

THE ANALYSIS OF ELECTRIC VEHICLE CHARGING STATION USERS: CASE STUDY OF INDONESIA ELECTRICITY MARKET

[Fajar Nurrohman Haryadi, PT PLN (Persero) Research Institute, +622179973774, fajar.haryadi@pln.co.id]

[Dzikri Firmansyah Hakam, PT PLN (Persero) Research Institute, School of Business and Management ITB, dzikri.f@pln.co.id]

Introduction

A mitigation strategy for road transportation is needed (Javid et al., 2014) because transportation is a major contributor to greenhouse gas emissions due to high energy consumption for vehicles (Suharyati et al., 2019). The number of vehicles in Indonesia is increasing every year which is dominated by two-wheeled vehicles, around 81.7% in 2018 (BPS, 2019). Emissions contributed by the transportation sector are high, transportation is now starting to be given an alternative to switching to low-emission electric vehicles, as well as household appliances. Electric vehicles have been around since the 1900s in the United States (US). As emissions from transportation increase, now several countries have redeveloped electric vehicles. Likewise with Indonesia which began to develop electric vehicles. Electric vehicles are able to reduce emissions intensively in several countries, including all of Europe, the United States, and China (Knobloch, 2020).

The State-Owned Electricity Company (PLN) supports the program by establishing ECS (Electric Charging Station) and EVCS (Electric Vehicle Charging Station) in several areas. PLN has built more than 7,000 ECSs throughout Indonesia (Kompas.com, 2019). Several major cities in Indonesia already have ECS such as DKI Jakarta, Surabaya, Semarang and Bandung. In Jakarta there are 1,922 ECSs that have been built and are ready to operate. EVCS is a means of charging electrical energy for Battery-Based vehicles for the public (Presidential Decree No. 55 of 2019). The construction of ECS and EVCS aims to facilitate the community in accessing electricity needs. Facts on the ground show that the ECS and EVCS infrastructure development does not appear to be very effective. The effectiveness of the construction of the ECS and EVCS cannot be seen because there are few visitors, there are not many electric vehicle users, the majority of ECS visitors are street vendors, and so on. Therefore, this study is focused on seeing how stereotypes of behavior patterns and needs of electric vehicle users can be used as information to increase the effectiveness of the roles of ECS and EVCS.

There are several research discussing about EV adoption, such as research talking individual factors, for example gender (Chen et al., 2020; Javid et al., 2019; Sovacool et al., 2018), level of education (Habich-Sobiegalla et al., 2018; JH Kim et al., 2019; Mukherjee & Ryan, 2020; Sovacool et al., 2018; Vergis & Chen, 2015) and a person's age (Chen et al., 2020; Mukherjee & Ryan, 2020) which have a positive effect on individual decisions in adopting EV. But it is hard to find any research about the effectiveness of ECS and EVCS especially in Indonesia. This study focuses on the analysis of electric vehicle charging station users in Indonesia electricity market.

Methods

This study uses two types of research approaches, namely descriptive and quantitative research approaches. A descriptive approach is a type of approach that seeks to systematically describe a situation, problem, phenomenon, service, or describe an attitude towards a problem (Kumar, 2011). Whereas the quantitative approach is an approach used to measure variations in a phenomenon, situation, problem, or issue and if information is collected using dominant quantitative variables and analysis is directed to ascertain the amount of variation (Kumar, 2011).

Descriptive approaches and quantitative approaches are used in this research. The descriptive approach is used for several purposes, namely: (1) to help describe the user profiles of general electric charging stations (ECS) and public electric vehicle charging stations (EVCS); (2) describe the customer satisfaction variables ECS. A quantitative approach is used to determine which factors significantly influence the customer usage patterns of ECS / EVCS and electric vehicles. The analysis technique used in the quantitative approach in this study is logistic regression analysis.

Results and Conclusions

The results of the survey based on all respondents showed that the average age of the respondents was 36 years, had an income of 5.7 million rupiah, the number of family members was 4 people, did not have a bicycle or car at home but had a motorbike, the distance from where they lived to the city center was around 7.9 km, the last education graduated from high school / equivalent, electrical power in class R-1 (450 VA to 2200 VA), and is not involved in community and environmental activities. The composition of respondents is more from potential customers than existing users. The results of the logistic regression with the dependent ECS and EVCS dummy variables show that the gender, age, education level of the respondent, the distance from the residence to the city center, the number of vehicles owned, the number of family members, household income, electricity class, and environmental care activities. and community organizations did not show any significant changes in the use of ECS and EVCS.

The use of ECS / EVCS by respondents for both electric vehicles and others was based on several reasons. Respondents agreed with the statement that they chose to charge the battery of an electric vehicle or electronic device at the ECS or EVCS rather than at home because the ECS or EVCS location was around the workplace, chose to charge the battery of an electric vehicle or electronic device at the ECS or EVCS rather than at home because of the number of electrical plugs in their house is limited and also when parking or doing other activities. Respondents also agreed that the number of ECS or EVCS was increased in order to make it easier for respondents to charge electric vehicle batteries or electronic devices anytime, anywhere easily and comfortably.

From the results of the analysis of factors, personal and cultural variables, ease of access, and environment have a significant influence on the decision to use ECS / EVCS, while the variables of the availability of facilities and infrastructure and flexibility do not significantly influence the decision to use ECS / EVCS. Increasingly, a person's assessment of his / her profile, such as lifestyle in terms of relationships and the use of popular or trending technology; age; and work, the opportunity for decisions to use ECS / EVCS is also increasing. The existence of ECS / EVCS which is easily found in their area and the practicality of using it also increases the opportunity to use ECS / EVCS. In terms of environmental factors, the increasing information or experience obtained from the closest family members, the smaller the chances of the decision to use ECS / EVCS, or in other words someone will tend not to use ECS / EVCS if they get input from close family members. In this environmental factor, it can also be explained that a person who increasingly charges electronic device batteries at home at night while sleeping will tend not to use ECS / EVCS.

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