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The Road Toward Electric Vehicles in America

ABSTRACT

Invented in 1800s, electric vehicles (EVs) face significant barriers in America car industry, which is still overwhelmingly gasoline-dominated. In this study, we investigate the causes of the stagnation of EV acceptance in America through social and cultural lenses and identify the major barriers in American society: consumers' reluctance of adopting new technologies, resistance to innovation and their misperceptions on EV's technical challenges, reliability, and environmental impact. To facilitate greater acceptance of EV in American society, we propose strategies to overcome these social and cultural barriers, including consumer education, infrastructure improvement and tax incentives.

Electric vehicles (EVs) can reduce greenhouse gas emissions and improve fuel economy. Many people see Tesla's electric car as a novel technology. However, electric vehicles were invented in 1832, almost half a century before the internal combustion engine. According to Dr. Guarnieri, at the beginning of the 20th century, EVs held 38% of the automobile market in the US, compared with 40% of steam and 22% internal combustion. Despite this head start, because of advances in combustion technology, the car industry in the 20th century was overwhelmingly gasoline-dominated. As of 2021, "EVs make up less than 2% of U.S. new-vehicle sales and about 3% worldwide" (Krisher and McHugh, 2021). It is time for a comprehensive review of the causes of the stagnation of EV acceptance in America. To understand consumer views on EVs, it is necessary to understand their social and cultural context, including American consumers' negative attitudes toward new technologies. To promote the use of EVs, it is critical to form a clear understanding of the barriers to their adoption and identify strategies to overcome them including consumer education, infrastructure improvement, and tax incentives.

American consumers' misconceptions about EVs' technical challenges are the leading deterrence to EVs' acceptance. According to studies published in Transportation Policy and Energy Policy, the EVs that were produced in the early 21st century had a short range, low speed, and expensive and heavy rechargeable batteries, making them a poor choice compared to constantly improving gasoline cars (Egbue and Long, 2012; Sovacool and Hirsh, 2009; Axsen et al., 2010). However, Tesla has addressed the vehicle range issue with novel battery designs that can travel nearly 400 miles on a single charge (www.tesla.com/models). Although expensive, these new batteries are in fact very cost efficient. According to a study by the Idaho National Laboratory (2022), the cost of traveling about 43 miles in an EV is $1.00, while the average gasoline vehicle will only go about 18 miles on $1.00. Today's EVs offer superior efficiency and range, making them more cost effective than traditional gas vehicles. Furthermore, recent advances in novel solid-state batteries mean that electric car batteries will soon be lighter, faster charging, and more durable than ever (Burrows, 2021). Thus, electric cars today are no longer limited by the technological hurdles of a few decades ago.

In addition to concerns about EVs' technical challenges, consumers have reservations about the reliability of EVs. For instance, in a 2021 survey "about twice as many Americans consider electric vehicles lacking compared with their gas-powered counterparts when it comes to reliability" (Spencer and Funk, 2021). The truth is that electric cars are more than ready for the open road and can compete with traditional vehicles in terms of reliability. The U.S. Environmental Protection Agency (EPA, 2021) points out that "Electric vehicles must meet the same safety standards [Federal Motor Vehicle Safety Standards] as conventional vehicles…. Separately, EV battery packs must meet their own testing standards. Moreover, EVs are designed with additional safety features that shut down the electrical system when they detect a collision or short circuit." KIA, which manufactures both electrical and gas-powered cars, states that compared with gasoline vehicles, EVs are more reliable because they have fewer moving parts; Lithium-ion batteries have much less risk of fire explosion because of the protective cooling shroud surrounding the batteries (www.kia.com/discover-kia). Given the continuous technological breakthroughs in the EV industry and the strict safety regulations, consumers' concerns about EV's reliability are indeed misconceptions.

Myths about EVs' environmental impact also contribute to their low social acceptance. Ben Lieberman, a member of the U.S. House Committee on Energy, spoke for many consumers when he noted that the extraction of rare earth elements like lithium and cobalt, required for EV batteries, may cause more environmental damage than the emissions from gasoline vehicles (Lieberman, 2020). Many consumers are mistrustful of EV manufacturers' claims about the environmental benefits of EVs. Some argue that the negative environmental impacts of EV production create a "carbon debt" for an EV before it has driven a single mile. However, EPA (2021) points out that greenhouse gas emissions associated with an EV over its lifetime are typically lower than those from gasoline vehicle, even when accounting for carbon produced in EVs' manufacturing and disposal. Furthermore, the "carbon debt" of EVs can be further compensated for if drivers charge the vehicles with power generated by a renewable energy source. Thus, although the manufacture of electric vehicles is not emission free, with the proper regulation of the manufacturing process and the use of renewable energy sources for electricity, EVs definitely have smaller environmental footprints than gasoline vehicles.

Clearly, most consumer concerns about EVs' technical hurdles, reliability, and negative environmental impacts are not based on facts. The root cause of the reluctance to purchase EVs is American consumers' reluctance to adopt new technologies and their resistance to innovations. According to Professors Sovacool and Hirsh from National University of Singapore, "The majority of consumers, while making choices, stick to 'notions of tradition and familiarity' rather than embracing technology" (Sovacool and Hirsh, 2009, p.1100). This attitude results in consumers not giving new technologies a chance. Unless there is a change in consumer mindset, the novel EV technology will be killed before it can take off. Jose et al. (2022) point out that "The main factor that discourages customers to buy an electric vehicle is that they are not educated enough on electric vehicle" (11). Thus, educating the public about EVs is critical; there is a need for more transparent communication between consumers and manufacturers.

According to Boudway and Stock (2022), industry leaders are promoting the move towards a more electrical future by increasing the number of national TV spots for EVs. They claim that, "Ad viewers who saw an Audi EV, for instance, were 90% more likely to search for the brand online than viewers who saw an ad for one of the brand's combustion engine models." Therefore, as major manufacturers like General Motors and Ford Motor begin advertising EVs and educating consumers on the true capabilities of these cars, the social acceptance of electric cars will increase. Consumer education through advertising and vehicle demonstrations, among other methods, will address American consumers' hesitancy to accept EVs, making the full implementation of EVs more feasible.

Along with greater consumer education, the growth of EVs depends on the availability of charging stations and upgrades to the electricity grids. According to the California Hydrogen Coalition, "EVs are more likely to be accepted by consumers if [there is] more access to charging stations" (Maviglio, 2021). American consumers are used to easily refueling their cars. Thus, to make electric cars more appealing to the public, it is necessary to make it just as easy to refuel electric cars. This also means improvements to the energy infrastructure, as the existing electric grids cannot support a full-scale implementation of electric cars. For instance, in California, the increase in the use of household ACs has already caused rolling blackouts and increased fire risks. The load on the electric grid will be further increased as EVs become more common, because "charging an electric vehicle can consume as much electricity as three households" (Takahashi, 2020). Given these problems, improving the electrical grid must be an infrastructure priority.

Changing America's gasoline habit may be challenging without government intervention. From the policy perspective, stricter pollution limits and tax incentives for purchasing EVs are the most common approaches to boosting sales, and these strategies have successfully increased sales of EVs in Europe and China, with China accounting for more than 40% of global EV sales (Krisher and McHugh, 2021).

Together, consumer education, an EV-friendly infrastructure, policies that facilitate EV sales such as tax incentives, and stricter pollution policies could shift America's social paradigm and EVs could gradually replace gasoline cars. As states like California take the lead, implementing EV mandates by 2035, a future in which Americans love their electric Fords and Dodges becomes feasible.

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