



## WHITE PAPER

# Electric Vehicles: 10 Predictions for 2014

Published 1Q 2014

**John Gartner**  
Research Director

## Section 1

### INTRODUCTION

During 2014, the global electric vehicle (EV) industry is poised to grow by 86% and will surpass more than 346,000 new vehicles sold. North America, Europe, and Asia Pacific will continue to drive EV sales, as the technology will have only limited availability in the emerging markets of Latin America and Africa.

The selection of models will increase as luxury automakers Audi, BMW, Cadillac, Mercedes, Saab, and Volvo will all introduce their first plug-in cars. These vehicles will expand the higher end of the market while also putting competitive pressure on Tesla Motors. More affordable options will also be introduced by Kia, Mahindra, Skoda, and Volkswagen, which will bring new customers to these established companies. Nissan's upcoming electric van, the e-NV200, will give fleets a new option for reducing their carbon emissions footprint. Increasing interest in natural gas for the truck segment will continue to reduce the opportunity for EVs in that segment, though a few companies will likely announce their intent to develop a plug-in electric truck by year's end.

Electric alternatives to owning a passenger car will continue to impact the automotive market. EVs will play a supporting role in carsharing programs, while many younger urbanites will opt for electric bikes, scooters, and motorcycles as cost-effective and easier-to-park vehicles. Local governments will continue to provide incentives to reduce the number of cars burning gasoline or diesel in cities, which will result in tangible air quality benefits.

The shakeout in the electric vehicle supply equipment (EVSE) market that occurred during 2013 will continue in 2014, as this industry is rapidly becoming a commodity market. Manufacturers will introduce wireless and bidirectional equipment in an effort to differentiate their products and increase revenue. Based on extensive study of the automotive industry, Navigant Research has identified 10 significant trends that will shape the EV market in 2014, which are described in detail in Section 2.

## Section 2

### **ELECTRIC VEHICLES: 10 PREDICTIONS FOR 2014**

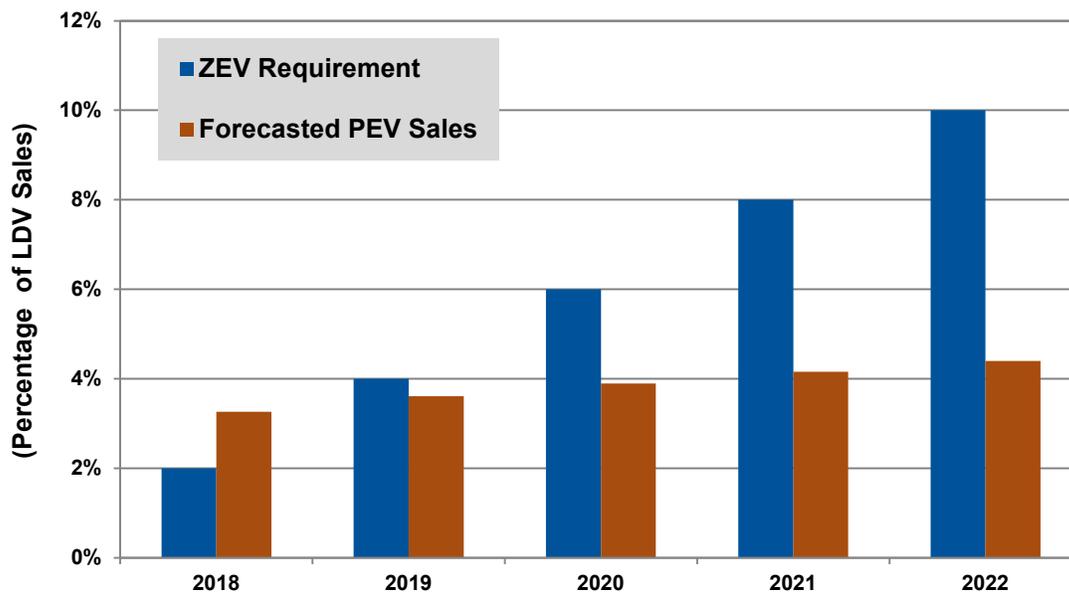
#### **2.1 Automakers Accelerate Push for Changes in the California ZEV Mandates**

California’s zero emission vehicle (ZEV) regulations require that volume automakers sell a minimum number of plug-in electric vehicles (PEVs) each year in the state. The requirement has been extended through 2025; however, the mandated sales levels are not likely to be met and will be heard about frequently in 2014. The latest rules found in California code 1962.2 require a minimum of 2% of vehicles sold in 2018 – which escalates to 10% in 2022 – to be PEVs. Since some vehicles can receive more than one ZEV credit each (there are eight ZEV tiers in all), the actual number of vehicles produced could be lower than the required percentage.

A second set of rules for improving fuel efficiency requires a variety of enhancements to new models, such as offering hybrids. This number is calculated by a byzantine set of credits and swaps between companies and states. Under the rules, automakers will be required to create emissions reductions equal to new vehicle sales of 4.5% ZEVs in 2018, growing to 22% in 2025. Seven other states (Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island, and Vermont) currently follow California’s ZEV rules for sales of vehicles locally.

However, based on Navigant Research’s state-by-state analysis in *Electric Vehicle Geographic Forecasts*, consumers are not likely to buy enough PEVs to meet the minimum level in many of the eight states that have signed an agreement to meet the ZEV goals. These forecasts, which are based on a myriad of factors including individuals’ income, cost premiums of the vehicles, historical purchases of hybrids, local incentives, models likely to be offered by the automakers, etc., indicate that only buyers in California and Oregon will purchase sufficient numbers of vehicles in order to meet the ZEV requirement in 2018 and 2019. By 2022, not even California will meet the 10% ZEV requirement.

**Chart 2.1 PEV Percentage of Light Duty Vehicle Sales, Eight ZEV States: 2018-2022**



(Source: Navigant Research)

Since automakers have already designed the vehicles that they will be selling in 2018, they will become more vocal in 2014 to push for changes. Automakers asked the U.S. Environmental Protection Agency (EPA) for relief from the ZEV mandate in 2013 and received no response. As a result, the dispute will get louder and more contentious during 2014. Taking legal action over the ZEV mandates would be a repeat of the late 1990s: automakers filed a federal lawsuit that led California to water down its ZEV requirements beginning in 2001, thus effectively ending most automakers electric vehicle (EV) programs for more than a decade. The automakers may also put pressure on the other states that voluntarily follow California’s ZEV mandate. The governors in those states can choose to opt out of following the rules at any time, though currently eight states including California are co-developing strategies to increase EV adoption.

Since litigation is often the most costly and acrimonious way to settle a business dispute, a better alternative would be to create an environment where the ZEV mandates could be met.

Possibilities include dramatic reductions in the cost of EV batteries that lead to more cost-competitive vehicles, greater state or federal incentives, or increasing taxes on fossil fuels.

## 2.2 Tesla Motors Will Have a Volatile Year

Aside from the bad press over three Model S fires, 2013 was by and large a highly successful year for Tesla Motors. The Model S was a critical triumph, garnering the most awards of any car in 2013, including the Motor Trend Car of the Year award and Consumer Reports' highest-scoring car ever; sales have also steadily increased throughout the year. From a low of \$32.91 in January, Tesla's stock soared to a high of \$193.37 in September, and then a significant correction in 4Q dropped the price back down to a more modest \$143 near year's end.

Several new challenges will be presented to the innovative automaker in 2014. First, Tesla plans to vastly expand the supercharger network in North America to address charging infrastructure concerns. Currently, there are 37 supercharger stations located exclusively in the United States, and Tesla plans to have 80% of the U.S. population (over 150 superchargers) and parts of Canada (11 superchargers) covered by the end of 2014. With each supercharger station estimated to cost \$500,000, at least \$62 million will be required to meet this goal.

Scaling up the production of vehicles will perhaps be the largest challenge for Tesla in the coming year. More than 19,000 Model S vehicles have sold worldwide since its debut in June 2012, and Tesla is expanding its facilities in northern California to be able to produce more than 56,000 in 2014. Automakers and their suppliers face greater quality control issues as production expands, and any perception of a reduction of quality would be magnified by the media.

Selling in new markets will also be a test for Tesla. The first deliveries of the Model S in China are anticipated to take place in 1Q 2014, but as of the start of the year, the company cannot use its brand name due to a local trademark issue. Tesla is also readying the Model X, a more affordable crossover for launch by the end of 2014. Unfortunately, EV makers – including Tesla – have not had a stellar record of launching new models on time. Manufacturing and distributing vehicles in multiple regions of the world presents many logistical issues, though established automakers have overcome similar challenges in the past.

Lastly, after slowly developing their vehicles, the first real competitors in the luxury EV space will be targeting the same potential customers as Tesla in 2014. Plug-in models that will be fighting for market share include the BMW i8 and i3, the Audi e-tron, the Cadillac ELR, the Mercedes B-Class Electric Drive, and the Porsche Panamera S E-Hybrid. Since consumers will have more options when it comes to luxury EVs, Tesla may see a decline in overall market share for 2014.

Throughout 2014, Tesla Motors fortunes will have tongues wagging (and international car buyers salivating) as the brand becomes a global phenomenon. The company has had a nearly flawless record of execution thus far, but as the stakes get higher, even the smallest of missteps will likely be exaggerated as the company will continue to be one of the focal points of the EV industry.

### 2.3 Electric Motorcycles Breakout as Transportation Alternative

The last few years have seen growth in the two-wheel EV market, but that growth has largely been attributable to either e-bicycles or e-scooters. Sales of e-motorcycles have been increasing, but the market remains a tiny fraction of the e-bicycle and e-scooter market (5.2 million e-bicycles and e-scooters compared to about 30,000 e-motorcycles were estimated to have been sold in 2013 outside of China). However, there are a number of factors that point to the potential that higher powered e-motorcycles may see a big year in 2014.

First and foremost, there are more products available for purchase with new entrants ready to boost the market profile. While in the past e-motorcycle growth was focused on range and cost-effectiveness, 2013 turned a corner on these issues with Zero Motorcycles and Brammo both offering higher power (>60hp) motors and a range of 100-plus miles. Superbikes have been coming fast and furious as well, with Lightning Motorcycles, Mission Motorcycles, and a new player, Agility Motors, demonstrating high-powered (and expensive) e-motorcycles. Traditional motorcycle players are now on the verge of entering the market as well, with Yamaha and BMW offering products in 2015.

In a sign that regional economies are rebounding, the motorcycle markets in North America and Europe are showing signs of life after several years of decline. While Europe likely ended 2013 down for motorcycle sales, the decrease will be smaller than in past years and some key markets (Germany, Austria, and the United Kingdom) are on the rise. Additionally, the 11% decrease in Europe for motorcycles in 2013 is significantly better than the 20% year-on-year decline for smaller powered two-wheelers. China is also seeing a slowing motorcycle market, yet the export market for Chinese products ended slightly ahead of 2012.

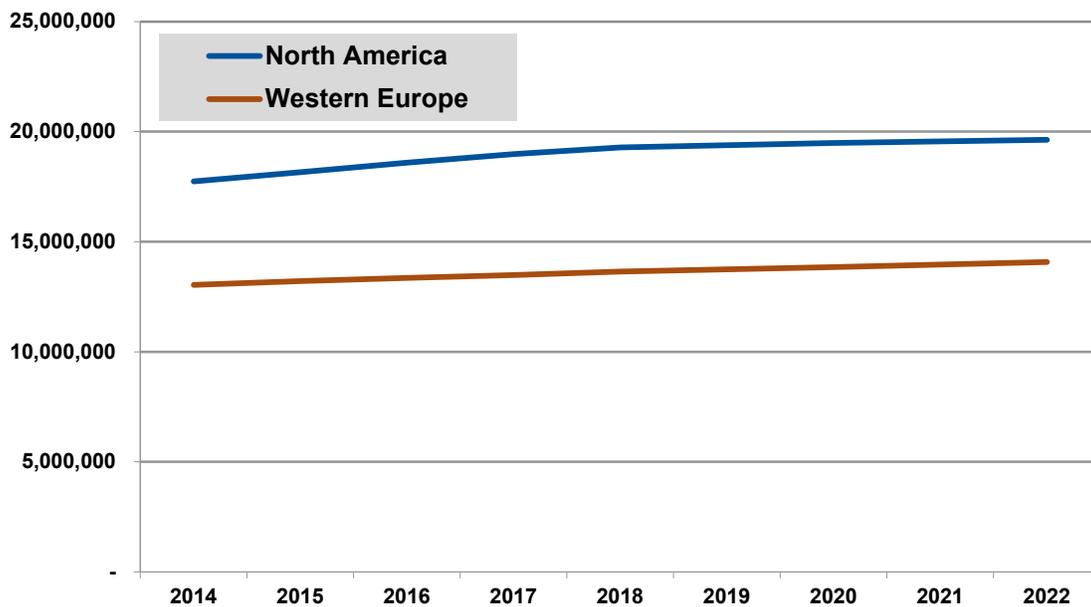
The luxury internal combustion engine (ICE) motorcycle market may be growing in both the United States and Europe, as well. The Indian brand (a competitor to Harley Davidson) is back as of August with deliveries beginning in early 2014, so the market for bigger, more expensive motorcycles is likely to see a rebound. While these factors do not directly impact the e-motorcycle market, they do point to potential strength in the motorcycle market for 2014. Another signal more specific to the e-motorcycle market is that Brammo is eyeing an initial public offering (IPO) in the last half of 2014. While IPOs do not sell motorcycles, it does point to the potential market strength of a major player in the e-motorcycle market.

The result of all the factors is that 2014 could prove to be a significant year for the e-motorcycle. E-motorcycle companies' product lines have come a long way, and lower-powered e-motorcycles that have not been commercially successful are being revised or dumped all together. In broader context, battery prices have come down providing competitive price points for e-motorcycles, and Tesla has proven that EVs can be lust-worthy vehicles. The result is a marketplace that is more competitive with better products. The finances of e-motorcycle companies are also more stable thanks to the recent focus on the fleet market, which provides a reliable base to pursue new market strategies and new customers in 2014.

**2.4 EV Makers Pursue Revenue Beyond Vehicle Sales**

In the mature automotive markets of North America and Western Europe, sales of new vehicles are close to peaking. Sales of all light duty vehicles are expected to grow at a compound annual growth rate (CAGR) of just 1% annually in Western Europe and 1.3% in North America between 2014 and 2022, according to data from Navigant Research’s *Electric Vehicle Market Forecasts* report.

**Chart 2.2 Annual Light Duty Vehicle Sales for Select Regions: 2014-2022**



(Source: Navigant Research)

EVs will, however, represent an increasing portion of new vehicle sales. Since EVs require less maintenance and replacement of parts, which currently provides considerable revenue to dealers and automakers, car companies are looking to diversify their revenue streams. PEVs are inherently connected cars with state-of-the-art telematics and communications systems that also sync with mobile phones, and automakers will want to tap into that connectivity to offer information and entertainment services. Automakers are also launching their own carsharing programs (BMW, Daimler, etc.), as described in Section 2.6

Another revenue avenue that automakers will vigorously pursue includes providing data about the power that is being consumed by their vehicles by partnering with energy aggregator services and utilities, such as demand response and ancillary services. Automakers like Ford are already looking to manage customers’ home energy by extending the data platforms that they are using to track vehicle power consumption.

**2.5 Fuel Cell Car Launches Will Spur a New Round of “Fuel Cell Vehicle versus Battery Electric Vehicle” Hype**

The fuel cell vehicle (FCV) market had a bumpy 2013, starting with Daimler’s announcement that it was postponing its commercial FCV introduction from 2015 to 2017. In 2014, in the face of continuing skepticism about this technology, a handful of automakers will forge ahead on their next commercial models. In 2013, Toyota, Honda, and Hyundai each reaffirmed a commitment to introducing a commercial FCV, albeit at low volumes, in 2014 and 2015. Honda and Toyota recently unveiled the concepts for their 2015 production FCVs: Honda at the LA Auto show and Toyota at the Tokyo Auto Show. Hyundai is expected to bring its Tucson FCV to the United States in 2014, as well.

The arrival of these vehicles will generate ample media coverage hyping the return of the fuel cell car, which had been declared dead by EV advocates and the media. Included in the frenzy will be contrived “battery electric vehicle (BEV) versus FCV” debates in the media and among clean fuel vehicle advocates. FCVs offer far greater driving range than most BEVs, and with their significantly higher price point, they will only compete with BEVs in the luxury vehicle market. Since the FCV and BEV platforms share many of the same systems (e.g., batteries, electric drive systems, etc.), the companies developing the components can achieve scale production more quickly if both succeed.

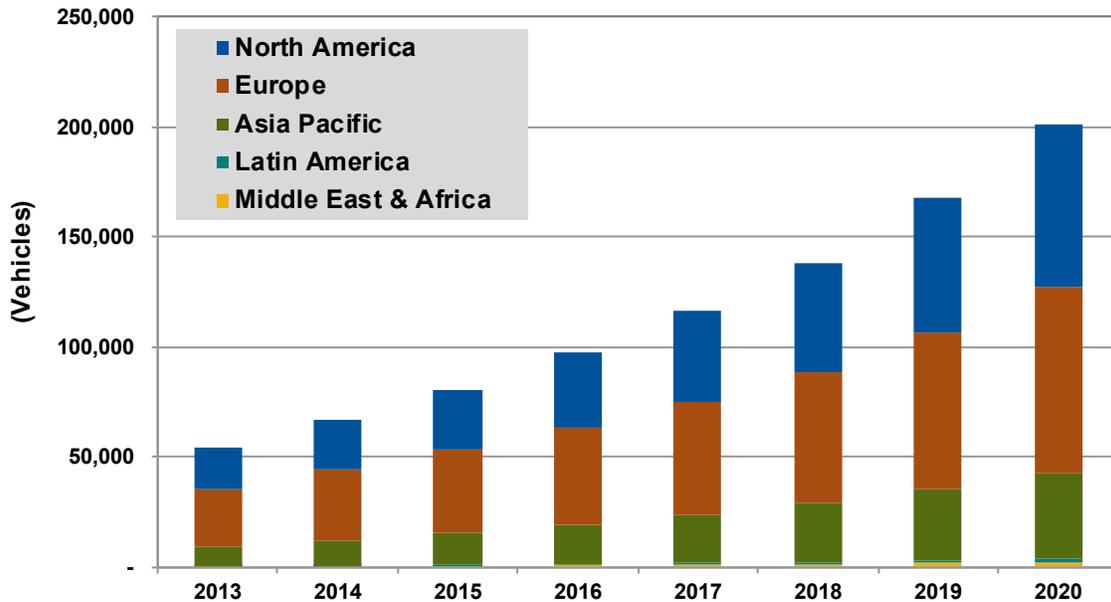
At the same time, a few geographic markets will continue to prepare for FCV introduction by building hydrogen stations. In October, California passed legislation committing to build 100 hydrogen stations by 2024. Germany, the United Kingdom, several Nordic countries, Japan, and South Korea are continuing to pursue their hydrogen infrastructure roadmaps. H2USA, the new U.S. initiative to develop a plan for hydrogen infrastructure rollout, is still in the early stages, and 2014 is unlikely to see any major result.

This upcoming year will thus lay the groundwork for what the early commercial market for FCVs will look like: clusters of hydrogen stations in a few regions of the world, which will become the de facto proving ground for early commercial FCVs that have been produced at low levels to test out the market. The FCV market is unlikely to take see major penetration until the end of the decade, so the competition in 2014 will be limited. With this lengthy timeframe of production ramp up, FCV makers are positioning themselves either to slowly jump in if the market looks promising or to quietly pull back on FCV programs over time.

**2.6 EVs Will Play a Leading Role in Carshare Growth**

Carsharing programs are spreading to many major cities, and 2014 will be a breakout year for the alternative renting programs – in part thanks to EVs. It is still the early days for carsharing, but the total number of vehicles in service in carshare programs will grow by 20% in North America to more than 22,000 vehicles, as forecast in Navigant Research’s *Carsharing Programs* report. EVs are good fit for those who do not want to own vehicles because of the savings and convenience of driving on electricity rather than paying at the pump. Also, many consumers curious about EVs can have their first experience at a low cost. Many EV models are smaller and easier to park, and they uniformly include GPS systems as a standard feature.

**Chart 2.3 Total Vehicles in Carsharing Services by Region, World Markets: 2013-2020**



(Source: Navigant Research)

The AutoLib program in and around Paris features only the electric Bollore BlueCar model and has had amazing growth since its inception in December 2011. The program now averages 62,000 rentals per week and will expand to 3,000 cars by the end of 2014. This model of saturating a city and its nearby suburbs provides great flexibility for drivers who primarily walk, bike, or rely on public transportation but occasionally need access to a car. IER, which runs Autolib, is expanding to Lyon and Bordeaux in France and will have its initial U.S. presence in Indianapolis. France has been the epicenter of EV carsharing programs, with the Auto Blue, AutoPartage, and Yelomobile fleets all including a considerable number of EVs in their fleets.

Startup companies, traditional car rental agencies, and car makers themselves will continue to replicate this model in new cities around the world throughout 2014. For example, BMW and Daimler are growing programs that started in their home country of Germany, as well as in the United States, where they started out in San Francisco and San Diego, respectively. City governments have also identified the value of emissions-free carshare programs, and many others will follow the likes of Houston in providing EVs to their workforce for travel to daytime meetings.

## 2.7 Wireless Charging Moves from the Lab to the Street

Considerable progress was made in commercializing wireless EV charging in 2013, and the first products will be shipped in small quantities in 2014. In June 2013, Bosch began selling the Plugless Power unit developed by Evatran for \$3,000. The charger can be installed as a retrofit for the Nissan LEAF and the Chevrolet Volt and is currently only available in North America.

Toyota made a public commitment to offer wireless charging when it signed a licensing agreement to use technology from the startup Witricity.

In a significant announcement that will prompt standardization in what was a wide open field, the Society of Automotive Engineers (SAE) agreed upon a single frequency and three power levels for light duty vehicle charging. The SAE standard is critical to achieving interoperability among wireless systems brought to market. The appeal of wireless charging systems will be limited until vendors can incorporate regional standards that provide interoperability and give automakers confidence that their vehicles will be able to charge at a broader number of locations.

With the focus on research and development (R&D) in the rearview mirror, wireless charging development will move to finalizing commercial products and pilot deployment projects. Technology developed by Qualcomm Halo will be tested on the streets of London as well as debuting on the racing circuit in 2014 through an agreement with the Formula E global series of races.

There will also be continued development of dynamic charging, a promising application particularly for the transit sector in 2014. The Korea Advanced Institute of Science and Technology (KAIST) has been trialing two electric buses along a 7.5-mile route equipped with wireless charging since August 2013. U.S. company WAVE, Inc. is set to test its system with buses at the University of Utah and Long Beach Transit. The value proposition is not only in extending the range of an electric bus but also in allowing the use of a smaller battery and thus reducing the price of the electric bus. The upcoming year will see continued development of this promising application for light duty PEVs as well.

If these trials prove successful, more automakers are likely to sign licensing agreements for offering wireless charging as an option with their vehicles. In addition to bus lines, fleet operators where vehicles have predictable routes and stopping locations are the next likely programs to start trials in 2014. However, wireless charging still needs to move from retrofit equipment to a dealer option in order to see greater market penetration. For the near term, wireless charging will remain a promising premium option for a small segment of PEV customers.

## **2.8 EVs Will Reduce Vehicle Carbon Dioxide Emissions in the United States by More Than 1 Million Tons**

Although the penetration of EV sales has not been as high as some predicted and others hoped, numbers are steadily climbing. Data from Navigant Research's *Electric Vehicle Market Forecasts* report shows that by the end of 2014, the United States will have just over 304,000 PEVs on its roads. Of these, 170,000 will be plug-in hybrid electric vehicles (PHEVs) and 134,000 will be BEVs.

Assuming that these vehicles replace a car that would have gotten the current fleet average of 25 mpg and that the annual electric miles driven was between 10,000 and 12,000, the total reduction in carbon dioxide (CO<sub>2</sub>) emissions in 2014 will be about 1.2 million tons. While EV

sales will fall shy of 1% of new vehicle sales in 2014, the benefits to air quality in urban areas are beginning to become significant. Additional emissions will still occur from the power generated for the vehicle's electricity, but many of the states where EV sales are strongest (e.g., Oregon, Washington) have cleaner power production than the U.S. average.

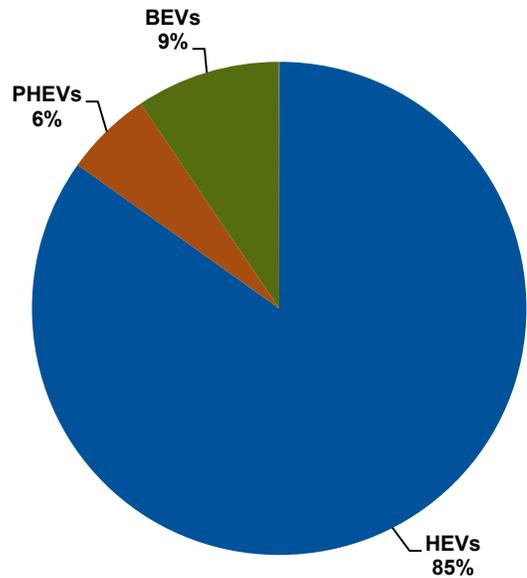
Hybrid electric vehicles (HEVs) will also add to the CO<sub>2</sub> savings. Navigant Research forecasts that by the end of 2014, nearly 3 million HEVs will be on the road in the United States. Based on fuel efficiency assumptions data from the U.S. Department of Energy's Alternative Fuel Data Center, HEVs in the United States will reduce CO<sub>2</sub> emissions by an additional 133,000 tons.

**2.9 More Than 2.2 Million Electric-Drive Motors Will Ship in 2014**

In 2014, light duty electric motors, which provide propulsion for HEVs, PHEVs, and BEVs, will surpass the 2 million mark globally in annual shipments for the first time. More than 1.9 million HEVs will be sold globally in 2014, far outpacing the sales of BEVs (216,235) and PHEVs (130,226).

Automotive companies are anxiously awaiting substantial reductions in the cost of the battery pack (the largest added cost in many EVs) to increase sales of PHEVs and BEVs in future years. For now, most of their attention is focused on what can be accomplished at the other end of the technology ladder to get the most improvement from the least investment.

**Chart 2.4 Light Duty Electric Vehicle Motor Sales by Vehicle Type, World Markets: 2014**



(Source: Navigant Research)

Most original equipment manufacturers (OEMs) have now invested in their own electric motor manufacturing capability for the high-power drive motors, but the next wave of technology is likely to be electrification of ancillaries such as power steering, brake assist, and heating, ventilation, and air conditioning (HVAC). The ICE is also likely to get efficiency improvements from electric oil and water pumps. All of these represent loads that have traditionally taken energy from the engine by being driven directly and continuously from belts connected to the crankshaft. What is not yet clear is if OEMs will develop their own small electric motors or look to purchase off-the-shelf. The 12V supply is seen as a limiting factor for major electrification and adding a 48V subsystem appears to be the preferred solution in the immediate future.

As vehicle manufacturers prepare for increasingly stringent emissions and efficiency targets, they will look for ways to make their conventional vehicles more efficient. This cannot be done entirely by improving the combustion process. Electric motors will be an important part of the solution, and increasing the basic voltage from 12V to 48V will be one critical step that will begin in 2014.

## 2.10 **Vehicle-to-Grid Pilot Projects will Expand and Begin Generating Revenue across the United States**

Vehicle-to-grid (V2G) technologies have been tested sporadically during the past few years in several countries, including Denmark and Japan, and V2G revenue generation in the United States began in earnest in 2013. V2G technologies allow PEVs to assist grid operators in maintaining a consistent and reliable supply of power to electricity consumers by drawing or storing power to offset the intermittent variations in demand for power and supply.

NRG Energy subsidiary eV2G began generating revenue by swapping power between the grid and EV batteries in conjunction with Mid-Atlantic state grid operator PJM in 2013. Demonstration programs carried out by the U.S. Department of Defense also enhanced V2G development through PEV fleets at bases in the California ISO (CAISO) area, which is another likely region for more V2G projects in 2014.

During 2014, the number of projects will expand to additional regions thanks to the Federal Electricity Regulatory Commission's (FERC) Order 755, also known as "Pay for Performance," requirements. The order, passed in late 2011, mandates that the compensation be higher for assets supplying frequency regulation markets that quickly and accurately respond to the grid operator's generation signal, which plays to the strength of EV batteries. The FERC's Order 755 significantly enhances the revenue potential that PEVs can accrue per kW of service provided to the grid. The order applies directly to independent system operators (ISOs) and regional transmission organizations (RTOs) in the United States. ISOs and RTOs have begun to implement the order, and all ISOs and RTOs should have full implementation in 2014.

As other ISOs and RTOs finalize the implementation of the FERC's Order 755, large fleets will become more interested in V2G-enabling their PEVs. Legacy PEV automakers and EVSE manufacturers will also invest in bidirectional technologies that enable vehicles to both give and receive power from the grid.

## Section 3

### ACRONYM AND ABBREVIATION LIST

Battery Electric Vehicle .....	BEV
California Independent System Operator .....	CAISO
Carbon Dioxide .....	CO <sub>2</sub>
Compound Annual Growth Rate .....	CAGR
Electric Vehicle .....	EV
Electric Vehicle Supply Equipment .....	EVSE
Environmental Protection Agency (United States) .....	EPA
Federal Electricity Regulatory Commission .....	FERC
Fuel Cell Vehicle .....	FCV
Heating, Ventilation, and Air Conditioning .....	HVAC
Horsepower .....	hp
Hybrid Electric Vehicle .....	HEV
Independent System Operator .....	ISO
Initial Public Offering .....	IPO
Internal Combustion Engine .....	ICE
Kilowatt .....	kW
Korea Advanced Institute of Science and Technology .....	KAIST
Miles per Gallon .....	mpg
Original Equipment Manufacturer .....	OEM
Plug-in Electric Vehicle .....	PEV
Plug-in Hybrid Electric Vehicle .....	PHEV
Regional Transmission Organization .....	RTO
Research and Development .....	R&D

Society of Automotive Engineers ..... SAE

United States ..... U.S.

Vehicle-to-Grid..... V2G

Volt ..... V

Zero Emission Vehicle.....ZEV

## Section 4

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## Section 6

### SCOPE OF STUDY

Navigant Research has prepared this white paper to provide current and interested stakeholders in the electric vehicle (EV) market, including automakers, charging equipment service companies, suppliers, utilities, investors, and policymakers, with an overview of 10 key predictions for the EV market during 2014 and beyond. The major objective of this white paper is to provide an understanding of how these key market developments will impact the automotive and utility industries in the coming years. Note that this white paper does not intend to offer an exhaustive assessment of these predictions and their impacts. Navigant Research will provide comprehensive analyses in more in-depth reports during 2014.

### SOURCES AND METHODOLOGY

Navigant Research’s industry analysts utilize a variety of research sources in preparing Research Reports. The key component of Navigant Research’s analysis is primary research gained from phone and in-person interviews with industry leaders including executives, engineers, and marketing professionals. Analysts are diligent in ensuring that they speak with representatives from every part of the value chain, including but not limited to technology companies, utilities and other service providers, industry associations, government agencies, and the investment community.

Additional analysis includes secondary research conducted by Navigant Research’s analysts and its staff of research assistants. Where applicable, all secondary research sources are appropriately cited within this report.

These primary and secondary research sources, combined with the analyst’s industry expertise, are synthesized into the qualitative and quantitative analysis presented in Navigant Research’s reports. Great care is taken in making sure that all analysis is well-supported by facts, but where the facts are unknown and assumptions must be made, analysts document their assumptions and are prepared to explain their methodology, both within the body of a report and in direct conversations with clients.

Navigant Research is a market research group whose goal is to present an objective, unbiased view of market opportunities within its coverage areas. Navigant Research is not beholden to any special interests and is thus able to offer clear, actionable advice to help clients succeed in the industry, unfettered by technology hype, political agendas, or emotional factors that are inherent in cleantech markets.

## NOTES

CAGR refers to compound average annual growth rate, using the formula:

$$\text{CAGR} = (\text{End Year Value} \div \text{Start Year Value})^{(1/\text{steps})} - 1.$$

CAGRs presented in the tables are for the entire timeframe in the title. Where data for fewer years are given, the CAGR is for the range presented. Where relevant, CAGRs for shorter timeframes may be given as well.

Figures are based on the best estimates available at the time of calculation. Annual revenues, shipments, and sales are based on end-of-year figures unless otherwise noted. All values are expressed in year 2014 U.S. dollars unless otherwise noted. Percentages may not add up to 100 due to rounding.

Published 1Q 2014

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Boulder, CO 80302 USA  
Tel: +1.303.997.7609  
<http://www.navigantresearch.com>

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