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The Electric Vehicle Challenge
Electric Vehicle Growth in an Evolving Market
Dependent on Seven Success Factors
High performance. Delivered.

As the automotive industry moves through the second decade of the 21st century, uncertainty over whether or not electric vehicles (EVs) will become a key part of the mainstream global car-buying market remains largely unchanged.

The question of long-term viability has taken a back seat to a more immediate and pressing question for automotive original equipment manufacturers (OEMs) – what approach is needed to succeed in today's EV market? The answer is not without challenges. Unlike traditional vehicles, EVs require a different value chain and processes to support them. Moreover, consumer perceptions of the practicality, functionality, and the potential advantages of EVs remain largely mixed in such areas as cost, savings, convenience, travel range, and charging infrastructure. To succeed in the current business environment, OEMs will need to adopt new strategies to realize the full potential of the evolving eMobility market. One important factor will be integrating and collaborating with a group of diverse players, such as utilities, charging infrastructure owners, and mobility providers in a new mobility ecosphere.

To succeed in today's EV market OEMs have to face various challenges as mentioned above. Therefore, Accenture has identified seven success factors for the eMobility market that will ensure its long-term viability:

A. Government Regulations and Subsidies

B. Integration of Electric Vehicles within the Product Portfolios of OEMs

C. Collaboration within the eMobility Value Chain

D. Relevant Charging Infrastructure

E. Reduction of Customer Anxiety and Marketing of eMobility Benefits

F. eMobility as an Innovation Leader

G. Adjustment of Core Operations and Processes

A. Government Regulations and Subsidies

Driving the focus on EVs are ever-tightening CO2 emissions regulations and the investment of billions in subsidies and incentives by governments around the world, encouraging greater industry participation and adoption in the marketplace. In 2020, CO2 emissions will be regulatory limited at 95 g/km as an average value throughout the vehicle fleet. In order to outbalance the CO2 performance of cars with higher emission values, OEMs need to have zero-emission vehicles like the EV. The U.S. Government recently invested $5 billion in electric cars, including loans and grants to automakers and battery producers, spending on charging stations, and $7,500 tax credits to car buyers with the goal of having one million EVs on U.S. roads by 2015.[1] In addition, more and more global cities will become networked, integrated and branded smart cities, where electric vehicles[2] can be ideally deployed in order to offer a better, cleaner urban mobility experience and help balance future smart electricity grids.

Table 1: Overview of Global Tax Subsidies, August 2014; Source: Accenture

Country	Tax Reduction
Austria	Exempt of car tax
Belgium	Reduced annual circulation tax, no registration tax
China	Subsidies of $9.900 for PEV
Czech	No road tax (business vehicles only)
Denmark	Exempt from registration tax
Finland	Reduced registration tax
France	n/a (only sales bonus)
Germany	Exempt from annual circulation tax
Greece	Exempt from registration tax
Ireland	Exempt from registration tax
Italy	n/a (only sales bonus)
Japan	Subsidies pp to $8.500 for PEV; Additionally tax exemption of automobile acquisition & automobile weight tax
Luxembourg	n/a (only sales bonus)
Netherlands	Exempt from private motor vehicle tax, registration tax and annual circulation tax
Norway	No VAT and registration tax
Portugal	Exempt of registration tax and annual circulation tax
Russia	Tax exemption for 2 years
Spain	Regional car tax reductions
Sweden	Exempt of registration tax
Swiss	Regional car tax reductions
UK	n/a (only sales bonus)
USA	State rebates from $1000-$6000, additionally federal tax credit up to $7500

B. Integration of Electric Vehicles within the Product Portfolios of OEMs

For the first time a range of EV and hybrid models are on our roads, signaling that eMobility, the electrification of the vehicle, has begun in earnest. The auto sector, in its inaugural stage of electric vehicle manufacturing on a broad scale, is close to the point where every major marquee is producing at least one EV model. Today, the universe of available EV drivetrains includes battery electric vehicles (BEVs); plug-in electric vehicles (PEVs), plug-in hybrid electric vehicles (PHEVs); and BEVs with range extender (E-REVs) capabilities.

While 2011 showed only a handful of EVs being manufactured, in 2014 production is widespread, as new models are introduced. EVs are projected to become 10 to 15 percent of the global auto market by 2020 from a current base of ca. 0.2 percent.[3] While adding a minimum of one EV to vehicle product lines will help OEMs' momentum in the marketplace, producing an EV model series like Volkswagen and Toyota will significantly increase market presence and perhaps generate better opportunities for sustained EV growth.

In Europe, the market share of EVs including BEVs, PHEVs, and E-REVs, is expected to represent the lion's share of the market by 2040 in terms of drive technologies compared to internal combustion engines (ICE), fuel cells, and other alternative fuels.[4] Plug-in electric vehicles (PEVs) continue to gain in popularity in various regions, such as North America. PEV sales are forecast to reach 400,073 annual sales in the U.S. market and 107,146 in Canada by 2020.[5]

Furthermore, increased EV sales will set the stage for a significant eMobility-related growth market in the coming years. Global eMobility is expected to create an estimated $390 billion market by 2020.[6] New electric vehicles and component production, innovative financing models, charging infrastructure stations, green power-generation businesses, eMobility providers, battery producers, energy suppliers and distributors will be key growth drivers. Contributing to this market will be OEMs like General Motors (GM) that plans to build up to 500,000 electric-technology vehicles annually by 2017. This includes the Chevrolet Volt plug-in hybrid. GM has made rolling out cars with electric technology, including its eAssist system, part of its global strategy.[7]

The BMW i3 and i8

In an industry that is affected by changing customer needs, new technologies and upcoming regulation, the whole auto sector is perpetually setting the focus on the development of alternative engine technologies and concepts, seeking answers for the challenges that come along with eMobility. The Original Equipment Manufacturers (OEMs) differ, however, regarding the technologies they develop as well as the extent to which they realize eMobility concepts. With the new sub brand BMW i, BMW aims to meet the new challenges in a very holistic and sustainable way.

Whereas other OEMs are following a step-by-step approach implementing electric drive in already existing vehicles of their fleets, BMW i rethought many aspects like design or materials when developing completely new cars. In 2007, the "Project i" started with a team consisting of only a handful of people.[8] Six years later and after an investment of approximately 2 billion Euro, the BMW i3 was introduced in November 2013 as the first battery electric vehicle under the BMW i brand.[9] BMW is producing one hundred i3s per day and aims to sell 10,000 vehicles in 2014.[10] The BMW i3's maximum electric range is at 160 km (mean customer value) but can be extended through the integration of a conventional engine, the Range Extender. The maximum speed of the zero-emission vehicle is limited at 150 km/h. Using a conventional power point, the car's battery can be charged within 6-8 hours whereas less than 30 minutes are needed when charging at fast charging stations.[11]

The auto body of the BMW i3 consists of carbon, an expensive material which is about five times lighter than steel. This goes along with better performance regarding aerodynamics and energy consumption. The ecological approach is also proven in the interior of the vehicle where only materials of sustainable sources are used, for example the textiles on the seats which are created from up to 100 percent recycled fibers.[12]

Whereas the BMW i3 (from 34,950€)[13] is aimed at a wide audience, the BMW i8 (from 126,000€)[14] addresses the luxury customer segment. The sports car, introduced in the summer of 2014, is a plug-in hybrid electric vehicle, providing an electric engine for the front axle as well as a conventional three-cylinder gasoline engine powering the rear axle. Using both power sources, the i8 accelerates from 0-100 km/h in 4.4 seconds.[15]

Photos: BMW Group

C. Collaboration within the eMobility Value Chain

This first phase of electric vehicles in the marketplace presents new challenges for OEMs in terms of executing an effective and sustained growth strategy. As a departure from conventional automobiles, EVs are engaged in an eMobility ecosphere comprised of a wide range of players that, while not part of the sector, are critical to its success in the EV space. They represent a new value chain with which OEMs must collaborate and innovate to establish a viable, global eMobility market. The mentioned players include utilities, charging location owners, charging infrastructure operators, service providers, vehicle users, mobility providers, and financial services and leasing companies.

To increase consumer acceptance of EVs, an interconnected partners' ecosphere will need to be designed and organized on many levels, including developing contracts, processes and exchanging data. Although integration platforms are emerging, they are not broadly established yet. Realizing this interconnectivity is crucial for ensuring the success of eMobility. Utilities, for example, may want to offer CO2-neutral energy products and integrated charging solutions, while charging location owners integrate charging offerings like a cooperative parking business model. Investments in charging infrastructure that result in profitable business models will be required. eMobility solutions will need to be simplified to increase their appeal, and mobility providers can play a key role in EV market growth through innovative mobility offerings.

Customers may prefer to lease, rent, or share green vehicles rather than purchase them. OEMs will need to determine how to differentiate themselves in the EV market in this regard, as well as through engine features, service for batteries, grid technologies, or mobile services. To make car-sharing work, OEMs and their ecosphere partners will need to collaborate on the necessary infrastructure. Mobile crews may be better in a given market for pickup and drop-off than fixed return stations. OEMs will need to continue working with partners that may have more roadside assistance experience to develop the systems required to communicate to the service crew a problem with a disabled EV on the road. Mobile connections to a central testing capability also will be necessary to oversee the performance of critical vehicle components. Finally, pricing and payment processes will need to be put in place to complete the transaction—another area that OEMs will need to explore through collaboration with appropriate ecosphere partners.

D. Relevant Charging Infrastructure

Convenient EV charging infrastructure will be a key factor for a successful EV market. Currently, there are two primary charging locations, at home or work. Both sources involve legal challenges in terms of taxation, theft and accounting that will need to be addressed. While OEMs are offering home-charging solutions with customer EV purchases, and attempting to kickstart the charging market through platforms integration with other eMobility ecosphere partners, the lack of widespread public charging stations as of yet, continues to place a greater focus on hybrid vehicles.

Public and semi-public charging infrastructure is still uncertain, as large-scale investment has not yet surfaced to support semi- and public-charging infrastructures as a standalone business. Currently, there are limited pilot projects, including cooperative urban initiatives supported by city-government funding and installed by energy utilities, state-funded projects, and business-supported efforts designed to show eMobility feasibility.

Accenture research of PEV pilots reveals that, despite existing barriers to greater EV acceptance, drivers do change their perceptions toward PEVs once they are provided with information and hands-on experiences.[16]

Table 2: Total Investments Of Public Charging Points In Germany; Source: Federal Ministry of Education and Research of Germany

Year	2011	2012	2013	2014
Total stock of public charging points	2200	3600	5000	7000
Annual investment in Mio. Euros (rounded)	7	8.5	8.5	12

Connected Electric Vehicles - Supporting Infrastructure Functions

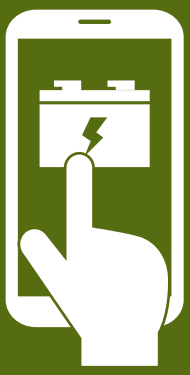
Connectivity as a module of infrastructure represents an essential prerequisite in electric vehicles and plug-in hybrids to help alleviate range anxiety. Essential connected vehicle features support the anxiety of an accessible infrastructure and will affect future EV adoption.

Vehicle range control:

New infrastructure (charging stations) and real-time information about availability, having the ability to reserve charging stations on the move and payment methods would be useful for the success of electric cars.

Locate charging station:

The range anxiety issue could be solved using a GPS and web-based system to locate charging stations. The Nissan LEAF's in-vehicle digital system called EV-IT uses communication networks and a dashboard to keep the driver constantly updated about the range of the vehicle and the closest charge point.[17]

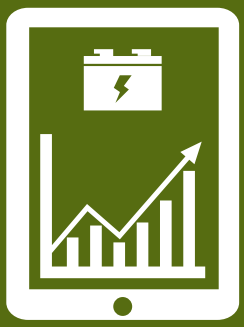


Recharging costs information and payment:

Connectivity could allow data communication with the electricity providers in order to receive costs information and payments in real-time.

Monitor and manage battery charging online:

Battery charging could be controlled using a mobile phone or a computer and provide interaction with a smart charging system. The BMW i Remote App for iOS and Android shows detailed information on the current status of BMW i – e.g. car location, range, and battery charge level and service messages. The charging process can be initiated remotely using the weekly timer.[18]



Battery performance overview:

Applications could provide coaching on driving techniques and traffic levels to help extend the range of PEVs. The BMW i Remote App measures the efficiency of each journey in a BMW i model and gives helpful tips on how to drive the car more efficiently and extend the range.[19]

E. Reduction of Customer Anxiety and Marketing of eMobility Benefits

For the most part, consumers link an eco-friendly mindset to eMobility. But, part of transforming this anticipated market into reality will lie in the ability of OEMs to address current consumer concerns about EVs and to give them what they want in an eMobility experience.

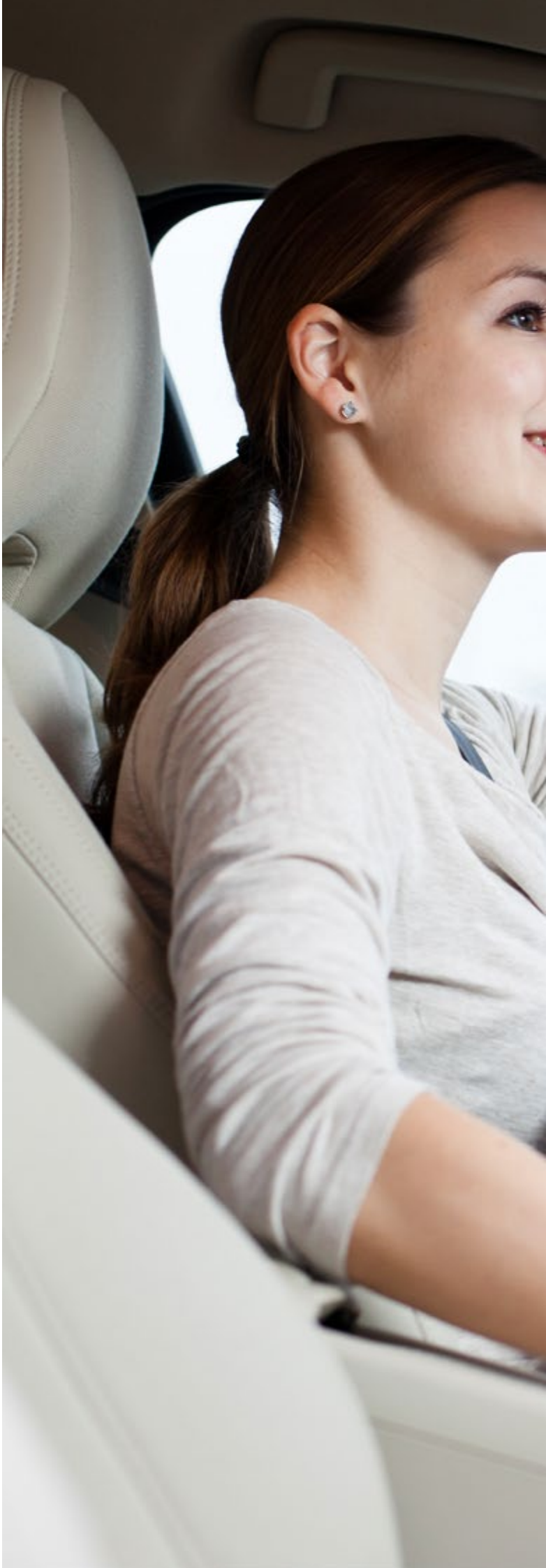
"Range anxiety" reflects a key concern about batteries in electric cars losing power before reaching a destination or charging point. It is among the most common perceived disadvantages of electric vehicles. Therefore, the consumers' perception of EVs will continue to play a major role in the evolution of the market. OEMs have a window of opportunity to shape and make the most of the market's promise. For this, they will need to effectively respond to and shape consumers' perceptions.

The introduction of electric vehicles into the global market has massively influenced consumers who consider buying a new vehicle. In the Accenture global study of over 7,000 people in 13 countries "Plug-in electric vehicles: Changing perceptions, hedging bets," 60 percent of those respondents who intend to purchase a car within the next decade say that they will probably or certainly consider EVs as an option. This includes both plug-in hybrid electric vehicles and full-electric models.[20] The research shows high levels of awareness of EVs among drivers, and a need for more information. The vast majority (97 percent) has heard of electric vehicles. However, more than two-thirds of respondents either need to know more about them before making a decision on their next car purchase or do not understand enough about EVs to do so.[21]

Here are some of the most pressing questions: What are the advantages of driving an EV? Will there be an accessible infrastructure? Where should an EV purchase be made? What is the best purchase decision: Lease or Buy? Such questions will require that OEMs not only aggressively promote EVs as another transportation option, but educate consumers on the advantages EVs offer. This will help ensure a successful EV market.

Several advantages to EV ownership that have encouraged sales can be identified, including fuel cost savings, lower emissions, low maintenance costs, fewer maintenance cycles, sales and tax incentives, and avoidance of volatile fuel prices at the pump.

According to the U.S. Department of Energy, electric vehicles are highly energy efficient, converting about 59 to 62 percent of electric energy from the grid to power at the wheels, while conventional gasoline vehicles only convert about 17 to 21 percent of the energy stored in gasoline to power at the wheels. Moreover, EVs emit no tailpipe pollutants and in the U.S. market their purchase in or after 2010 can include various incentives like the U.S. federal income tax credit of up to $7,500.[22]



F. eMobility as an Innovation Leader

Until recently, major automotive industry innovations were product-only related. With the introduction of EVs, many OEMs have undergone major changes not only in terms of production, but also relative to cutting edge processes and additional services. These developments in the EV market also will be key to EV success. State-of-the-art sales channels, financial products, sales and distribution and service and after sales are just a few among many other innovations.

The introduction of EVs enables the customer for the first time to use innovative sales channels. The Internet gives car buyers the option of shopping online, while auto dealers have expanded their sales footprint to include field sales. Consumers are offered a new variety of sales channels—shopping at traditional dealerships, on the Web, or through a field sales representative.

Buying in the comfort of their own home from a field representative offers consumers added convenience, while shopping online—from browsing manufacturer, dealer, and vehicle evaluation websites like Kelly Blue Book, to social media sites that offer peer feedback—provides a wide range of convenient information at consumers' fingertips. Buying from a brick and mortar shop preserves the charm of car-buying and provides a level of practicality, given that any model will require after sales service. This includes specialized regular maintenance and repair, including charging-device maintenance, battery capacity and usage monitoring, EV system diagnosis, and a warranty on the maintenance of the e-powertrain. Most leading EV dealers provide battery warranties in addition to general service warranties, as well as EV roadside assistance.

This approach seems to be helping sales performance. Although, hybrid vehicles have been widely available for more than a dozen years, the market for plug-in electric vehicles (PEVs) has grown rapidly in the last few years. Sales channel optimization to capture evolving customer demand across customer segments and countries will be of high importance for OEMs. Employing analytics capabilities will be essential to achieving this goal. Moreover, this will be critical, as increasing competition, such as "mobility providers" might emerge in the future as manufacturer independent EV sellers.

Also, the question of whether to lease or buy an EV is an important one in the eMobility equation. Two primary factors influencing the consumer's decision are price and battery reliability. The price markups for EVs compared to similar category models from the same carmaker in Europe range from 50 percent to almost 200 percent. In response, OEMs have implemented new, innovative flexible full service leasing offers that can address many of the barriers concerning the cost of EV ownership. Some auto companies also offer battery rental programs. Whichever option consumers choose, financing is likely to be made easier by more flexible billing and payment plans to encourage greater interest in EVs. Consumers also have the option of sharing electric vehicles rather than purchasing or leasing them.

Consumers also are concerned about battery decay over long periods of time. Although the majority (73 percent) of respondents in a recent Accenture global consumer study preferred buying their EV, reflecting the existing culture in most surveyed markets, more and more variations of leasing and buying packages are surfacing, giving customers more choice.[23] Current options include: Leasing the vehicle, including the battery; buying the vehicle, but leasing the battery; or buying both the vehicle and the battery.

In addition, pricing and payment processes would need to be put in place to complete a transaction. Mobile phones could be a convenient way for consumers to be charged after an initial registration process. Such a phone model could be possible in the future and include capabilities to facilitate energy contracts, as well as handle vehicle hardware add-on purchases. Whether leasing, buying, renting or car-sharing EVs, the experience may help foster a better understanding of the EV and generate greater acceptance of it.

EVs are driving changes in OEM sales, marketing, and branding strategies. Dealership sales forces must be trained on the different aspects of EVs to provide more relevant information about them to help accomplish the sell versus using a traditional vehicle sales presentation. This includes informing customers about electric drivetrains, batteries, kilowatts, amperage and volts, as well as providing information on home-charging packages and accessibility to public and semi-public charging infrastructure.

OEMs not only will need to revamp their core operations to accommodate EVs, but develop innovative ways to ignite and sustain growth in EV service and after sales. This need will grow in importance as the degree of electrification increases, decreasing maintenance intensity and reducing after sales potential for manufacturers and dealers.

Peugeot, for example, is addressing this issue by elevating the concept of "green" transportation through its "mu by Peugeot" platform that takes into consideration growing consumer interest in multi-modality. The concept includes eco-friendly forms of transport—from electric vehicles and vans to mopeds and bicycles, emphasizing vehicle electrification in a multi-modal way that should help support the OEM's EV service and after sales. Other OEMs will need to pursue similar strategies and create new services and after sales approaches to keep the momentum for EVs going in the marketplace.

OEMs' service support will range from helping dealers manage complex repair or a difficult diagnosis through the technical help desk, to creating and distributing technical publications, such as repair manuals in a timely and efficient way, to sustaining dealer processes via the help desk. Additionally, dealer efficiency and effectiveness can be further enhanced through on-board technologies that improve service processes and provide better customer support.

G. Adjustment of Core Operations and Processes

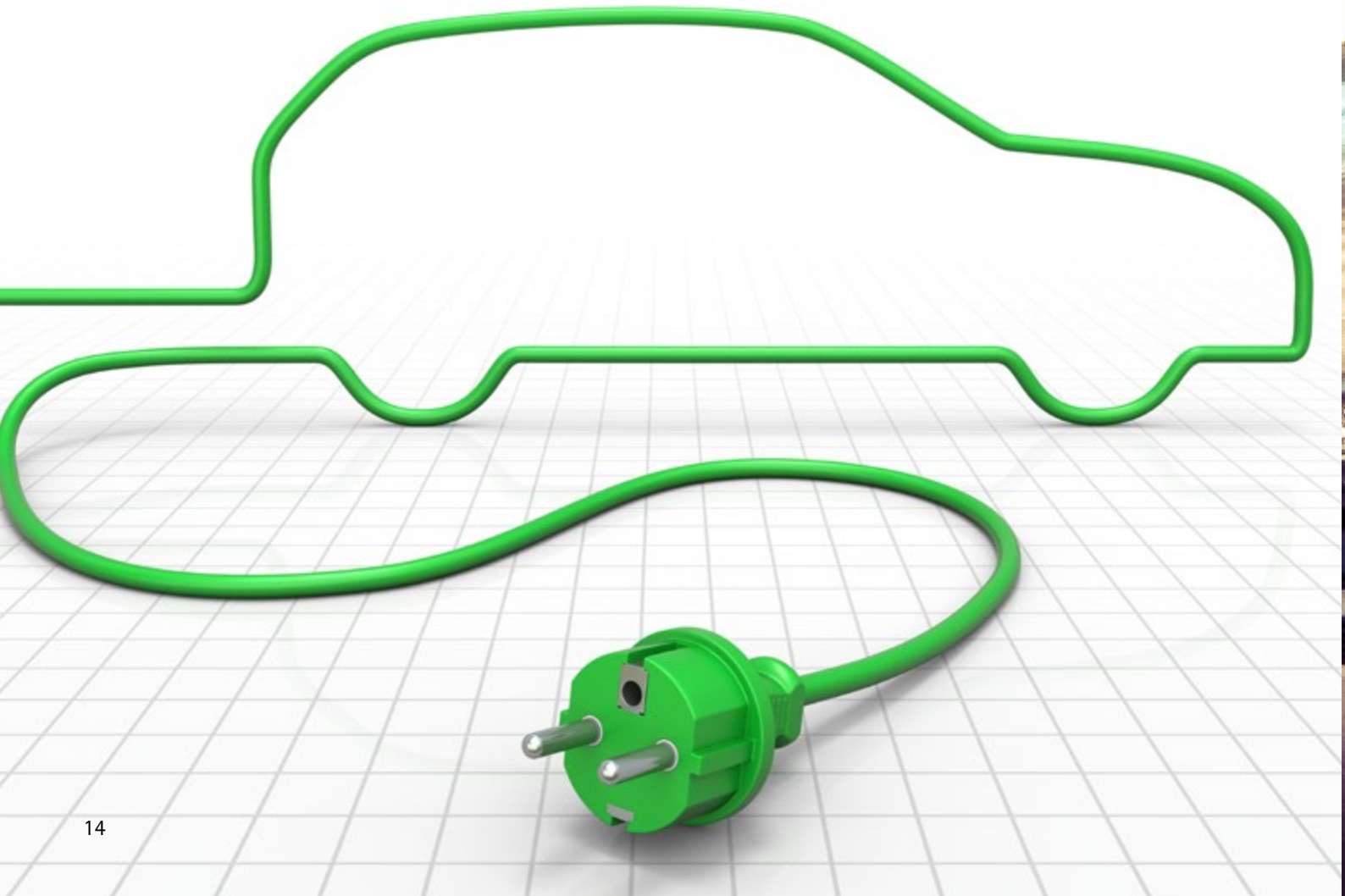
Alongside a growing public acceptance of EVs, especially PEVs, further approaches to putting greener and more fuel efficient vehicles on the road are developing. OEMs will need to continue hedging their bets by modifying their platforms to support a variety of fuel technologies to include gas, PHEV, and full electric vehicles, as Ford is doing, or by licensing technology. Daimler AG and BYD Auto in China are partnering to build EVs.[24]

As far as supporting the core operations of EVs, new services will still be needed, such as battery exchanges and breakdown services. Other services will need to be tailored to EVs, including installation, planning, and warranties, especially for batteries. Further, OEMs will have to ensure dealers and repair shops have the capabilities to service this new "species" of vehicle and manage customer expectations concerning the "repairability" of the vehicle and "fixing it right" the first time. Select dealers will need to retrofit their service stations and get further qualification in order to handle specific EV repairs, including the servicing of high voltage batteries. The warranty and maintenance of the e-powertain will also be a major topic in this space.

In terms of manufacturing, revamping core processes to prepare for mass production of non-ICE vehicles will be required. Volkswagen is introducing a modular manufacturing system, which will allow its different brands and models to share the same collection of components, making it a simple matter to install plug-in hybrid systems in other cars made by the company.[25] Manufacturing plant changes and new competencies in chemical and electrical engineering will be required. Major car design changes also will be needed with core parts like the combustion engine, tank, and electronics replaced by an electric engine, a battery, and battery management systems software.

OEMS also will need to access and work with new categories of suppliers that will be part of the emerging eMobility value chain. Furthermore, they will have to negotiate on an equal level with partners, build their own knowledge about new technologies, such as carbon fiber as a steel replacement in body kits, and adhere to battery standards.

Finally, as the EV market evolves, OEMs and suppliers are likely to experience greater pressure to standardize core components to comply with new government regulations, grid infrastructure restrictions, and partners' requirements. They will need to adjust their core components based on an externally driven schedule of product and component updates. Today, lithium ion remains the top contender for PEV batteries. OEMs will need to hedge their risk associated with sourcing lithium, a rare metal subject to shortages and price fluctuations. Option contracts or vertical integration to maintain access to the raw material are both options, together with getting involved in exploring new sources for lithium, like brine extraction. Alternative battery technologies like aluminum-air and graphene are included in this changing landscape, going beyond pure lab research to becoming hot topics for OEMs.



Conclusion

Whether or not electric vehicles will become commonplace in the global mass-market or will dominate in the alternative vehicle segment is dependent on seven success factors. This point of view shows that within the automotive industry all these factors have been accomplished. However, the uniqueness of the success factors differ from country to country and OEM to OEM. Among the markets and OEMs where the success factors are highly developed includes well-established EV markets like Norway.

Governmental subsidies encouraging EV-buys show a highly heterogeneous picture around the globe. France, the Netherlands and the U.K. have provided strong government support, suggesting that these countries offer better opportunities for the success of EVs in their markets.

Collaboration with a range of ecosphere players as partners in the electrification value chain will be critical to succeeding. All OEMs have various partners involved in their eMobility value chain in order to succeed within the market and further strengthen their market positions.

Relevant infrastructure support like governmental subsidies is very fragmented around the globe. Markets like Norway which already has a very developed infrastructure demonstrates the potential for strong EV growth in the marketplace. By contrast, a lack of relevant charging infrastructure often reflects a stagnating number of EV retailers, for instance, in markets like Germany and Portugal.

Moreover, crucial for the success and the growth of the EV market around the globe will be the reduction of customer anxiety, especially in terms of EV travel range capability. Therefore, OEMs not only have to promote EVs, but also demonstrate the benefits that come with eMobility concepts. So far, only a handful of OEMs are proactively marketing to their customers the advantages of driving and owning an EV. Within the automotive industry eMobility has proven to be an innovation leader. OEMs vary, however, regarding the technologies they develop, as well as the extent to which they realize eMobility concepts. For instance, with the new sub brand BMW i, BMW aims to meet new challenges in a very holistic and sustainable way. Given the fact that the alternative vehicle market is still evolving, it is also critical that OEMs balance their core processes and platforms to accommodate several technologies, including gas and "green" technologies as a way to be prepared for different market development scenarios.

All in all one can say that today the automotive industry without EVs is no longer imaginable. The fulfilled success factors offer a breeding ground for the EV market. Therefore, EVs are rapidly becoming a mainstay in vehicle product lines. Already today all major OEMs offer at least one EV. More models will follow in the near future. As a consequence, OEMs are confronted with a growing challenge as how best to succeed and to become market leaders in the EV market.

About Accenture

Accenture is a global management consulting, technology services and outsourcing company, with more than 305,000 people serving clients in more than 120 countries. Combining unparalleled experience, comprehensive capabilities across all industries and business functions, and extensive research on the world's most successful companies, Accenture collaborates with clients to help them become high-performance businesses and governments. The company generated net revenues of US$30.0 billion for the fiscal year ended Aug. 31, 2014. Its home page is www.accenture.com.

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