The Electric Vehicle Study

December 2010

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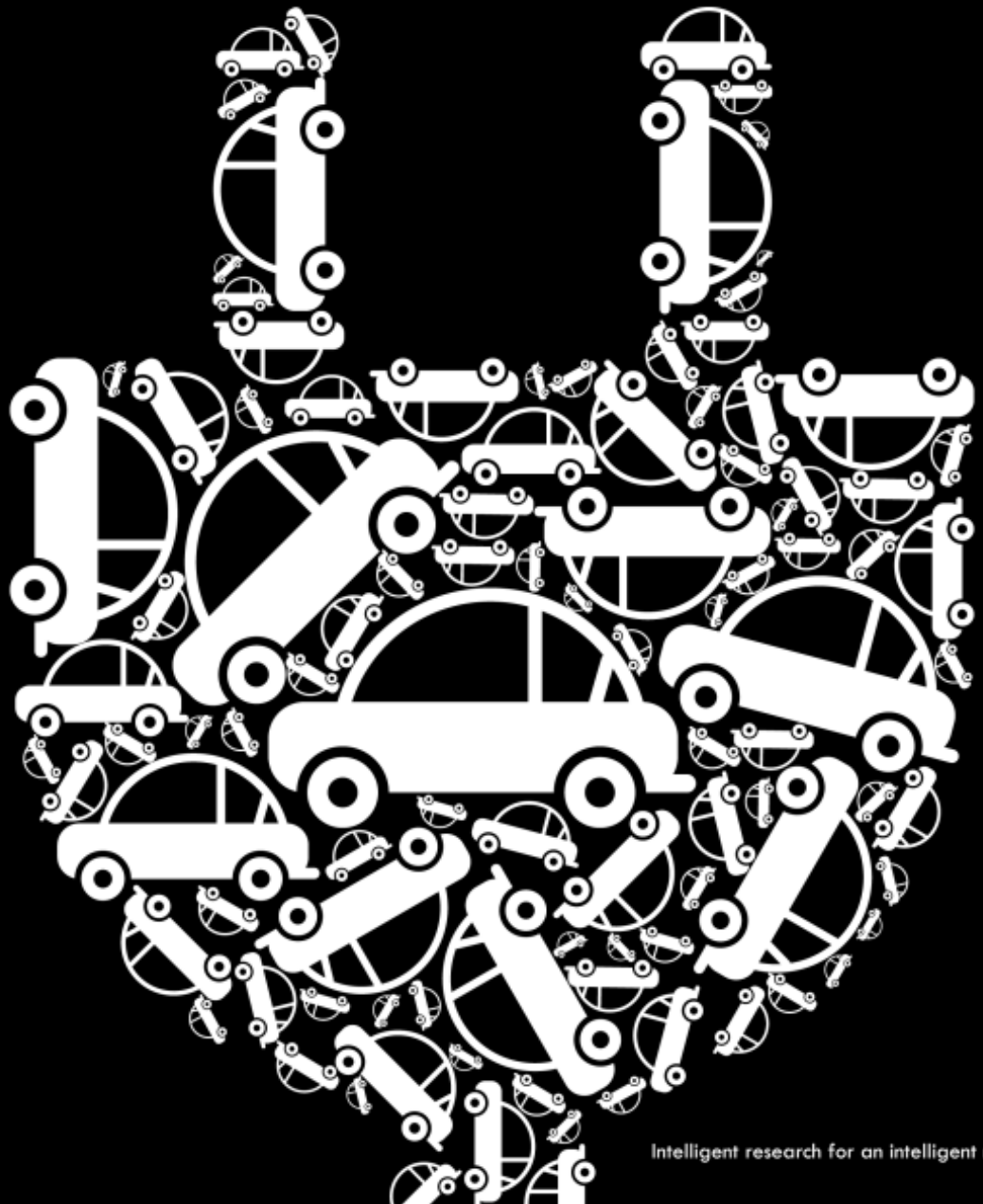

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Contributors

Zpryme and Airbiquity would like to extend the kindest regards to the following organizations that contributed to this issue of Smart Grid Insights

Airbiquity®

The Proven Leader in Vehicle Connectivity

Dear Executives,

2011 will not only be a breakthrough year for the Smart Grid and the energy sector, but also a history maker for the electric vehicle (EV) and automotive industry. In an unprecedented series of events automotive manufacturers such as GM, Ford, CODA, and Nissan are on the brink of launching the first generation of EVs to the U.S. mainstream.

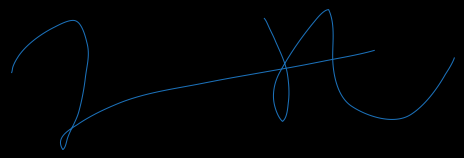
So how will car markers get consumers into the driver's seat? From the Nissan Leaf and Chevy Volt advertisements in magazine gloss and viral videos to the GE Wattstation making regular television appearances, consumers are finally getting up close and personal to the brands that can potentially become synonymous with the EV.

Standing in the way of consumers moving beyond the marketing is the price tag and quite simply EV education. During the course of this study Zpryme found that there is a sizable group of consumers that will likely purchase an EV in the next two years, however there is a substantial void in educating consumers on the value of making the crossover, ICE (internal combustion engine) to EV.

As 2011 starts to unfold consumers will have the ultimate say on whether the U.S. will be just an EV testing bed for the automotive industry or the catalyst for global proliferation of next generation vehicles.

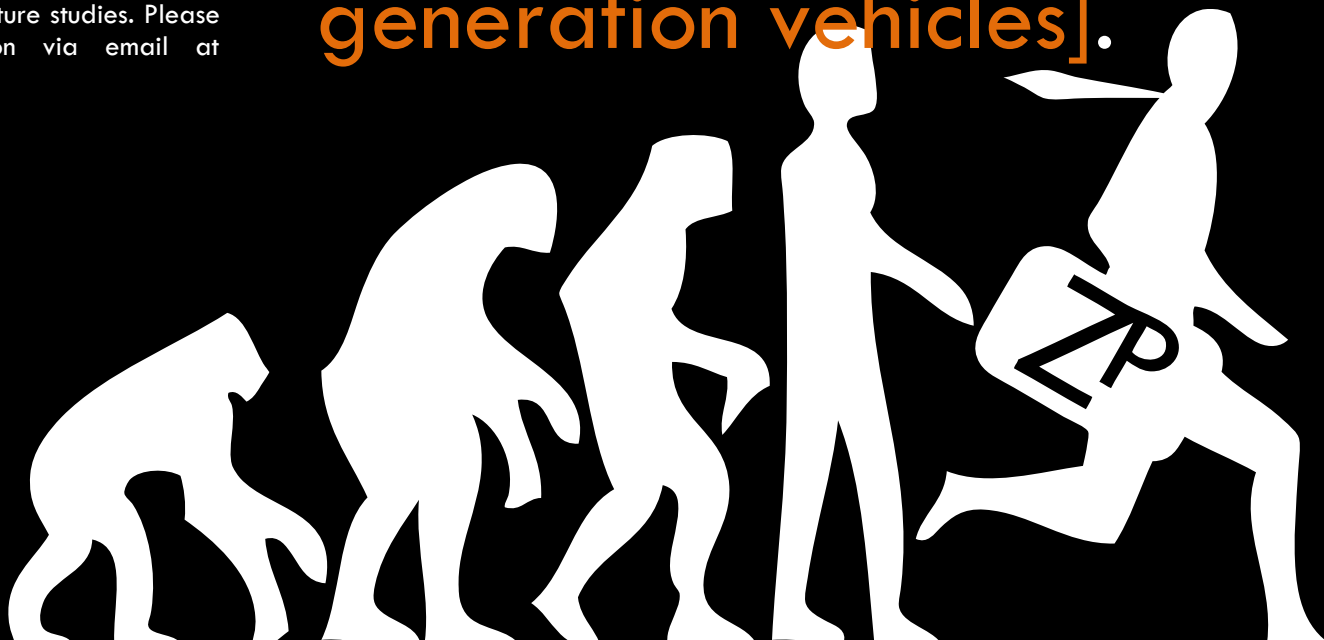
All of us at Zpryme and Airbiquity know this study will provide thought-provoking commentary and actionable insight for your organization to make strategic decisions in 2011. I personally welcome your thoughts on the diverse topics addressed in this study as well as suggestions for future studies. Please feel free to contact Zpryme about this publication via email at smart.grid@zpryme.com.

Kind Regards,



Jason S. Rodriguez
CEO & Director of Research
Zpryme Research & Consulting, LLC

> "... [consumers will have the ultimate say] on whether the U.S. will be just an EV testing bed for the automotive industry or the [catalyst for the global proliferation of next generation vehicles].



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Executive Summary

EXECUTIVE SUMMARY

As 2010 comes to a close many electric vehicle (EV) developments, initiatives, and movements are converging to make U.S. automotive history for 2011. Consumers may be ready for EVs too as 37.2% of respondents in Zpryme's EV Consumer Survey said they are very or somewhat likely to purchase an EV in the next two years. Nissan and GM are the first mainstream vehicle makers out of the gate in 2010 under the Leaf and Volt monikers while at the same time EV pioneers CODA, Fisker and Tesla launched their own interpretation of what an EV is supposed to be. Interestingly, Zpryme's EV Consumer Survey found that the Chevy Volt (53.1%), Ford Focus EV (49.1%), and Nissan Leaf (30.8%) hold the top three spots in terms of EV brand awareness.

At the forefront are blue chips such as GE, Leviton, ABB and Siemens providing advanced EV infrastructure and components. Closing the gap with charging stations will be pure players ECOtality, Coulomb Technologies, Better Place, and ClipperCreek. Utilities such as Southern California Edison, Florida Power & Light, and Xcel Energy are developing EV grid integration road maps and infrastructure that can safely absorb the impacts thousands of EVs on the grid. In-vehicle telematics companies such as Airbiquity, combined with smartphones like Apple's iPhone will make up the central node of the EV ecosystem. In fact, 52.9% of likely EV drivers in Zpryme's EV Consumer Survey indicated that being able to use all their smartphone apps inside the vehicle would have a positive influence on their decision to purchase an EV. Both of these technologies (telematics, smartphone) will not only enhance the EV experience that consumers demand, but also empower EV owners to make real-time decisions in energy management, safety, and entertainment.

So how will the industry get consumers to adopt the EV? It starts with the automotive and electric utility industry educating consumers at a grassroots level on the value of EVs with trailblazers such as Plug In America leading the way in EV advocacy. Such outreach programs can assist in loosening up anxiety about EV battery range, identifying government programs and subsidies that curtail the EV price tag, and detailing the short/long term cost benefits of owning an EV. This is only the beginning, as EV adoption becomes more widespread electric utilities will have to be cognizant and prepared for the clustering phenomenon, Smart Grid interoperability, and upgrading current infrastructure.

Like any new technology launch both the EV ecosystem and consumers will encounter challenges. Yet, motivated by more than $5 billion in EV-related government loans and grants to date and a projected 730 thousand EV/PHEVs on the road by 2016, a vibrant plugged-in auto sector in the U.S. appears possible.

EV Consumer Survey Highlights

EV Model Awareness: When asked about the EV models they are currently aware of, the top four brands chosen were the Chevy Volt (53.1%), Ford Focus EV (49.1%), Nissan Leaf (30.8%), and Tesla Roadster (16.8%).

Awarness of Current EV Models

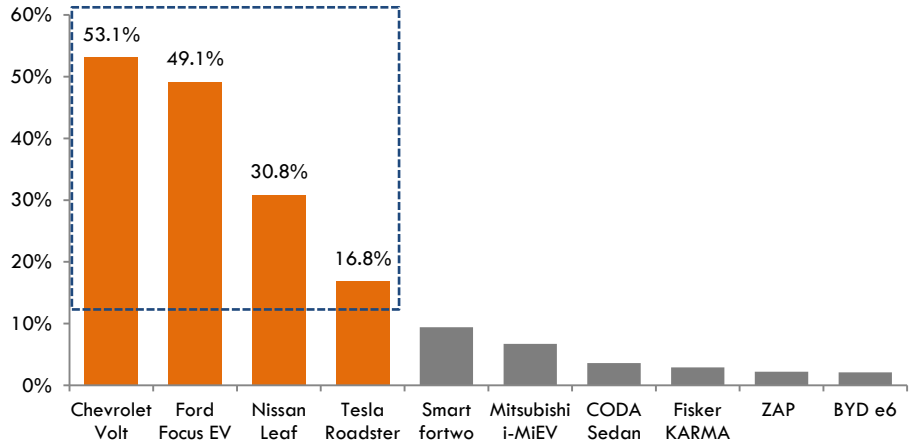


Figure a, Source: Zpryme

EV Brand Preferences: When asked about the vehicle brand they would consider buying an EV from, the top five brands chosen were Ford (17.8%), Toyota (16.7%), Chevrolet (16.0%), Honda (12.6%), and Nissan (7.1%). These five brands accounted for 70.1% of all responses.

Top Brands When Considering the Purchase of an EV

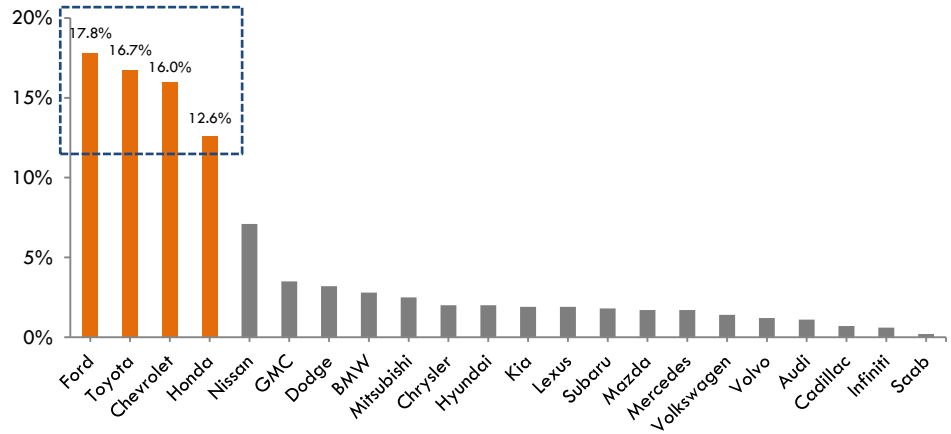


Figure b, Source: Zpryme

Willingness to Purchase an EV: A substantial amount of survey respondents indicated they were either very likely (8.5%) or somewhat likely (28.7%) to purchase an EV in the next two years. However, among those respondents who were not likely to purchase an EV in the next two years, 1.1% indicated they were very likely to purchase an EV in the next five years, while 25.8% said they were somewhat likely to purchase an EV in the next five years.

How likely are you to purchase an EV in the next two years?

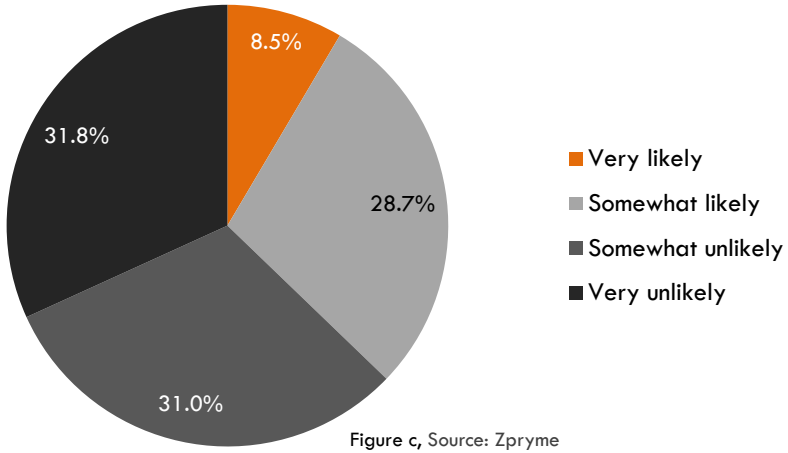


Figure c, Source: Zpryme

Reason to Purchase an EV: Economic factors dominated the key reasons to purchase an EV as 66.8% indicated vehicle price would be the top reason to purchase an EV, followed by saving money on fuel costs (50.4%).

Technological Preferences: Potential EV drivers in the next two years were more inclined to be involved in online activities, use technology to enhance their driving experience, and use a smartphone. In fact, among this group, 20.5% owned an iPhone.

Price to Pay for an EV: Nearly one-third (31.1%) of all respondents said they would pay more than the conventional vehicle price for an EV. Among all respondents, 12.6% indicated they would pay $5,000 over the conventional vehicle price while only 5.2% they pay $10,000 over the conventional vehicle price for an EV. For those that indicated they were either very or somewhat likely to purchase an EV in the next two years, 21.3% indicated they would pay $5,000 over the conventional vehicle price and 9.8% said they would pay $10,000 over the conventional vehicle price for an EV.

Environmental Concerns: Forty-four percent indicated environmental concerns were very important to them. Among those very or somewhat likely to purchase an EV in the next two years, 64.1% said environmental concerns were very important. Only 32.4% of those who were very or somewhat unlikely to purchase an EV in the next two years indicated environmental concerns were very important to them.

Buy, Lease, and Rent: Four-fifths (83.7%) said they would rather buy than lease (16.3%) an EV. Less than half (40.6%) reported they would be willing to pay a premium to rent an electric vehicle.

Buy or Lease an EV

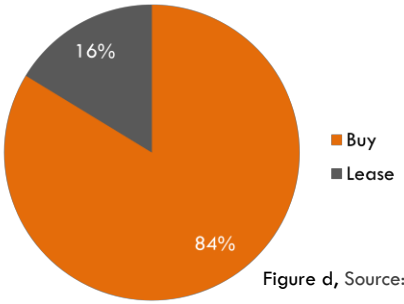


Figure d, Source: Zpryme

Would You Pay a Premium to Rent an EV?

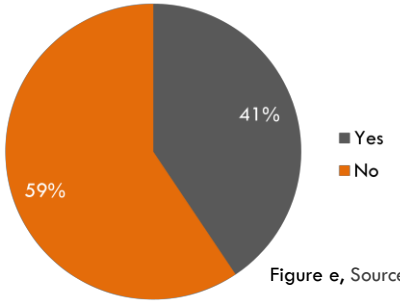


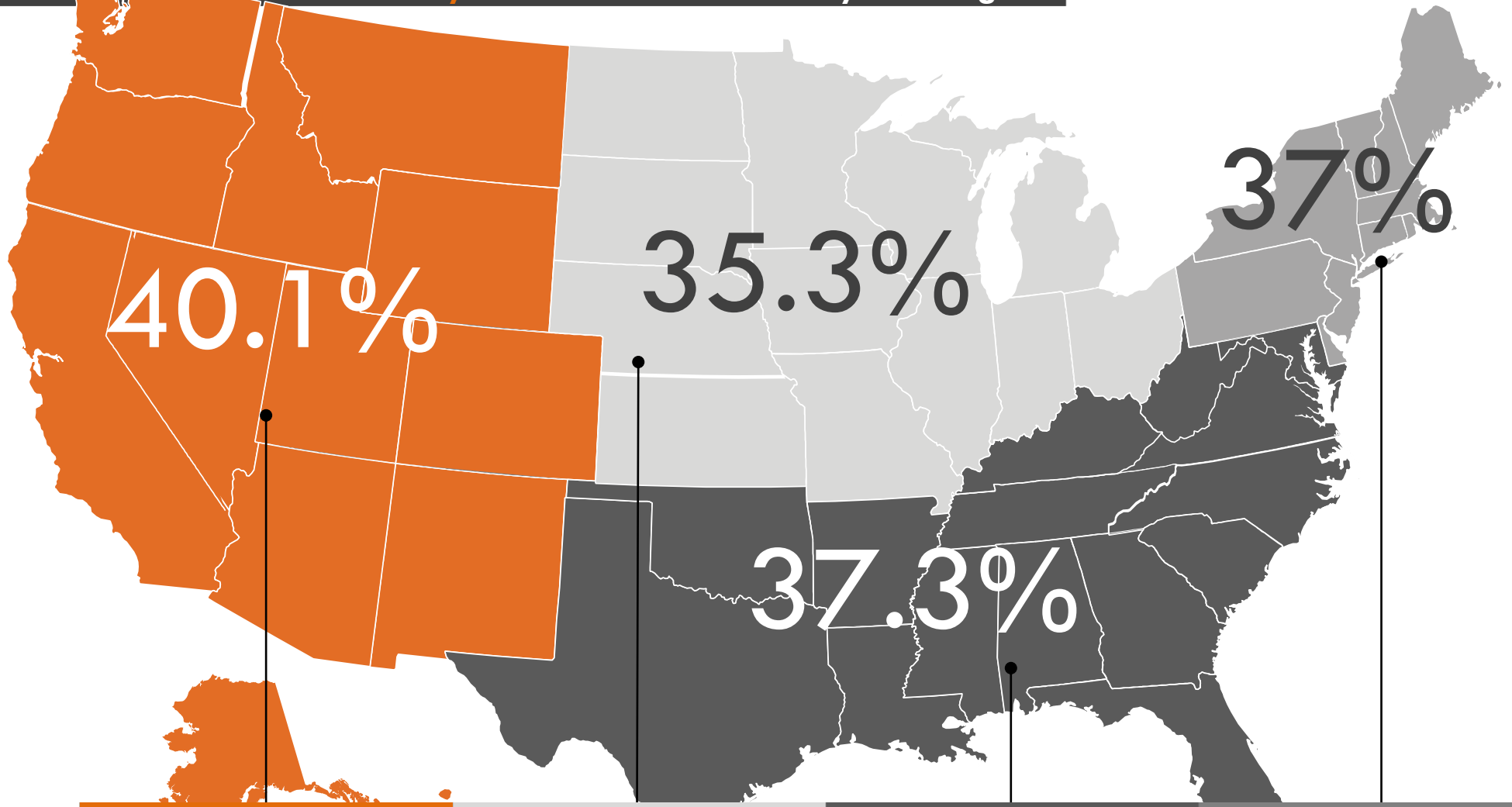
Figure e, Source: Zpryme

Charging Expectations: Respondents who were either very or somewhat likely to purchase an EV in two to five years indicated that 400 miles (33.7%) or 300 miles (33.3%) would be an acceptable driving range for an EV before it would need to be recharged. Among this group, 32.1% indicated that 4 hours would be an acceptable time to recharge an EV, 18.1% said 6 hours and 20.0% said 8 hours. Interestingly, 87.4% indicated they would be willing to pay a premium to charge their EVs in a faster manner.

EV Usage: Usage of an EV as a primary vehicle would more often be the choice of 77.7% of the people, while 22.3% said an EV would become a secondary vehicle.

EV Geography: More than two-fifths (40.1%) of likely EV consumers reside in Western U.S., while the South (37.3%), Northeast (37%), and Midwest (35.3%) fall closely behind. Please see the 'Likely EV Consumer Profiles by U.S. Region' infographic on the next page that illustrates this finding.

Likely EV Consumer Profiles by U.S. Region*



Region	West	Midwest	South	Northeast
Age	18-25: 33% 26-30: 15% 31-40: 16% 41-50: 15% 51-60: 16% 61-70: 4%	18-25: 21% 26-30: 23% 31-40: 19% 41-50: 18% 51-60: 14% 61-70: 6%	18-25: 30% 26-30: 17% 31-40: 20% 41-50: 14% 51-60: 12% 61-70: 6%	18-25: 27% 26-30: 16% 31-40: 27% 41-50: 12% 51-60: 15% 61-70: 3%
Gender	M 63% F 37%	M 55% F 45%	M 49% F 51%	M 45% F 55%
Income	<30k: 20% 30k-75k: 41% 75k-200k: 37% >200k: 1%	<30k: 22% 30k-75k: 47% 75k-200k: 30% >200k: 1%	<30k: 29% 30k-75k: 51% 75k-200k: 18% >200k: 2%	<30k: 17% 30k-75k: 47% 75k-200k: 31% >200k: 3%

Source: Zpryme

*Based on participants from the EV consumer survey used in this study that are likely to purchase an EV in the next two years.

EV Ecosystem Highlights

EV

Finding: Rental car companies will play a large role in acceptance of EVs (as well as identification of problems and solutions).
Insight: EV adoption may be more about consumer education than anything else.
Trend: Smartphone apps could assist in finding charging locations, setting charging times, and initiating charges.

Smart Grid

Finding: Available 4G communications technology can be used by EVs to connect to Smart Grid.
Insight: Smart grid technology will anticipate peak charging and prevent overload by pricing options and intersystem balancing.
Trend: Multiple interfaces include smartphone apps, mobile web, desktop web, and the EV itself.

Charging Stations & Infrastructure

Finding: Charging station owner initiatives exist for: turn-key installations, assistance for federal and state tax credits, 30-day money back guarantees.
Insight: Some expect need for public recharging to diminish as battery technology improves and home recharging increases.
Trend: Data are being collected on potential charging station corridors (similar to early cell phone tower build outs).

EV Marketplace Highlights

EV Charging Infrastructure: Home charging stations, public (level II) charging stations, and fast charging station annual unit sales are projected to grow by 37.7%, 43.1%, and 44.2%, respectively, from 2011 to 2016. By 2016, the number of installed home charging and public charging stations (level II and level III) are projected to reach 442,900 and 344,900, respectively.

EV/PHEV Annual Units and Total Stock: Annual EV/PHEV unit sales are projected grow by 36.2% annually from 2011 to 2016, from 43,400 to 203,200. By 2016, the total EV/PHEV stock is projected to reach 730,700 in 2016 in the U.S.

Projected U.S. EV/PHEV Annual Unit Sales and Total Stock
(2011 - 2016)

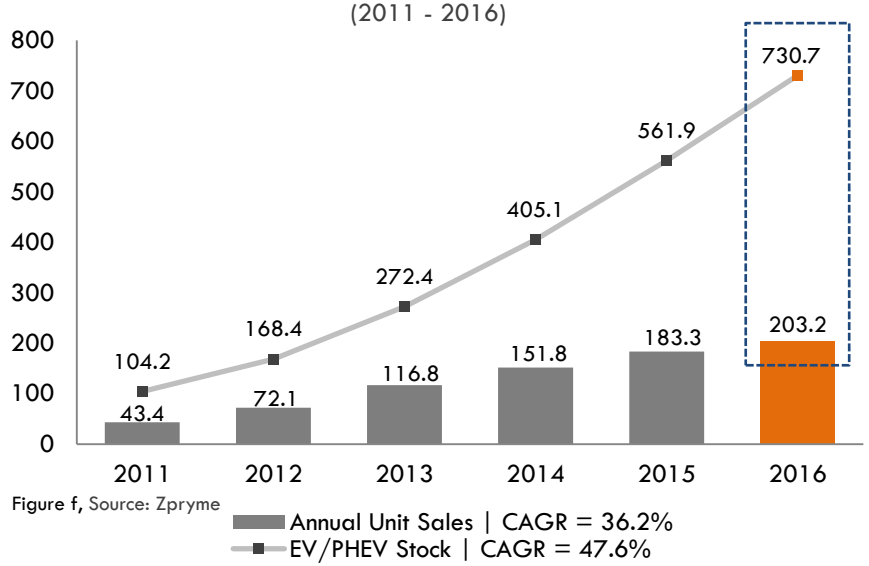


Figure f, Source: Zpryme

EV Charging Infrastructure Market Value: The EV charging infrastructure market is projected grow from $746.3 million in 2011 to $3.95 billion in 2016. This represents a compound annual growth rate of 39.5% during this time period.

Projected U.S. Charging Infrastructure Market Value (in U.S. millions)
2010- 2016 | CAGR = 39.5%

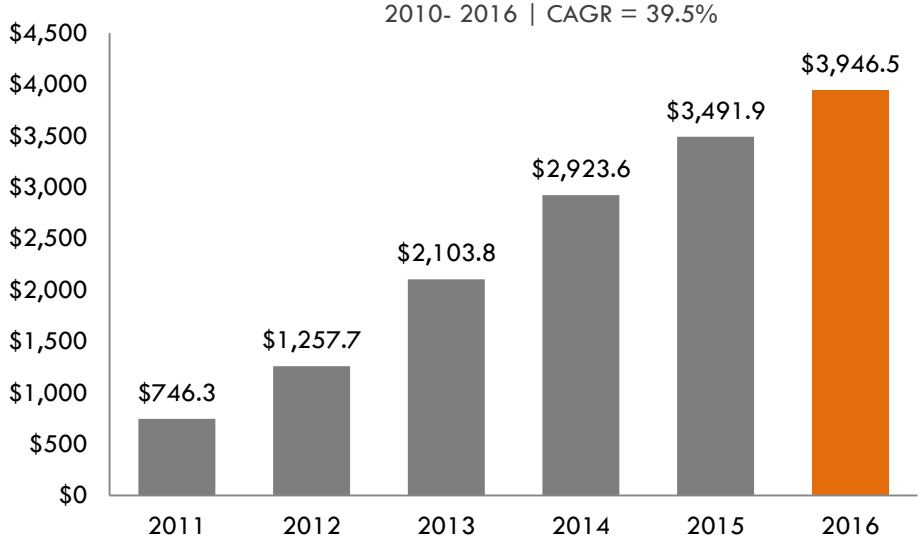


Figure g, Source: Zpryme

EV Charging Services Users and Market Value: The cumulative total number of charging service users is projected to grow from 39,800 in 2011 to 574,900 million in 2016. During this time period, the EV charging services market is projected grow from $30.4 million to $505.2 million.

EV Insight Highlights

Zpryme predicts EV adoption to be driven by three core groups of EV consumers. First, the EV Evangelists will make up the majority of EV drivers, next the EV brand loyalists will enter the market in 2 – 3 years, and finally followed by the EV sideliners who will purchase an EV in 4 – 5 years.

EV Evangelists: living mostly in the west (U.S.) and in metropolitan areas this group will make up the majority of EV drivers for the first 2 years.

EV Brand Loyalists: inspired by the 'EV Evangelists' and ever-faithful to their vehicle brand, this group will adopt the EV after 2 years.

EV Sideliners: hesitant because of the low price of gas and EV price tag, this 'wait and see' group will adopt the EV after 4 years.

Background & Scope

BACKGROUND & SCOPE

Scope

The purpose of this report is to present a comprehensive look at the electric vehicle and electric vehicle infrastructure market in the U.S. – Zpryme has employed a three-stage research approach to accomplish this objective. The results of each of the research tasks below are presented in this report.

- U.S. Consumer EV Survey: A survey of 1,046 U.S. drivers age 18 – 65 was conducted to assess the overall interest in EVs, EV brand awareness, key reasons to purchase and EV, charging preferences, and to discover key traits of potential EV buyers.

- In Depth Industry Q&A's with 11 major EV and EV Infrastructure Stakeholders

- Market size and value projections for EV/PHEVs, EV Charging Infrastructure, and EV Charging Services in the U.S.

Market Definitions

Electric Vehicles (EV): According to the U.S. Department of Energy's Energy information Administration (U.S. EIA), an electric vehicle is defined as: A motor vehicle powered by an electric motor that draws current from rechargeable storage batteries, fuel cells, photovoltaic arrays, or other sources of electric current.

Plug-in hybrid vehicles (PHEV): According to the Argonne National Laboratory, a PHEV operates on battery power that is charged both by the vehicle's gasoline engine and from plugging into an electrical outlet or charging station.

EV/PHEV market size: The EV/PHEV market size in this report is presented as the annual unit sales of EV/PHEV manufactures in the U.S. Further, the total stock of EV/PHEVs is also presented in the report. The 'stock' is the cumulative total number of EV/PHEVs in use in the U.S. for a given period.

EV charging infrastructure market size and value: The EV charging infrastructure market size is expressed as the annual number of charging station units sold in the U.S. Further, the cumulative number of charging stations installed in the U.S. is also presented in this report. For each of the charging station market value projections, the expected manufacturer selling prices have been used to calculate the market value. All figures are stated in US nominal dollars. Also, some percentages may not add up exactly to 100% due to rounding. The definitions for the types of charging stations projected in this report are below.

- Home charge points/stations (level I): Residential charging stations are commonly referred to as level 2 charging stations. According to the Society of Automotive Engineers, level 2 charging takes place over 240 Volt AC. Depending on the power supply, it will take an EV 4 – 8 hours to fully charge a 24kwh battery using a level 2 charger. These charging stations are installed at an EV driver's place of residence. This can be a home or apartment complex.

- Public charging stations (level II): These are level 2 charging stations which will used by municipalities, utilities, businesses, educational institutions, parking lot operators, apartment building managers, and various businesses or organizations to offer their respective tenants, employees, citizens, or customers the ability to charge their EV or PHEV.

- Fast public charging stations (level III): According to the Society of Automotive Engineers, level 3 charging, or 'fast charging' takes place over 500 Volt AC. Level 3 charging stations look much like a gas pump and are specifically designed for public access in a centrally located location. Level 3 charging stations should be able to charge a 24kwh battery in 30 minutes.

EV charging services market size and value: The EV Charging Services market is comprised of charging service providers that allow businesses, municipalities, educational institutions, parking lot operators, and apartment building managers to monitor and manage their network of charging stations. The core services include including metering, billing, and demand response participation services. Service providers give EV users the ability to track their usage, pay their bills online, and participate in demand response or peak load shaving programs. The market size for the EV charging services market is expressed in the total number of EV drivers who will use EV charging services. The market value for the EV charging services market is the summation of the revenues earned by service providers from subscription revenues, grid integration and network/data management, and energy sharing fees. Each of the revenue segments is described below.

- EV charging service users: These are EV drivers who can be individual consumers or associated with a fleet of EVs owned by a company or public organization such as a city, who will utilize public charging station infrastructure to charge their EVs. They must sign up with a

given charging service provider to access the charging services and privileges associated with a charging service network.

- Subscription revenues: Providers of EV charging serves will earn fees from EV drivers who sign up for access to their network of charging stations. They can use a pay-as-you-go model or purchase in advance model. For such access, the service providers can charge the EV driver a small member fee. Please note that a service provider in most cases will not own the physical charging stations (infrastructure).

- Smart Grid integration, network and data management services: For a fee, providers of EV charging services will enable EV drivers and owner/operators of public charging stations to interface with the Smart Grid, which enables the end-user to leverage V2G technology and participate in the demand response programs for a given utility. Additionally, the service provider will manage the billing, collection, payment, customer support, and end-user account management for a network of either public or private charging stations. Further, data storage and management services will be needed to run public EV charging stations will be offered by service providers.

- Energy sharing fees: Providers of EV charging services will earn fees from revenue sharing agreements they enter into with the owner(s) of charging station equipment. When such agreements are entered into, the service provider will earn a small share of fees charged to EV drivers who charge at a charging station that is managed by the service provider. However, the actual owner of the charging station will set the fee to charge at their respective station.

Forecast period: The forecast period for this report is 2011 – 2016. This period was chosen due to the expected launch of major EV models such as the Chevy Volt and Nissan Leaf in the U.S. in late 2010.

Geographic coverage: This report showcases the projected market size and market value for the U.S. for EV/PHEVs, charging infrastructure, and EV charging services.

Methodology

METHODOLOGY

Zpryme forecasts for EVs and charging station infrastructure were derived using the U.S. Energy Information Administration's Baseline (reference case) Economic Growth scenario for Alternative Fuel Vehicles from 2010 to 2035. The forecasts provided the underlying baseline data for the following market value forecasts. The baseline data was then synthesized with inputs from publicly available information. The key inputs are listed below. Further, heavy investigation into the Smart Grid industry was analyzed as the Smart Grid is considered as a main driver of growth for EVs and EV infrastructure. Last, infrastructure development and projected deployments were assessed to identify the feasibility of a market to support the projected number of EVs in the U.S. The forecast period for this report is 2011 to 2016. The forecasts do not account for such new regulations or targets as we lack sufficient information to implement such inputs into the forecast.

Key Assumptions to EIA Forecasts

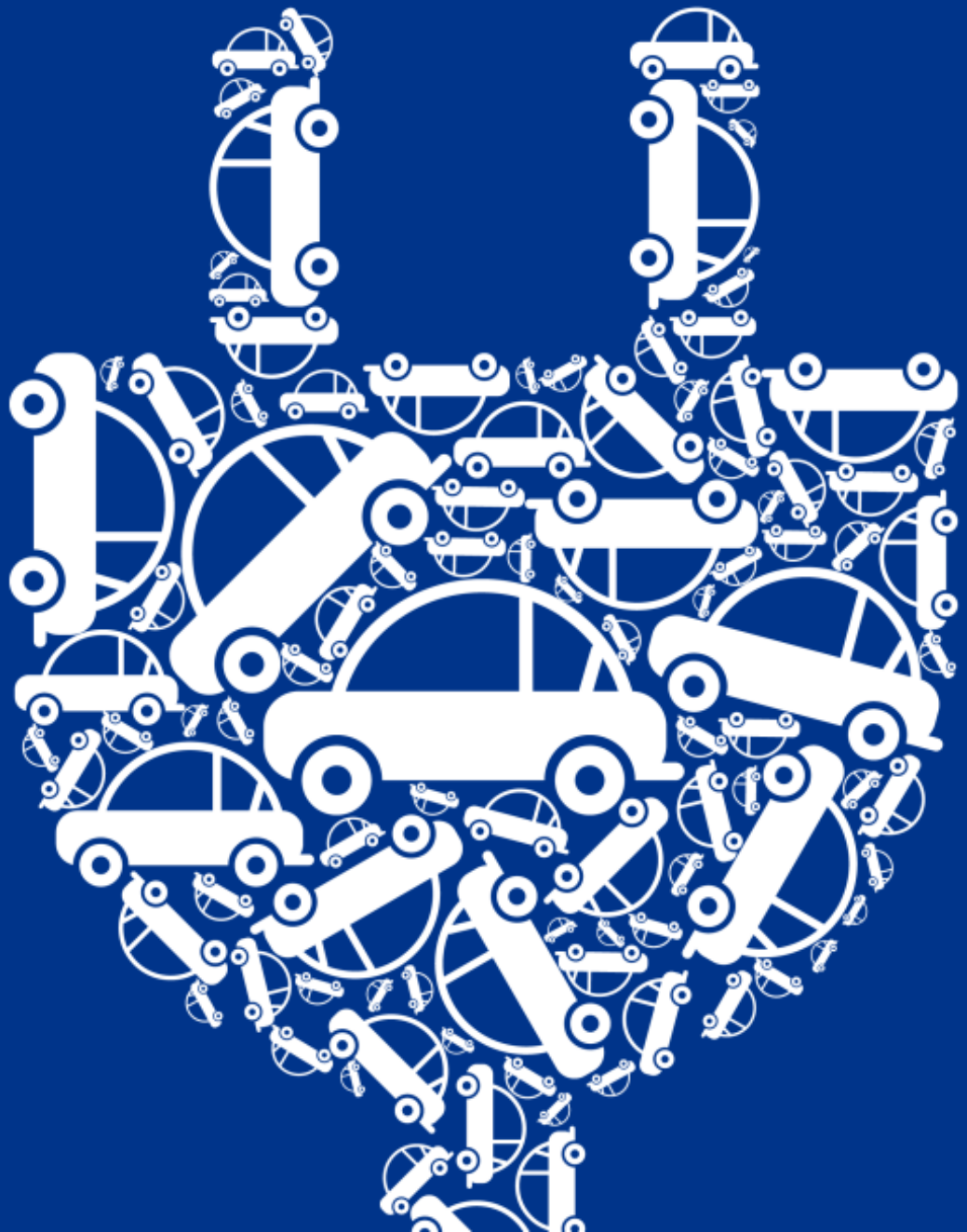
- Real GDP growth of 2.4% a year from 2011 to 2016.
- Energy supply, consumption, price, and macroeconomic assumptions by scenario are the same used by the EIA, which can be found in tables B1 – B4 in located in the document below.
    a. For scenario assumption comparison please see:[1] http://www.eia.doe.gov/oiaf/aeo/pdf/appb.pdf

Key Forecast Inputs

- Historical data and market performance: Historical data on Hybrid sales in the U.S. was analyzed to identify growth modes and expected unit sales at the market entry phase and market development phase. Once forecasts were produced, the data were used to test the validity of the growth in units and the annual compound growth rate in the U.S. Further, the current stock of EVs in the U.S. was also taken into account.
- Forecast model: Time series forecasting was used to derive the projections in this report. Growth trajectory was expected to be in line with that of the EIA forecast and also have elements of historical hybrid sales growth from 2000 to 2009. Once key demand inputs were accounted for, econometric modeling was employed to develop the forecasts in this report.
- Costs, price, and infrastructure considerations: Reductions in cost and the price of the EV/PHEVs to consumers are expected to fall as the market expands. Key basic infrastructure such as charging stations are expected to be built in conjunction with planned EV and PHEV programs for utilities and governments.
- Automobile manufacturer EV and PHEV model announcements: In 2009 and 2010, major automobile manufacturers such as Ford, Toyota, and Nissan announced EV, Hybrid, and PHEV models or potential models and made EVs and PHEVs a key to their future growth.
- Explicit U.S. government EV and PHEV stimulus, targets, and programs: In 2009, the Obama Administration set a target of 1 million plug-in hybrids (PHEVs) by 2015 in the U.S. As part of the program, $2.0 billion in federal stimulus was to be awarded to develop EV advanced batteries and drive components. The program also included $400 million for EV demonstration projects.

[1] U.S. Energy Information Administration / Annual Energy Outlook 2010

EV Consumer Survey



EV Consumer Survey Highlights

Overall EV Interest	EV Purchase Behavior	EV Brand Preferences	Charging Preferences	EV Driver Traits
37.2% are very or somewhat likely to buy an EV in the next 2 years	**77.7%** are very or somewhat likely to use EV as primary vehicle	**53.1%** are aware of the Chevy Volt; the highest among EV models	**32.1%** of likely EV drivers say a 4 hour charge time is acceptable	**64.1%** of likely EV drivers say environmental concerns are very important
50.4% say they would buy an EV to save money of fuel costs	**84.7%** say they would rather buy than lease an EV	**17.8%** would consider buying an EV from Ford; based on brand alone	**87.4%** of likely EV drivers would pay a premium for fast charging	**52.1%** of likely EV drivers use a smartphone (the majority are iPhones)
5.2% are willing to pay $10,000 over the conventional vehicle price for an EV	**40.6%** are willing to pay a premium to rent an EV	**16.7%** would consider buying an EV from Toyota; second only to Ford based on brand alone	**93.2%** of likely EV drivers say it is very important to be able to charge at their home/ residence	**56.1%** of likely EV drivers use a GPS/Navigation system to enhance their driving experience

CHAPTER 1: EV CONSUMER SURVEY

About the EV Consumer Survey

A survey was conducted from November 17 – 22, 2010, to a representative sample of 1,046 men and women drivers in the U.S. This following analysis will describe the overall responses to the survey, analyze the relationship between those who say they would likely purchase an EV in the next two years and selected other survey items (crosstabs), and end with some key findings from the survey.

Likely to Purchase an EV in the Next Two Years

All of those who took the survey were asked how likely they were to purchase an EV in the next two years and the next five years. A substantial group said they were very likely (8.5%) or somewhat likely (28.7%) in the next two years, while more said somewhat unlikely (31.0%) or very unlikely (31.8%).

How likely are you to purchase an EV in the next two years?
(asked to all survey respondents)

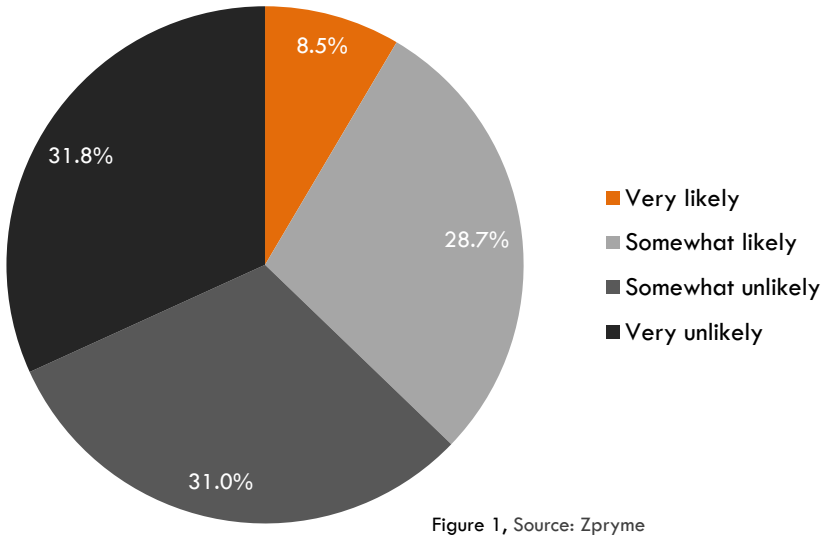


Figure 1, Source: Zpryme

Likely to Purchase an EV in the Next Five Years

If the respondent indicated they were somewhat unlikely or very unlikely to purchase an EV in two years they were then asked how likely they were to purchase an EV in the next five years.

Among respondents who answered this question, only 1.1% indicated they were very likely to purchase an EV in the next five years. However, 25.8% did indicate they were somewhat likely to purchase an EV within five years, and more saying they were unlikely to purchase (41.9% somewhat unlikely, 31.2% very unlikely). This decline may be because most EV purchases were likely to be made earlier (two years) rather than later (five years).

How likely are you to purchase an EV in the next five years?
(asked only to those who responded somewhat unlikely or very unlikely to purchase an EV in the next two years)

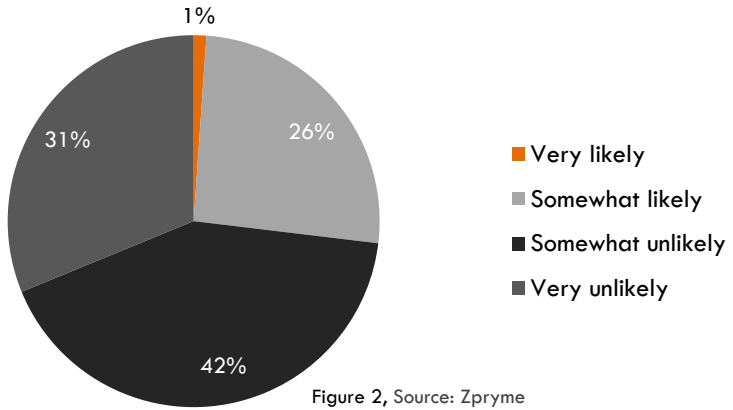


Figure 2, Source: Zpryme

EV Interest Comparative Analysis

The following results present the data from the overall group, the likely group, and the not likely group. Data are presented as a percentage of the total group. For example, 43.5% of the overall group was made up of males while 51.9% of the likely group was made of males. The main purpose of the comparative analyses is to assess whether key trends or differences can be discovered among consumers interested in EVs and consumers who are not interested in EVs. Further, the segmentation can assist strategy and marketing teams in building potential target EV consumer profiles and in preparing marketing programs designed to build EV awareness. The group definitions are defined below.

Overall Group: These data represent the responses by all survey respondents. There are a total of 1,046 respondents in this group.

Likely Group: These data represent the responses from survey respondents who indicated they are very likely or somewhat likely to purchase an EV in the next two years. This group represents 37.2% of all survey respondents.

Not Likely Group: These data represent the responses from survey respondents who indicated they are very unlikely or somewhat unlikely to purchase an EV in the next two years. This group represents 62.8% of all survey respondents.

Demographics

Overall Group: Over half of the respondents were aged 18 – 40 (54.3%), but the age distribution was relatively flat from 18 to 70. More females (56.5%) responded to the items than males (43.5%). Educationally, most respondents said they had at least some college (77.4%) and overall, the sample was quite educated with only 22.6% saying they had no college. More respondents reported a household income of $30,001 - $50,000 than any other category, but the distribution of incomes roughly split between those earning $50,000 or less (53.1%) and those earning over $50,000 (46.9%). Nearly every state (except Vermont) had a respondent with the top six states revealing nearly 40% of the total: Florida (8.7%), California (8.3%), New York (6.3%), Texas (6.3%), Illinois (5.8%), and Pennsylvania (5.3%).

Likely vs. Not Likely: More of those who were likely to purchase an EV in the next two years were younger, with 66.0% 40 years old or younger. However, the not likely group was older compared to the likely group as only 47.7% of respondents were age 40 years old or younger.

Just over half of the likely group was male (51.9%), while the not likely group was made up of more females (61.9%).

Those likely to purchase tended to have more education: 78.7% had at least some college, 21.3% had only a high school diploma/GED or less. The not likely group had a similar education level as 77.0% had at least some college.

Household incomes of those likely to purchase about evenly divided with those earning $50,000 or less composing 47.3% of the sample, and those over $50,000 in 52.7%. On the other hand, the incomes of those not likely to purchase were relatively lower than those likely to purchase, as 44.3% had a household income over $50,000.

Very similar to the overall sample, the five top states containing the likely group (with 38.5% of all states) were: Florida (9.8%), California (9.0%), Illinois (7.2%), New York (6.6%), and Texas (5.9%). The five top states containing the not likely group (33.4% of all states) were: Florida (8.0%), California (7.6%), Texas (6.5%), New York (6.1%), and Illinois (5.2%).

Online Activities

Overall Group: On line activities that had the highest frequency were email (92.1%), researching topics of interest (60.3%), social networking (60.1%), search (51.3%), and purchasing products (47.4%).

Likely vs. Not Likely: Among the likely group, email (89.4%), social networking (71.5%), research topics (66.0%), search (61.4%), and online games (57.4%) were the top 5 online activities. The top 5 online activities of the not likely group were email (93.9%), research topics (57.6%), social networking (54.5%), search (43.3%), and purchasing products (43.0%).

Major Online Activites (% of group)
Overall, Likely, and Not Likely Groups

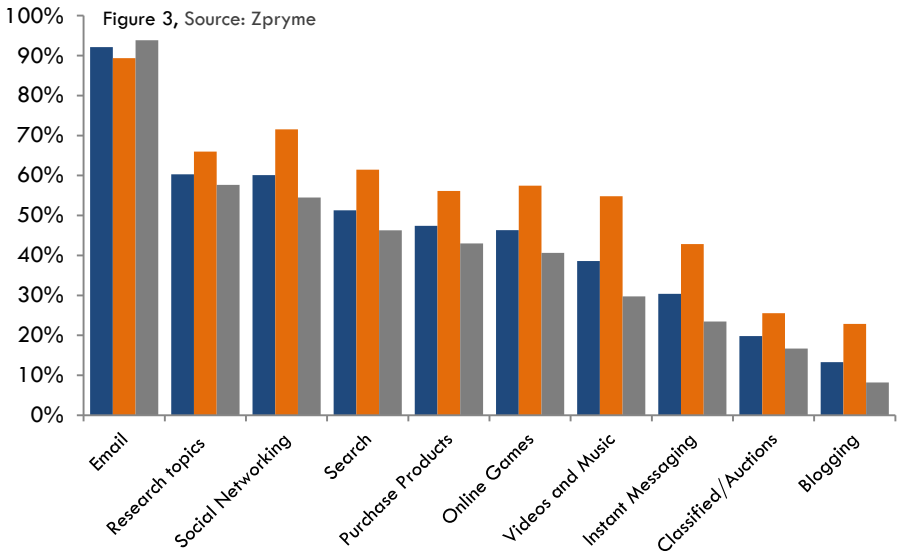


Figure 3, Source: Zpryme

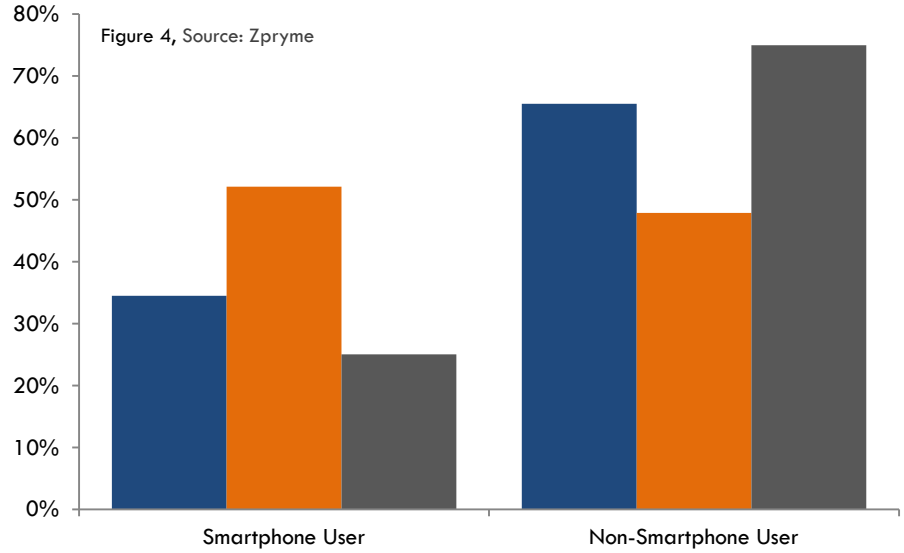
Group Legend: Overall Likely Not Likely

Smartphone Penetration

Overall Group: When asked what type of smartphone operating system you use, the largest number of respondents said they had a cell phone, but it isn't a smartphone (53.7%). Other responses, in order of frequency were: RIM (Blackberry)—12.1%, Apple –11.8%, Android—9.7%, don't have cell phone—6.9%, not sure—4.9%, and Symbian (Nokia)—0.9%. Other specified responses most often revealed the brand name, Samsung—0.8%.

Likely vs. Not Likely: Among the likely to purchase group, 52.1% were smartphone users. The type of smartphone used by these respondents revealed: having a cell phone but it is not a smartphone (39.9%), Apple (20.5%), RIM (Blackberry) (16.8%), Android (13.0%), not sure (4.5%), no cell phone (3.5%), Symbian (Nokia) (1.9%). Among those not likely to purchase, only 25.0% had a smartphone. The type of smartphone used was: RIM (Blackberry) (9.8%), Android (7.9%), and Apple (7.1%). The majority of those not likely to purchase had a cell phone but it was not a smartphone (61.4%) and 8.7% did not own a cell phone.

Smartphone Use (% of group)
Overall, Likely, and Not Likely Groups

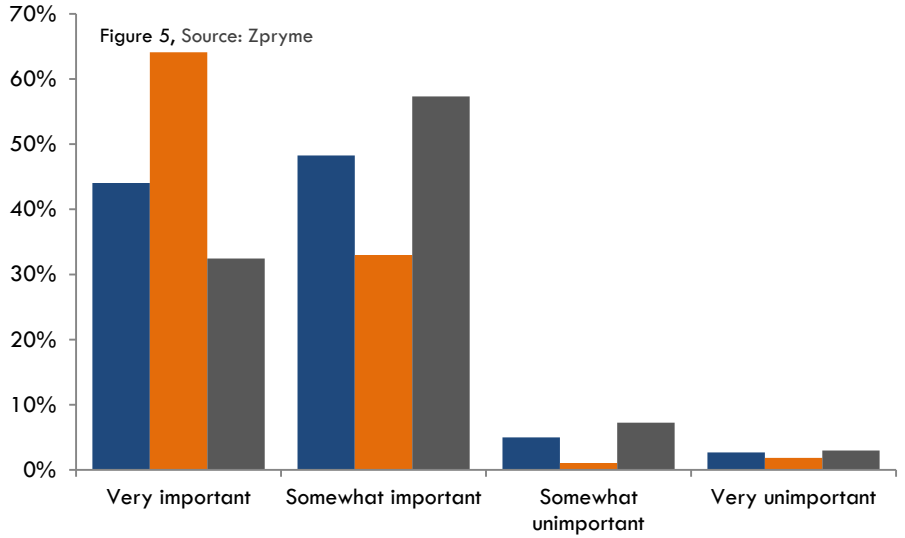


Environmental Concerns

Overall Group: Environmental concerns were important to the survey takers with 44.1% saying very important and 48.4% saying somewhat important. Only 7.7% said environmental concerns were not important.

Likely vs. Not Likely: The likely group was quite environmentally conscious as 64.1% said that environmental concerns were very important. However, only 32.4 % of the not likely group considered environmental concerns as very important.

Importance of Environmental Concerns (% of group)
Overall, Likely, and Not Likely Groups



Devices Used to Enhance Driving Experience

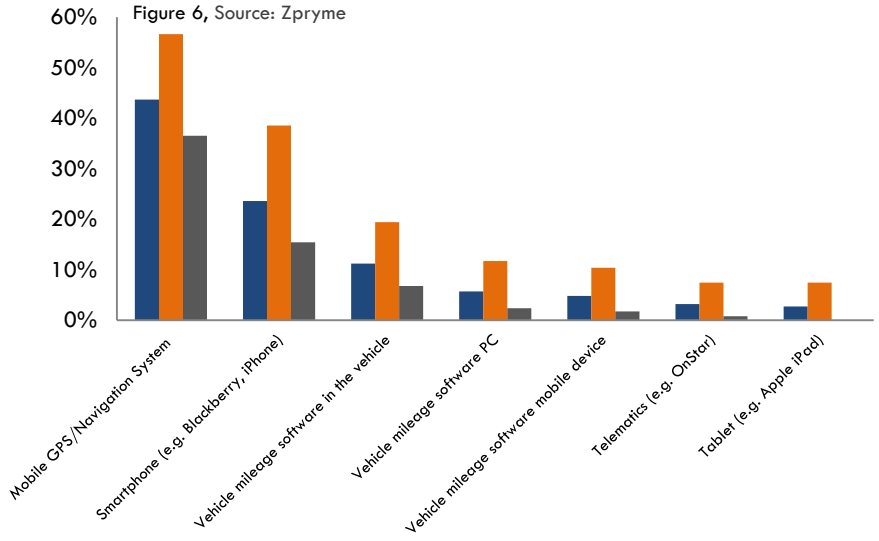
Overall Group: When queried which system they used to enhance their driving experience, more said a mobile GPS/navigation system (43.7%) than any other choice. Other responses (in rank order) were: don't use any of those listed (40.0%), smartphone (23.6%), mileage tracking in vehicle (11.2%), mileage tracking in personal computer (5.7%), mileage tracking on mobile device (4.8%), telematics (OnStar) (3.2%), and tablet (2.7%).

Likely vs. Not Likely: The following devices were used by the likely group to enhance their driving experience: Mobile GPS/navigation system (56.6%), smartphone (38.6%), do not use any (of those on list) (19.7%), vehicle mileage tracking in vehicle (19.4%), vehicle mileage tracking on personal computer (11.7%), vehicle mileage tracking on mobile device (10.4%), tablet (7.4%), and telematics (OnStar) (7.4%). The majority of the not likely group said don't use any of those listed (50.7%), followed by Mobile GPS/navigation system (36.5%), smartphone (15.4%), and

vehicle mileage tracking in the vehicle (6.8%), on a PC (2.4%), and on a mobile device (1.7%).

Devices Used to Enhance Driving Experience (% of group)
Overall, Likely, and Not Likely Groups

Figure 6, Source: Zpryme



Current Vehicle Brand

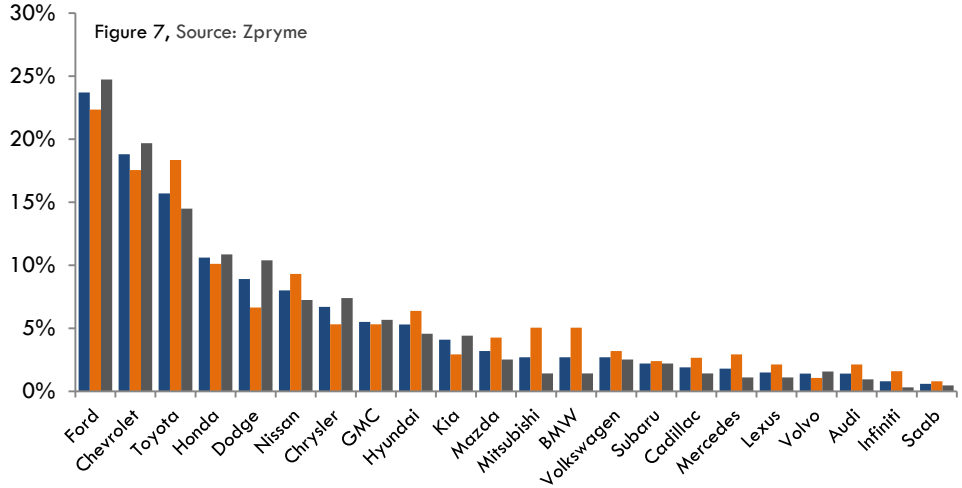
Overall Group: When asked about their current brand of vehicle, the top five choices were: Ford (23.7%), Chevrolet (18.8%), Toyota (15.7%), Honda (10.6%), and Dodge (8.9%). These five accounted for over three-fourths (77.7%) of all brands.

Likely vs. Not Likely: Among the likely group, the top five brands of their current vehicle(s) were: Ford (22.3%), Toyota (18.4%), Chevrolet (17.6%), Honda (10.1%), and Nissan (9.3%). These five brands also accounted for 77.7% of all brands for the likely group. The top five vehicle (s) brands of the not likely group were: Ford (24.7%), Chevrolet (19.7%), Toyota (14.5%), Honda (10.9%), and Dodge (10.4%). These five brands accounted for 80.2% of the not likely group.

Group Legend: Overall Likely Not Likely

Current Vehicle Brand (% of group)
Overall, Likely, and Not Likely Groups

Figure 7, Source: Zpryme



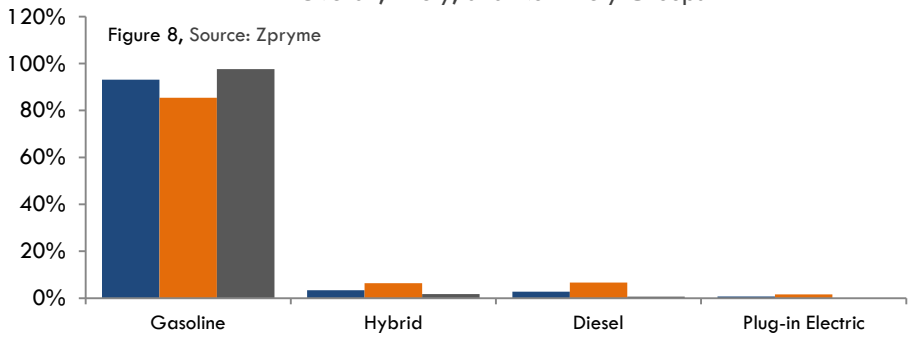
Current Engine Type

Overall Group: The type of engine in their current primary vehicle was gasoline by far (93.1%), followed by hybrid (3.4%), diesel (2.8%), and electric vehicle (0.7%).

Likely vs. Not Likely: Among the likely group, the largest percentage own gasoline engine vehicles (85.4%), with fewer owning diesels (6.6%) and hybrids (6.4%). Interestingly, six respondents (out of seven in the overall sample) already own EVs. The not likely group had a larger share of gasoline vehicles (97.6%), and a smaller share of hybrid (1.7%) and diesel (0.6%) vehicles.

Engine Type of Primary Vehicle (% of group)
Overall, Likely, and Not Likely Groups

Figure 8, Source: Zpryme



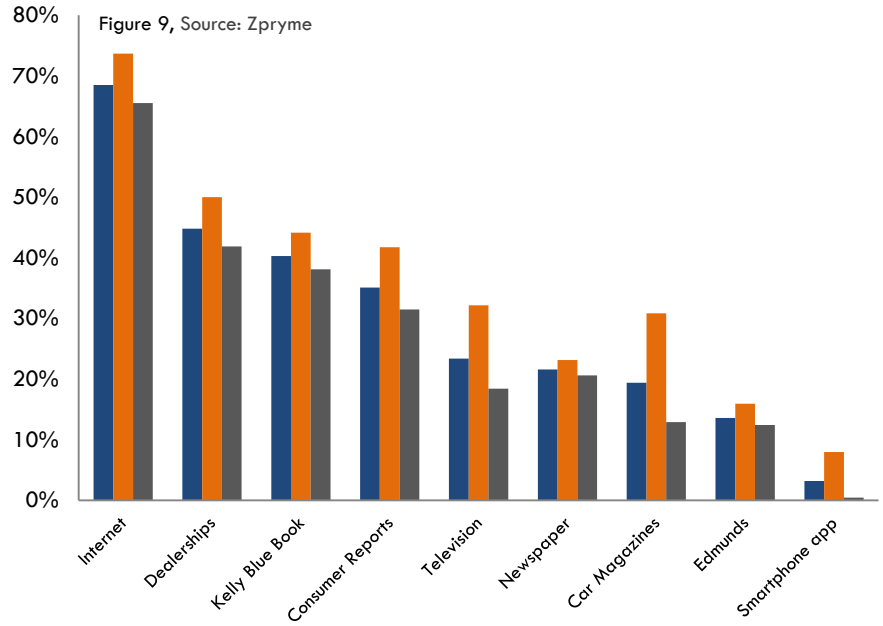
Group Legend: Overall Likely Not Likely

Sources Used When Purchasing a Vehicle

Overall Group: When purchasing a vehicle, over two-thirds (68.5%) use information from the internet, followed (in order) by: dealerships (44.8%), Kelly Blue Book (40.3%), Consumer Reports (35.1%), television (23.4%), newspaper (21.6%), car magazines (19.4%), Edmunds (13.6%), and smartphone app (3.2%). Two percent stated that they talked to friends or relatives before purchasing a vehicle.

Likely vs. Not Likely: Within the likely group, the Information about purchasing a vehicle was obtained from: internet (73.7%), dealerships (50.0%), Kelly Blue Book (44.1%), Consumer Reports (41.8%), television (32.2%), car magazines (30.9%), newspaper (23.1%), Edmunds (16.0%), and smartphone app (8.0%). Among the not likely group, the Information about purchasing a vehicle was obtained from: internet (65.5%), dealerships (41.9%), Kelly Blue Book (38.1%), Consumer Reports (31.5%), newspaper (20.6%), television (18.4%), car magazines (12.9%), Edmunds (12.4%), and smartphone app (0.5%).

Sources Used When Purchasing a Vehicle (% of group)
Overall, Likely, and Not Likely Groups

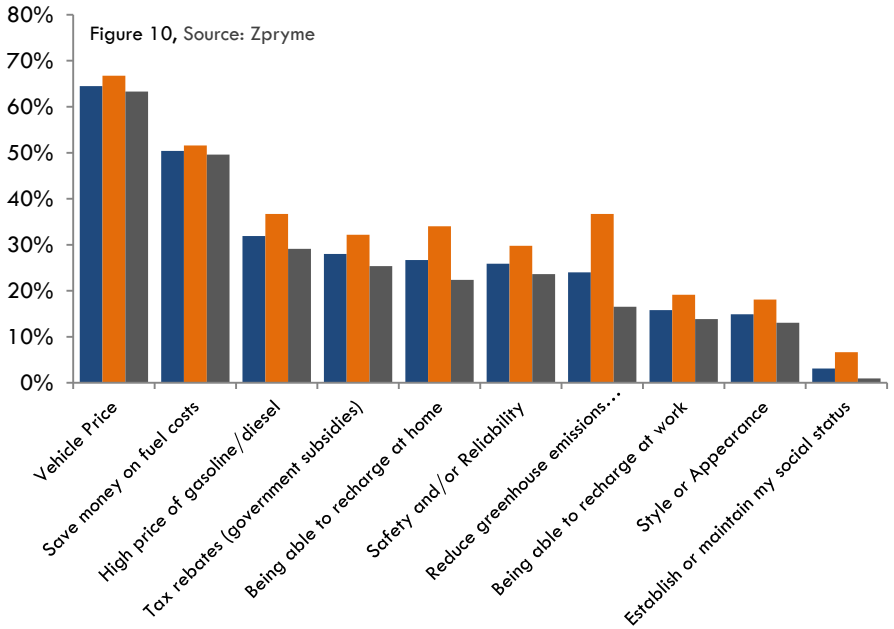


Top Reasons to Purchase an EV

Overall Group: Respondents were asked to pick the top two reasons that would convince them to buy an electric vehicle. Their number one factor was vehicle price (64.5%). Other convincing factors of lower frequency were: save money on fuel (50.4%), high price of fuel (31.9%), tax rebates (28.0%), being able to recharge at home (26.7%), safety/reliability (25.9%), reduce greenhouse emissions (24.0%), being able to recharge at work (15.8%), style/appearance (14.9%), and establish/maintain social status (3.1%). Clearly, the highest chosen factors revolve around economics.

Likely vs. Not Likely: The top five convincing factors for the likely group when buying an EV were: vehicle price (66.8%), save money on fuel (51.6%), high price of fuel (36.7%) tied with reduce greenhouse emissions (36.7%), and being able to recharge at home (34.0%). Compared to the overall sample, reducing greenhouse emissions was about 53% more important to the likely to purchase group. For the not likely group, the top five factors were: vehicle price (63.3%), save money on fuel (49.6%), high price of fuel (29.1%), tax rebates (25.4%), and safety/reliability (23.6%).

Top Reasons to Purchase an EV (% of group)
Overall, Likely, and Not Likely Groups

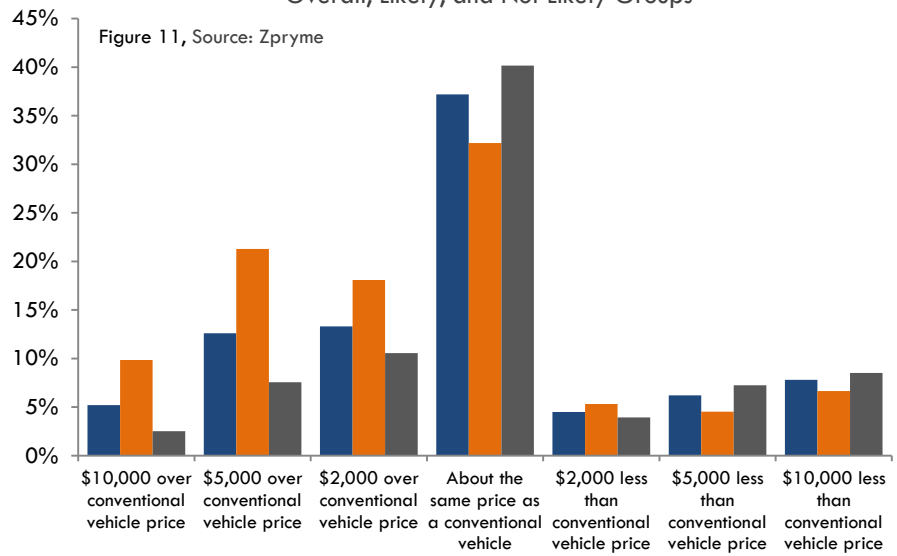


Amount to Spend on an EV

Overall Group: Survey respondents next chose the amount they would spend to purchase an electric vehicle. Most often, the response was about the same price as a conventional vehicle (37.2%). While 18.5% said they would only spend less than a conventional vehicle, 31.1% said they would spend more for an EV than a conventional vehicle. Another 13.1% said they would not purchase an EV.

Likely vs. Not Likely: The likely group would pay the same price (32.2%) or more (49.2%) to purchase an EV. In fact, 21.3% said they would pay $5,000 over the conventional vehicle price to buy an EV, while 9.8% would pay $10,000 over the conventional vehicle price to buy an EV. Only 7.6% of the not likely group indicated they would pay $5,000 over the conventional vehicle price to buy an EV, and only 2.5% said they would pay $10,000 over the conventional vehicle price to buy an EV.

Amount Willing to Spend on an EV (% of group)
Overall, Likely, and Not Likely Groups



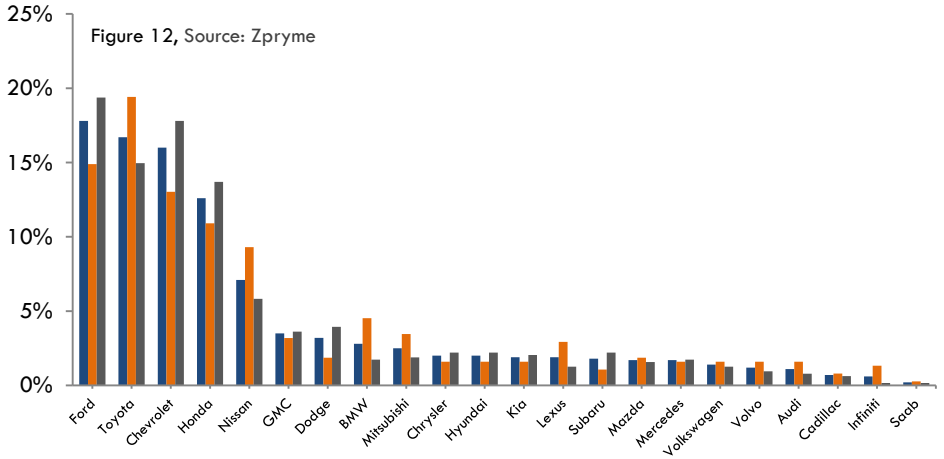
Brand to Purchase an EV From

Overall Group: The EV brand that would lead to a purchase consideration was most often Ford (17.8%), followed by Toyota (16.7%), Chevrolet (16.0%), Honda (12.6%), and Nissan (7.1%). The remaining brands only totaled less than 30%. There appears to be brand allegiance (to current primary vehicle) in consideration of an EV purchase.

Group Legend: Overall Likely Not Likely

Likely vs. Not Likely: The top five most selected brands among the likely group for buying an EV were: Toyota (19.4%), Ford (14.9%), Chevrolet (13.0%), Honda (10.9%), and Nissan (9.3%), which accounted for two-thirds (67.5%) of all brands. The top five most selected brands among the not likely group were: Ford (19.4%), Chevrolet (17.8%), Toyota (15.0%), Honda (13.7%), and Nissan (5.8%), which accounted for two-thirds (71.7%) of all brands.

Top Brands When Considering the Purchase of an EV (% of group)
Overall, Likely, and Not Likely Groups



Familiarity with Current EV Models

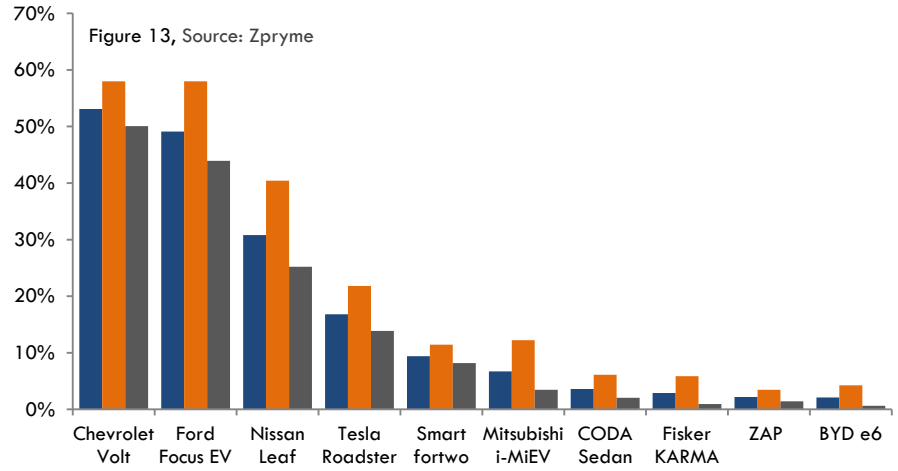
Overall Group: Familiarity with existing EV brands revealed the following distribution: Chevrolet Volt (53.1%)—most popular, Ford Focus EV (49.1%), Nissan Leaf (30.8%), Tesla Roadster (16.8%), Smart fortwo (9.4%), Mitsubishi i-MiEV (6.7%), CODA Sedan (3.6%), Fisker KARMA (2.9%), ZAP (2.2%), BYD e6 (2.1%). Just over one-fourth (25.7%) said they had not heard of any of the listed EVs.

Likely vs. Not Likely: EV brand familiarity among the likely to purchase group revealed the following frequencies: Chevrolet Volt (58.0%) tied with Ford Focus EV (58.0%), Nissan Leaf (40.4%), Tesla Roadster (21.8%), Mitsubishi i-MiEV (12.2%), Smart fortwo (11.4%), CODA Sedan (6.1%), Fisker KARMA (5.9%), BYD e6 (4.3%), and SAP (3.5%). Another 15.7% said they had not heard of any of the listed electric vehicles.

Similarly, EV brand familiarity among the not likely to purchase group revealed the following frequencies: Chevrolet Volt (50.1%), the Ford Focus EV (43.9%), Nissan Leaf (25.2%), Tesla Roadster (13.9%), Smart Fortwo (8.2%), Mitsubishi i-MiEV (3.5%), CODA Sedan (2.0%), ZAP

(1.4%), BYD e6 (0.6%), and ZAP (1.4%). However, 31.7% said they had not heard of any of the listed electric vehicles.

Awarness of Current EV Models (% of group)
Overall, Likely, and Not Likely Groups

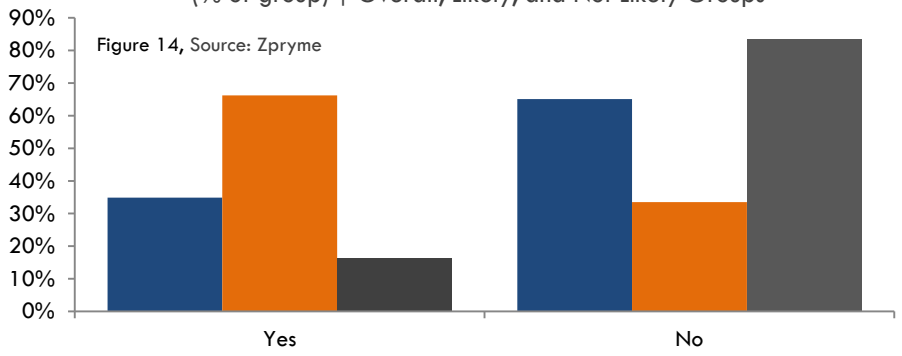


Purchase a Vehicle in 12 Months

Overall Group: Sixty-five point one percent said they were not planning to buy a new vehicle (regardless of type of engine) in the next twelve months.

Likely vs. Not Likely: When asked whether they planned to buy a new vehicle of any type within the next 12 months, 66.2% of the likely group said yes, and only 16.2% of the not likely group said yes.

Planning to Purchase a Vehicle within the next 12 months
(% of group) | Overall, Likely, and Not Likely Groups



Group Legend: Overall | Likely | Not Likely

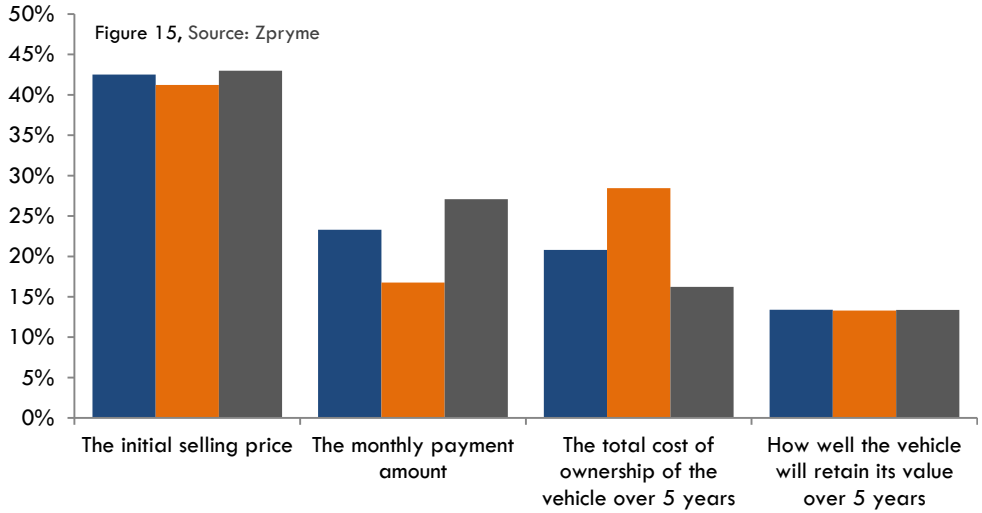
Main Purchasing Factor

Overall Group: The most influential factor in purchasing a new vehicle was (in descending order): initial selling price (42.5%), monthly payment amount (23.3%), total cost of ownership over five years (20.8%), and how well vehicle retains value over five years (13.4%). As seen earlier when reviewing factors that would convince respondents to purchase an EV, economics is a heavy issue for purchasing any vehicle in the U.S.

Likely vs. Not Likely: When queried about the greatest influence on buying a new vehicle (of any type) the likely group responded: initial selling price (41.2%), total cost of ownership over five years (28.5%), monthly payment amount (16.8%), and how well the value is retained over five years (13.3%).

The not likely group responded: initial selling price (43.0%), monthly payment amount (27.1%), how well the value is retained over five years (16.2%), and the total cost of ownership of the vehicle over five years (13.4%).

Major Factor Influencing New Vehicle Purchasing Decision
(% of group) | Overall, Likely, and Not Likely Groups



Likely to Purchase an Electric Vehicle

Those who responded that they were likely (very or somewhat) to purchase an EV in the next two or five years were asked to respond to the following series of questions. There were 546 respondents who fell into this category.

- Usage of an EV as a primary vehicle would more often be the choice of 77.7% of the people, while 22.3% said an EV would become a secondary vehicle. Four-fifths (83.7%) said they would rather buy than lease (16.3%) an EV. Less than half (40.6%) reported they would be willing to pay a premium to rent an electric vehicle.

EV Use as a Primary or Secondary Vehicle
(likely to purchase an EV in the next two or five years)

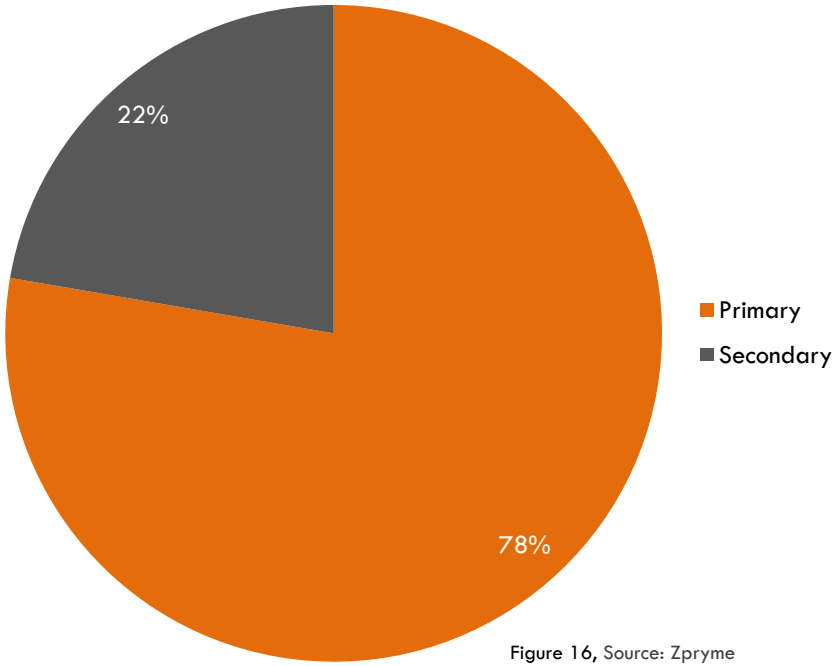


Figure 16, Source: Zpryme

Buy or Lease an EV
(likely to purchase an EV in the next two or five years)

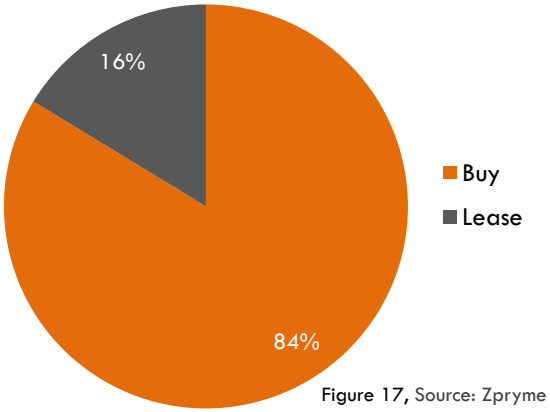


Figure 17, Source: Zpryme

Would You Pay a Premium to Rent an EV?
(likely to purchase an EV in the next two or five years)

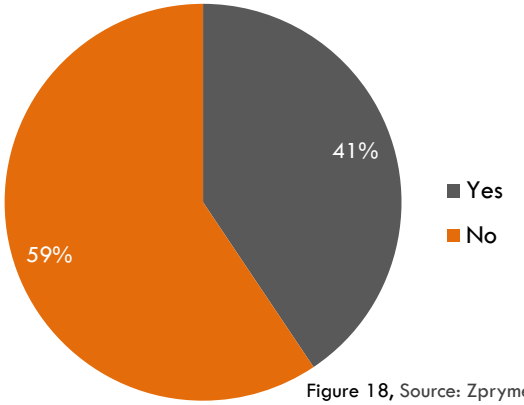


Figure 18, Source: Zpryme

- An acceptable mileage range to respondents for an EV was more often 400 miles (33.7%), with 300 miles next chosen (33.3%). For all respondents, a weighted average for this survey from the 546 respondents who answered this question was a 294 mile range. The most acceptable time for recharging an EV was four hours, with

responses ranging from eight to less than ½ hour. A weighted average for the 546 respondents was 4.4 hours which could be accomplished both at home (overnight) and at work (for full-time workers). A strong majority (87.4%) reported they would pay a premium to charge their EV in 30 minutes using an advanced charger.

Acceptable EV Driving Range Before Needing to Be Recharged
(likely to purchase an EV in the next two or five years)

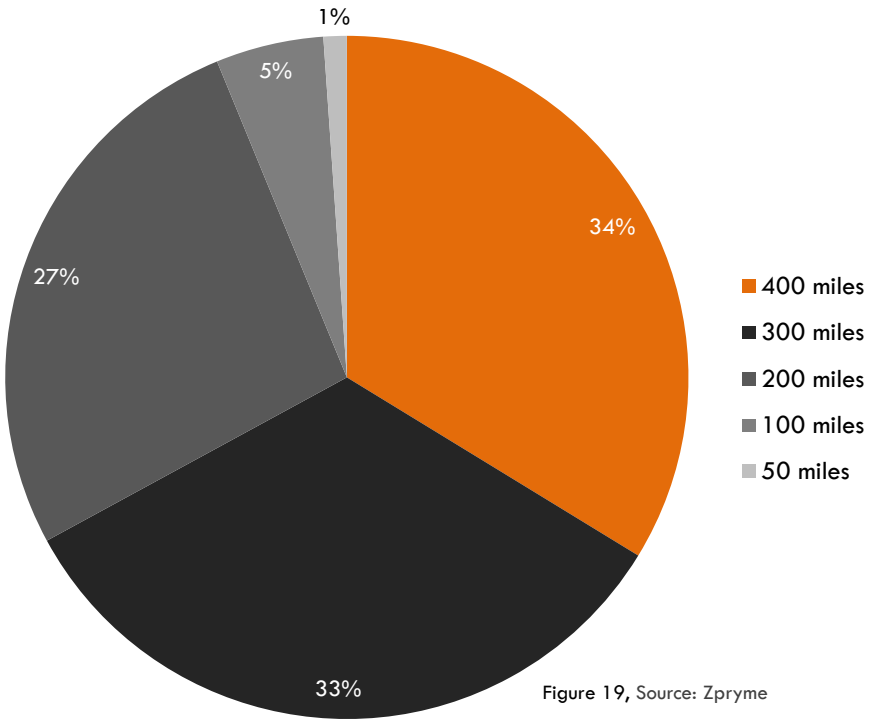


Figure 19, Source: Zpryme

Acceptable Time to For an EV to Recharge
(likely to purchase an EV in the next two or five years)

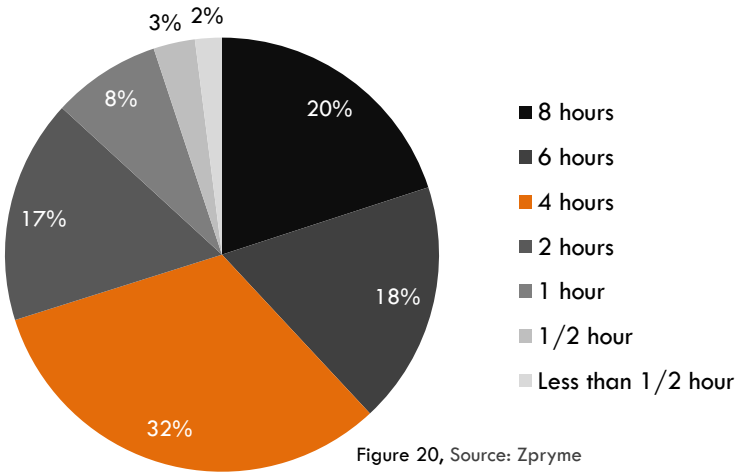


Figure 20, Source: Zpryme

Willingness to Pay a Premium for Fast Charging
(likely to purchase an EV in the next two or five years)

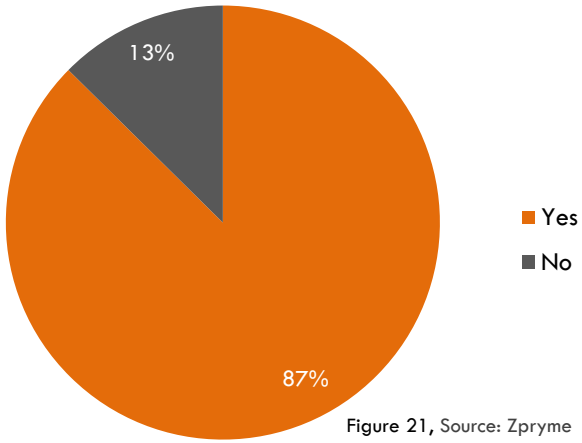


Figure 21, Source: Zpryme

- A list of locations was presented and respondents were asked how important it was (very important, somewhat important, not important) to be able to recharge their vehicles at those places. When focusing

upon the most frequent responses, it was very important to recharge at home (93.2%), work (53.9%), and on the highway (53.2%). Of somewhat importance was recharging at a grocery store/mall (48.8%), convenience store (42.6%), or a general public access (47.2%). Using the same importance scale, survey respondents rated where they would prefer to monitor an EV's recharging. Again, the most frequent responses were that it was very important inside the EV (83.5%), on a home computer (60.9%), on a mobile device (51.9%), or on a Smartphone app (41. 7%). The most frequent response for a somewhat important rating was via phone per a customer service representative (44.6%).

Places Considered Very Important to Charge an EV at
(likely to purchase an EV in the next two or five years)

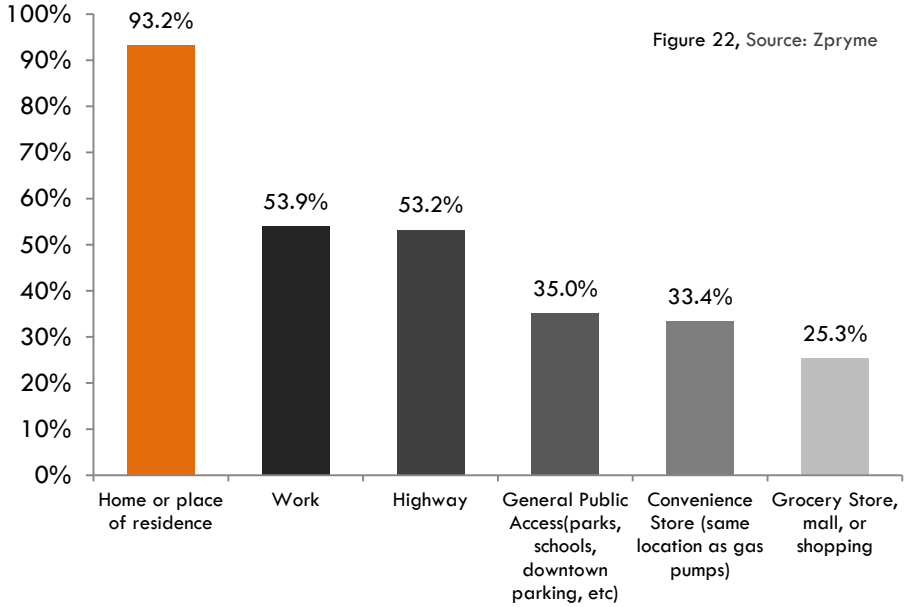


Figure 22, Source: Zpryme

Devices Considered Very Important to Manage and Monitor EV Charging On
(likely to purchase an EV in the next two or five years)

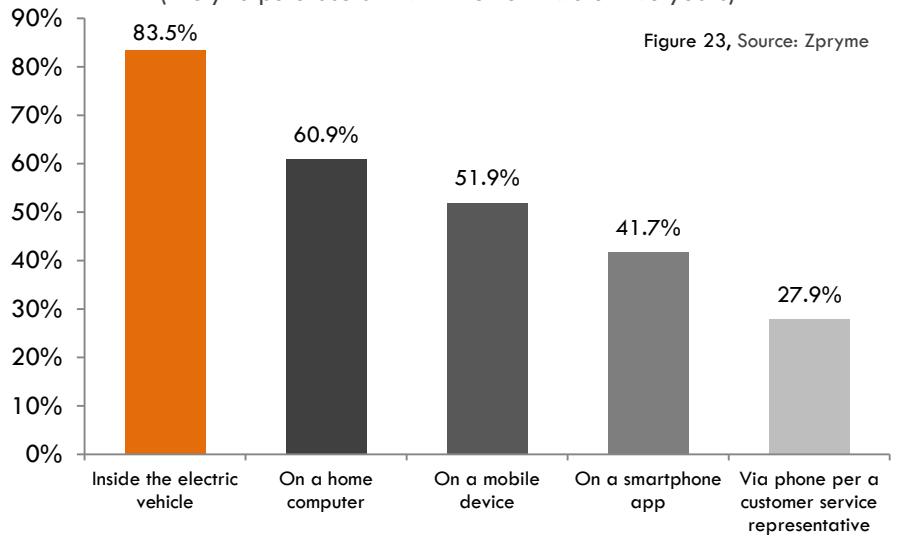


Figure 23, Source: Zpryme

- A different listing of where to receive information about energy usage and billing was rated. In rank order of preference: an online energy management portal (35.3%), mailed with monthly bill (31.1%), emailed periodically (18.4%), periodically inside the EV (9.2%), and on a mobile device (6.1%). A majority (50.6%) wanted the information delivered real-time regardless of location.

EV Energy and Billing Information Preferences
(likely to purchase an EV in the next two or five years)

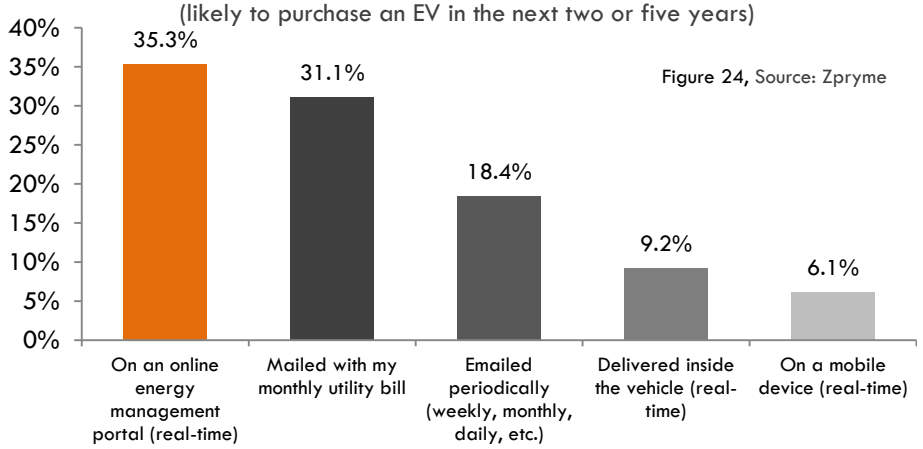


Figure 24, Source: Zpryme

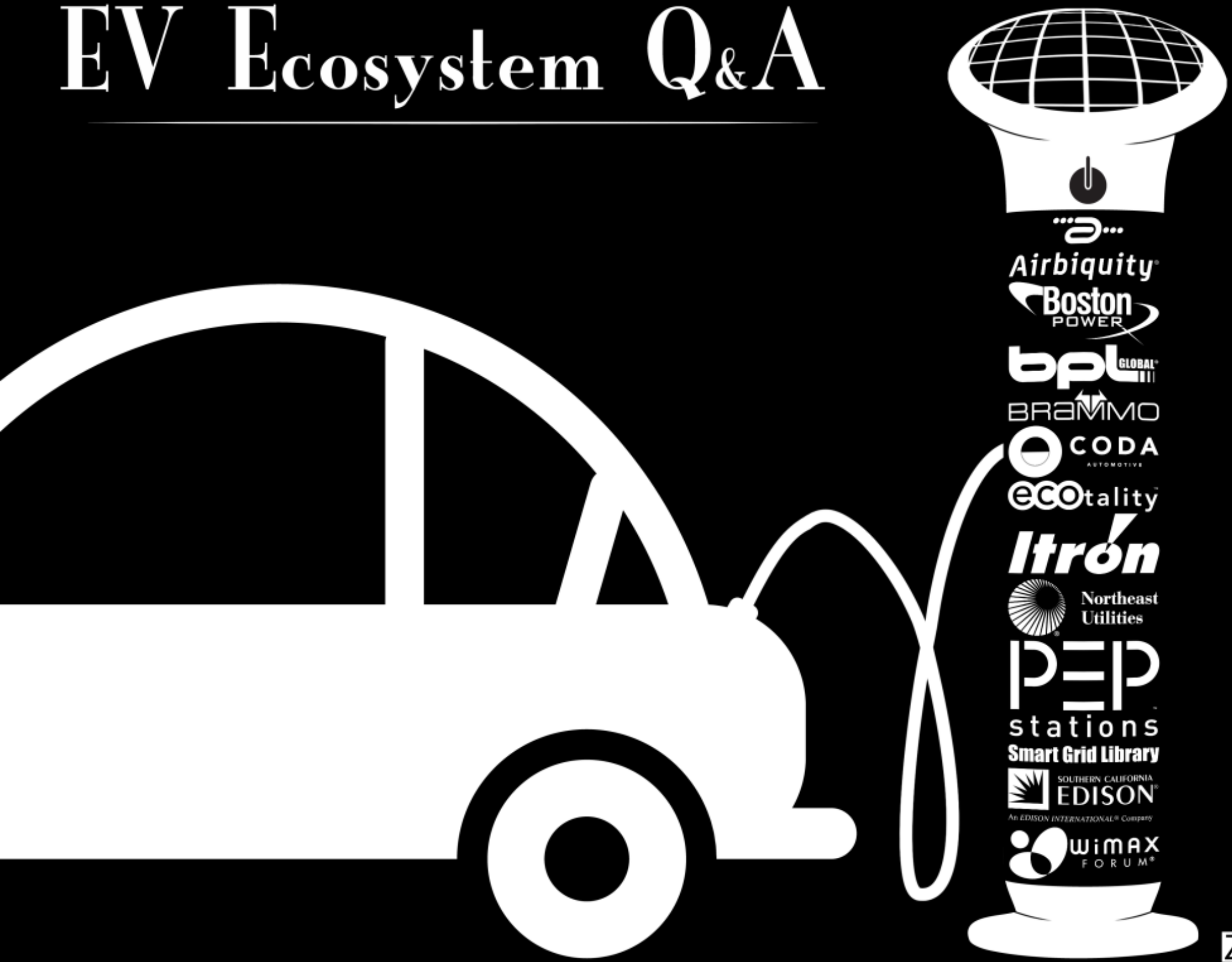
- Being able to use all of their Smartphone apps in the EV would have a positive influence on an EV purchase for 52.9% of respondents, have no influence for 45.5%, and a negative influence for 1.7% of the survey takers.

Key Findings

The overall sample was relatively young and "tech savvy" with a heavy use of online activities. Respondents had a moderate income with substantial levels of education. They reflected a high usage of the internet to research and gain information about vehicles. Over half (53.5%) of the sample said they were very or somewhat likely to buy an EV in the next two to five years with financial reasons having the most weight in convincing them to purchase. The average recharge preferred time was around four and one-half hours; while they said they would like a vehicle range of around 300 miles. Although shorter recharge times were preferred, the respondents said they would pay a premium to obtain lower recharge times. Several insights were revealed when looking at those who would likely purchase an EV in the next two years.

- Those that currently own an EV are likely to repurchase one.
- Males appear to be more likely to purchase an EV given their relatively high representation in the likely to purchase group (vs. their representation in the overall group).
- Those likely to purchase an EV were more environmentally concerned than those unlikely to purchase an EV.
- Respondents exhibited a very high frequency of online activities.
- One-fifth said they would pay $5,000 over the conventional vehicle price to buy an EV.
- Over half are familiar with American branded EVs (Ford, Chevrolet).

EV Ecosystem Q&A



EV Ecosystem Q&A Highlights

Electric Vehicles	Smart Grid	EV Charging Stations	Outlook
EV adoption may be more about **consumer education** than anything else	Utilities will offer EV customers options on **where and when to charge** their EVs and for providing energy back to the grid	Utilities and the charging station industry participate in workgroups to discuss **standards, trends, and new technologies**	**When the price is comparable to a gas powered vehicle, many more people will realistically consider purchasing an EV**
On-board EV devices could be connected to the internet to **help in energy management**	V2G has potential to **lower EV usage costs**	Concern exists about **overbuilding public charging infrastructure** too early	Two critical occurrences could greatly accelerate the adoption of EVs:
Rental car companies will play a large role in **the acceptance of EVs**	Communications technology is crucial to enable the **successful integration of EVs to the grid**	Highway corridor **recharge points may be more important** than in-city/at-work recharge stations	a huge **increase in the cost of gasoline**, and/or breakthrough technological **advances in batteries** which would increase charge duration
Smartphone apps could assist in finding charging locations, setting charging times, and initiating charges	Success has to be based upon giving consumers **simple, convenient, and economical options**	Level III charging will **greatly decrease recharge times**	

CHAPTER 2: EV ECOSYSTEM Q&A

About the EV Q&A

Eleven representatives from a broad spectrum of organizations (see page 28) were asked a series of questions via e-mail about the future for electric vehicles (EVs), the Smart Grid, and charging stations/infrastructure. The questions were posed from the end of October to mid-November 2010. The following represents a summary of the responses that is organized around the three major categories, but it is acknowledged that these categories overlap and may blend into each other. Each of the three categories (EVs, Smart Grid, charging station/infrastructure) will contain key findings, insights, and trends as discussed by the eleven representatives.

EVs

Much has recently been written about EVs as major automotive corporations place their own vehicles on the market for consumers to purchase.

Key Findings:

- A general rule-of-thumb in the utilities industry is that for every five percent of EV market share, about a one percent increase in electricity use is expected
- An EV with a dependable 100+ mile range is enough to meet most peoples' daily driving needs
- A CODA Sedan has 30% more usable energy than a Nissan Leaf with an onboard charger that is twice as fast (competition leads to technology advances)
- Rental car companies will play a large role in acceptance of EVs (as well as identification of problems and solutions)
- It is estimated that each plugged in EV has the effect of two new households, in terms of energy consumption
- It's typically a 2 – 3 year lag between consumer electronics adoption and vehicle availability
- 75% of U.S. drivers drive less than 40 miles per day
- Some believe electric motorcycles will be at the forefront of EV adoption

Insights:

- EV adoption may be more about consumer education than anything else
- The biggest hurdle for EV adoption is battery technology (recharge time, reliability, life)
- Global government support plays a vital role in creating a shift in how people view and use EVs
- More systems integration is needed among battery technology, electronics, and drivetrains
- Building consumer confidence (for EVs generally, for electronic motorcycles specifically) is a huge challenge for the industry
- Reliable vehicle data will motivate better driving planning (which can mitigate range anxiety)
- Plugged in EVs will have built-in sensors to recharge when prices are lowest
- Connection between the internet and EVs will greatly expand consumer options

Trends:

- EV equipment can include an 8-inch touchscreen that provides navigation system, phone, music, traffic, weather, news, and energy usage (remaining charge, and most efficient driving)
- Touchscreens are interactive
- Information in EVs is instructional, educational, and demonstrable
- Recharge durations are trending down
- Lower battery costs can be achieved through larger production scale

- Nanotechnology batteries offer significant reliability and durability
- Smartphone apps could assist in finding charging locations, setting charging times, and initiating charges
- On-board EV device could be connected to internet to help in energy management

Smart Grid

The Smart Grid will play an instrumental role in the efficient utilization of energy with EVs. Also included in this discussion is the connection to vehicles often referred to as vehicle to grid or, V2G.

Key Findings:

- Flexibility in utilities offers EV customers options on where and when to charge their EVs and for providing energy back to the grid
- Available 4G communications technology can be used by EVs to connect to Smart Grid
- Customer engagement, net metering, and demand response are all enabled through multiple applications in new devices
- Reverse power flow (EV to grid) is part of Smart Grid load control potential

Insights:

- There are many unknowns that future research should answer: Will customers charge at their convenience or when electricity prices are lower? Will customers sell power to the grid? Are customers interested in a greener environment?
- In order to sustain EV market share, customer demand goes beyond the EV early adopters: success has to be based upon giving consumers simple, convenient, and economical options
- Communications technology is crucial to enable the successful integration of EVs to the grid
- Utilities must integrate a variety of EV brands, charging systems, and processes
- Customer engagement with utilities is built upon trust
- Every EV will be connected (for monitoring and charging) to the grid
- Smart grid technology will anticipate peak charging and prevent overload by pricing options and intersystem balancing
- Revenue stream into EVs for using stored energy has potential to lower EV usage costs

Trends:

- Utilities are integrating customer loads, grid sensors, switches, and voltage/phase controls
- Utilities are collaborating with the automotive industry, universities, and research laboratories to respond to EV challenges such as standards development
- A workable transition to an EV-ready Smart Grid includes metering for multiple assets (e.g., smart chargers, transformers), communications networks, data management, web portals
- Secure feedback control loops will provide energy management information to and from EVs to enable rapid power transfer with high reliability
- Education of consumer is occurring through websites such as Facebook, LA Auto Show, YouTube
- Multiple interfaces include smartphone apps, mobile web, desktop web, and the EV itself

Charging Stations & Infrastructure

Charging stations and their supporting infrastructure are a challenge in knowing how many to build, where to build, and what types to build. The charging station industry is proceeding cautiously because the expense for such a build out is high.

Key Findings:

- Standards development is underway (with NIST, Society of Automotive Engineers) to include cord sets of multiple manufacturers
- Charging station owner initiatives exist for: turn-key installations, assistance for federal and state tax credits, 30-day money back guarantees
- Charging station characteristics: level 2 (240V/30A) charging, 8 inch LCD touch screens, card reader, reinforced concrete pedestal, stainless steel housing, and network connectivity
- Charging station security (to prevent theft) is a must

Insights:

- Utilities and charging station industry participate in various national workgroups to discuss standards, emerging trends, and new technologies
- Concern exists about overbuilding public charging infrastructure too early that could backfire (as there are too many unknowns about demand and location)
- Some expect need for public recharging to diminish as battery technology improves and home recharging increases
- Highway corridor recharge points (for range extension) may be more important than in-city/at-work recharge stations
- Level 3 (480V) charging option will greatly decrease recharge times

Trends:

- Studies are underway to measure charging station usage
- Data are being collected on potential charging station corridors (similar to early cell phone tower build outs)
- Communication requirements are being measured among EVs, charging stations, and utilities: each transaction must be collected in real time

Summary

Electric vehicles will have a marked effect on the power grid and greatly increase electricity consumption. Direct benefits are lower carbon emissions, less dependency on foreign oil, and better environmental conditions. New technologies associated with EVs have some lag, however, before becoming widely available in vehicles. The integration of communications, internet, and energy management systems is a challenge across the several utility, automobile, and charging systems.

Utilities will have to change their mode of interacting with consumers and shift from a monthly bill to a daily (even hourly) interaction, as EVs become more commonplace. Making sure consumers have a high level of trust with utilities will lead to an effective on-going customer engagement. Reliable feedback control loops will be needed as the "glue" that holds the Smart Grid together.

Charging station standardization is underway and a necessary condition for the effective and efficient rollout of EVs. Research is being conducted that will provide some answers about where, when, what type, and how many recharge stations are needed by the customers.

Outlook

Generally, the U.S. is inexorably moving toward utilization of this new type of vehicle. The biggest hurdle currently is the price of EVs. When the price is comparable to a gasoline powered vehicle, many more people will realistically consider purchasing an EV. Two critical occurrences could greatly accelerate the adoption of EVs: a huge increase in the cost of gasoline, and breakthrough technological advances in batteries which would increase charge duration and decrease recharge times.

The EV Experts Plug-in

In the next series of Q&A's, the following companies will share their insight on the current and future trajectory of the EV:

Airbiquity
Boston Power
BPL Global
Brammo Motorcycles
CODA Automotive
ECOtality
Itron
Northeast Utilities
Pep Stations
Southern California Edison
WiMAX Forum

Airbiquity

Kamyar Moinzadeh, President & CEO

1. ZP: How will telematics play a role in the rollout of the EV?

AB: Every electric vehicle will be connected. An EV is a new technology product for the average consumer with different needs than any current vehicle. Nearly everyone cites the concept of "range anxiety" as a chief obstacle to adoption. The best way to solve range anxiety is to create transparency to vehicle performance. If the consumer learns to trust the information and has sufficient access to the information, both inside and outside the vehicle, then anxiety will be replaced by range certainty and lead to consumer behavior adaptation. Said simply, if you know you can believe the vehicle data, then you'll know how to plan your driving activities that mitigates anxiety.

2. ZP: What current initiatives does Airbiquity currently have in place for the EV to communicate with chargers?

AB: Airbiquity is working with the automotive OEMs and significant players in the EV ecosystem to create data flows and exchanges amongst the participants. As a company that offers an open, flexible infrastructure for the connected vehicle, Airbiquity will be the central communications cog in this new ecosystem. Whether the charger is a device at home, work or at a shopping mall, or whether the charger is a commercial provider, Airbiquity's infrastructure will manage the information transactions each and every time. The consumer will have multiple interfaces to manage transaction events and details, including smartphone apps, mobile web, desktop web and in the vehicle itself. We will learn many things in the coming months and years about how the EV is used and how support features and information creates a new owner experience. And Airbiquity's infrastructure will be at the center of all of it.

3. ZP: How is the smartphone shaping the trajectory of the EV; how is Airbiquity involved in mobile?

AB: The smartphone is at the center of a hyper-personalized consumer digital lifestyle. The best way forward for the industry will be for the vehicle to adapt to the consumer's digital lifestyle, rather than try to force new digital behaviors onto a consumer because of the vehicle they purchased. We are very active on projects integrating the smartphone and other mobile devices with the vehicle into a compelling driving experience. We have a solid foundation in using the mobile as a communications gateway and have significant development efforts focused on integrating the smartphone and apps into a managed vehicle infotainment experience. For the EV in particular, we are putting finishing touches on OEM-branded smartphone apps so that consumers can interact with their vehicles whenever convenient, including finding charging locations, setting charge times, and initiating or suspending charge operations. The smartphone app is part of a comprehensive CRM approach that is essential for any new technology product.

4. ZP: What type of next-gen infotainment EV technologies should we see from the telematic industry and Airbiquity for 2011?

AB: The timing for when different technologies make their way into vehicles is decided by our customers, the automotive OEMs. Certainly, though, there are many active discussions in this particular area. While Airbiquity expects to finalize agreements with a number of OEMs in the next year for services enabling smartphone content in the vehicle, these are unlikely to result in consumer use until 2012 or 2013. It's worth remembering that the development cycles for consumer electronics, like smartphones, are quite different from the automotive OEM development cycles. It's typically a two-three year lag between consumer electronics adoption and vehicle availability. That said, nearly every OEM has active projects in this very area. So, when it comes, it will come quickly and be broadly available.

5. ZP: What is the biggest EV milestone to date by Airbiquity?

AB: We are very pleased to have announced a partnership agreement with Hitachi earlier this year. Together, we are actively working a number of projects, which we hope to discuss publicly before the end of the year. While we cannot disclose our customer wins, we have several active EV projects underway for release in the coming quarters. In some sense, our major milestone is the growing awareness, pushed by the EV, that to accommodate a new and expanding ecosystem, as well as incorporate a huge number of popular consumer content and services providers, the service delivery infrastructure must be open and flexible. Our private cloud for automotive service delivery decouples the applications, contents and services from the infrastructure and provides a nearly unlimited degree of freedom for the automotive OEMs to create truly unique in-vehicle infotainment experiences that are tailored to make, model, trim, year, geography or a number of other filters. When the vehicle is an extension of the consumer's digital lifestyle, then we've really reached a major milestone.

Boston Power

Dr. Christina Lampe-Onnerud, Founder & CEO

1. ZP: What was the greatest milestone for Boston Power in 2010?

   BP: Boston-Power had several very significant milestones during 2010, supporting its growth and continued momentum in multiple key markets. Of those we announced publicly, probably the greatest was Saab's unveiling of the new Saab 9-3 ePower at the Paris auto show -- its first all-electric car powered by Boston-Power batteries with 130 miles/200kms range on one charge and a charging capability of 3 to 6 hours.

2. ZP: How important was it for the U.S. government to spend up to $5 billion to date on loans and grants to boost the battery and EV industry?

   BP: Government support globally is playing a vital role in driving momentum and creating a fundamental shift in the way people see and use electric automobiles. The U.S. specifically has chosen to support very few battery vendors, which will be insufficient to tip the electric vehicle market. In our opinion, money should be targeted to the deployment of systems and fostering U.S. collaboration.

3. ZP: How important is battery performance technology (e.g. curbing 'range anxiety') to encourage the success of the EV?

   BP: Reliable, high-energy battery performance is critical to the success of electric transportation. The electric vehicle market has remained relatively nascent due in part to the drive range limitations, as well as the cost, of current battery technology. Boston-Power will be instrumental in delivering advanced battery technology to specifically address these performance and cost issues -- offering superior energy density to deliver extended drive range, space and weight savings, as well as lower $/kWh. In fact, the successful fast tracking of the Saab 9-3 ePower is a result of Boston-Power's batteries providing significantly more energy density than any other EV batteries on the market at a considerably reduced total cost of ownership.

4. ZP: What will be the greatest hurdle for the EV battery industry for 2011?

   BP: The greatest hurdle that the EV battery industry is likely to face will be the need to quickly integrate innovation and deploy pilot fleets big enough to meet end-customer curiosity. In 2011, there also needs to be more systems integration between battery technology, electronics, and drive trains, as well as efforts towards laying the foundation for grid infrastructure with small pilot trials. Long term, total cost of ownership combined with reliability will ultimately control the success of wide deployment in 2020 and beyond. Advanced energy battery systems, such as Boston-Power's, offer a significant advantage with industry-leading energy density combined with proven high-quality mass production benefits which support a high-performance, cost-competitive solution for the market today. We are pleased to be at the table where decisions are made, but we would like to see more participation across the industry.

5. ZP: What is the role of Boston Power with the charging station industry?

   BP: Boston-Power's advanced battery systems are designed to be charged up to 80% in 30 minutes, making them flexible enough to be supported by virtually any charging station technology in development today. While we are not directly involved in building the charging infrastructure, our battery technology can take the energy as quickly as a charger can send it.

BPL Global

Keith Schaefer, CEO

1. ZP: What current (or future) technologies or initiatives does BPL Global® (BPLG) have in place to prepare for V2G (vehicle-to-grid)?

   BPLG: BPLG offers utilities Power SG® iDER™, an integrated control platform to manage any distributed energy resource including electric vehicles. We co-developed and successfully demonstrated the solution with FirstEnergy. It enables the bridge between distribution automation and distributed resources like EV's and HEVs. This bridge optimizes management of the diverse set of energy resources on the grid including customer load, energy storage and distributed renewables/generation. EVs are unique as a potential dual energy resource – customer load and energy storage. They are also unique in that they are mobile and will not fit the tradition grid model. Power SG iDER is designed to connect to and manage stationary distributed resources as part of a managed area or mobile assets like EVs which may demand a recharge during a load reduction event or may be in a parking garage as an available source. This flexibility allows a utility to offer individual EV customers options for when and where to charge their cars as well as for providing energy back to the grid. Working together, utilities and their EV customers can use energy more efficiently for a greener environment! Isn't that the point of the V2G relationship.

2. ZP: How important is it for utilities to be actively involved in not only EVs, but also V2G?

   BPLG: Leading utilities are preparing now for EVs and V2G. They are building the underlying foundation into their grid with advanced distribution automation capability. The two-way interaction between distributed energy resources on the distribution grid and distribution automation is core to the modern grid. In the short term, this means integrating with customer loads, grid sensors, switches and voltage/phase control assets. The same integrated control platform will then be applied to renewable/distributed generation, energy storage and EVs. In our experience, utilities deploying distributed resource management and distribution automation projects are generating solid ROIs by improving efficiency and helping the environment. So, it is very important to be in the implementation phase of new distribution automation technology. It is a win for the utility, their customers and regulators.

3. ZP: Though implementation of V2G is many years away, what could be example barriers to V2G adoption by consumers?

   BPLG: By their very nature, EVs must connect with the grid. The technology will be in place making it easy for customers and utilities to integrate electric vehicles with the grid. We believe that the root challenges of V2G are not technological. The challenges will be bridging service level expectations from the EV owners with energy availability from the grid. In the case of EVs, the consumer owns the energy asset (the EV) while the Electric Utility owns the resource by which the EV is enabled (energy). What we must learn and implement within the technology is the set of services that EV customers will value. Will they want to charge at their convenience? Will they charge their cars when the price of electricity is lower? Will they sell power to the grid? Are they interested in a greener environment? The answer is yes to all these questions. Our Power SG technology will provide utilities and their customers the flexibility to form relationships that are mutually beneficial to both the utility and EV owner.

4. ZP: BPLG has a history of accomplishment, including a current win of Metropolitan Edison Direct Load Control Project. What parallels can you draw upon between the EV rollout and the Smart Grid successes?

   BPLG: The same technology that enables Met-Ed to manage individual customer air conditioning and pool pump loads applies directly to the EV rollout. Each A/C unit or pool pump is uniquely identified in Power SG and we have closed loop monitoring and management. This allows Met-Ed to offer customer's energy management programs that save money and help the environment. At the same time, the utility benefits with a solid ROI by reducing peak load, delivering energy more efficiently and minimizing the risk of broader outages. Most of the time, the customer's thermostat controls their A/C and Power SG monitors the load. Only on 10 to 20 days a year, when regional energy consumption is high, or during peak load emergencies, are customer A/C systems and pool pumps managed by Power SG. Likewise, the value of V2G technology will be managing EVs to charge during off-peak times and fuel the grid when load peaks. It is important to understand that grid optimization requires different responses in different locations. When an EV plugs into a feeder and substation with plenty of capacity, it should be permitted to charge at any time. EVs clustering on a congested feeder create significant opportunity for optimization. An integrated control system like Power SG must be smart enough to identify and then manage the difference.

Brammo Motorcycles

Adrian Stewart, Director of Sales & Marketing

1. ZP: How will the rollout of EVs affect interest in electric motorcycles?

   BM: Because of the superior power to weight ratio compared to automobiles we believe that electric motorcycles will be at the forefront of EV adoption. Particularly with appropriate fleet applications and a wide range of consumers. Obviously there are cultural variations and the motorcycle tends to be a recreational vehicle in the US yet has greater utility value in Asia for example.

2. ZP: What is the overall sentiment from traditional motorcycle enthusiasts to crossover to electric?

   BM: It would be foolish to generalize about motorcycle riders particularly between riders in different countries. Even within each region the answer is not black and white. Some riders are electric evangelists and can't wait to get their hands on a Brammo electric motorcycle which is why within 120 days of launch over 1000 people had already pre-ordered a Brammo Empulse, others riders are open to persuasion and some swear they will never ride electric. Some of these riders are what we refer to as "electric virgins" in the industry, as their fears and doubts are nearly always based on their imagination - as they have never ridden an electric vehicle. Getting bikes into dealers and riders on to bikes is the next step in getting riders familiar and comfortable with electric bikes.

3. ZP: What differentiates Brammo's products from companies such as Zero Motorcyles?

   BM: What makes Brammo unique is that our bikes are designed from the ground up by Brammo and they are designed to go into mass production. It is relatively easy to build a one off bike or even hand build bikes in small batches. But to put a bike into continuous commercial production while maintaining our reputation for styling elegance, quality and affordable pricing requires a totally different approach. Our strategic relationship with Flextronics underlines just how advanced we are in this regard. To be able to hand over production to another company in another country requires that the motorcycle has been designed and documented to exceedingly high standards. I believe without this approach it will be very hard for companies to grow their business and almost impossible to build dealer and consumer confidence in their products.

4. ZP: How important are rebates and tax credits from the government to encourage electric motorcycle opt-in?

   BM: If the incentives are large enough they obviously become very important to the consumer. We always compare and contrast our bikes with ICE bikes and only occasionally with other electric bikes, because this is how consumers evaluate our products. Anything that makes us more competitive with ICE bikes is good news whether its incentives like we have here in the USA or penalties on ICE bikes like we see in some Scandinavian countries and in certain Asian regions, both approaches are effective.[2]

5. ZP: What's the greatest hurdle for the electric motorcycle industry for 2011?

   BM: Building our reputations and brands with dealers and consumers. This is a process that cannot easily be accelerated but as an industry we have also seen the damage that low cost imported, poor quality products can have on consumer confidence.

6. ZP: How would you describe a Brammo customer?

   BM: Delighted, we try not to make assumptions or generalizations about a typical Brammo customer. Our extensive use of social media enables us to engage with hundreds of potential customers in their native language on a one to one basis and these dialogues are critical to our success. So while the product may be fundamentally the same your experience of Brammo is unique and as deep as you want it to be.

[2] ICE: Internal Combustion Engine

CODA Automotive

Kevin Czinger, CEO

1. ZP: Why should consumers not be concerned with 'range phobia'?

   CA: An electric car with a dependable 100+ mile range is more than adequate for most peoples' day-to-day driving needs, so this issue is more about education than anything else. On our website, codaautomotive.com, we have built a tool that allows folks to enter-in their routine destinations to help them determine if the CODA meets their needs. What we've found is that most people realize for the first time that they only need a range of more than 100 miles a few times a year. For families with multiple cars, this situation is easily resolved, and for single-car households, simply renting a vehicle is an economical solution.

2. ZP: With vehicles being rolled out from companies such as Nissan and GM this year how is CODA differentiating itself?

   CA: First and foremost, we believe that CODA is the only car on the market that will offer customers a dependable all-electric range of 100 miles per charge across seasons. This is because we do not source our battery system, we build it ourselves, and our system is designed specifically for use in cars – it is not an adaptation of a cell phone battery. The CODA features an active thermal management system which keeps the battery at an optimal temperature ensuring that range will not be limited in cold/hot weather conditions – a system which the Nissan LEAF lacks. The battery also has a capacity of 34 kWh, 30% more usable energy than a Nissan LEAF. We also have an onboard charger that is twice as fast as the LEAF's, so our car will charge significantly faster even though the battery is larger. Perhaps the most significant differentiator is that CODA is a brand focused only on electric cars and reducing dependence on oil. We will not sell cars that emit CO2, and we will revolutionize the sales and ownership processes so they are truly customer centric. If you buy a CODA, you will be at the vanguard of a movement to end dependence on oil and change the way auto companies operate. Joining that club is a bold statement.

3. ZP: What role will the rental car industry have in the rollout of EVs?

   CA: The rental car companies will play a large role. Many customers will experience an EV for the first time with an extended test drive courtesy of a rental agency. The agencies could also develop solutions for EV drivers like reduced rates for those few times a year that an EV driver wants to take an extended trip.

4. ZP: What V2G (vehicle-to-grid) initiatives is CODA currently involved in?

   CA: V2G technology is something that holds tremendous promise. We intend to be at the forefront of that research, and are opening an office which, among other things, will explore the technology specifically.

5. ZP: With the in-vehicle-experience becoming the center point for the automotive industry what does CODA have to offer in infotainment; also how is the charging station industry becoming involved in this space?

   CA: There are not dozens of options and packages to sift through when buying a CODA – we simplified things for our customers and each CODA comes fully loaded. Standard in every CODA is an 8-inch touchscreen infotainment system. Designed to keep driver interaction to a minimum, the interface is simple and easy to use, and serves as your access point to your green screen, navigation system, phone, music, traffic, weather and news. The green screen exemplifies the fuel gauge of the future. It tells you your remaining charge and offers advice on driving more efficiently to get the maximum range from your battery. One of the most unique features is a customizable telematics information feed that will keep you updated while you're on the road. Weather and traffic conditions, news, stocks, sports scores and movie times are all at your fingertips.

   The charging infrastructure industry will play a critical role in the space. Public charging stations in businesses such as movie theatres and malls will provide a valuable service to customers. As Level-III charging capabilities continue. Players in the Utility Systems Integration business such as IBM and GE, and many others, are collaborating with the Forum in this initiative.

ECOtality

Paul D. Heitmann, Utilities Market Developer

1. ZP: What makes ECOtality's EV charging equipment/solutions superior to other EV charging equipment currently available on the market?

ECO: Blink EVSE (our branding for the charging systems, network, and surrounding services) is equipped with various communications capabilities that support smart charging programs offered by electricity suppliers and distributors. This communication can be accomplished either via a Smart Grid network or through the Internet. Additionally, Blink EVSE provides revenue-grade metering of electricity demand and energy use.

Blink Network™ devices installed in the residence are capable of binding to a Home Area Network for operation under sophisticated Energy Management protocols, with potential for integration to a Utility AMI program. The Blink Network™ will also control access and point-of-sale revenue collection for Commercial deployments. Electrical demand and energy data, as well as time of day, will be collected from each charge event to allow analysis of charger use patterns to support business model refinement.

The technology is also complemented with a robust back end network and management services delivery capability to ensure operational excellence for the charging network. With its two-way Internet communications, scalable network operations center (NOC), and flexible charger database, the Blink Network™ is designed to allow flexibility to both grow and change to meet the needs of vehicle owners. ECOtality NA uses this flexibility to continuously improve and update its billing and charger application systems. Our worldwide EV charging experience will be applied to our chargers to ensure that, throughout the operating period, applications remain state of the art and are specifically adapted to the needs of the utility service territory.

2. ZP: In your opinion, what type of impact will the EV Project play in introducing EVs and EV charging infrastructure to U.S. consumers?

ECO: ECOtality is operating the EV Project for three direct goals:

1. To build out large scale electric vehicle charging infrastructure in and around major cities, and along critical transportation corridors.

2. To study individual EV recharging behaviors, and use profiles for private and public EVSE facilities.

3. Evaluate the viability of various commercial EV recharging business models

The secondary goals of the program are:

1. To signal to the public that electric drive transportation is a strong government supported initiative.

2. To evaluate the potential for integration of the EVSE network with emerging Smart Grid and Clean Energy technologies.

When the EV Project is completed, a comprehensive analysis will be performed and the results will be made available for public consumption. The expected audience for the findings include: EV OEM's, Utilities and Regulatory Agencies, Local and State Governments, Commercial Recharging Enterprises, and the potential future EV purchaser. These entities will be using this extensive data to identify the most efficient methods for implementing their respective products, programs and service offers or, in the case of the EV owner, will be looking for strong evidence that the adoption can be done with little sacrifice in convenience or functionality.

The network of chargers that is left behind at the end of the EV Project forms a backbone of the initial infrastructure build out, and is designed to incrementally scale and expand in accordance with expected EV adoption rates in the US. This will provide a huge jumpstart for efficient operation and expansion of the recharging network.

3. ZP: What roles will advancements in EV battery life play in increasing EV consumer adoption and the use of public charging stations (Level 2/3)?

ECO: A primary concern (and thus adoption barrier) seen by many potential EV owners is the longevity of the vehicle battery. Most are familiar with the relatively rapid performance degradation of cell phone and laptop rechargeable batteries, and are fearful of this effect leading to expensive, premature replacements of the vehicle battery. This fear is partially offset by the long warranty coverage offered by EV OEMs, but the costs of these warranties are simply embedded in the price of the vehicle. As battery technology advances, and extended usage data is collected through programs such as the EV Project, these adoption barriers should be greatly reduced, leading to lower overall battery costs and greater adoption.

The acceptance of Public Recharging facilities as convenience recharge points should initially be high, as their presence signals a reassurance for the EV purchaser that they will always have a ready source of energy to recharge depleted batteries – even if range begins to drop from the initial capacity.

As the batteries become more proven, and their on-board range capacity is extended, there should be a decreasing reliance on public charging for those with overnight residential or daytime workplace AC Level 2 charging. DC Fast Charging will initially be deployed at key range extension locations (i.e. highway corridors) and select convenience locations within city limits, and as more batteries come to market that can support high recharge rates, with less impact on the reliability of the battery, these facilities should flourish as the true analog to traditional refueling gas stations.

Lastly, as the batteries become more robust, and the vehicle manufacturers begin to allow stationary discharge from them, the EV can perform some valuable Demand Response support functions, which will earn revenue streams and thus enhance the value proposition for the initial vehicle purchase. This will accelerate the adoption of the technology.

4. ZP: What type of emerging services or technologies will be needed to serve EV drivers in the next three to five years (that are not currently available today)?

ECO: There are several technologies that are emerging currently which should become commonplace and be very useful for driving EV adoption, and enabling effective utilization of Electric Vehicles. These fall into several domains:

Interactive Touchscreens:

- These will increasingly provide important information from the On-board telematics that allow the driver to monitor and optimize the driving and recharging activities.
- EVSE based programming, and data access to utility and vehicle will allow the optimal management of recharge activity, and the easy participation of the EV is a variety of utility driven aggregation programs.
- Instructional, and educational, interactive demonstrations will become the norm, which will assist people in the adoption of the technology, and will also help rapidly disseminate the benefits of converting to electric drive.
- Advertising can be streamed to the public chargers which are tailored to the specific target audience. This can be used in conjunction with affiliate programs at various commercial charging host sites, which can help offset the costs of installing and operating a public charging station and make that a more attractive ROI.

Communications:

- Advances in secure, low data rate public wireless communication network offers will lead to widespread implementation of "connected anywhere" public and private charging locations which can offer rich application service sets.
- AMI Networks will also be accelerating from the early deployment volumes seen now. The ZigBee radio technologies will ensure that the Smart Energy Protocol stack can be run effectively to connect the Smart Grid applications to the "transportation appliance" that the EV represents.
- Secure, near real time bi-directional communications will enable aggregated vehicles to participate in the Energy and Capacity ISO markets, and provide a significantly robust feedback control loop for utilities interested in smart charging.

Processing:

- Home Energy Management systems will be developing that allow optimal load management against electricity rates and local equipment efficiencies. This will drive increasing capabilities for the home (or building) owner to balance energy use between home cooling/heating, appliance motors, and transportation recharging in periods of energy scarcity.
- IP V6 will allow unique addressing of devices such as smart chargers and refrigerators, and permit careful load balancing.

High Power Electronics:

- SiC power electronics that can support rapid power transfer to and from storage with high reliability.
- Shortening average recharge durations from higher power chargers will encourage longer trips, and will reinforce initial purchase decisions for buyers who are concerned about driving range extension.

- Higher ubiquity of these more powerful EVSE devices will cause more concern from utilities about potential grid reliability impacts. Although the amount of cars available in 5 years will not cause widespread peak load reinforcement, these devices in residential homes could cause issues for local distribution transformers.

Battery Economics:

- Lowering battery costs will be driven from reaching production scale, which will begin to enable wider use of grid- attached storage.
- The storage will be economical in conjunction with commercial EVSE facilities (and possibly even residential community based ones).
- The integrated storage elements will be managed carefully within microgrids that include distributed generation elements. This could lead to significant increase in generation system mix of renewable energy.
- The first sets of batteries from EVs that have reached end of life might be deployed into reused grid attached storage elements. These early trials may prove out the economic value of this reuse mode, and could therefore start to offset the up-front cost of the batteries.
- Some of the more advanced nanotechnology batteries could begin to appear as mainstream production at lowered costs, and offer significant reliability and durability benefits. These could begin to find their way into Electric Vehicle or Fixed Storage applications, and lower the barriers to V2G services.

5. ZP: What role, if any, will the rapid increase in Smart Grid investments play in increasing adoption of EVs?

ECO: ECOtality views the core function of the Blink Network as enabling an adaptive, intelligent and convenient system of EVSE charging stations, exposing "Smart Grid" intuitive applications for utilities and EV owners. The common term of "Smart Grid" is increasingly applied with reference to charging control and load balancing of the EV recharging function. Recognized by NIST and the US DOE for their anticipated controllable loads, and potentially the reverse flow power supply that these EV storage batteries can bring to the electric grid, managed EV recharging certainly has the potential to become the "killer application" for Smart Grid.

ECOtality recognizes the future configurations that will be required, and has positioned the Blink Network architecture to support the full range of smart charging applications which will bring the utility and their customer into close alignment in their EV recharging service goals. The increased investment in Smart Grid technologies will enable the development of these valuable Demand Response programs and the Blink Network will assure the rapid deployment and scale of these programs, getting them into the hands of the increasing population of EV owners. Potential new adopters of the technology will begin to see ways to have their Smart EV recharging earn economic return and offset their up-front costs.

Ultimately, as the availability of near real time, bi directional network communication increases, and appropriate user programs are developed, the participation of aggregated vehicles in the Ancillary Services markets can be achieved through third party or Utility sponsored services. This has the ultimate goal of tying in the EV batteries as offset and balance to the intermittency of the increasing proportion of Renewable Energy mixed into the generation sources. This is a truly Smart (and Clean) Grid operation.

Itron

Ed May, Director of Business Development

1. ZP: Itron is already in the EV game with Itron's OpenWay® Smart Grid technology, how has the collaboration with DTE Energy been helpful in extending the value of the Smart Grid by giving consumers a mechanism for participation?

   IT: Utilities adopting OpenWay Smart Grid technology, such as DTE Energy, are equipping themselves with a capability to perform customer engagement, net metering and demand response throughout their service territories—all with a flexible network capable of accommodating multiple applications and new types of devices. Electric vehicle (EV) adoption will leverage all of these capabilities to ensure that energy delivery meets the needs of smart automotive charging, at both in-home and public charging stations. Itron and DTE Energy actively collaborate with the automotive industry, as well as universities and research laboratories, to find solutions to a broad spectrum of EV-related challenges. Itron and DTE Energy also collaborate in standards development, especially the National Institute of Standards and Technology (NIST) Smart Grid Framework, to ensure long-term interoperability of Smart Grid and EV solutions.

2. ZP: How will the introduction of EVs at the end of the year by Nissan and GM affect the way in which V2G (vehicle-to-grid) is rolled out?

   IT: Commercial availability of EVs from several auto manufacturers will result in EVs appearing in utility customer's garages – that is the first critical step to catalyze V2G. A number of similar steps must follow: "smart charging" infrastructure must be available to grid enable EVs; customers must become actively engaged and educated in the optimization of their EV batteries; and utilities must integrate systems and processes for V2G transactions. In addition to these steps, there must be an ongoing engagement between utilities and their EV-equipped customers. Thus, the first utilities to demonstrate V2G readiness will be those which are proactive in rolling out programs that integrate metrology and communications infrastructure with both residential and public smart charging stations. Leveraging technology as a means to establish an ongoing, productive dialog with customers must be at the top of a utility's V2G agenda.

3. ZP: What current technologies and initiatives does Itron currently have in place for EVs?

   IT: Itron is integrating metrology and communications into smart charging infrastructure to ensure that utilities understand charging patterns and grid implications. Asset protection, particularly for secondary transformers, is a primary concern of utilities. In addition, Smart Grid deployments are often accompanied by utility programs for customer engagement and demand response; smart charging equipment must facilitate expanding these programs to take advantage of the large load shifting and load shaping potential of EVs. Thus, customer presentment and energy management initiatives must seamlessly accommodate electric vehicles, to expand the footprint and impact of existing programs. Itron is working toward a smooth transition to an EV-ready Smart Grid by adding EV capabilities to our entire portfolio of products, including metering for multiple assets (from the smart charger to the transformer); communications networks; Itron Enterprise Edition™ meter data management systems; the Customer Care Web portal; and our Active Smart Grid Analytics™ engine.

4. ZP: With standards being developed, what is the biggest hurdle V2G will face in the next couple years?

   IT: Existing standards development work underway in NIST and Society of Automotive Engineers (SAE) will close the larger gaps in the near future. In fact, 2009 and 2010 have seen standards emerge which cover the majority of the bases of electric vehicles, especially the SAE J1772 standard for cordsets, which enables multiple charge cord manufacturers to create products compatible with all the EVs hitting the market in late 2010 and early 2011. Existing Smart Grid standards are already well positioned to serve the needs of EV consumers seeking energy management solutions.

   The biggest hurdle for V2G remains customer awareness and battery technology, both of which are necessary to create an informed consumer who knows when and how to leverage their energy storage capacity to return energy to the grid. As stated above, utility programs and systems also must be in place to correctly value EV capacity, and credit consumers for EV micro-generation, in much the same way that Photovoltaic (PV) generation is used today. However, even in the absence of utility participation and energy markets, the potential will soon exist for consumers who have charged their EV batteries in off-peak times to utilize the energy within their homes during on-peak times. This 'half step' towards V2G will become a reality for many EV owners in the near future.

5. ZP: What has the Smart Grid industry learned in 2010 about V2G that it can apply to next year?

   IT: The primary lesson of the Smart Grid industry in 2010 as been the importance of open dialog between customers and utilities. This same lesson applies to leveraging the potential of EVs for V2G applications. The importance of customer engagement cannot be overstated, as it establishes

the trust relationship necessary for customers to become active participants in the energy consumption and delivery equation. More than any emerging technology, that is the critical paradigm shift that will determine the extent to which V2G will become a reality, and shape our energy future in a positive direction.

Northeast Utilities

Watson Collins, Business Development Manager

1. ZP: How will the rollout of EVs impact utilities in the U.S. for the next couple of years?

NU: Utilities will be responding near-term to the automakers' roll-out plans which determine when and where new EV models come to market, and in what numbers they're available for purchase. Of course, the biggest variable is consumer response. We have a general rule-of-thumb that for every 5 percent of market share for EVs, we expect about a 1 percent corresponding increase in electricity use. To put that level of market acceptance in context, today's hybrid cars (not plug-ins) are now about 2-3 percent of passenger vehicles after being on the market 10 years. For California and a few other markets, the numbers will be higher.

In terms of the existing electric system, utilities will be looking at how quickly customers in our service areas are bringing EVs home and recharging them in significant numbers. For example, if there's a high concentration of EVs in one specific location, we'll try to anticipate peak charging and prevent overload through local system upgrades or new pricing offers for customers. Historically, utilities have kept pace with customer interests – from the introduction of new kitchen and laundry appliances in the 1950s-60s, mass-market popularity of air conditioning in the 1970s-80s, to today's ever-expanding use of computers and other electronics.

2. ZP: What should consumers expect from Northeast Utilities in 2011?

NU: Northeast Utilities (NU) has been studying transportation electrification for more than two years as we believe this is an important strategy for reducing carbon emissions and greenhouse gases. We're well-positioned to support the arrival of new EVs. They are a good fit with New England's generation supply mix, and we can safely and reliably offer our customers a clean, lower-cost fuel alternative. NU has three electric utility subsidiaries – Connecticut Light & Power, Western Massachusetts Electric Company, and Public Service of New Hampshire – and one of those states is an early roll-out market. Connecticut consumers will be among the first in the U.S. to see the Chevy Volt in some local showrooms as of January 2011, due in part to our work with General Motors and the governor's task force. It will be later in 2011 for the Nissan Leaf and other models and markets.

We recently kicked off a research project to study EV charging station usage. We're partnering with interested municipalities and business customers to install about two dozen charging stations in Connecticut and western Massachusetts. Additionally, we're exploring options for customers who purchase EVs to encourage them to charge at home overnight.

3. ZP: What is the relationship between utilities and the charging station industry?

NU: Both sectors participate in various national workgroups that came together to create industry standards, discuss new technologies and share perspectives on emerging trends. So-called Level 2 charging with the J1772 connector is a prime example of charging station companies interfacing with the utilities and, of course, car manufacturers. Locally, utilities that are deploying charging stations will work directly with the equipment companies to ensure system integration and a positive customer experience.

Federally-funded programs to install charging stations are gaining momentum in support of President Obama's goal to have one million EVs on the road by 2015. Does this mean that the thousands of EVs expected to come to market in 2011-2012 need multiple thousands of charging stations installed in advance? We believe overbuilding the public charging infrastructure too early could backfire. Important elements of the equation are still evolving, such as: consumer purchase levels in the aggregate and by EV type, since plug-in hybrids are dual fuel; and charging station technology including functionality, software requirements and pricing. Utilities planning for future large-scale deployments want to see charging station costs coming down over time, as with any new technology introduction.

4. ZP: What is Northeast Utilities' greatest success to date in the EV space?

NU: That would have to be our early and ongoing collaboration with key stakeholders and leadership at national, regional, state and local levels. We were an integral part of Connecticut's Electric Vehicle Infrastructure Council, created by the governor's executive order. By demonstrating our home state's interest in EVs, we successfully reached out to GM for the Volt launch, co-hosted a preview event with the Nissan Leaf, and were chosen for BMW's ActiveE field test next summer. In June 2009, we founded the Regional Electric Vehicle Initiative with other New England-based utilities, and we are working closely with Massachusetts' Department of Energy Resources, Project Get Ready in Rhode Island, and local Clean Cities coalitions of the U.S. Department of Energy. We've had exploratory discussions with other groups about a multi-region EV charging corridor. These alliances prove that cooperation and coordination are key to getting "plug-in ready" with the right programs and policies in place. Where we go from here depends in large part on consumers' EV choices.

5. ZP: What is the greatest hurdle that Northeast Utilities has overcome with its EV initiatives?

NU: We believe the greatest hurdle is yet to come, and that is having a charging infrastructure that matches the broader EV consumer market. Rather than focusing on what could be and rushing to make it happen, it's critical to go beyond the EV early adopters. Let's expand the dialogue to include the pragmatists and skeptics alike. Most importantly, let's be realistic about giving consumers simple, convenient and economical solutions. As a utility leading the advancement of EVs, NU is taking a utilitarian approach to this promising innovation.

Northeast Utilities

Pep Stations

Ryan McCaffrey, Director of Operations

1. ZP: What current 'consumer initiatives' does Pep Stations have in place?

PS: PEP Stations have several consumer initiatives in place for the charging station owner. Some of these initiatives include:

- Assistance with applying for and obtaining federal and state tax credits
- Optional turn-key installation
- 30 day money back guarantee

2. ZP: How will telematics play a role in the rollout of the EV in the U.S.; also how are telematics shaping Pep Stations?

PS: Since the vehicle has an on-board intelligent device, it can be connected to internet applications for things like locating available charging locations, charging status and energy management. PEP Stations will link to vehicle systems as they become available.

3. ZP: What technology would be considered Pep Station's 'killer app'?

PS: PEP Stations do not have a 'killer app' similar to some of the competitors. PEP Stations do not have a subscription based business model, therefore, such an application is not necessary. PEP Stations include the following features, which differentiate PEP Stations from the competition:

- Dual Level 2(240V/30A) charging ability
- 8.0" LCD touch screen
- Card reader which permits multiple types of access.
- Highly visible coiled cord
- Durable reinforced concrete pedestal
- Indestructible and identifiable stainless steel component housing

Network connectivity for:

- Monitoring station usage
- Rate management
- Access management
- Advertising management

4. ZP: What is Pep Stations doing with automakers and utilities to ensure that EVs and charging stations are compatible?

PS: PEP Stations are engineered by Ricardo, Inc. Ricardo has over a 100 year history of providing engineering expertise to the world's major automakers. Ricardo has significant involvement and participation with all relevant national standards for electric vehicle supply equipment (EVSE) design. PEP Stations have tested with major automakers and comply with any SAE J1772 compliant vehicle.

5. What is the biggest milestone of 2010 by Pep Stations in the U.S?

PS: In 2010 PEP Stations completed product engineering, testing, launched a sales program, began to receive orders and executed pre-production installations.

Southern California Edison

Edward T. Kjaer, Director of Electric Transportation

1. ZP: Can you briefly expand on the outreach programs SCE is implementing to educate consumers about EVs and EV integration?

SCE: There are a number of considerations that customers considering the purchase of a PEV must wrestle with: what level of charging is best for them, what electric rate will help save the most money, who to contact to get started with vehicle charging, to name just a few. SCE's education and outreach efforts help customers better understand the fueling options that are available to them and the impacts of the choices that they make. We have developed new tools for customers, like the Plug-in Car Rate Assistant, which assists customers in understanding the impacts to their electricity bills of vehicle charging and how different rate choices can change their bill. SCE's website (www.sce.com/pev) is filled with rich content on everything from the differences between a plug-in hybrid and a battery electric vehicle, to three simple steps for getting "plug-in ready". SCE is also joining the PEV conversation via social media--launching a PEV Get Ready Facebook site to target and engage early adopters. The LA Auto Show will once again be an event where SCE will converse with the media and potential PEV buyers to extend our messages. Whether we are conversing face-to-face with customers at OEM ride & drive events or providing educational videos on our website and YouTube, the goal is to inform our customers about fueling their PEVs--and to contact the utility when they begin the purchase process.

2. ZP: What are two or three of the core benefits utilities can gain in preparing for and deploying EV and EV integration programs?

SCE: Electric Vehicles are an exciting new technology SCE customers are going to be adopting--Southern California will be an early launch market for most OEMs, many of which have announced PEV model releases over the next few years. By readying itself and its customers, SCE is able to reduce the impacts on our local distribution grid by encouraging off-peak charging behavior through electric vehicle rate options. At the same time, this can save customers money on their electric bills--a win-win that helps strengthen the customer relationship. In the longer term, advances in electric vehicle technology and the introduction of new load management programs may contribute to the integration of renewable resources or local grid stability. By staying engaged in the PEV market, utilities gain and extend their knowledge of PEVs and will find new ways to improve the integration of these vehicles into our grid.

3. ZP: What type of emerging services or technologies will be needed to serve EV drivers in the next three to five years (that are not currently available today)?

SCE: Many people will find electric vehicles that are suitable for their lifestyle now, and there are services and technologies available to enhance their experience. 75% of people in the U.S. drive less than 40 miles a day, so charging at home is a viable option for many electric vehicle drivers. SCE provides time-of-use rates that allow our customers to save money when charging at home, and there are a number of third parties that sell charging equipment for the home. The ongoing proceeding at the California Public Utilities Commission on alternative fuel vehicles is laying the groundwork for the role utilities should take in providing electric vehicle services and technological solutions. Additionally, advancements such as the deployment of public and workplace charging equipment will alleviate range anxiety. While SCE is neutral on services needed by electric vehicle drivers, a number of electric vehicle service providers are emerging with unique, promising business models.

4. ZP: What role, if any, will the rapid increase in Smart Grid investments play in increasing adoption of EVs?

SCE: The coming of Smart Grid technology will allow SCE and other utilities to provide pricing information and other load management programs which can, in turn, result in a lower cost for fueling alternative fuel vehicles. This will support the growth of electric vehicles.

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WiMAX Forum

Declan Byrne, Director of Marketing

1. ZP: How is the WiMAX Forum getting involved with the onset of the new EV revolution?

WF: Electric Vehicles will revolutionize the way power is consumed, that is clear. Consumers readily understand that EV's represent a bold step forward to smarter energy consumption and a more ecologically efficient method for personal transport. Utilities appreciate that the growth of EV's in use by consumers represents a major challenge. PG&E has estimated that each EV plugged into the grid has the effect of 2 new Households, in terms of energy consumption, "appearing" suddenly on the grid – and the Utility has no knowledge in advance of where the EV will plug in! This clearly will be a major challenge for energy distribution companies and is a big driver, among others, to upgrade Utility communications networks so the Utility has real-time visibility and management of energy flows and requirements. WiMAX, as a readily available 4G technology in use by over 500 Commercial Service Providers in over 150 countries, has been identified by the Utility industry as an excellent solution for their burgeoning communications requirements. WiMAX is stable, commercially available, and at a price point which works for the Utility business case. The WiMAX Forum is deeply engaged directly as a trade association and via our 320 Member Companies with many of the utilities in the US and internationally. The discussions center on technical requirements which the Utility industry must achieve and how fast we, as a communications industry, can meet those requirements.

2. ZP: How is WiMAX technology being used in telematics for EVs?

WF: Telematics is a fascinating, but relatively new, market opportunity for automobile manufacturers and communications equipment suppliers. We consumers can readily envision a new world in which we establish and maintain a 4G multiple megabit connection between our vehicles and the Internet while on the road. The commercial attractions to such a paradigm are manifest – real property management and security, entertainment, emergency response, navigational assist – to name a few. To date, the absence of ubiquitous 4G coverage has limited this telematics discussion – but with the aggressive build-out of the Clearwire/Sprint network (scheduled to cover 120M POPs by end of 2010) and other WiMAX 4G networks, it becomes timely to advance these discussions.

3. ZP: What role will WiMAX technology have in the rollout of EVs?

WF: Well, certainly we believe that WiMAX technology be a major boon to the Utility industry so that it can maintain efficient, predictable and reliable power to the grid, even with the increasing use of EV's. We have discussed above the attractiveness of WiMAX to the nascent telematics industry and the potential market applications. To the extent WiMAX assists Utilities more efficiently manage their networks (and WiMAX is already doing so in multiple Utility networks) this will assure consumers that an investment in an EV is a sound investment strictly in terms of available power – which is clearly a predecessor question for consumers contemplating an EV purchase. We believe that WiMAX will therefore be a critical commercial driver to EV uptake by consumers.

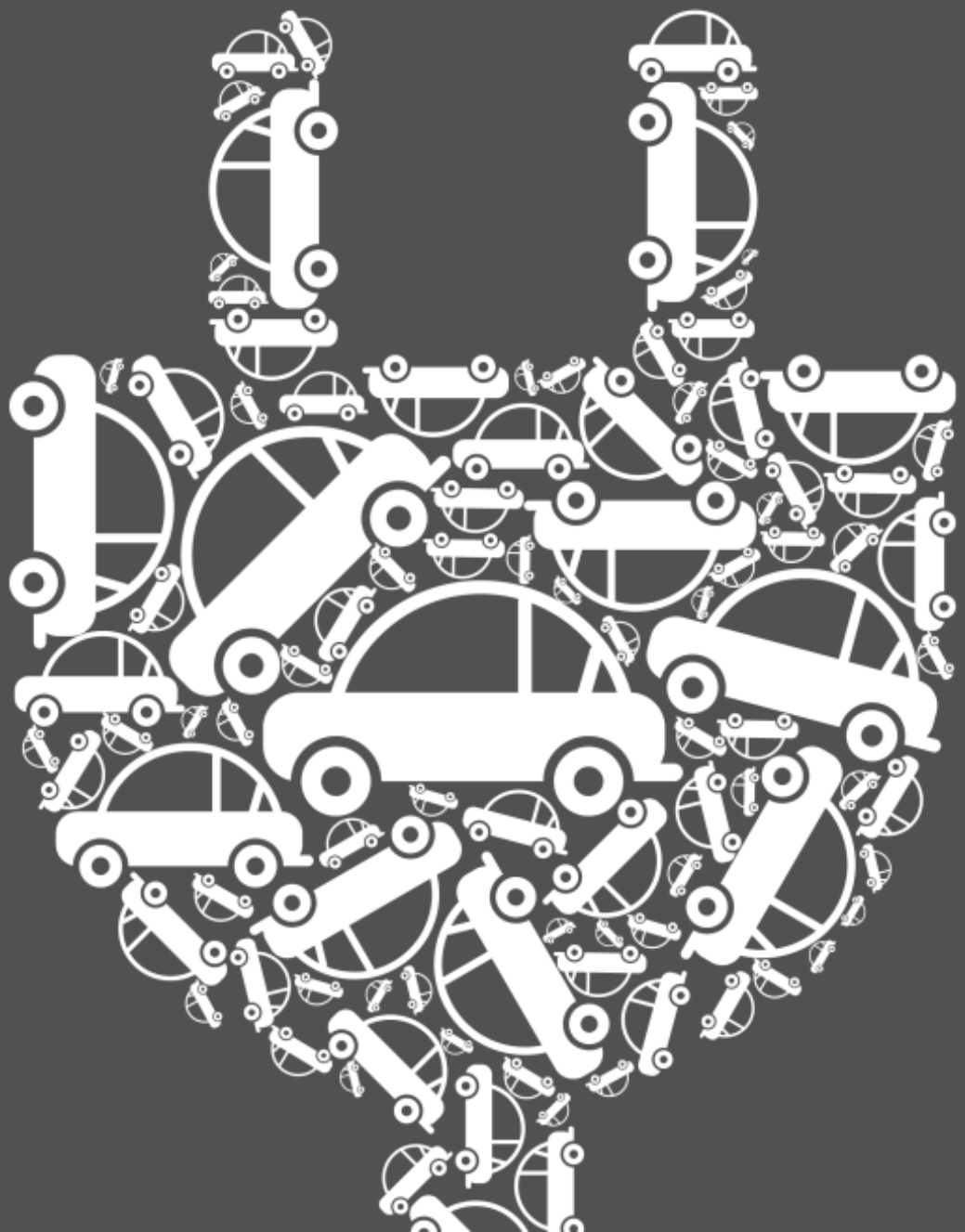
4. ZP: How can WiMAX differentiate itself from LTE in the automotive space?

WF: Both technologies are remarkably similar and it is clear to us in the WiMAX industry that LTE will in the future, have the capabilities and industry maturity which WiMAX currently enjoys. The major difference to us is that WiMAX Networks are robust and coverage is broad under functioning networks – this is the major difference. The needs of the Utility industry are urgent and funding assistance from Stimulus and other sources is available today and should be spent efficiently and quickly. The only solution available to Utilities today is WiMAX – this is a fact. One other major difference obtains. LTE will be a technology which functions over Commercial Service Provider (AT&T, Verizon, others) networks and any use by industry will be adjunct and secondary to the principal application – which will always be the provision of commercial voice and data services to consumers and businesses. The utility industry has little interest in placing their Smart Grid communications needs in the hands of private cellular providers, irrespective of the technology question. WiMAX is ideally suited, given its ability to operate on relatively available and inexpensive frequencies, to the Private Networking requirements of the Utility Industry.

5. ZP: What U.S. companies are leading the way in automotive/WiMAX integration?

WF: Companies specialize in Automotive/WiMAX integration. The major equipment, device and silicon members of my organization are quite focused on the Smart Grid segment as evidenced by the intense collaboration we are helping to foster. Additionally, the traditionally strong

EV Marketplace



EV Marketplace Highlights

Electric Vehicles (EV/PHEVs)

203,200
Projected number of EV/PHEVs to be sold in 2016

36.2%
Projected annual growth rate of EV/PHEVs from 2011 to 2016

730,700
Projected number of EV/PHEVs on the road in 2016

EV Charging Stations

$3.95B
Projected market value for EV charging stations in 2016

39.5%
Projected annual growth rate of the EV charging services market from 2011 to 2016

442,900
Projected number of residential charge points installed in 2016

EV Charging Services

$505.2M
Projected market value for EV charging services in 2016

75.4%
Projected annual growth rate of the EV charging services market from2011 to 2016

574,900
Projected number of EV charging service users in 2016

CHAPTER 4: EV MARKETPLACE

About the EV Marketplace

Zpryme forecasts for EVs and charging station infrastructure were derived using the U.S. Energy Information Administration's Baseline (reference case) Economic Growth scenario for Alternative Fuel Vehicles from 2010 to 2035. The forecasts provided the underlying baseline data for the following market value forecasts. The baseline data was then synthesized with inputs from publicly available information. Further, heavy investigation into the Smart Grid industry was analyzed as the Smart Grid is considered as a main driver of growth for EVs and EV infrastructure. Last, infrastructure development and projected deployments were assessed to identify the feasibility of a market to support the projected number of EVs in the U.S. The forecast period for this section, 'EV Marketplace' is 2011 to 2016. The forecasts do not account for such new regulations or targets as we lack sufficient information to implement such inputs into the forecast.[3]

Market Size & Segmentation

The potentially lucrative EV/PHEV vehicle market, charging station infrastructure market, and charging services market are set to experience significant industry growth from 2011 to 2016. Zpryme predicts the number of EV/PHEVs sold in 2016 will reach 203,200, and that the charging infrastructure and charging services market is will grow from $776.8 million in 2011 to $4.45 billion in 2016 (CAGR of 41.6%).[4]

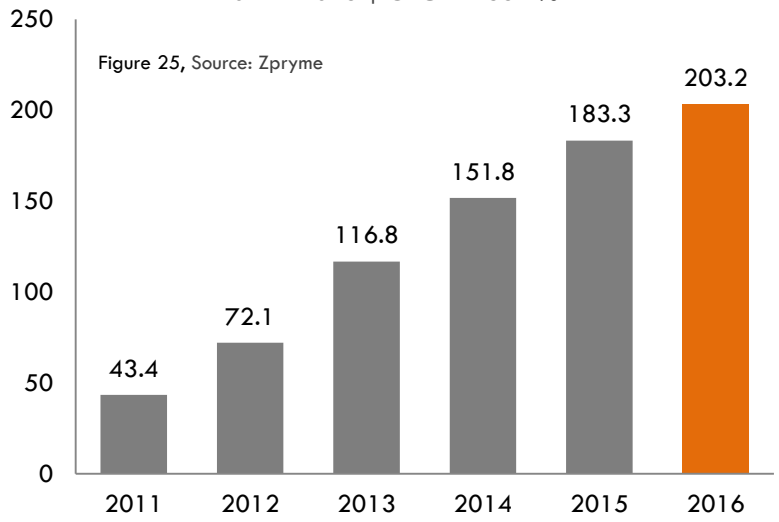
The projections show that the charging service market value is expected to grow at faster rate than the charging station market value, but the charging station market is expected to be almost eight times larger than the service industry by 2016.

U.S. Market Size and Value Projections 2011 – 2016

EVs/PHEVs

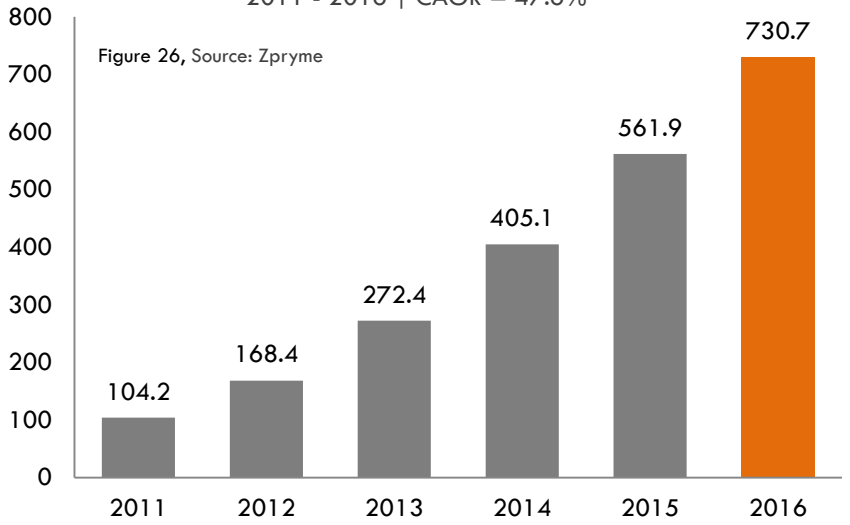
a. Annual EV/PHEV unit sales are projected grow by 36.2% annually from 2011 to 2016, from 43,400 to 203,200.

Projected U.S. EV/PHEV Annual Unit Sales (in thousands)
2011 - 2016 | CAGR = 36.2%



b. The total EV/PHEV stock are projected to grow from 104,200 in 2011 to 730,700 in 2016.

Projected U.S. EV/PHEV Stock (in thousands)
2011 - 2016 | CAGR = 47.6%

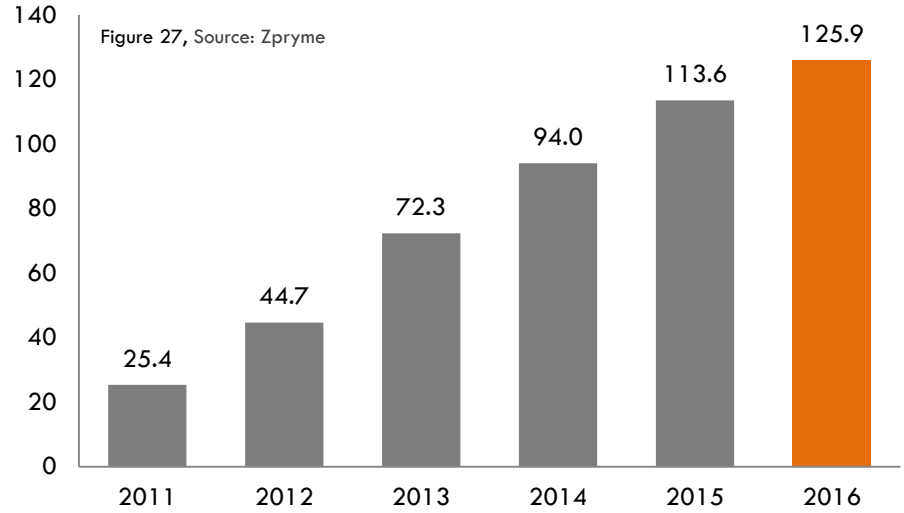


[3] For more information please see the 'Methodology' section located at the beginning of this study
[4] CAGR: Compound Annual Growth Rate

Charging Stations

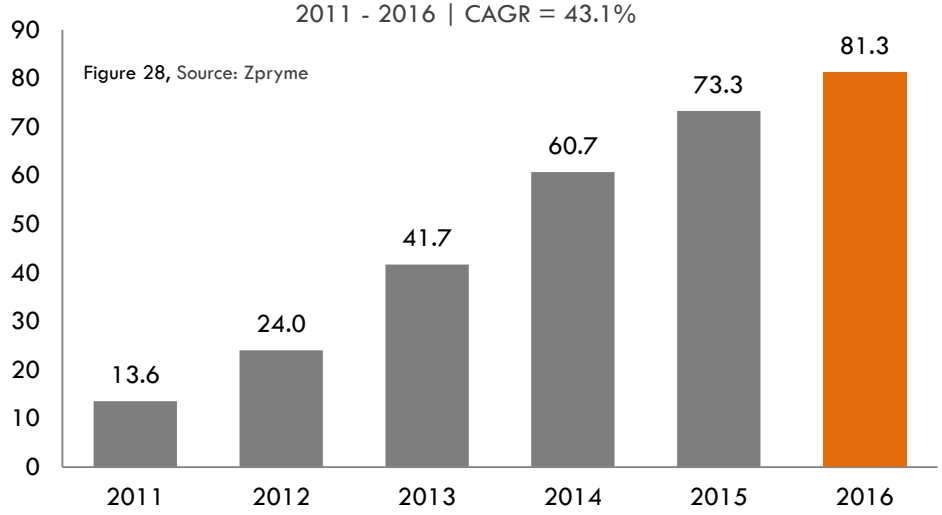
a. Home charging station unit sales are projected to grow by 37.7% annually from 2011 to 2016, from 25,400 to 125,900.

Projected U.S. Home Charging Point Annual Unit Sales (in thousands)
2011 - 2016 | CAGR = 37.7%



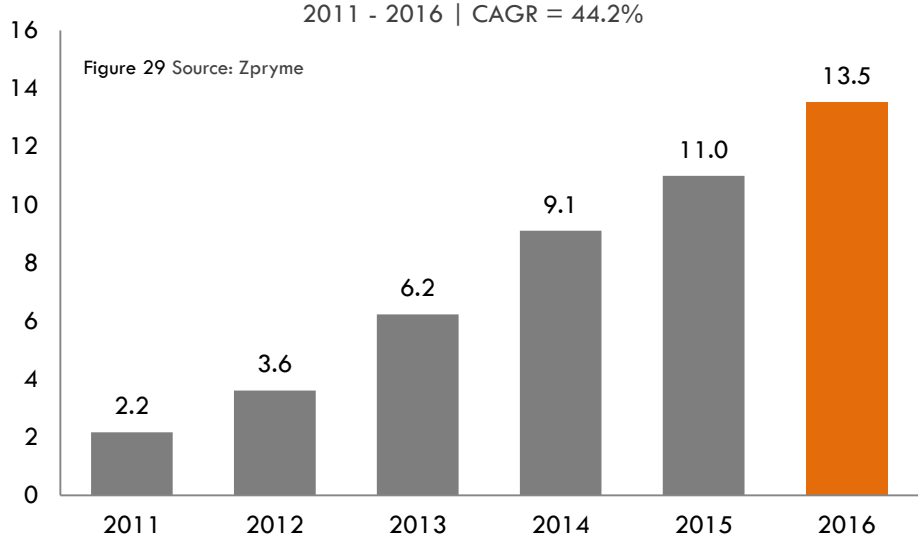
b. Public (level II) charging station unit sales are projected to grow by 43.1% annually from 2011 to 2016, from 13,600 to 81,300.

Projected Public Charging Station Annual Unit Sales (in thousands)
2011 - 2016 | CAGR = 43.1%



c. Fast (level III) charging station unit sales are projected to grow by 44.2% annually from 2011 to 2016, from 2,200 to 13,500.

Projected Public Fast Charging Station Annual Unit Sales (in thousands)
2011 - 2016 | CAGR = 44.2%



d. The total home charging station units are projected to grow from 30,000 in 2011 to 442,900 in 2016. (see table 1 below)

e. The total public charging station (level II and level III) units are projected to grow from 20,300 in 2011 to 344,900 in 2016. (see table 1 below)

Table 1: EV & Charging Station Market Value & Segmentation (2011 – 2016)

Segment	2011	2012	2013	2014	2015	2016	CAGR
EV/PHEV Units (in thousands)							
EV/PHEV Unit Sales	43.4	72.1	116.8	151.8	183.3	203.2	36.2%
EV/PHEV Stock	104.2	168.4	272.4	405.1	561.9	730.7	47.6%
Annual Charging Station Unit Sales (in thousands)							
Home Charge Points	25.4	44.7	72.3	94.0	113.6	125.9	37.7%
Public - Level II Stations	13.6	24.0	41.7	60.7	73.3	81.3	43.1%
Public - Level III Stations	2.2	3.6	6.2	9.1	11.0	13.5	44.2%
Cumulative Charging Station Stock (in thousands)							
Home Charging Stock	30.0	72.5	140.4	227.4	330.8	442.9	71.3%
Public Charging Stock	20.3	48.0	95.9	165.7	250.1	344.9	76.1%
Market Value (in U.S. millions)							
Home Charge Points	$239.6	$394.2	$631.6	$813.0	$972.0	$1,066.5	34.8%
Public - Level II Stations	$282.0	$495.0	$849.6	$1,224.9	$1,464.4	$1,606.9	41.6%
Public - Level III Stations	$193.4	$318.2	$543.8	$787.4	$941.4	$1,147.8	42.8%
Other	$31.4	$50.4	$78.7	$98.3	$114.1	$125.2	31.9%
Total Market Value	$746.3	$1,257.7	$2,103.8	$2,923.6	$3,491.9	$3,946.5	39.5%
Market Segmentation (percent of total market value)							
Home Charge Points	32.1%	31.3%	30.0%	27.8%	27.8%	27.0%	
Public - Level II Stations	37.8%	39.4%	40.4%	41.9%	41.9%	40.7%	
Public - Level III Stations	25.9%	25.3%	25.8%	26.9%	27.0%	29.1%	
Other	4.2%	4.0%	3.7%	3.4%	3.3%	3.2%	
Total Market	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Source: Zpryme

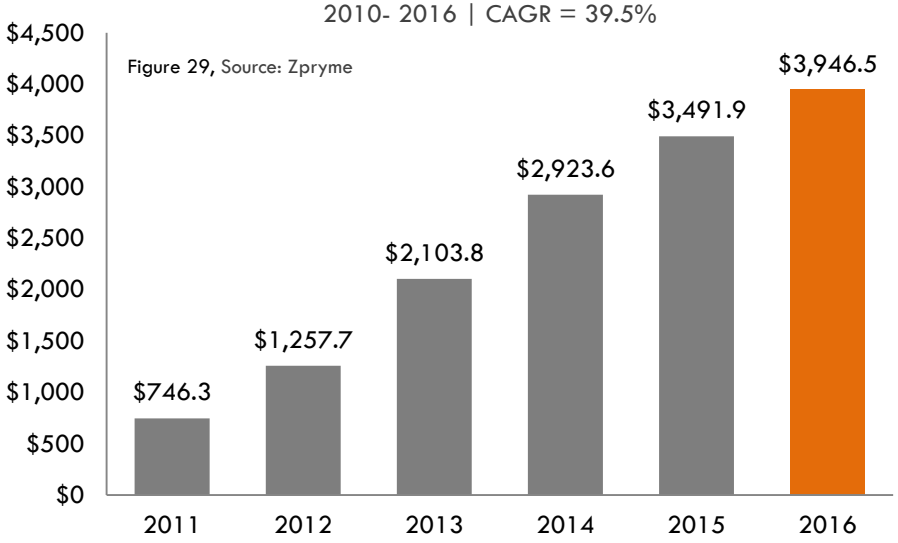
U.S. EV Charging Infrastructure Market Value Forecast

(see table 1 below)

The EV charging infrastructure market is projected grow from $746.3 million in 2011 to $3.95 billion in 2016. This represents a compound annual growth rate of 39.5% during this time period.

Projected U.S. Charging Infrastructure Market Value (in U.S. millions)
2010- 2016 | CAGR = 39.5%

Figure 29, Source: Zpryme



a. Home charging station sales will grow from $239.6 million to $1.07 billion during this time period. Home charging stations are projected to account for 32.1% of the market value in 2011 and 27.0% in 2016. (see table 1 above)

b. Public (level II) charging station sales will grow from $282.0 million to $1.60 billion during this time period. Level II charging stations are projected to account for 37.8% of the market value in 2011 and 40.7% in 2016. (see table 1 above)

c. Fast (level III) charging station sales will grow from $193.4 million to $1.15 billion during this time period. Level III charging stations are projected to account for 25.9% of the market in 2011 and 29.1% 2016. (see table 1 above)

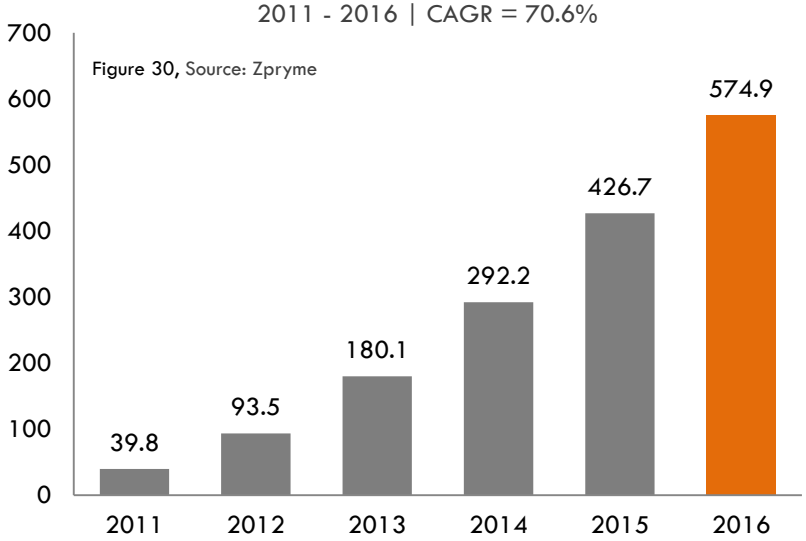
EV Charging Service Users

a. Annual new charging service users are projected to grow by 40.4% annually from 2011 to 2016, from 27,600 to 150,400. (see table 2 below)

b. The cumulative total number of charging service users is projected to grow from 39,800 in 2011 to 574,900 million in 2016.

Projected Total U.S. EV Charging Service Users (in thousands)
2011 - 2016 | CAGR = 70.6%

Figure 30, Source: Zpryme

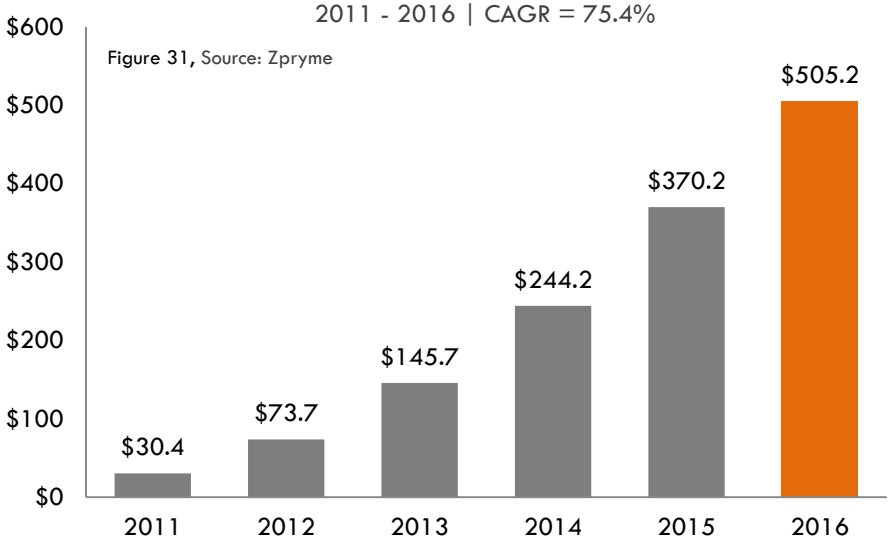


U.S. EV Charging Services

The EV charging services market is projected grow from $30.4 million in 2011 to $505.2 million in 2016. This represents a compound annual growth rate of 75.4% during this time period.

Projected U.S. EV Charging Services Market Value (in U.S. millions)
2011 - 2016 | CAGR = 75.4%

Figure 31, Source: Zpryme



a. Subscription revenues will grow from $16.1 million to $282.6 million during this time period. Subscription revenues will account for 52.9% of the market value in 2011 and 55.9% 2016. (see table 2 below)

b. Smart Grid and data management revenue will grow from $12.9 million to $197.6 million during this time period. Smart Grid and data management revenues will account for 42.3% of the market value in 2011 and 39.1% 2016. (see table 2 below)

c. Energy sharing fees will grow from $1.4 million to $25.0 million during this time period. Energy sharing fees will account for 4.6% of the market value in 2011 and 4.9% 2016. (see table 2 below)

Table 2: EV Services Market Value & Segmentation (2011 – 2016)

Segment	2011	2012	2013	2014	2015	2016	CAGR
Service Users (in thousands)							
New Charging Services Users	27.6	51.1	85.6	111.9	136.5	150.4	40.4%
Cumulative Service Users	39.8	93.5	180.1	292.2	426.7	574.9	70.6%
Market Value (in U.S. millions)							
Subscription Revenues	$16.1	$38.9	$77.9	$132.9	$202.0	$282.6	77.4%
Grid/Data MNGT Services	$12.9	$30.6	$59.7	$98.1	$144.9	$197.6	72.6%
Energy Sharing Fees	$1.4	$4.2	$8.2	$13.2	$23.2	$25.0	76.9%
Total Service Market Value	$30.4	$73.7	$145.7	$244.2	$370.2	$505.2	75.4%
Market Segmentation (percent of total market value)							
Subscription Revenues	52.9%	52.7%	53.4%	54.4%	54.6%	55.9%	
Grid/Data MNGT Services	42.3%	41.6%	41.0%	40.2%	39.2%	39.1%	
Energy Sharing Fees	4.7%	5.7%	5.6%	5.4%	6.3%	4.9%	
Total Market	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	

Source: Zpryme

Historical EV Market Results

1. The U.S. EV market has witnessed lackluster performance from 2000 to 2010. In 2010, there are a projected 65,731 EVs in use in the U.S. The EV market saw its greatest one year growth from 2002 to 2003, then the number of EVs in use increased by just over 14,000.

Historical U.S. EVs in the Use
(1992 - 2010)

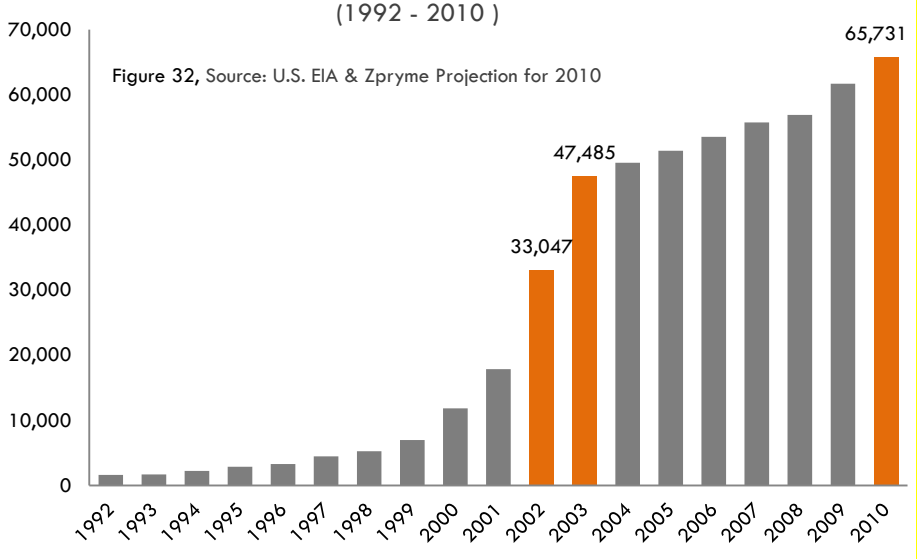


Figure 32, Source: U.S. EIA & Zpryme Projection for 2010

2. In 2009, there were only 465 public charging stations in use in the U.S. California is the clear leader in public charging station deployment (401).

Total U.S. Public Charging Stations
(2009)

State	Total
California	401
Oregon	23
Illinois	6
Arizona	5
Idaho	5
All Other States	25
Total	465

Table 3, Source: U.S. EIA

1. In 2008, the top 15 states for EVs accounted for 95.6% of the total EVs in use. For AFVs, the top 15 states accounted for 67.8% of the total AFVs in use in the U.S.

Top 15 States by Total EV and Alternative Fuel Vehicles (AFVs) in Use
(2008)

Rank	State	EVs	State	All AFVs
1	California	30,242	California	117,000
2	New York	8,094	Texas	100,393
3	Arizona	3,821	Arizona	36,943
4	Massachusetts	2,477	North Carolina	33,133
5	Michigan	1,919	Florida	32,497
6	Oregon	1,889	New York	31,325
7	Texas	1,096	Georgia	24,426
8	Georgia	1,018	Illinois	22,285
9	Maryland	775	Virginia	21,505
10	North Carolina	747	Michigan	19,731
11	Vermont	562	New Jersey	18,742
12	New Jersey	467	Ohio	17,518
13	South Carolina	457	Colorado	17,292
14	Florida	431	South Carolina	16,553
15	Ohio	429	Maryland	16,278
	Total EVs	56,901	Total AFVs	775,667

Table 4, Source: U.S. EIA

Regional Growth of EVs/PHEVs

Projected Distribution EV/PHEV Annual Unit Sales by Major U.S. Region
(2015 – 2035)

U.S. Region	2015	2020	2025	2030	2035
South Atlantic	19.8%	20.2%	20.6%	21.0%	21.5%
Pacific	16.8%	16.9%	17.1%	17.4%	17.6%
East North Central	14.8%	14.4%	14.1%	13.7%	13.2%
Middle Atlantic	13.6%	13.2%	12.8%	12.4%	12.0%
West South Central	11.2%	11.4%	11.6%	11.8%	12.0%
Mountain	7.0%	7.3%	7.5%	7.8%	8.0%
West North Central	6.4%	6.3%	6.2%	6.1%	5.9%
East South Central	5.4%	5.4%	5.3%	5.3%	5.2%
New England	4.9%	4.9%	4.8%	4.6%	4.5%
Total U.S.	100%	100%	100%	100%	100%

Table 5, Source: U.S. EIA Annual Energy Outlook (baseline scenario forecasts)

1. The U.S. EIA has projected that total EV growth in the U.S. will be led by the South Atlantic and Pacific regions. These two regions will account for 36.6% of total EV sales in 2015, 37.7% in 2025, and 39.2% by 2035. (see table 5 above)

2. EV growth will be low in the New England, East and West South Central, and the Mountain States. (see table 5 above)

A Closer Look at the EV Roadmap

Amid great fanfare, 2011 will see the first widespread introduction of EVs to the US market. While the varying models set to debut in 2011 offer a range of options and possibilities, several factors and obstacles will drive the development of EVs over the foreseeable future. A closer look at these forces and potential areas for growth reveals both promise and uncertainty for the future of EVs.

When asked about the EV Roadmap in the U.S. by Zpryme, Eedo Lifshitz, Director of Business Development at Alvarion Ltd. responded:

> "There is no doubt in my mind that the EV will gradually replace the cars we use today. It will happen because we need to reduce gas emissions; limit our dependency on the scarce oil resources and because China has made up its mind to go in this direction. The EV will have a huge influence on the power grid towards distributed generation and storage, resulting in a new set of communication, devices and applications.

When asked about significant findings from a recent EV Survey by the Consumer Electronics Association Chris Ely, Manager (Industry Analysis at CEA) revealed:

> "Based on CEA's EV Survey, 4 out of 10 consumers would want to learn more about an EV – just the fact that American drivers would like to learn more about a product that does not exist is worth investigating further."

EV Adoption Obstacles

While enthusiasm for EVs has grown, their widespread adoption faces challenges that are yet to be resolved. The most significant obstacle is EVs' higher price than that of conventional cars, which is primarily due to the cost of lithium-ion batteries. Because the batteries that power EVs are not entirely new products, they are unlikely to become dramatically cheaper over the near term. Political and economic risks to the supply of rare earth minerals pose a degree of uncertainty to the rapid growth of lithium-ion battery production that is necessary to bring down the cost of EVs. Over the next two to three years, EVs will remain more expensive than conventional cars and hybrid to initially purchase.

Besides a higher initial purchase price, other challenges exist for the widespread adoption of EVs. Concerns regarding the limited driving range of most EVs, the lack of charging stations to accommodate extended trips, and long recharging times limit the freedom and flexibility most buyers expect from automobiles. Beyond their limited range, the lack of coordinated standards between local governments and utilities prevent EVs from being driven across state lines. Installing a charging station and a system to manage electricity demand within the home or garage will also bring additional costs for buyers of EVs. Higher maintenance costs, the diminishing capacity of batteries to hold power as they age, and questions surrounding the reliability of EV technology further detract potential buyers.

Government programs and regulations supporting EVs are subject to changes that can impede widespread adoption. In the near future, the EPA will revise the mile per gallon rating system to accommodate non-conventional cars and provide a more accurate comparison of all vehicles for consumers. How this will affect the marketability of EVs remains to be seen. Furthermore, while federal and state tax credits help defray the initial cost of purchasing an EV, uncertainty arises regarding the commitment of state and federal support over the long term as government deficits increase.

Public utilities have expressed concerns about adding a large number of EVs to the grid without substantial upgrades to manage spikes in electricity demand. Although utilities have enough capacity to accommodate thousands of EVs, major complications will arise as many consumers within localized areas purchase EVs, a process known as clustering. Because early adopters of EVs will likely live within the same communities, they will collectively increase demand for power from the same section of the grid. This type of concentration causes incredible strain on electricity distribution networks, leading to temporary disruptions and even blackouts. For EVs to become widely adopted, utilities must find a way to mitigate the effects of clustering. Utilities also face possible regulation of carbon emissions that will place additional costs on coal and natural gas electricity generation that will further hurt the economics of EVs when compared to conventional cars.

Potential Customer Bases for EVs

Despite these obstacles, potential markets for EVs exist among residential buyers, commercial fleets, and government agencies.

Residential Buyers: Because of the higher upfront costs of EVs, car companies have targeted high-income, progressive individuals that live in urban areas (e.g. San Francisco, CA) as the most likely early adopters of EVs. Potential buyers must have financial means to absorb the higher initial price, a designated parking space to install a charging station, motivation to learn about and accommodate new technologies, and most likely a second car should the buyer need to travel long distances. While car companies have initiated campaigns to market EVs, recent consumer studies show that the public still misunderstands the benefits of EVs and is wary of overcoming this lack of familiarity. For this reason, the experience and reviews of early adopters (in some circles known as 'EV Evangelists') will play a crucial role in the EV's expansion to a wider portion of residential buyers.

In spite of these challenges, enthusiasm among early adopters is apparent. The two earliest EV releases, the Nissan Leaf and Chevy Volt, have been awaited with enormous anticipation. Despite production delays and a limited release, Nissan received 20,000 preorders for the Leaf and hopes to sell 25,000 by the end of 2011 at a retail price of $32,000. GM has also received strong interest in the Chevy Volt, which it will sell for $41,000, and plans to build 10,000 Volts in 2011 and 45,000 in 2012. Other EVs scheduled to be released in 2011 include Ford's Electric Focus, the CODA Sedan, Toyota's Plug-in Prius, and the Mitsubishi i-MiEV. These later releases will be watched closely to gauge enthusiasm for EVs beyond the initial excitement of early adopters.

In the EV game:[5]

BYD e6	Ford Focus EV	Tesla Roadster
Chevy Volt	Mitsubishi i-MiEV	ZAP
CODA Sedan	Nissan Leaf	
Fisker KARMA	Smart fortwo	

Commercial Fleets: Private companies will most likely be the first to widely adopt EVs. Commercial fleet operators focus on long-term returns on investment rather than upfront costs, making EVs a smart purchase that will reduce fuel consumption and mitigate exposure to spikes in gas prices. Companies can also defray the cost of additional infrastructure by efficiently allocating time at charging stations to accommodate varying routes and time schedules. Perhaps most importantly, commercial vehicles tend to run predictable routes that can lessen concerns regarding the limited range of EVs. Commercial fleets offer a significant market for EVs and can bolster their sales while charging infrastructure is expanded for the public and the price of EVs becomes more competitive with that of conventional cars. A recent study commissioned by the Electrification Coalition found that the 16.3 million fleet vehicles were in operation in 2009 and that EVs are now currently cost-competitive in many applications without government subsidies.

Because of these advantages, companies have already begun incorporating EVs into future plans. As cited before, GE recently announced that it will convert at least half of its global fleet of 30,000 vehicles to EVs and will partner with fleet customers to deploy a total of 25,000 electric vehicles by 2015. GE pledged to purchase 12,000 GM vehicles, beginning with the Chevrolet Volt in 2011, and will add other vehicles as EV options grow. Commercial delivery services are another likely market for EVs to expand. Staples recently ordered 41 all-electric delivery trucks from Smith Electric Vehicles that it will test in different locations. Earlier this year, FedEx announced the implementation of four electric delivery vans manufactured by Navistar and has indicated plans to convert a large portion of its vehicle fleets to EVs. Car sharing companies are also a natural market for EVs to be adopted. Their client bases tend to drive short distances, schedule their trips beforehand, live in urban environments, and be environmentally conscious. Zipcar has launched pilot programs for EVs in London and San Francisco using the all-electric Citroen C1 and the plug-in Toyota Prius hybrid converted with a system provided by A123 Systems. Zipcar has expressed optimism in offering a permanent fleet of EVs to its customers although no concrete plans to expand its EV fleet are in place.

Government: In January 2010, President Obama issued an executive order to reduce emissions in all government agencies by 28 percent. In response, government agencies are laying the groundwork to purchase EVs and to install charging stations. The General Services Administration (GSA) issued a solicitation for 100 electric vehicles and could decide on its purchases before the end of December 2010. The United States Postal Service selected five companies to develop five prototypes of an electric delivery truck that will begin testing in 2011. California-based technology companies, AC Propulsion, AutoPort, Zap, and Quantum Technologies, along with EDAG of Michigan and Bright Automotive of Indiana, have received contracts to develop these prototypes.

Many local governments have also taken steps to expand the use of EVs among city agencies and employees. For example, the City of Richmond plans to purchase and test up to four all-electric vehicles in their city motor pool

[5] Not an exhaustive list for the U.S.

fleet. If this pilot is successful, the City will replace as many as 40 vehicles with all-electric vehicles as the fleet vehicles are scheduled for replacement over the coming years.

Geographical suitability of EVs

A variety of factors contribute to the suitability of EVs for different markets throughout the United States. Locales with utilities and governments that are committed to offering infrastructure to recharge EVs and implementing systems to manage demand will the most prepared to adopt EVs on a large scale. In particular, city governments and utilities must be willing to offer enough charging stations located in convenient locations to accommodate the growing number of EVs; the geographical areas of opportunity can be identified as:

- Locales with enough space to accommodate residential garages
- Have efficient public transportation networks
- Average commuting distances are within 10 miles
- Predictable traffic patterns

Locales with high average household income, favorable views of limiting greenhouse gas emissions, and an open attitude towards new technologies are also well suited for EV communities. According to the Zpryme EV Consumer Survey, the western part of the U.S. will be the center of the EV market for the next two to three years. Large cities such as Chicago in the Midwest and New York City in the Northeast are also likely places for EVs to develop.

Beyond Green & Affluent – Smart Grid for Everyone Else

Special contribution made by
Christine Hertzog, Managing Director of Smart Grid Library

There's a lot of fear, uncertainty, and doubt – the FUD factor – around Smart Grid technologies and what's in store in our energy future. Everyone is concerned about rising electricity costs. Everyone should recognize that global warming is a real threat to our national security. The Smart Grid can address these concerns, but the FUD factor is slowing progress and limiting options.

So let's get creative in identifying and developing some of the benefits that a Smart Grid can bring to us into innovative programs. For instance, the University of Delaware has been conducting a pilot in collaboration with PJM, the regional Independent System Operator (ISO); PEPCO Holdings, the local utility; and AC Propulsion, an electric vehicle (EV) manufacturer. Their hypothesis was that EVs could help with load-frequency control, and thus encourage integration of intermittent renewables like wind and solar into the grid. Increasing our use of renewables decreases dependence on foreign energy sources and dirty fossil fuels, and as an added bonus, builds local jobs. The grid depends on a steady frequency of 60 KHz for grid stability, and intermittent renewables and today's dearth of energy storage present challenges for grid operators. When the wind dies down, for example, it can cause heartburn for grid operators if there are no alternative energy sources to take up the gap. The team at Delaware experimented with EVs that remain plugged into the grid when not in use, responding to requests to discharge energy from the EV batteries back to the grid. This is also known as Vehicle to Grid, or V2G, leveraging Smart Grid technologies to enable communications between utilities and EVs. The pilot included incentives of $10/day/EV to provide frequency-load control services to the local utility. That works out to $3650 each year to each EV owner.

What's an ideal demographic for this type of V2G program? Senior citizens. Think about your retired relatives and neighbors. Living independently or in retirement communities, they often have cars that are infrequently used. Why aren't utilities, regulators, EV manufacturers, and the AARP putting together programs that, with financial assistance if necessary, encourage trade-ins of senior citizens' gas-burning cars for EVs, with enrollment options to sell back EV battery power and earn money? Many seniors have driving habits that fall well within the EV charge ranges, and they have perhaps more flexibility with their daily schedules than commuters and families with children, so they can be reliable frequency regulation sources. When they need to use their cars, there's no penalty for not being connected to the grid, just the loss of that incentive for the day. Programs like these can make people understand one of the many benefits that the Smart Grid brings to consumers.

The payoffs of an EV program targeted to seniors for grid frequency-load control extend beyond the participating consumers. Utilities can add renewable energy sources with confidence and reduce reliance on dirty fossil fuels. Regulators will see more stability in electric rates as utilities can avoid additional generation investments. Air quality boards and health officials will like the reductions in car emissions. All citizens benefit from these positive consequences of an enlightened V2G program. Yes, Grandma would give up her Buick in a nanosecond if an EV actually earned money for her, and she'd love the Smart Grid for doing that.

EV & Telematics

Beyond the electrification of their drivetrains, EVs will be the first vehicles to fully take advantage of telematics by connecting cars to drivers, services,

suppliers, and manufacturers through a network of mobile communications and wireless devices. Telematics will offer owners of EVs a significantly enhanced driving experience that will deliver information and conveniences essential to the widespread adoption of EVs.

Telematics will serve as the nerve center of each EV and will wirelessly network each car to a central hub that can provide owners with information to improve performance and reduce costs. This connectivity will play a crucial role in addressing concerns over EVs' limited range. Because new drivers of EVs will have no experience managing battery levels, each EV will provide a flow of information and directions that will lessen "range anxiety." Drivers will be alerted in real time when battery levels are low and which charging stations are available, with directions and maps appearing either on smartphones or on the EVs' dashboard. External factors, such as traffic, will be incorporated into readings of each EVs position and range to give drivers the most efficient way to reach an available charging station. Furthermore, drivers will be able to reserve spaces and charging stations through their smartphones, computers (tablets e.g. Apple's iPad could also play a role), or car dashboards in order to plan commutes and reduce range limitations. The availability of real time information and planning capabilities will reduce anxieties and increase flexibility for potential buyers.

Through telematics, drivers will also manage the way they charge their cars and measure its performance. Real time energy pricing will be available to drivers and will enable them to charge their EVs in the most economical way possible. Telematics will also give drivers the option to choose the source of their electricity, be it renewable energy, natural gas, or coal, with the appropriate varying prices readily available. Telematics will improve the performance of EVs by providing owners with accumulated consumption reports that will help them plan strategies to reduce their charging costs. The Nissan Leaf will be connected through its navigation system to Nissan's CARWINGS Data Center that will record historical usage, monitor battery conditions, and even allow drivers to compete with each other in electricity consumption, distances traveled, and the amount of charge produced by regenerative braking. EVs will be integrated through an open, flexible communications platform that will be available for upgrades through third party developers that can revolutionize the car much like smartphones have revolutionized the telephone. The data collected from EVs can eventually be used to improve traffic flow, coordinate traffic lights, and improve local infrastructure.

Telematics will not only reduce range anxiety and reduce costs for buyers but also provide conveniences that will enhance the driver's experience. In particular, smartphones will play an integral role in the connectivity of EVs. According to comScore, half of all U.S. mobile customers will be using smartphones in 2011. Recent research from the Pew Internet Project found that 24 percent of adults are using apps on their smartphones, with an average of 18 apps on each mobile device. With the increasing number of people using smartphones and the improving speed of mobile connections, smartphones serve as a perfect platform to remotely engage and manage EVs. In addition to providing data on charging stations and energy pricing, smartphone applications will let drivers set reminders to plug in the car and alerts for when charging is complete or if charging has been interrupted.

The Chevy Volt and Nissan Leaf's telematics will allow drivers to remotely check the status of their cars (battery charge level, available range, and tire pressure), lock and unlock doors, and start their cars in order to heat or cool the interior through their smartphones. These EVs will also include features that will allow drivers to sync a MP3 player or USB flash drive to the stereo system and answer calls through a Bluetooth connection. Even wider possibilities exist. Audi's A1 e-tron prototype offers a navigation system that integrates Google Earth navigation with three-dimensional graphics, a factory-installed Wi-Fi hot spot that supports up to eight devices, and Internet search capabilities that allow for general searches rather than just specific addresses or points of interest. Unlike conventional cars, these next generation telematic features will be included in all models of EVs - making them more than an electrified version of conventional cars.

EV Charging Stations

While it is understood that the adoption of EVs will require a wide network of public charging stations, many of the problems underlying the construction of this network have yet to be resolved. Charging stations must be able to communicate directly with all EVs in order to enable remote reservation systems, to provide an accurate gauge of its status, to properly handle billing, and to manage the transmission of electricity. Charging station companies are now partnering with EV manufacturers to make the necessary technical adjustments and to improve communication.

Charging Station Companies

With such high anticipation for the growing U.S. EV market, developing and deploying charging stations has quickly become an extremely competitive enterprise. Both large companies and start-ups are vying for market share, including Coulomb Technologies, ClipperCreek, ECOtality, GE, Siemens, Leviton, AeroVironment and Pep Stations.

While competition is stiff, the potential profits help explain why giant companies such as GE are stepping into the charging station market. Several

months ago GE and Better Place announced a technology and financing partnership to accelerate the global deployment of electric vehicle infrastructure through collaboration in four key areas: standards-based technology development, battery financing, joint fleet electrification programs and consumer awareness.[6] ECOtality, which is managing the largest pilot project for charging stations in the U.S. through the Electric Vehicle Project, received a $99.8 million government grant to install 15,000 charging stations in 16 cities. The project has been successful to date, with the company announcing in November 2010 that revenue increased by 68% percent to $3.2 million for the third quarter 2010. The Tennessee Valley Authority (TVA) is partnering with ECOtality to install solar-powered charging stations at 125 locations in Tennessee.

In the Charging Station game:[7]

ABB	Coulomb Technologies	GoSmart	Pep Stations
AeroVironment	Eaton	GRIDbot	Plugless Power
Better Place	ECOtality	Leviton	Shorepower
ClipperCreek	GE	OpConnect	Siemens

ClipperCreek has installed 3,000 chargers since its founding and created partnerships with Silver Spring Networks and PG&E to develop communication technologies to protect the electrical grid from strain. In November 2010, Coulomb Technologies unveiled the first ChargePoint® Network charging station that accepts MasterCard® PayPass™ contactless payments.

The Role of EV Charging Station Infrastructure

The adoption of EVs over the next several years will be accompanied by a significant boost in power grid infrastructure that will be needed to support an expanding network of charging stations (regardless of whether these charging stations are public or placed in residential homes). The production and sales of EVs is expected to skyrocket in the next five years. In President Barack Obama's 2008 campaign, a pledge was made to put one million EVs on the road by the year 2015. The past few months have shown rapid development in making this pledge a reality.

However, as EVs become a reality the need for a significant infrastructure adjustment becomes apparent. The majority of charging stations, approximately 64%, will be installed in private residential homes for the convenience of an overnight charge. As prepared as a consumer might be, the need for public charging stations is clear for longer trips and emergency fuel needs. Trends from current U.S. pilots and demonstrations indicate that public charging stations, along streets and typical driving routes, will be managed by one company per city during the pilot trial period for EVs. [8]

Charging Stations: Private & Public Backing

Currently, both public and private charging station systems are being deployed at a staggered rate. In the private sector, a major player to emerge is NRG Energy. NRG's recent announcement is significant because it is the first by an electricity supplier that intends to blanket a city with chargers without federal assistance. NRG will use their own smart metering system for EV infrastructure installments in the 13 states with deregulated retail electricity markets. This approach is unique in that it makes direct changes to the public electricity grid rather than solely improving the communication technology of the charging station.

One of the largest public EV projects in the U.S. is ChargePoint America, a partnership between the Department of Energy and Coulomb Technologies to provide EV charging stations in nine different cities. The $37 million ChargePoint America program is made possible by a $15 million grant funded by the American Recovery and Reinvestment Act through the Transportation Electrification Initiative administered by the Department of Energy. ChargePoint Networked Charging Stations are available now for installation in all nine designated regional metropolitan areas of the US. More than 1,000 new public charging stations will be installed by December 2010, adding to the existing ChargePoint Network. Recipients of the program include station owners, municipalities, and homeowners with an EV who wish to install a home station, Any purchaser of a program EV (the Chevrolet Volt, the Ford Transit Connect and Ford Focus Electric, or the smart for two electric drive), whose home is located within one of the nine target regions, will be eligible to receive a home charging station at no cost.[9]

Another major pilot program in the United States for charging station infrastructure is the EV Project. ECOtality North America was awarded a $99.8 million grant from the U.S. Department of Energy to embark on this Project. The Project was officially launched in October 2009 and is expected to last three years. ECOtality will deploy nearly 15,000 charging stations in 16 cities located in six states (Oregon, Washington, California, Arizona, Tennessee and Texas) and the District of Columbia. Nissan North American and General Motors/Chevrolet are partners in The EV Project. The Nissan Leaf zero-emissions EV and the Chevrolet Volt plug-in qualify to participate in

[6] www.betterplace.com
[7] Not an exhaustive list for the U.S.
[8] Pike Research, Electric Vehicle Charging Equipment, September 2010
[9] www.chargepointamerica.com

The EV Project. Residential charging stations will be provided free of cost to EV Project participants.[10]

Making a Connection with Consumers

In addition to advocacy groups such as Plug In America educating consumers on the value of EVs, several consumer surveys have been conducted in 2010 by a variety of firms to explore the consumer market for EVs. According to these surveys, three main obstacles have been identified as preventing widespread adoption of EVs:

1. Price of EVs
2. Anxiety over their ability to go long distances (i.e. range anxiety or range phobia)
3. Infrastructure convenience (or lack thereof) to recharge an EV

Multiple consumer surveys suggest that while many consumers aspire to drive a more environmentally friendly car, price is still the most important factor in their determination of which car to buy. A recent Consumer Reports survey found that consumers ranked environmental sustainability 11th out of 12 features that consumers look for when purchasing a car. The most important was price. This finding is echoed in other consumer surveys as well. According to a study completed by Deloitte on consumer attitudes towards EVs, 69% of participants responded that price was the number one factor in choosing a vehicle, and most respondents expect to pay no more than $30,000 for an electric vehicle.[11] This finding is consistent with Zpryme's EV Consumer Survey, where 64.5% of respondents said that price was the main reason they would not buy an EV. Another survey conducted by Pike Research found that 44% of participants expressed interest in buying an EV but not at the price currently planned by auto manufacturers.[12] As one automotive executive interviewed by Deloitte aptly surmised, "Customers will buy an EV if the cost is comparable to an ICE vehicle; if it's more they won't buy it. People will not sacrifice themselves to save the environment."[13] These early market studies show that while many consumers aspire to be environmentally friendly, their willingness to pay a premium for a reduced or zero emissions car is low.

Surveys indicate that the limited range of EVs are the second most important obstacle to the widespread adoption of EVs. Consumer Reports' study suggested that most drivers would like a range of 89 miles for daily driving. This finding is supported in Zpryme's EV Consumer survey as well, where only 5.1% of potential EV drivers indicated that 100 miles was an acceptable range for an EV. Although consumers express a desire to be able to drive long distances, their actual needs are much smaller. According to Pike Research, 82% of respondents reported driving only 27 miles a day. Consumer Reports found that 63% of respondents traveled less than 40 miles a day.

The third largest concern that surveys have found among consumers is finding the time and place to charge an EV. Surveys overwhelmingly show that the public will want to charge EVs at home. A study done by Electric Power Resource Institute (EPRI) reports that 95% of Southern Californians surveyed want to charge from home. Zpryme's EV Consumer Survey found that 93.2% of potential EV Drivers considered it 'very important' for them to be able charge at their home or place of residence. Although the majority of respondents prefer to charge at home, 61% of Americans do not have this capability. Consumers also expressed an unwillingness to charge their cars for the time required by most EVs.[14] Only 17% of respondents in the Deloitte study were willing to charge their vehicle for 8 hours; however, if the amount of time to charge an EV is reduced to 4 hours consumer willingness doubles. Zpryme's EV Consumer Survey even found that 87.4% of potential EV drivers would be willing to pay a premium for access to fast charging. Many respondents, 54%, reported that they would not be willing to purchase an EV until charging stations were widely available as customers are unwilling to change their refueling habits. All of the surveys mentioned reveal that customers appear to prefer the convenience associated with gas cars.

Consumer Demographics and Education

Recent consumer EV studies reveal which demographic groups are likely to be the first to welcome EVs. According to Deloitte, early EV adopters are likely to live in urban and suburban Southern California, as it has the most EV infrastructure and a higher than average income. Moreover, the early adapter is likely to be male between the ages 40-44, be environmentally sensitive and politically active, and to be concerned about the US' dependency on foreign oil. A study of early EV adopters completed by the City of New York in partnership with McKinsey & Company has similar findings. According to the study early adapters will have an above average income and willing to pay the premium for an EV. Nearly half, 41%, of early adopters reported that the incentive to save on gas in the long-term is an important part of their decision to purchase an EV. The study also showed that

[10] www.theevproject.com
[11] Consumer Reports, EV Consumer Survey, October 2010
[12] Pike Research, Electric Vehicle Consumer Survey, November 2010
[13] Deloitte, Gaining traction: A customer view of electric vehicle mass adoption in the U.S. automotive market, June 2010
[14] EPRI, Characterizing Consumers' Interest in and Infrastructure Expectations for Electric Vehicles: Research Design and Survey Results, May 2010

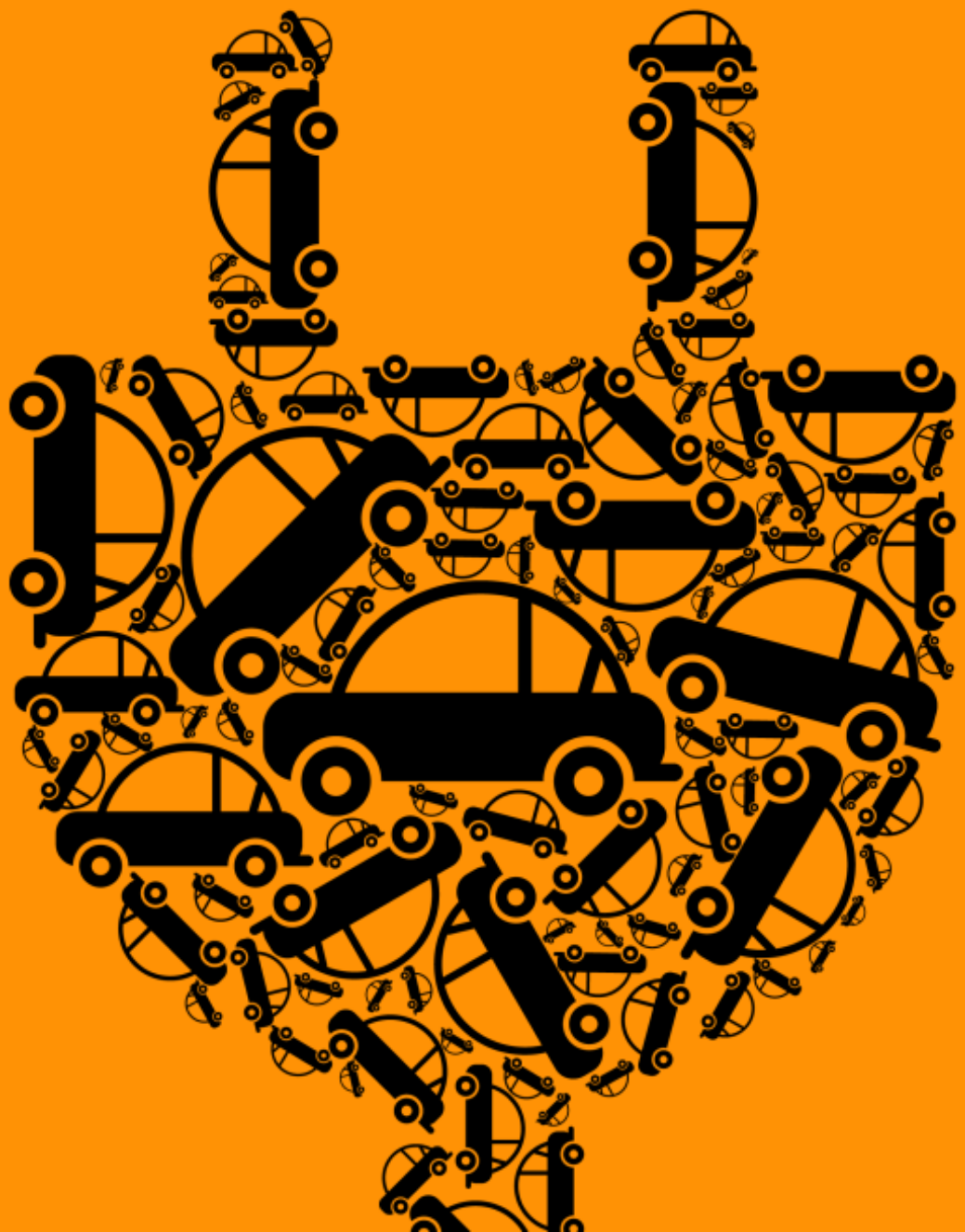
22% of early adapters are willing to pay more for an EV because they enjoy having the newest technology.[15]

Many of the barriers to the widespread adoption of EVs can be overcome with education campaigns. According to a Mercedes-Benz/Harris Interactive study, 71% of US residents are not knowledgeable about alternative fuel vehicles.[16]This lack of familiarity can change. Many experts point to Toyota Prius' successful educational campaign that taught consumers about hybrid vehicles. An educational campaign will allow the auto industry and utility companies to respond to early consumer concerns. The City of New York's consumer survey found that 21% of consumers were more likely to consider purchasing an EV after being educated about them. To further public familiarity with EVs, Ford and PG&E are working together to educate potential customers in Oregon as part of Ford's "Changing Into the Future Tour," which educates consumers before the advent of the EV in 2011.

[15] The City of New York in partnership with McKinsey & Company, Exploring Electric Vehicle Adoption in New York City, January 2010

[16] Mercedes-Benz USA in partnership with Harris Interactive, MBUSA/Harris Interactive survey, October 2010

EV Insights



CHAPTER 4: EV INSIGHTS

The Connected Consumer

Potential EV drivers are heavily immersed in technology and have a strong desire to be constantly connected. Telematics and the smartphone will play one of the most vital roles for EV adoption. As EVs become integrated into the Smart Grid, the Internet, and wireless networks; smartphones and telematics will become the EV nerve center consumers. EV makers who capitalize on these trends will likely hold a competitive advantage over EV auto makers that choose to ignore the in-vehicle experience and mobile technology.

The Smart Grid

The Smart Grid will enable utilities across the U.S. to safely integrate, monitor, and manage the increase in energy demand EVs will require to stay charged. Without an intelligent grid, utilities run the risk of facing major electrical system disturbances such as blown transformers, black outs, and significant increases in the prices utilities pay for wholesale peak-time power. Companies that create charging stations, hardware and software, communications, and networking systems that enable utilities, EV drivers, EV charging infrastructure owners, and EV charging service providers to meet these challenges will stand to profit from the development of the Smart Grid and EV adoption.

Batteries

Mainstream EV adoption will 'take-off' when the price and driving range of an EV is equal to the average conventional vehicle price in the U.S. For this to occur, the cost of advanced EV batteries must decrease while being able to go 250 to 350 miles before a recharge. Economies of scale are essential to driving down the cost of EV batteries, while heavy private sector investment in R&D is the key to increasing the range of the batteries. The auto maker and battery manufacturer who can unravel this industry obstacle in the shortest amount of time is certain to secure a leadership position in their respective industry.

Charging Infrastructure

The EV home charging station market is set to thrive along with the EV market as the majority of early EV drivers will rely heavily on home charging for their charging needs. However, the fate of the public charging infrastructure is closely tied to the success or failure of national demonstration projects such as the ChargePoint America and EV Project. Consumers will look to purchase charging stations:

- Bundled in the price of their EV from dealers
- Online
- From retailers
- Directly from the manufacturers

Market Leadership

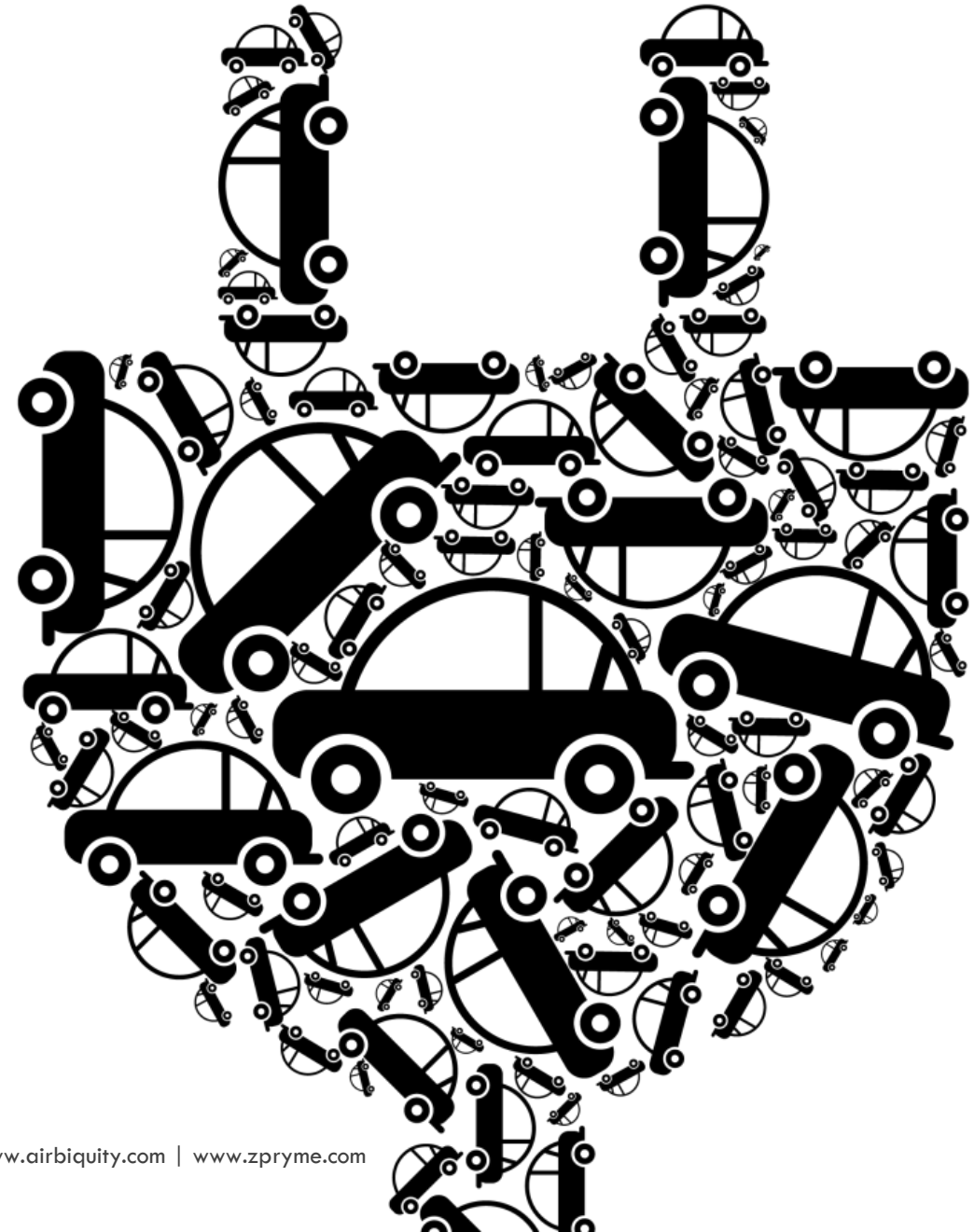
Although GM and Nissan will likely soak up the majority of the U.S. EV market share in 2011 and 2012, second movers such as Toyota and Ford will quickly and aggressively penetrate this automotive segment given the strong brand loyalty of their customers. Additionally, the second movers will benefit by learning from the challenges and gaffes the first movers will likely encounter in areas such as vehicle design, the in-vehicle experience, and a possible increase in EV driving range. Further, Toyota and Ford may be able to leverage their advanced manufacturing capabilities to drive down the price of their EV models. Lastly, it's important to note that immediate marketing and immersive branding strategies by all EV players is vital to success in this space beyond 2012.

EV Adoption

Consumer education is at the heart of EV adoption. Irrespective of advances in EV driving range and the price of an EV, if consumers hold on to their EV misconceptions they will not purchase an EV. Utilities, the auto industry, charging station companies, the government, and public outreach organizations must leverage both grass roots and social media platforms to increase EV consumer education. As EV consumer education increases, adoption will become increasingly dependent on price, battery range, charging infrastructure deployments, and brand loyalty. Zpryme predicts EV adoption to be driven by three core groups of EV consumers. First, the EV Evangelists will make up the majority of EV drivers, next the EV brand loyalists will enter the market in 2 – 3 years, and finally followed by the EV sideliners who will purchase an EV in 4 – 5 years:

Core EV Consumer Groups	Adoption
• EV Evangelists	Immediate term
• EV Brand Loyalists	2 to 3 years
• EV Sideliners (i.e. 'wait and see' group)	4 to 5 years

Credits



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The Airbiquity Difference

Airbiquity, Inc. operates a global software-as-a-service platform for the delivery of connected vehicle services. The company is the global leader in the connected vehicle services market, with more than 15 million connected vehicles on the road conducting tens of thousands of transactions per day across its infrastructure. Airbiquity has year-on-year revenue growth exceeding 100%, a forecast for continued rapid growth, and a rich portfolio of more than 70 issued and more than 100 pending patents globally that makes it an essential player within the connected vehicle ecosystem.

Airbiquity is taking a leadership role in enabling automakers to Go Green by creating connected vehicle services for environmental sustainability. Every electric vehicle must be connected. Electric vehicles are a new technology product for the consumer with different needs than any current vehicle, with "range anxiety" listed as a chief obstacle to adoption. The best way to solve range anxiety is to create transparency to vehicle performance. If the driver learns to trust the information and has sufficient access to the information, both inside and outside the vehicle, anxiety will be replaced by "range certainty" and lead to consumer behavior adaptation.

Airbiquity is working with the automotive OEMs and significant players in the EV ecosystem to create data flows and exchanges amongst the participants. As a company that offers an open, flexible infrastructure for the connected vehicle, Airbiquity will be the central communications cog in this new ecosystem. Whether the charger is a device at home, work or at a shopping mall, or whether the charger is a commercial provider, Airbiquity's infrastructure will manage the information transactions each and every time. The consumer will have multiple interfaces to manage transaction events and details, including smartphone apps, mobile web, desktop web and in the vehicle itself.

Airbiquity has several active EV projects underway for release in the coming quarters. To accommodate a new and expanding EV ecosystem, as well as incorporate a huge number of popular consumer content and services providers, Airbiquity's service delivery infrastructure remains open and flexible. The company's private cloud for automotive service delivery decouples the applications, contents and services from the infrastructure and provides a nearly unlimited degree of freedom for the automotive OEMs to create truly unique in-vehicle infotainment experiences that are tailored to make, model, trim, year, geography or a number of other filters.

Airbiquity employs approximately 75 people worldwide, and maintains offices in Seattle, WA, London, UK and development offices in Chengdu, China, and operates service nodes in North America, Europe and China. Airbiquity is recognized for its track record of success with major automotive manufacturers and component suppliers, including GM, Ford, Toyota, BMW, Shell, Hitachi, Denso, Continental, Motorola and LGE, among others.

RETHINK RESEARCH

Intelligent Research for an Intelligent Market