alternative and conventional fuel, when operating on a highway that is not part of the interstate system.

Colorado Utility and Private Business Incentives Related to EVs

As of July 30th, 2012 there are no electric utilities or private businesses that offer EV related incentives.

Colorado State Laws and Regulations Concerning EVs

Alternative Fuel Resale and Generation Regulations

A corporation or individual that resells alternative fuel supplied by a public utility for use in an alternative fuel vehicle (AFV) is not subject to regulation as a public utility. Additionally, a corporation or individual that owns, controls, operates, or manages a facility that generates electricity exclusively for use in AFV charging or fueling facilities is not subject to regulation as a public utility provided that the electricity is generated on the property where the charging or fueling facilities are located and the electricity is generated from a renewable resource. For the purposes of this definition, alternative fuel is defined as propane, liquefied natural gas, compressed natural gas, or electricity.

Alternative Fuel Vehicle (AFV) Registration

Upon registering a motor vehicle with the Colorado Department of Revenue Division of Motor Vehicles, the vehicle owner must report the type of alternative fuel used to operate the vehicle and whether the vehicle is dedicated to one alternative fuel or uses more than one fuel. The Department of Revenue provides forms for the purpose of registering motor vehicles and must include space for the following fuel types: gasoline, diesel, propane, electricity, natural gas, methanol/M85, ethanol/E85, biodiesel, and other.

Alternative Fuel Definition

Alternative fuel is defined as compressed natural gas, propane, ethanol, or any mixture containing 85% or more ethanol (E85) with gasoline or other fuels, electricity, or any other fuels, which may include, but are not limited to, clean diesel and reformulated gasoline, so long as the Colorado Air Quality Control Commission determines that these other fuels result in comparable reductions in carbon monoxide emissions and brown cloud pollutants. Alternative fuel does not include any fuel product that contains or is treated with methyl tertiary butyl ether (MTBE).

Oregon State Incentives for EVs

Commercial Electric Truck Vouchers

Through the Commercial Electric Truck Incentive Program (CETIP), the Oregon Department of Transportation (ODOT) provides vouchers to reimburse commercial fleets for $20,000 per qualified zero emission truck purchased. Vouchers are available on a first-come, first-served basis. Eligible vehicles must be new, titled and licensed in Oregon, have a gross vehicle weight rating of at least 10,001 pounds, and replace an existing diesel vehicle. Eligible fleets must operate the vehicles primarily in an air quality nonattainment or maintenance area. ODOT plans to distribute 200 vouchers within the first year of the program and data collection will continue for three years from the date of vehicle purchase.

Alternative Fueling Infrastructure Tax Credit for Residents

Through the Residential Energy Tax Credit program, qualified residents may receive a tax credit for 25% of alternative fuel infrastructure project costs, up to $750. Qualified alternative fuels include electricity, propane, hydrogen, and other fuels that the Oregon Department of Energy approves. Gasoline blended with at least 85% ethanol (E85) also qualifies as an alternative fuel. A company that constructs a dwelling in Oregon and installs fueling infrastructure in the dwelling may claim the credit. This credit is available through December 31, 2017.

Alternative Fueling Infrastructure Tax Credit for Businesses

Beginning January 1, 2011, business owners and others may be eligible for a tax credit of 35% of eligible costs for qualified alternative fuel infrastructure projects. Qualified infrastructure includes facilities for mixing, storing, compressing, or dispensing fuels for vehicles operating on electricity, ethanol, natural gas, and propane. Unused credits can be carried forward up to five years. Non-profit organizations and public entities that do not have an Oregon tax liability may receive the credit for an eligible project but must "pass-through" or transfer their project eligibility to a pass-through partner in exchange for a lump-sum cash payment. The Oregon Department of Energy (ODOE) determines the rate that is used to calculate the cash payment. The pass-through option is also available to a project owner with an Oregon tax liability who chooses to transfer their tax credit. The credit is available through December 31, 2018.

Alternative Fuel School Bus Grant and Loan Program

The Oregon Department of Energy (ODOE) must establish the Clean Energy Deployment Program. Under this program, school districts may be eligible for grants and loans to retrofit school bus fleets to operate on compressed natural gas, propane, or other alternative fuels, or to operate with highly efficient engine technologies, such as hybrid electric engines. Funds may also be used to replace school buses with buses that operate on these fuels or technologies.

Alternative Fuel Loans

The Oregon Department of Energy administers the State Energy Loan Program (SELP) offers low-interest loans for qualified projects. Eligible alternative fuel projects include fuel production facilities, dedicated feedstock production, fueling infrastructure, and fleet vehicles. Loan recipients must complete a loan application and pay a loan application fee.

Pollution Control Equipment Exemption

Dedicated original equipment manufacturer natural gas vehicles and all-electric vehicles are not required to be equipped with a certified pollution control system.

Electric Vehicle (EV) Charging Infrastructure Project Funding

The Oregon Department of Transportation will fund the installation of qualified EV charging infrastructure in rural areas along the I-5 West Coast Green Highway corridor. Competitive funding is available from the American Recovery and Reinvestment Act.

Oregon Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Portland, Eugene, Salem, and Corvallis metropolitan areas. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Oregon State Laws and Regulations Concerning EVs

Electricity Provider and Plug-In Electric Vehicle (PEV) Charging Rate Regulations

Regulated electric utility tariffs must explicitly permit customers to resell electricity for use as a motor fuel, as long as the entity is not considered a public utility as defined in Oregon Revised Statutes 757.005 and does not provide any utility service. Additionally, each regulated electric utility must provide customers with a choice of flat rate or time of use electricity rates specific to PEV owners.

Establishment Low Carbon Transportation Fuel Standards

The Oregon Department of Environmental Quality (DEQ) developed a proposed low carbon fuel standard for all transportation fuels, including a lifecycle greenhouse gas (GHG) emission standard for the production, storage, transportation and combustion of fuels. DEQ will conduct a formal rulemaking process to seek review and comments in 2011. The proposed standards aim to reduce average GHG emissions per unit of fuel energy by 10% below 2012 levels by 2022.

Alternative Fuel Vehicle (AFV) Acquisition, Fuel Use, and Emissions Reductions Requirements

All state agencies and transit districts must purchase AFVs and use alternative fuels to operate those vehicles to the maximum extent possible, except when it is not economically or logistically possible to purchase or fuel an AFV. Each state agency must develop and report a greenhouse gas reduction baseline and determine annual reduction targets. Reports to the Oregon Department of Administrative Services must include the volume of ethanol and biodiesel used by state agency fleets, as well as any cost savings attributable to driving more fuel-efficient vehicles and using alternative fuels.

Electric Vehicle (EV) and Hybrid Electric Vehicle (HEV) Registration Fees

EVs and HEVs are registered biennially, with the exception of new vehicles for which new registration plates are issued. Certain EVs and HEVs, including commercial buses, follow an annual registration period. The registration fee is $43 per vehicle for each year of the registration period. There is an additional fee for EVs or HEVs in certain weight categories.

Georgia State Incentives for EVs

Alternative Fuel Vehicle (AFV) Tax Credit

An income tax credit is available to individuals who purchase or lease a new dedicated AFV or convert a vehicle to operate solely on an alternative fuel. The amount of the tax credit is 10% of the vehicle cost, up to $2,500. Qualified vehicles must meet emissions standards defined by the Georgia Board of Natural Resources. Eligible alternative fuels include natural gas, propane, hydrogen, coal derived liquid fuels, fuels other than alcohol derived from biological materials, and electricity. Any portion of the credit not used in the year the AFV is purchased or converted may be carried over for up to five years. This incentive does not apply to hybrid electric vehicles.

Alternative Fuel and Advanced Vehicle Job Creation Tax Credit

A business that manufactures alternative energy products for use in battery, biofuel, and electric vehicle enterprises may claim an annual tax credit per eligible new full-time employee job for five years. Qualified entities must be defined as business enterprises, which do not include retail businesses. Credit amounts differ depending on how the county in which the business is located ranks based on unemployment rates and income levels. Other conditions apply.

Zero Emission Vehicle (ZEV) Tax Credit

An income tax credit is available to individuals who purchase or lease a new ZEV. The amount of the tax credit is 20% of the vehicle cost, up to $5,000. For the purpose of this credit, a ZEV is defined as a motor vehicle that has zero tailpipe and evaporative emissions, including a pure electric vehicle. Low-speed vehicles do not qualify for this credit. Any portion of the credit not used in the year the ZEV is purchased or leased may be carried over for up to five years.

Electric Vehicle Supply Equipment (EVSE) Tax Credit

An eligible business enterprise may claim an income tax credit for the purchase or lease of qualified EVSE provided that the EVSE is located in the state and accessible to the public. The amount of the credit is 10% of the cost of the EVSE, up to $2,500.

Alternative Fuel Vehicle (AFV) High Occupancy Vehicle (HOV) Lane Exemption

AFVs displaying the proper alternative fuel license plate may use HOV lanes, regardless of the number of passengers.

Georgia Utility and Private Business Incentives Related to EVs

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Atlanta metropolitan area. To be eligible for free home charging stations, individuals living within the specified area must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Plug-In Electric Vehicle Charging Rate Incentive - Georgia Power (public utility)

Georgia Power offers a Plug-in Electric Vehicle (PEV) time-of-use electricity rate for residential customers who own an electric or plug-in hybrid electric vehicle. The PEV rate is optional and does not require a separate meter.

Georgia State Laws and Regulations Concerning EVs

As of July 30th, 2012 there are no laws or regulation specific to EVs/EVSEs

Hawaii State Incentives for EVs

Plug-In Electric Vehicle (PEV) High Occupancy Vehicle (HOV) Lane and Parking Fee Exemptions

Qualified PEVs affixed with special state-issued PEV license plates may use HOV lanes regardless of the number of passengers and are exempt from parking fees charged by any non-federal governmental authority.

Hawaii Utility and Private Business Incentives Related to EVs

Plug-In Electric Vehicle (PEV) Charging Rate Incentive - Hawaiian Electric Company (private utility)

Hawaiian Electric Company offers Electric Vehicle (EV) Pilot Rates for residential and commercial customers. The pilot PEV rates are available to 1,000 customers on Oahu, 300 in Maui County, and 300 on the Island of Hawaii for charging highway-capable, four-wheeled PEVs. The pilot will remain in effect until October 1, 2013.

Hawaii State Laws and Regulations Concerning EVs

Plug-in Electric Vehicle (PEV) Parking Requirement

All parking facilities that are available for use by the general public and include at least one hundred parking spaces must designate at least one parking space specifically for PEVs by July 1, 2012, provided that no parking spaces required by the Americans with Disabilities Act Accessibility Guidelines are reduced or displaced. Spaces must be clearly marked and equipped with electric vehicle supply equipment (EVSE). Owners of multiple parking lots may designate and install EVSE in fewer parking spaces than required in one parking lot, as long as the total number of aggregate spaces for all parking lots is met. Penalties apply for non-PEVs that park in spaces designated for PEVs.

Electric Vehicle Supply Equipment (EVSE) Requirements

A multi-family residential dwelling or townhouse owner may install EVSE in or at a parking stall at the dwelling as long as the EVSE is in compliance with applicable rules and specifications, the EVSE is registered within 30 days of installation, and the homeowner receives consent from the private entity if the EVSE is placed in a common area. Private entities may adopt rules that restrict the placement and use of EVSE but may not charge a fee for the installation. The EVSE owner is responsible for any damages resulting from the installation, maintenance, repair, removal, or replacement of the EVSE. A private entity includes any association of homeowners, community association, condominium association, or cooperative.

Plug-in Electric Vehicle (PEV) Promotion

To achieve Hawaii's transportation efficiency goals and to create jobs, foster economic growth, and reduce greenhouse gas emissions, the Hawaii Senate encourages the promotion of PEV use in the state. As a first step, PEV charging infrastructure must be developed. In addition, stakeholders should work together to expedite the use of PEVs in Hawaii. Additionally, the Hawaii House of Representatives urges the Hawaii Clean Energy Initiative End-Use Efficiency Work Group to address the challenges related to PEV charging stations and access to electrical outlets to facilitate the use of PEVs.

Alternative Fuel Standard Development

The state of Hawaii is responsible for facilitating the development of alternative fuels and supporting the attainment of a statewide alternative fuels standard. The alternative fuels standard will be as follows: alternative fuels will provide 15% by 2015, 20% by 2020, and 30% by 2030. For the purposes of the alternative fuels standard, ethanol produced from cellulosic materials is equivalent to 2.5 gallons of non-cellulosic ethanol.

Alternative Fuel and Advanced Vehicle Acquisition Requirements

State and county agencies must purchase light-duty vehicles that reduce petroleum consumption and meet the needs of the agency. The priority to be used for purchasing such vehicles is as follows:

- Plug-in electric vehicles;
- Hydrogen or fuel cell vehicles;
- Other alternative fuel vehicles;
- Hybrid electric vehicles; and
- Vehicles identified as top performers for fuel economy in the U.S. Environmental Protection Agency's annual "Fuel Economy Leaders" report.

State agencies must purchase alternative fuels and ethanol blended gasoline when available, evaluate a purchase preference for biodiesel blends, and promote the efficient operation of vehicles. For the purpose of this requirement, an alternative fuel is defined as an alcohol fuel, an alcohol fuel blend containing at least 85% alcohol, natural gas, liquefied petroleum gas (propane), hydrogen, biodiesel, a biodiesel blend containing at least 20% biodiesel, a fuel derived from biological materials, or electricity generated from off-board energy sources.

Alternative Fuels Promotion

The state of Hawaii has signed a Memorandum of Understanding (MOU) with the U.S. Department of Energy to collaborate to produce 70% of the state's energy needs from energy-efficient and renewable sources by 2030. This effort is part of the Hawaii Clean Energy Initiative. The goals of the partnership include defining the structural transformation required to transition the state to a clean energy-dominated economy; demonstrating and fostering innovation in the use of clean energy, including alternative fuels; creating opportunities for the widespread distribution of clean energy benefits; establishing an open learning model for other states and entities to adopt; and building a workforce with cross-cutting skills to support a clean energy economy in the state.

Minnesota State Incentives for EVs

As of July 30^{th}, 2012 there are no incentives specific to EVs/EVSEs.

Minnesota Utility and Private Business Incentives Related to EVs

As of July 30^{th}, 2012 there are no Utility and Private Business Incentives specific to EVs/EVSEs.

Minnesota State Laws and Regulations Concerning EVs

State Agency Sustainability Plan and Requirements

State agencies must establish interagency teams to develop and implement sustainability goals that reduce state vehicle petroleum consumption. In addition, each state department or agency must prepare an annual sustainability plan that includes ways to modify vehicle use practices and report annually on progress towards implementing their plan. Each state agency plan must be based on following targets and mandates:

- Using 2005 as a baseline, the state must achieve a 50% reduction in gasoline used to operate state agency-owned on-road vehicles by 2015;
- Using 2005 as a baseline, the state must achieve a 25% reduction in the use of petroleum-based diesel fuel for state owned on-road vehicles by 2015;
- When reasonably possible, state agencies must purchase on-road vehicles that use alternative fuels, including biodiesel blends of 20% (B20) or greater, compressed or liquefied natural gas, ethanol blends of 70% (E70) or greater, hydrogen, propane, or electricity, or (with the exception of buses, snowplows, and construction vehicles) have a fuel economy rating that exceeds 30 miles per gallon (mpg) in the city and 35 mpg on the highway;
- When reasonably possible, state employees must fuel vehicles capable of operating on an alternative fuel with that fuel;
- State agencies must increase the use of renewable fuels derived from agricultural products or waste products; and
- State agencies must increase the use of technology for delivering information and services in order to reduce reliance on the state's fleet.

Electric Vehicle Supply Equipment (EVSE) Requirements

EVSE installed in Minnesota must: 1) be able to be used by any make, model, or type of plug-in electric vehicles; 2) comply with state safety standards and standards set by the Society of Automotive Engineers; and 3) be capable of bi-directional charging once electrical utilities achieve a cost-effective ability to draw electricity from plug-in electric vehicles connected to the utility grid. These requirements may not apply if the installations require significant upgrades.

Plug-In Electric Vehicle Initiatives

All solicitation documents that include the purchase of passenger automobiles issued under the jurisdiction of the Minnesota Department of Administration must assert the intention of the state to begin purchasing all-electric vehicles (EVs), plug-in hybrid electric vehicles (PHEVs), and neighborhood electric vehicles (NEVs) as soon as they become commercially available. In order for this requirement to apply, vehicles must meet the state's performance specifications and be priced no more than 10% above the price for comparable gasoline-powered vehicles. An EV is defined as a motor vehicle that can be powered by an electric motor drawing current from rechargeable storage batteries, fuel cells, or other portable sources of electrical current, and meets or exceeds applicable requirements in Title 49 of the Code of Federal Regulations, section 571, and future regulations. A PHEV is an EV containing an internal combustion engine that uses a battery-powered electric motor to deliver power to the drive wheels. When connected to the electrical grid via an electrical outlet, the vehicle must be able to recharge its battery. The vehicle must have the ability to travel at least 20 miles powered substantially by electricity.

Medium-Speed Electric Vehicle (EV) Access to Roadways

A medium-speed EV is an electrically powered four-wheeled motor vehicle capable of achieving speeds between 25 miles per hours (mph) and 35 mph on a paved, level surface. Except with respect to maximum speed, a medium-speed EV must meet or exceed regulations in Title 49 of the Code of Federal Regulations, section 571.500. A medium-speed EV may not operate on a roadway with a speed limit greater than 35 mph, except to cross that roadway. A road authority may prohibit or further restrict the operation of medium-speed EVs on any street or highway under the road authority's jurisdiction.

Louisiana State Incentives for EVs

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Tax Credit

The state offers an income tax credit of 50% of the cost of converting a vehicle to operate on an alternative fuel, 50% of the incremental cost of purchasing an original equipment manufacturer AFV, and 50% of the cost of constructing an alternative fueling station. Only dedicated AFVs registered in Louisiana may receive the tax credit. Alternatively, a taxpayer may take a tax credit of 10% of the cost of the motor vehicle, up to $3,000. For the purpose of this incentive, alternative fuels include compressed natural gas, liquefied natural gas, liquefied petroleum gas (propane), biofuel, biodiesel, methanol, ethanol, electricity, and any other fuels that meet or exceed federal clean air standards.

Green Jobs Tax Credit

The state offers a corporate or income tax credit for qualified capital infrastructure projects in Louisiana that are directly related to industries including but not limited to the energy efficient and advanced drivetrain vehicle industry and the biofuels industry. The tax credit is for 10% to 25% of the project costs, calculated based on the investment costs, up to $1 million per state-certified green project. The portion of the base investment expended on payroll for Louisiana residents employed in connection with the construction of the project may be eligible for an additional 10% tax credit on the payroll.

Louisiana Utility and Private Business Incentives Related to EVs

As of July 30th, 2012 there are no Utility and Private Business Incentives specific to EVs/EVSEs.

Louisiana State Laws and Regulations Concerning EVs

Authorization for Alternative Fuel Vehicle (AFV) Loans

The Louisiana Department of Natural Resources (Department) will administer the Alternative Fuel Vehicle Revolving Load Fund to provide loan assistance to local government entities, including cities, parishes, school boards, and local municipal subdivisions for the cost of converting conventional vehicles to operate on alternative fuels, or the incremental cost of purchasing new AFVs. Eligible alternative fuels must meet or exceed federal emissions standards and include compressed natural gas, liquefied natural gas (propane), biodiesel, ethanol, methanol, and electricity. The Department must promulgate rules and regulations necessary to implement the loan program.

Alternative Fuel and Advanced Vehicle and Infrastructure Acquisition Requirements

The Louisiana Division of Administration must purchase alternative fuel vehicles (AFVs) capable of operating on alternative fuels that meet or exceed the federal Clean Air Act (CAA) standards, including hybrid electric vehicles (HEVs). Alternative fuels include compressed natural gas, liquefied petroleum gas (propane), reformulated gasoline, methanol, ethanol, advanced biofuels, electricity, and other fuels that meet or exceed the CAA standards. State agency vehicles may be granted a waiver.

Political subdivisions may also purchase or lease AFVs, including HEVs and may acquire infrastructure to fuel AFVs. If the infrastructure is donated, loaned, or provided through an alternative fuel supplier, the supplier is entitled to recoup the cost of the equipment through fuel charges under the supply contract.

Florida State Incentives for EVs

Electric Vehicle Supply Equipment (EVSE) Financing

Property owners may apply to their local government for funding to help finance EVSE installations on their property or enter into a financing agreement with the local government for the same purpose.

High Occupancy Vehicle (HOV) Lane Exemption

A driver may operate an Inherently Low Emission Vehicle (ILEV) or a hybrid electric vehicle (HEV) in an HOV lane at any time, regardless of the number of passengers, provided that the vehicle is certified and labeled in accordance with federal regulations. All eligible ILEVs and HEVs must comply with the minimum fuel economy standards set forth in Title 23 of the U.S. Code, section 166(f)(3)(B). The vehicle must display a Florida Division of Motor Vehicles issued decal, which is renewed annually. Special fees may apply. Vehicles with decals may also use any HOV lane designated as a HOV toll lane without paying the toll. An HEV is defined as a motor vehicle that draws propulsion energy from onboard sources of stored energy comprised of both an internal combustion engine using combustible fuel and a rechargeable energy storage system and meets or exceeds the qualifying California standards for a Low Emission Vehicle. Three-wheeled vehicles are considered ILEVs for the purposes of HOV lane exemption.

Florida Utility and Private Business Incentives Related to EVs

As of July 30th, 2012 there are no Utility and Private Business Incentives specific to EVs/EVSEs.

Florida State Laws and Regulations Concerning EVs

Authorization for Electric Vehicle Supply Equipment (EVSE) Incentives

Local governments may use income from the infrastructure surtax to provide loans, grants, or rebates to residential or commercial property owners to install EVSE, if a local government ordinance authorizing this use is approved by referendum.

Plug-in Electric Vehicle (PEV) Charging Regulation Exemption

PEV charging for the public by a non-utility is not considered a retail sale of electricity and, therefore, the rates, terms, and conditions of EV charging services are not subject to regulation.

Electric Vehicle Supply Equipment (EVSE) Rules

A person may not stop, stand, or park a vehicle that is not capable of using EVSE in a parking space designated for plug-in electric vehicles. To allow for consistency for consumers and the industry, the Florida Department of Agriculture and Consumer Services must adopt additional rules to provide definitions, methods of sale, labeling requirements, and price-posting requirements for EVSE.

Electric Vehicle Supply Equipment (EVSE) Study

By December 31, 2012, the Florida Public Service Commission must conduct a study of the potential effects of public and private EVSE on energy consumption and the electric grid in the state. The study should also look into the feasibility of using off-grid solar photovoltaic power as a source of electricity for EVSE.

Alternative Fuels Tax

A person operating an alternative fuel vehicle (AFV) must purchase an annual decal from the Florida Department of Motor Vehicles to be exempt from the excise tax on gasoline. Fueling stations may not fuel a vehicle with propane or compressed natural gas that does not display the proper decal. State and local government AFV fleets are exempt from paying the decal fee. In addition to the state alternative fuel fee, a person fueling a vehicle from their own facility must pay a local alternative fuel fee instead of the excise tax a county levies.

Alternative Fuel License

An individual who wishes to be a wholesale distributor of an alternative fuel must obtain a license from the Florida Department of Revenue.

Electric Vehicle (EV) Insurance Regulation

Insurance companies may not impose surcharges on EVs based on factors such as new technology, passenger payload, weight-to-horsepower ratio, and the types of material used to manufacture the vehicle, unless the Florida Office of Insurance Regulation receives actuarial data that determines the surcharges are justified.

Wisconsin State Incentives for EVs

Alternative Fuel Tax Refund for Taxis

A person using alternative fuel to operate a taxi used to transport passengers may be reimbursed for the paid amount of the Wisconsin state fuel tax. Refund claims must be filed within one year of the date the fuel is purchased and must be for a minimum 100 gallons of alternative fuel.

Alternative Fuel Tax Exemption

No county, city, village, town, or other political subdivision is allowed to levy or collect any excise, license, privilege, or occupational tax on motor vehicle fuel or alternative fuels, or on the purchase, sale, handling, or consumption of motor vehicle fuel or alternative fuels.

Wisconsin Utility and Private Business Incentives Related to EVs

As of July 30th, 2012 there are no Utility and Private Business Incentives specific to EVs/EVSEs.

Wisconsin State Laws and Regulations Concerning EVs

Alternative Fuel Vehicle (AFV) Acquisition and Alternative Fuel Use Requirements

The Wisconsin Department of Administration (DOA) encourages state employees operating state-owned or leased motor vehicles to use hybrid electric vehicles or vehicles that operate on gasohol (a motor fuel containing at least 10% alcohol) or alternative fuels whenever feasible and cost effective. The DOA must place a list of gasohol and alternative fuel station locations in each state-owned or state-leased motor vehicle for driver reference. The DOA also encourages Wisconsin residents and state employees who use personal motor vehicles on state business to use gasohol and alternative fuels.

Petroleum Reduction Requirements

The Wisconsin Department of Administration's fleet management policy requires all state agencies to collectively reduce gasoline use in state-owned vehicles by at least 50% by 2015 as compared to the total amount used in 2006. In addition, state agencies must reduce petroleum-based diesel fuel use by 25% by 2015.

Alternative Fueling Infrastructure Development

The Wisconsin Department of Administration must pursue, in cooperation with the Department of Agriculture, Trade and Consumer Protection, the establishment and maintenance of sufficient alternative fueling infrastructure at public retail outlets to meet the public's traveling needs.

Alternative Fuel License

Any person acting as an alternative fuels dealer must hold a valid alternative fuels license and certificate from the Wisconsin Department of Administration. Except for alternative fuels that an alternative fuels dealer delivers into a fuel supply tank of any motor vehicle in the state, no person may use alternative fuels in the state unless the person holds a valid alternative fuels license or an authorized supplier has delivered the alternative fuel. For more information, see the State of Wisconsin License, Permit and Registration Services.

Virginia State Incentives for EVs

Alternative Fuels Grants and Loans

The Alternative Fuels Revolving Fund is used to distribute loans and grants to municipal, county, and commonwealth government agencies to support alternative fuel vehicle (AFV) programs; pay for AFV maintenance, operation, evaluation, or testing; pay for vehicle conversions; or improve alternative fuel infrastructure. Eligible alternative fuels include electricity, hydrogen, and natural gas. Projects with a funding match are given priority in the evaluation process.

High Occupancy Vehicle (HOV) Lane Exemption

Alternative fuel vehicles (AFVs) displaying the Virginia Clean Special Fuels license plate may use Virginia HOV lanes, regardless of the number of occupants. For HOV lanes serving the I-95/I-395 corridor, only registered vehicles displaying Clean Special Fuels license plates issued before July 1, 2006, are exempt from HOV lane requirements. For HOV lanes serving the I-66 corridor, only registered vehicles displaying Clean Special Fuels license plates issued before July 1, 2011, are exempt from HOV lane requirements. Eligible vehicles include dedicated AFVs and some hybrid electric vehicles; see the Virginia Department of Motor Vehicles website for a complete list of qualifying vehicles. The annual fee for Clean Special Fuels license plates is $25 in addition to the prescribed fee for commonwealth license plates.

Alternative Fuel Job Creation Tax Credit

Businesses involved in alternative fuel vehicle (AFV) and component manufacturing, alternative fueling equipment component manufacturing, AFV conversions, and advanced biofuel productions are eligible for a job creation tax credit of up to $700 per full-time employee. The credit is allowed in the taxable year in which the job is created and in each of the two succeeding years in which the job is continued. Qualified AFVs include vehicles that operate using natural gas, propane, hydrogen, electricity, or advanced biofuels. This credit is effective for taxable years through December 31, 2014.

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Loans

The Virginia Board of Education may use funding from the Literary Fund to provide loans to school boards that convert school buses to operate on alternative fuels or construct alternative fueling stations.

Alternative Fuel and Hybrid Electric Vehicle (HEV) Emissions Testing Exemption

The Virginia emissions inspection program, which requires biennial inspections of motor vehicles, does not apply to vehicles powered by compressed or liquefied natural gas, liquefied petroleum gas (propane), hydrogen, a combination of compressed natural gas and hydrogen, or electricity. Qualified HEVs with U.S. Environmental Protection Agency fuel economy ratings of at least 50 miles per gallon (city) are also exempt from the emissions inspection program unless remote sensing devices indicate the HEV may not meet current emissions standards.

Virginia Utility and Private Business Incentives Related to EVs

Plug-In Electric Vehicle (PEV) Charging Rate Reduction - Virginia Dominion Power (public utility)

Virginia Dominion Power offers two rates for residential customers who own qualified PEVs: the Electric

Vehicle Pricing Plan and the Electric Vehicle + Home Pricing Plan. The Electric Vehicle Pricing plan allows PEV owners to take advantage of lower rates during off-peak hours. Under this plan, customers must install an additional meter specifically for their electric vehicle supply equipment (EVSE); Dominion will provide this meter at no charge. The Electric Vehicle + Home Pricing Plan is a whole-house pricing plan in which the customer's EVSE is treated as another appliance. Dominion will provide a new meter at no charge to record energy usage in 30-minute intervals, allowing Dominion to apply pricing based on time of day and encourage customers to charge their PEV during off-peak hours as hours much as possible. PEV pricing plans are expected to expire on November 30, 2014.

Electric Vehicle Supply Equipment (EVSE) Incentive - ECOtality

Through the EV Project, ECOtality offers EVSE at no cost to individuals in the Washington, DC metropolitan area. To be eligible for free home charging stations, individuals living within the specified areas must purchase a qualified plug-in electric vehicle (PEV). Individuals purchasing an eligible PEV should apply at the dealership at the time of vehicle purchase. The EV Project incentive program will also cover most, if not all, of the costs of EVSE installation. All participants in the EV Project incentive program must agree to anonymous data collection after installation.

Virginia State Laws and Regulations Concerning EVs

Aftermarket Electric Vehicle (EV) Conversion Regulations

Effective October 1, 2012, any motor vehicle, other than a motorcycle, that has been modified to replace the internal combustion engine with an electric propulsion system must be titled by and registered with the Virginia Department of Motor Vehicles (DMV) as a converted EV. DMV converted EV registration requires certification by a certified Virginia safety inspector that the conversion to electric propulsion is complete and proof that the vehicle has passed a Virginia safety inspection. The inspector must verify that the internal combustion engine and fuel tank have been removed, a traction battery has been installed that is separate from the vehicle's original auxiliary battery system, and an electric motor has been installed to drive the wheels of the vehicle. The inspector is not liable for the quality of the conversion, but they are responsible for the accuracy of the safety inspection. Converted EVs must be equipped with special equipment, including high voltage cables, a temperature monitoring system for traction batteries other than lead acid batteries, and labeling on three sides of the vehicle identifying it as "Converted Electric." Once established, federal minimum equipment and safety standards for converted EVs will also apply.

Alternative Fuel Vehicle (AFV) Fund

The AFV Conversion Fund (Fund) is created to assist commonwealth agencies with the incremental cost of commonwealth-owned AFVs, both original equipment manufacturer vehicles and aftermarket conversions. Funding may be used in conjunction with or as matching funds for any eligible federal grants for the same purpose. The Virginia Department of General Services and the Department of Mines, Minerals and Energy must establish guidelines for contributions and reimbursements from the Fund for the purchase or conversion of commonwealth-owned vehicles. The Fund will include appropriations from the Virginia General Assembly as well as donations, grants, in-kind contributions, and other funding.

Alternative Fuel Public-Private Partnerships

The Virginia Offices of the Secretary of Administration and the Secretary of Natural Resources released a public-private partnership solicitation outlining their interest in forming partnerships with and among alternative fuel providers, infrastructure developers, vehicle manufacturers, and other alternative fuel industry stakeholders to expand fueling infrastructure and to support alternative fuel use in the commonwealth fleet. By May 2012, the Virginia Department of General Services and the Department of Mines, Minerals, and Energy must make a recommendation on whether the commonwealth should establish more formal public-private partnership agreements to accomplish the overall goal of transitioning commonwealth vehicles to alternative fuels.

Authorization for Plug-In Electric Vehicle Charging Rate Incentives

The Virginia State Corporation Commission (SCC) directs public utilities to evaluate time-differentiated rates and other incentives to encourage off-peak all-electric (EV) and plug-in hybrid electric vehicle charging. The SCC may authorize public utilities to conduct pilot programs to determine the feasibility and implications of offering off-peak rates and other incentives. Pilot programs may include voluntary load control options, rate structures with financial incentives, rebates, or other incentives that offset the cost of purchasing or installing electric vehicle supply equipment for users who elect off-peak rate structures. An electric utility that participates in an approved pilot program may be entitled to recover annually the costs of its participation in any pilot program conducted on or after January 1, 2011.

Retail Electric Vehicle (EV) Charging Regulations

Retail PEV charging services provided by an individual who is not a public utility, public service corporation, or public service company, do not constitute the retail sale of electricity if the electricity is used solely for transportation purposes and the person providing the PEV charging service has procured the electricity from an authorized public utility. The Virginia State Corporation Commission may not set the rates, charges, or fees for retail PEV charging services provided by non-utilities.

Alternative Fuel and Fuel-Efficient Vehicle Acquisition Plan

Virginia Department of General Services (DGS) policies and procedures must include guidelines for the purchase of fuel-efficient, low emissions, commonwealth-owned vehicles, as well as guidelines for leasing vehicles that give a preference to compact, fuel-efficient, and low emissions vehicles. By January 1, 2012, DGS was required to establish a plan to replace commonwealth-owned or operated vehicles with vehicles that operate using natural gas, electricity, or other alternative fuels, to the greatest extent reasonable, considering available infrastructure, vehicle location and use, capital and operating costs, and potential for fuel savings. All commonwealth agencies and institutions must cooperate with DGS in developing and implementing the plan.

Alternative Fuel Research and Development Funding

The Virginia Universities Clean Energy Development and Economic Stimulus Foundation will identify, obtain, disburse, and administer funding for alternative fuel and related technology research, development, and commercialization. The funds may be distributed as grants, loans, or through other methods.

Alternative Fuels and Electric Vehicle (EV) Tax

Liquid alternative fuels used to operate on-road vehicles are taxed at a rate of $0.175 per gallon. EVs registered in Virginia are subject to a $50.00 per vehicle annual license tax.

Alternative Fuel License

Alternative fuel providers, bulk users, and retailers, or any person who fuels an alternative fuel vehicle from a private source that does not pay the alternative fuels tax must obtain an alternative fuel license from the Virginia Department of Motor Vehicles.

Provision for Alternative Fuel Vehicle (AFV) Tax Reduction

Local governments may reduce personal property taxes paid on AFVs, specifically vehicles that operate using natural gas, liquefied petroleum gas or propane, hydrogen, or electricity, including low-speed vehicles.

State Energy Plan

The Virginia Energy Plan assesses the commonwealth's primary energy sources and recommends actions to meet the following goals: make Virginia the energy capital of the East Coast by expanding traditional and alternative energy production, jobs, and investment, and increasing energy conservation and efficiency; expand public education about Virginia's energy production and consumption, its effect on the economy, and methods to increase energy efficiency; and maximize investment in clean energy research and development. The plan includes policies to promote alternative fuel and efficient vehicle use, encourage efficient driving techniques, and reduce vehicle miles traveled.

Utah State Incentives for EVs

Alternative Fuel and Fuel Efficient Vehicle Tax Credit

The state provides an income tax credit of 35% of the vehicle purchase price, up to $2,500, for an original equipment manufacturer compressed natural gas vehicle registered in Utah. Other new clean fuel vehicles that meet air quality and fuel economy standards may be eligible for a credit of $605, including certain electric and hybrid electric vehicles.

Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants and Loans

The Utah Clean Fuels and Vehicle Technology Grant and Loan Program (Program), funded through the Clean Fuels and Vehicle Technology Fund, provides grants and loans to assist businesses and government entities in covering:

- The cost of converting vehicles to operate on clean fuels;
- The incremental cost of purchasing original equipment manufactured clean fuel vehicles;
- The cost of retrofitting diesel vehicles with U.S. Environmental Protection Agency verified closed crankcase filtration devices, diesel oxidation catalysts, and/or diesel particulate filters; and
- The cost of fueling equipment for public/private sector business and government vehicles (grants require federal and non-federal matching funds).

The Program does not support E85 or biodiesel projects. For the purpose of the Program, clean fuels include propane, compressed natural gas, and electricity.

Alternative Fuel Tax Rate Reduction and Exemption

Propane and electricity used to operate motor vehicles are exempt from state fuel taxes. The reduced tax on compressed natural gas and liquefied natural gas is $0.085 per gasoline gallon equivalent; this rate will be modified proportionally with any changes to the traditional motor fuel rate. The Utah Revenue and Tax Code allows a reduction of motor and special fuel taxes if the motor or special fuel is already taxed by the Navajo Nation. Retailers, wholesalers, and suppliers of special fuel are eligible for a refund of the special fuel tax if dyed diesel fuel is mixed with special fuel and the mixed special fuel is returned to the refinery for re-refining.

Alternative Fuel Vehicle Decal and High Occupancy Vehicle (HOV) Lane Exemption

Vehicles operating on propane, compressed natural gas, liquefied natural gas, or electricity are permitted to use HOV lanes, regardless of the number of passengers. Qualified vehicles must display special clean fuel decal issued by the Utah Department of Transportation.

Utah Utility and Private Business Incentives Related to EVs

As of July 30^{th}, 2012 there are no Utility and Private Business Incentives specific to EVs/EVSEs.

Utah State Laws and Regulations Concerning EVs

Alternative Fuel Vehicle Inspection and Permit

The State Tax Commission (Commission) may require vehicles operating on clean fuels to be inspected for safe operation. In addition, clean fuel vehicles that have a gross vehicle weight rating of more than 26,000 pounds or have more than three axels are required to obtain a special fuel user permit from the Commission. Clean fuels are defined as propane, compressed natural gas, liquefied natural gas, and electricity.

Provision for Establishment of Alternative Fuel Use Mandate

The Utah Air Quality Board may require fleets that own 10 or more vehicles that are capable of being fueled at a central location to use clean fuels, if such a mandate is necessary to meet national air quality standards. Clean fuels are defined as propane, compressed natural gas, and electricity.

Connecticut State Incentives for EVs

Alternative Fuel and Advanced Technology Vehicle Grants

The Connecticut Clean Fuel Program (Program) provides funding to municipalities and public agencies that purchase, operate, and maintain alternative fuel and advanced technology vehicles, including those that operate on compressed natural gas, propane, hydrogen, and electricity. The Program also provides funding to install diesel retrofit technologies, including diesel particulate filters, diesel oxidation catalysts, and closed crankcase filtration systems. Diesel retrofit technologies must be certified by the U.S. Environmental Protection Agency or the California Air Resources Board to be eligible for funding.

Connecticut Utility and Private Business Incentives Related to EVs

As of July 30^{th}, 2012 there are no Utility and Private Business Incentives specific to EVs/EVSEs.

Connecticut State Laws and Regulations Concerning EVs

Electric Vehicle (EV) Infrastructure Planning

The Connecticut EV Infrastructure Council (Council) must coordinate interagency strategies to prepare for the adoption of EVs, including establishing performance measures for meeting infrastructure, funding, environmental, and regulatory goals. The Council submitted a final report to the Connecticut Legislature providing recommendations on EV infrastructure investment and standardization on September 1, 2010.

Alternative Fuel Vehicle (AFV) Procurement Preference

In determining the lowest responsible qualified bidder for the award of state contracts, the Connecticut Department of Administrative Services may give a price preference of up to 10% for the purchase of AFVs or for the purchase of vehicles powered by fuel other than a clean alternative fuel plus the conversion equipment to convert the vehicles to dual or dedicated alternative fuel use. For these purposes, alternative fuels include natural gas or electricity used to operate a motor vehicle.

Alternative Fuel and Fuel-Efficient Vehicle Acquisition and Emissions Reduction Requirements

Cars and light-duty trucks that a state agency purchases must: 1) have an average U.S. Environmental Protection Agency estimated fuel economy of at least 40 miles per gallon; 2) comply with state fleet vehicle acquisition requirements set forth under the Energy Policy Act of 1992; and 3) obtain the best achievable fuel economy per pound of carbon dioxide emitted for the applicable vehicle classes. Alternative fuel vehicles (AFVs) that the state purchases to comply with these requirements must be capable of operating on an alternative fuel that is available in the state.

In addition, at least 50% of all cars and light-duty trucks that the state purchases or leases must be hybrid electric vehicles, plug-in hybrid electric vehicles, or capable of using alternative fuel. All AFVs purchased or leased must be certified to the California Air Resources Board's (ARB) Ultra Low Emission Vehicle II (ULEV II) standard, and all light-duty gasoline vehicles and hybrid electric vehicles the state purchases or leases must be certified, at a minimum, to the California ARB ULEV II standard. Beginning January 1, 2012, the required percentage of alternative fuel or advanced vehicles increases to 100%. The Connecticut Department of Administrative Services must report annually on the composition of the state fleet, including the volume of alternative fuels used.

Vehicles that the Connecticut Department of Public Safety designates as necessary for the Department of Public Safety to carry out its mission are exempt from these provisions.

School Bus Emissions Reduction

Each full-sized school bus with an engine model year of 1994 or newer that transports children in the state must be equipped with specific emissions control systems, including either: 1) a closed crankcase filtration system and a level 1, level 2, or level 3 device; 2) an engine that the U.S. Environmental Protection Agency (EPA) has certified as meeting Model Year 2007 emissions standards; or 3) use of compressed natural gas or other alternative fuel that EPA or the California Air Resources Board has certified to reduce particulate matter emissions by at least 85% as compared to ultra-low sulfur diesel fuel.

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