

Electric Car Advancements and their Consequences

Authors: Nikita Khandelwal, Shivangi Khare

Universal Business School, Gaurkamat, Vadap, Kushivili, PO, Karjat, Maharashtra 410201

ABSTRACT - Electric vehicle technologies have advanced significantly during the last decade. Electric vehicle technology is predicted to cause a significant shift in transportation systems in terms of user experience, mode choices, and business models.

Driving behavior and driving styles, or long-term tendencies to drive in specific ways, have been proven to cause changes in vehicle energy efficiency in conventional automobiles, with aggressive drivers, for example, consuming 30% more fuel.

Keywords: EV i.e., Electric Vehicle, Environmental Efficiency, Future Prospective.

I. OBJECTIVE

To analyse the impact of electric vehicles on the Indian market in the current scenario and what are the changes that are needed in respect to Indian market -

- i. To understand the changing demand scenario of EV in Indian market.
- ii. To gauge the consumer perception towards EV in the market.
- iii. Highly conservative & caring about their eco-system and environmental changes.

II. Literature Review

1. **US Environment Protection Agency. Greenhouse gas emission from the U.S. transportation sector,1990-2003,2006**

Carbon-based emissions and greenhouse gases (GHGs) are critical issues that policy-makers have sought to address globally since the Kyoto Protocol issued in 1998. Environmental Protection Agency (EPA) emissions standards for vehicles and engines cover everything from weed whackers to locomotives. Congress created the Renewable Fuel Standard program in an effort to reduce greenhouse gas emissions and expand the nation's renewable fuels sector while reducing reliance on imported oil. Renewable fuels are produced from plants, crops and other biomass, and can reduce greenhouse gas emissions when compared to burning the fossil fuels they replace. Smart Way helps the freight transportation sector improve supply chain efficiency, reducing greenhouse gases and saving fuel costs for companies who participate. Through Smart Way, EPA and its partners are making significant gains in the efficiency of how our nation moves goods, helping address air quality challenges,

improving public health and reducing freight's contribution to climate change.

2. OCED-ITF Joint Transport Research Centre. Greenhouse gas reduction strategies in the transport sector,2008

The transportation is 98% dependent on fossil oil which is exceedingly affected by changes in energy resources. Plug-in hybrid electric vehicle (PHEV) is one of the Alternative Fuel Vehicles (AFVs) which can reduce GHG emissions. Hydrogen Fuel Cell Vehicles (FCVs) are similar to electric vehicles (EVs) in that they use an electric motor instead of an internal combustion engine to power the wheels. Government and automotive companies have recognised the value of Alternative Fuel Vehicles (AFVs) for green transportation and have been implementing economic policies to support electric vehicles (EVs) market.

3. Hacker, F, Harthan, R, Matthes, F. Environmental impacts and impact on the electricity market of a large scale introduction of electric cars in Europe critical review of literature. ETC/ACC Technical paper 2009

Transportation, Air Pollution and Climate Changes, Mobile Source pollution and Related Health Effects of air toxics from vehicles to both groups and individuals looking to further their subject knowledge, learn about EPA's role in reducing air toxics, and find out how individuals can play a role.

4. Romm, j. The car and fuel of the future. Energy Policy 2006

The hybrid gasoline-EV is greatly promising in future since it can reduce gasoline consumption and GHG emissions from 30% to 50% without the need of changing the vehicle class. However, a more widespread use of EVs is still hindered by the limited battery capacity,

which allows cruising ranges between 150 and 200 km.

5. Melaina, MW. Initiating hydrogen infrastructures: preliminary analysis of a sufficient number of initial hydrogen stations in the US. Int j hydrogen Energy 2003

Who will build the refuelling infrastructure before the AFVs are built; it remains the most intractable barrier. The driving range limit inevitably introduces a certain level of restrictions to Battery Electric Vehicles (BEV) drivers travel behaviours, considering the insufficient coverage of recharging infrastructures in a foreseeable future time period.

6. Morrow, k, karner, D, Francfort, j. plug-in hybrid electric vehicle charging infrastructure review. Battelle Energy Alliance,2008

Charging facilities are essential for EV drivers. Suppliers, such as EV companies and governments, are concerned about where to locate charging stations and what type of charging station to locate because of the high cost of building these facilities. Although many cities are planning the construction and expansion of BEVs' charging infrastructures, it is likely that BEV commuters will need to charge their vehicles at home most of the time in the foreseeable future.

7. Bai, S, Yu, D, Lukic, S. Optimum design of an EV/PHEV charging station with DC bus and storage system. In: Proceedings of the 2010 IEEE energy conversion congress and exposition (ECCE), Atlanta, GA, 12-16 September 2010

Bai et al, proposed an optimum design of a fast charging station for PHEVs and EVs to minimize the strain on the power grid while supplying vehicles with the required power. Disquieting data concerning the world's

supply of lithium, a critical component of the batteries that would power Better Place's electric vehicles, cast doubt over the business model's long-term viability.

8. Shemer, N. Better place unveils battery-swap network,2012

This method of refuelling has the advantage that is reasonably quick. The unfortunate downside is that all of the vehicles served by the Battery Exchange Stations (BES's) are required to use the identical pallets and batteries. IT is assumed that the developers of these battery pallets will coalesce around a single common standard. BES's have been tried out by taxi vehicles in Tokyo in 2010.

9. Wang, YW, Lin, CC. Locating road-vehicle refuelling stations. Transport Res E: Log 2009

Wang and colleagues proposed a refuelling station location model based on vehicle routing logics using a set cover concept with consideration of both inter-city and intra-city travels. But electric cars are still far from being the environmental godsend that many are hoping for. "The problem", says Dudley Curtis from green group Transport and Environment "is how to make the electricity efficient." If electricity is not decarbonised – Poland for example gets most of its needs from coal – then electric cars could be more polluting than normal petrol cars, which are continually getting more efficient. "You need a really solid renewable energy structure," says Dudley.

10. Kuby, M, seow, L. The flow-refuelling location problem for alternative-fuel vehicles. Socio Econ Plan Sci 2005

To enable mobility of EV's, Model of the placement of least charging stations on the shortest path is proposed to avoid detours for charging. In the same period, Better Place

customers will spend around one-quarter of that amount operating their car, he added, explaining that because the company takes full responsibility for the battery, fluctuations in the price of electricity will not change the cost to consumers.

III. Hypothesis

Electric vehicle would lead to productivity and ability to growth faster in industry than other fuelling cars.

- Electric vehicles used to have greater improvement in technology and operations in the company.
- The impacts of the electric vehicle on other vehicle are electric vehicles which is hybrid cost lower than the fuelling cars with same functions and performance.
- Electric cars will most likely adopt this technology in the future.
- Electric vehicle uses to support the ecosystem by making the eco-friendly cars which cause edge on competition to fuelled vehicles.

IV. Some more information regarding EV -

TYPES OF ELECTRIC DRIVETRAINS:

BEV's:- Pure battery electric vehicles (BEV's) are also referred to as battery-only electric vehicles (BOEV's). BEV's had no engine and is propelled by electricity that comes from one and several on board high-energy batteries.

PHEV's:- Plug-in hybrid electric vehicles (PHEV'S) Allow electric driving on batteries, (in charge-depleting mode) but also conventional combustion-fuelled driving (in charging- sustaining mode). Usually they are equipped with an electric

motor and a high-energy battery, which can be charged from the power grid.

Is EV really the best solution for the environment :

- When discussing environmental impact, it is important to take into account the full life cycle of a vehicle.
- This allows looking beyond emissions from the vehicle itself to the environmental impact of batteries, the production of electricity, and so forth.
- In a full life cycle, electric vehicles emit two times less carbon dioxide (CO₂) in comparison to Diesel engines if we take the European electricity mix.
- This can be even four times less if we take, for example, the Belgian electricity mix.
- If cars were driving on sustainable electricity, carbon dioxide emissions could be further reduced by more than 10 times.

Electric Vehicles Affect Our Economy?

- Research indicates that the electrification of our transport system would generate one Million Additional jobs in India in 2030 and double in 2050.
- These jobs relate to the production of Components for electric vehicles, but they also relate to new services, such as charging infrastructure.
- Electrification will also reduce our oil dependency.
- Investing this in our own economies could mean a best improvement in employment rates.
- Families could increase their purchasing power when they no

longer need to depend on imported oil products.

- It is suggested, however, that loss of income from duties and taxes on diesel and petrol will negatively impact government budgets.
- However, this does not take into account improved air quality. Improved air quality will have a positive effect on the health budget, resulting in less expense for health care and the cleaning of monuments.

V. Research Design

The study is about the impact of Electric Vehicles on business from an operational and human perspective. At the end of the day each business is basically an operation and its integration with human resource elements.

The study seeks to analyse the influence that Electric Vehicle has made on businesses right from the introduction of EV's .

- Trend analysis and changing in usage of vehicles
- The variety of changes in the Automobile industry taken up over the years owing to change in people's perspective

Location of Study - The study will be carried out in Mumbai and sub-urban areas as a sample.

(Mumbai has been chosen as the sample due to its voracious business appetite and epicentre of business from Indian perspective).

Type of data required - From this study we have done trend analysis from past years and already existing portfolios of cases on various industries and changes in businesses (Secondary data) due to change people's perspective regarding to the environment to adapt the change of conversion from the combustible driven vehicle to non-combustible vehicle i.e. EV's .Transportation, Air pollution and climate changes, mobile source pollution and related health effects of air toxics from vehicles to both groups and individuals. Hydrogen Fuel Cell vehicles (FCVs) are similar to electric vehicles in that they use an electric motor instead of an internal combustion engine to power the wheels.

In addition to this interaction with business and local personnel through direct interaction and online and printed questionnaire would be used together real time data.

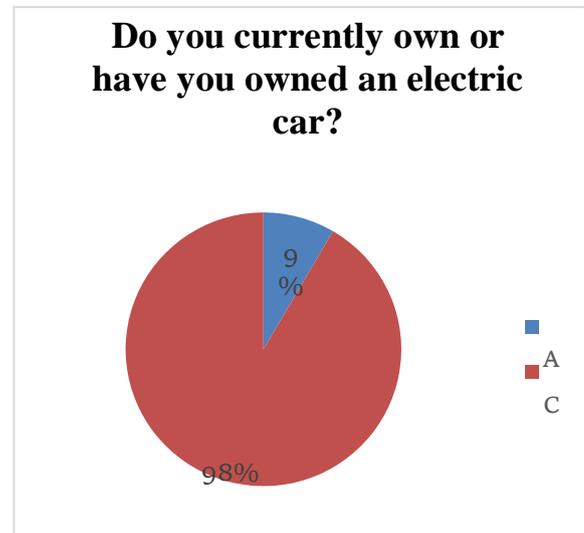
Sources of data – The required data can be found from below listed sources-

- Automobile case studies
- From recent case studies on changing People's perception regarding use of EV's.
- Existing research paper and news sources.
- Interaction with industry people and business at micro level to understand tickle down effect of technology.

Period - The period required is 1 month for initial survey including small scale businesses to People's preference regarding the future use of EV's.

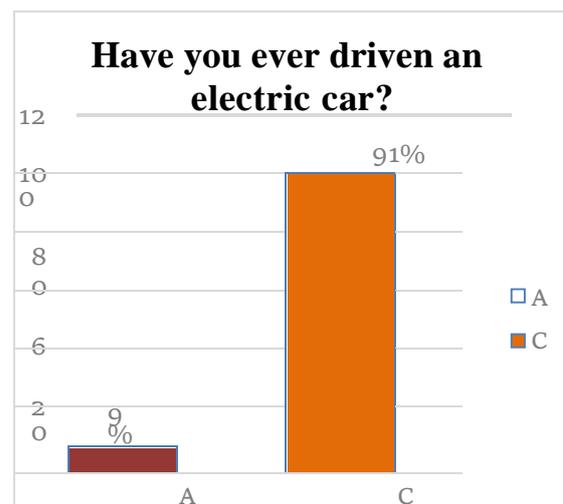
VI. Data Analysis and Interpretation

• Ownership of EV –



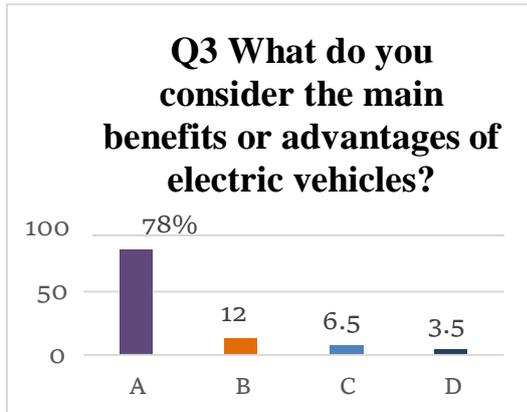
From the above stated data we can easily grasp that majority of our sample size have never owned an electric vehicle, only 9% of total people surveyed have owned an electric car at present or sometime in the past.

• Driving of EV –



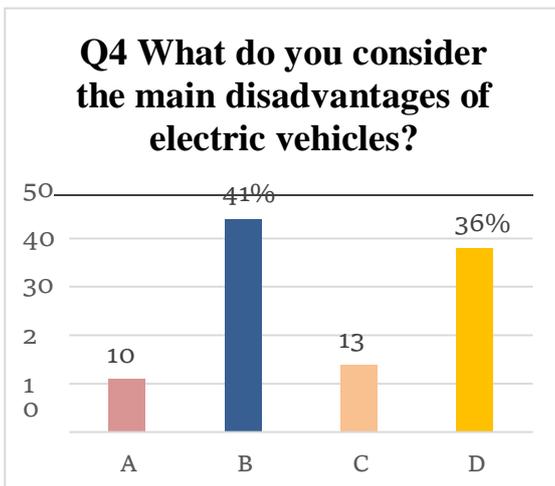
From the total sample size gathered only 9% have never driven an electric car in their lifetime, on the other side most of them have driven a hybrid-petrol car as per their convenience.

• Advantage of EV –



The bulk of our sample size believes that the main benefit of owning an electric car is that it leads to a friendlier living environment with low pollution & fuel usage. Low cost of maintenance is the second most important aspect of buying an electric car as per our survey at 12% followed by how budget friendly an electric car is and its performance, at 6.5 and 3.5% respectively.

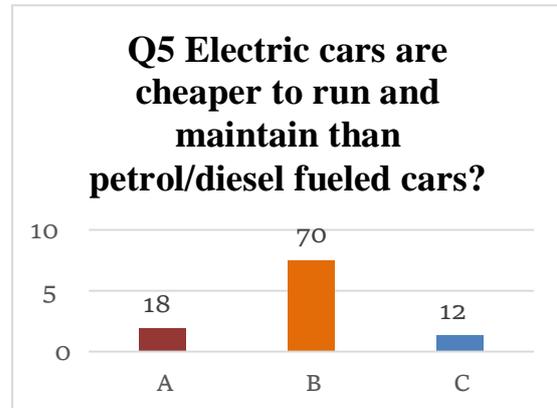
• Disadvantages of EV –



According to our survey the most disadvantageous aspect of buying an electric car is that of scarcity of charging stations at 41% closely followed at number second by the battery life of an electric car. High cost of repairs and scarcity of service stations for electric cars are the second last and last factors

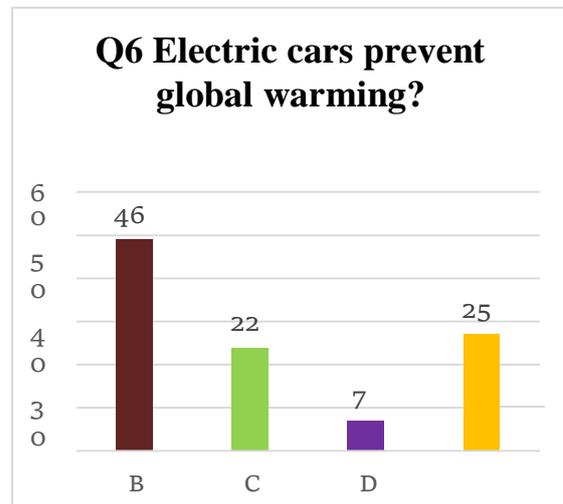
associated with buying an electric car at 13 and 10% respectively.

• EV cheaper to run and maintain -



Lion share of our sample size strongly agree that it is cheaper to run an electric car as compared to a car running on either diesel or petrol. With 18% some people mildly agree with this notion, on the other hand the remaining 12% are undecided on whether cars running on electricity are cheaper than those running on diesel or petrol.

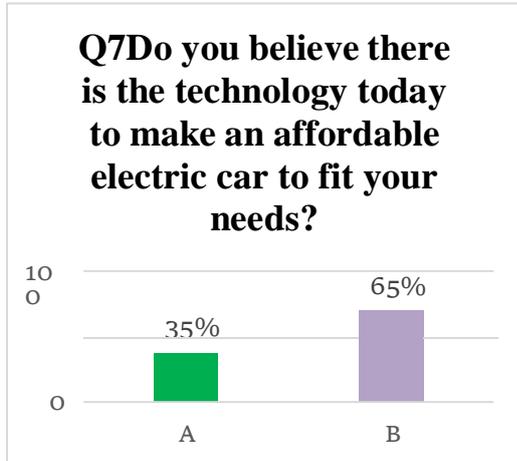
• EV & Global Warming –



Close to half i.e. 46% of the people surveyed agree with the fact that electric cars help in preventing global warming on the other hand 22% of the people are in disagreement over the fact that electric cars prevent global warming. 7% people strongly disagree with this notion and one-fourth of the total people surveyed

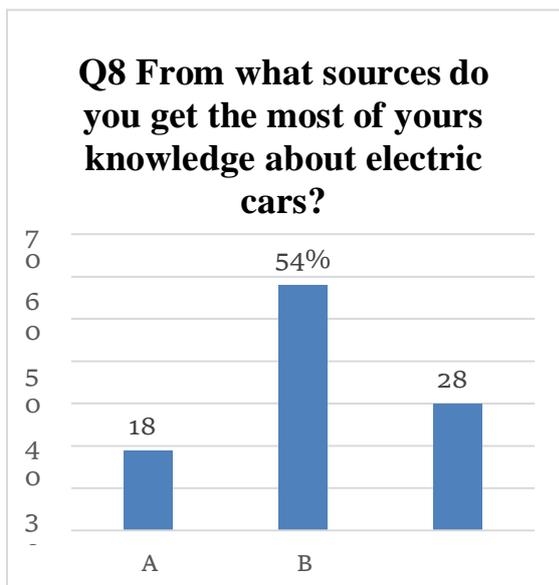
can't decide on either of the options i.e. weather to agree or disagree.

• EV & Affordability –



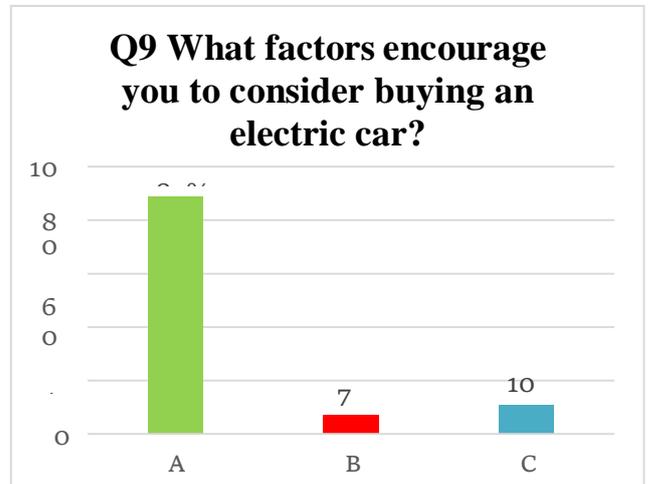
35% of total people believe that at present there is lack of proper technological advancements in order to prepare an electric car, where as 65 % people believe in the next couple of years we will have efficient enough technology to make an efficient & affordable electric car.

• Sources & Knowledge about EV –



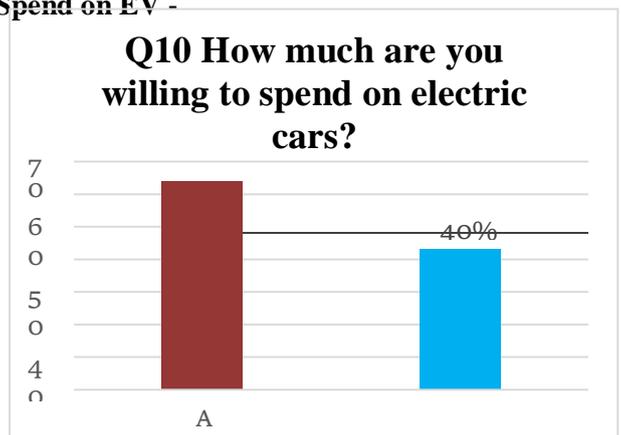
cars via TV sets. With 18% of people getting their dose of information through various internet sources.

• Factors induce to buy EV –



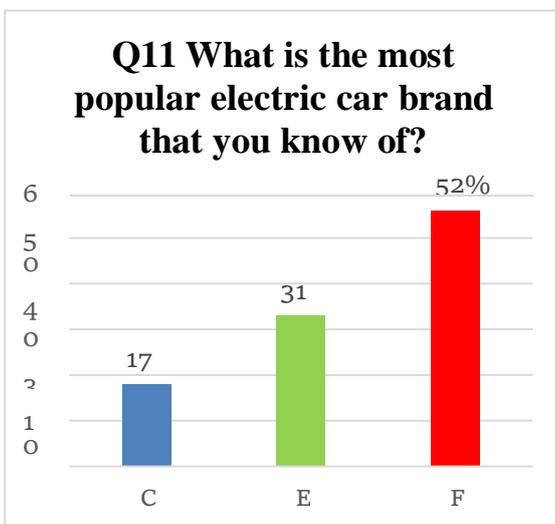
Bulk of our sample size believes that a positive environment is the key aspect for buying an electric car, followed by that of it being a cheaper option as compared to other vehicles and price of an electric car being last reason, at 7 & 10% respectively.

• Spend on EV -



As per our survey more than half the people surveyed get their information about electric cars from either magazines or newspapers (i.e. 54%). Television is at second spot with 28% of people getting their information on electric propensity spending customer cadder at 4-7 lakhs rupees i.e. 35% of total people surveyed.

- **Most popular EV among consumers-**



- A. Ford**
- B. Honda**
- C. Maruti**
- D. Tata motors**
- E. Mahindra**
- F. Tesla**

There were no points for guessing that the world renowned car manufacturer “Tesla” was the most know brand to the people we surveyed with more than half of them opting for it at 52%. The Indian automobile giant “Mahindra” was at second spot with 31% opting for it. Lastly the remaining 17% choose to go with the Indian brand 'Maruti'.

VII. CONCLUSION

- US Environment protection agency, Greenhouse gases (GHGs) are critical issues that policy-makers have sought to address globally.

Greenhouse gas reduction strategies in transport sector are 98% dependent on fossil oil which is exceedingly affected by changes in energy resources.

- Plug-in hybrid electric vehicle (PHEV) is one of the alternative fuel vehicles (AFVs) which can reduce GHG emissions. Hydrogen Fuel Cell vehicles (FCVs) are similar to electric vehicles in that they use an electric motor instead of an internal combustion engine to power the wheels.
- Transportation, Air pollution and climate changes, mobile source pollution and related health effects of air toxics from vehicles to both groups and individuals.
- The hybrid gasoline-EV is greatly promising in future since it can reduce gasoline consumption and GHG emission from 30% to 50% without the need of changing the vehicle class.
- The driving range limit inevitably introduces a certain level of restrictions to Battery Electric Vehicles (BEV) drivers travel behaviours considering the insufficient coverage of recharging infrastructures in a foreseeable future time period.

- Charging facilities are essential for EV drivers. Suppliers such as EV companies and governments are concerned about where to locate charging stations and what type of charging station to locate because of the high cost of building this facility.
- The method of refuelling has the advantage that is reasonably quick. Wang and colleagues proposed a refuelling station model based on vehicles routing logics for both inter-city and intra-city travels.

The progress that the electric vehicle industry has seen in recent years is not only extremely welcomed, but highly necessary in light of the increasing global greenhouse gas levels.

- The biggest obstacle to the widespread adoption of electric-powered transportation is cost related, as gasoline and the vehicles that run on it are readily available, convenient, and less costly.
- As is demonstrated in our timeline, we hope that over the course of the next decade technological advancements and policy changes will help ease the transition from traditional fuel-powered vehicles.
- The realization and success of this industry relies heavily on the global population, and it is our hope that through mass marketing and environmental education programs people will feel incentivized and empowered to drive an electric-powered vehicle. Each person can make a difference, so go electric and help make a difference!

- Numbers of peoples who have bought the EV are very less, Personnel's who have driven the cars is also below the 10%.
- According to the survey people find the EV cars more friendly as well as low cost of maintenance.
- The only disadvantage the maximum people find that of Scarcity if charging station at 41%.
- More than 65% people think that EV will be more efficient and affordable in coming years.
- At the Maximum Practical rate, as many as 40 million PHEVs could be on the road by 2030, but various factors (e.g., high costs of batteries, modest gasoline savings, and limited availability of places to plug in, competition from other vehicles, and consumer resistance to plugging in virtually every day) are likely to keep the number lower.
- No major problems are likely to be encountered for several decades in supplying the power to charge PHEVs, as long as most vehicles are charged at night.

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