Modelling the Determinants of Electrical Vehicles Adoption: A Saudi Perspective

Ryan Alyamani, KAPSARC, +966112903158, ryan.yamani@kapsarc.org
Dimitrios Pappelis, UCL, +447308158183, d.pappelis.19@ucl.ac.uk
Maria Kamargianni, UCL, +4420767955942, m.kamargianni@ucl.ac.uk

Overview

Global transport is one of the most significant contributors to fossil fuel consumption, local air pollution and greenhouse gas emissions. In 2019, it was responsible for almost a quarter of all direct carbon emissions globally, around three-quarters of which were due to road vehicles (IEA, 2020). A potential solution is offered by electric vehicles (EVs), which are four times more efficient than conventional internal combustion engine vehicles and provide an opportunity to significantly reduce national emissions when combined with low-carbon intensity energy systems (IEA, 2021). The EV market is expected to continue growing significantly as EV deployment is increasingly of interest in many countries as they strengthen their environmental commitments and efforts.

The Kingdom of Saudi Arabia, for example, has been a leader in the international energy markets, contributing to both global and its own domestic economic growth. However, the economic growth in the country is also associated with a surge in emissions: between 1990 and 2014, its total emissions tripled to 600 CO_2 million tons (Wogan et al., 2019). In 2016, however, the country embarked on a societal and economic makeover through its Vision 2030, placing sustainability at the core of its future development. In the days leading up to COP27 in 2021, Saudi Arabia amplified its Paris Agreement pledge, committing to carbon neutrality by 2060. Aware of the magnitude of this commitment for the world's largest oil exporter, the government has launched a range of further environmental-friendly initiatives. One of those initiatives is a target of 30% EV penetration in Riyadh by 2030. Thus, it is essential to build a comprehensive understanding of potential demand and response to different adoption-incentivising policies given that in the early stages of EV adoption, in particular, adopting optimal incentivising measures reduces the burden on government (Langbroek et al., 2016). However, to the best of our knowledge, no publicly available study investigates the demand for EVs by the population of Riyadh City. This study thus aims to fill the gap by examining consumers' acceptance of EVs in Riyadh City and the expected responses of consumers to various attributes and incentives.

Methods

The analysis was conducted through primary data from a stated-preference survey targeting adult residents (aged 18 and older) in Riyadh City. The sample was distributed through convenient sampling to attain a total of 703 responses from the targeted audience. Characteristic sample analysis was conducted to find that the collected sample closely follows the population shares. However, Saudis and those aged 25–34 are more highly represented than in the population. Aside from providing analysis on travelling behaviour and vehicle purchase preferences, the study utilised Biogeme python software to construct a mixed logit model, capturing the utility of EV adoption.

Results

According to the survey, an average household (average household = 5 members, excluding domestic workers) owns 3.04 vehicles, 40% of which are described as SUV, a van or similar. Even among those who indicated no car

ownership, 97% expressed their transfer through vehicles (taxi service, car rental, or friend/relatives' cars). The survey also showed that, on average, residents of Riyadh make about four trips a day: based on respondents' approximations, 20% of all the trips take less than 15 minutes and 70% less than 30 minutes.

In total, the stated-preference experiment collected 4110 observations, where EVs were chosen 1920 times (47%) and conventional vehicles 2190 times (53%). The model shows that unlike emissions from conventional vehicles, the emission levels of electric vehicles are insignificant in determining consumers' selection. Respondents were more sensitive to changes in the monetary values of electric vehicles than conventional vehicles. Regarding any anxiety about EV ranges, the same sensitivity was found in changes in EV ranges relative to traditional vehicles. Charging infrastructure availability and non-financial incentives (i.e., access to designated parking and road lanes) positively influence the likelihood of EV adoption. Regarding the socioeconomic and travel-behaviour determinants, Saudi participants were less likely than expats to purchase EVs. Meanwhile, females and those (both genders) in their 40s showed a likelihood of purchasing an EV, which aligns with studies conducted on the region. Also, those with an average of shorter trip durations (less than 30 minutes) and those who personally know EV owners in Riyadh were more likely to adopt them.

Conclusions

Attaining the determined target is a significant challenge that requires significant reforms to incentivise EV uptake. This is especially true since Saudis showed caution in their adoption decision-making, with high consideration to the variation in monetary incentives for EVs. Although providing economic incentives such as tax exemption will likely encourage adoption levels, there are also opportunities for policy interventions that create less of a financial burden on the government. This could be providing access to designated public parking spaces for EVs and providing EV owners access to the newly introduced bus road lanes in Riyadh City. Since being allowed to drive, an increasing number of females are acquiring vehicles in Riyadh, creating an opportunity to enhance EV adoption, given that this study shows their higher tendency relative to males. It is worth noting the study shows that almost 60% of the targeted population indicated an interest in purchasing a vehicle in the upcoming three years, where the great majority stated that a new vehicle would replace an existing vehicle. This creates a window of opportunity to implement optimal incentivising policies, as once a conventional vehicle is purchased, investment then becomes 'locked' for a period of years.

References

IEA 2020. Tracking Transport 2020.

International Energy Agency 2021. Global EV Outlook 2021 – Accelerating ambitions despite the pandemic. Langbroek, J.H.M., Franklin, J.P. and Susilo, Y.O. 2016. The effect of policy incentives on electric vehicle adoption. Energy Policy 94. doi: 10.1016/j.enpol.2016.03.050

Sheldon, T.L. and Dua, R. 2019. Measuring the cost-effectiveness of electric vehicle subsidies. Energy Economics 84. doi: 10.1016/j.eneco.2019.104545

Wogan, D., Carey, E. and Cooke, D. 2019. Policy pathways to meet Saudi Arabia's contribution to the Paris Agreement. The King Abdullah Petroleum Studies and Research Center (KAPSARC) (February).