

Acceptance of Electric Vehicle based on Pricing and Charging Station

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ABSTRACT

In the middle of 19th century, electric vehicle (EV) has taken place as favourite energy resources for car driving. EV does not have vibration, smell or noise in their operation that gives advantage compared to internal combustion vehicle. However, integration of electrical-based engine technology required extra cost and installation of public charging points. This study focus on finding out the acceptance of EV among Malaysian based on the pricing and charging station. This is due to the environmental problems caused by vehicles emissions that leads to greenhouse effect. Besides, the price of EV is more expensive than internal combustion vehicle and there are limited charging station provided. A survey was conducted in Gombak and Melaka Tengah by using simple random sampling. Sample size of 384 respondents were selected form each district out of 682,226 (Gombak) and 503,127(Melaka Tengah) population. About 46.74% of the respondents agreed to buy EV if the price is less than MYR 50,000 and 87.37% of the respondents agreed to purchase EV if access to a charging station is provided at commercial parking lot or garage. Unwillingness to pay for more than MYR 50,000 means that the community has a low financial ability instead of their interest to own an electric vehicle if public charging station are provided.

Keywords: *Electric Vehicle, Pricing, Charging Station*

Introduction

An Electric Vehicle (EV) can be clarified as an electric drive vehicle. It can be driven through the collector by the electric system of the sources of the vehicle or can contained with the battery or generator to convert fuel into electricity. There are many types of automotive vehicles that use EV such as electric cars, electric trains, electric lorry, electric aircraft, electric boats, electric bikes, electric scooters, and electric spaceship. Battery electric vehicle, hybrid electric vehicle and plug-in electric vehicle are among EV technology available today [1]. At the moment, Norway is the leading country which showed massive increase of registered EV since last few years [2]. This factor was influenced by multiple economic incentives from the authorities which contributed to huge purchase number of EV. According to SAE, there are 3 level of EV charging; Level 1, 2 and 3. Higher level will led to less charging time and it also depends on source of current [3]. Ziefle et al. [4] has conducted a study on public perception towards electric vehicle. It was found that internal combustion engine vehicle is more preferred compare to electric vehicle. Meanwhile, Liao et al. [5] found that consumer preference towards electric vehicle depending on several important factors such as financial, technical, infrastructure and policy attributes. Based on these attributes, random sampling was done to study the relation of consumer acceptance with pricing and charging station.

Methodology

Qualitative research was used in studying the acceptance of EV to understand and promote it in the future. A face to face interview with random respondents was conducted to obtain a detail understanding of EV or non-EV users against the vehicle they are using. Along with it, quantitative research used to analyse research framework of users purchase intention towards pricing and charging station. The combination of these two pillars has been used as reference in designing questionnaire. The questionnaire consisted of two sections, namely section A and B. The first section is collected data based on the variables embraced from the study done by Geuens et al. [6] including age, gender, education level, and salary. Second section quantified respondent's disposition towards EV subjective standards, buying expectation, and acknowledgement in terms of cost and charging stations. It also contained a progression of inquiries that investigate the learning and consciousness of respondents of their observation on EV. The items were measured using a 5-point represents the range of (1) strongly disagree, (2) disagree, (3) average, (4) agree, and (5) strongly agree. Gombak and Melaka

Tengah were chosen for random sampling. Table 1 and table 2 showed the formula used in conducting the survey.

Table 1: Sampling of Gombak District

Population size	682226
Margin of error	5%
Confidence level	95%
Sample size	384

Table 2: Sampling of Melaka Tengah District

Population size	503127
Margin of error	5%
Confidence level	95%
Sample size	384

It means 384 respondents of the total population for both districts will be interviewed on the acceptance of EV against pricing and charging station. If the sample size too large, the statistical analysis might be too sensitive, constructing goodness of fit measures indicate poor fit [7].

Results and Discussions

768 questionnaires were distributed to the respondents and the response rate is 100%. The results were presented by pie chart as shown by following figures.

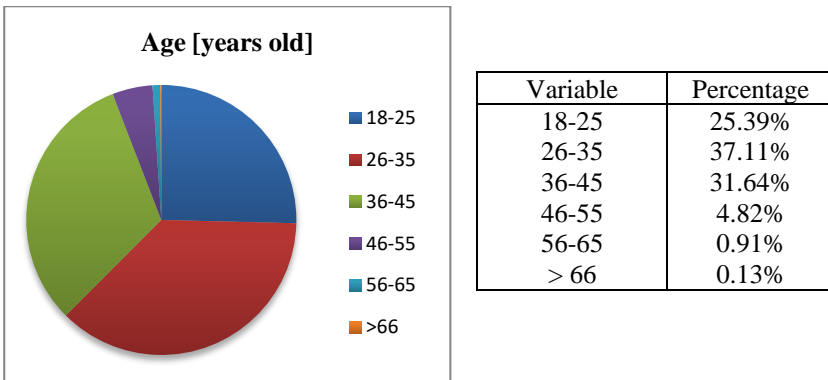
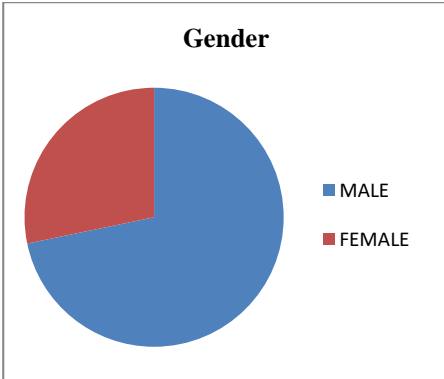
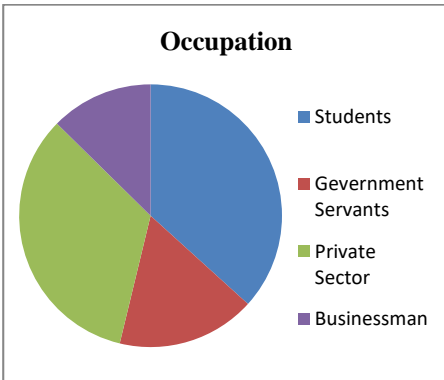


Figure 1: Age of Respondent



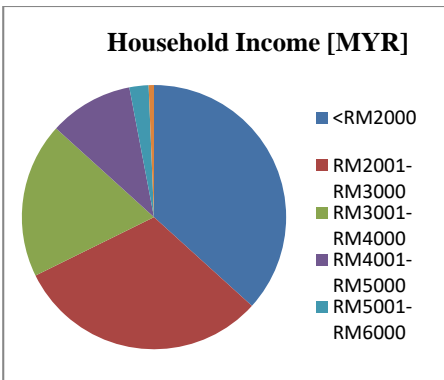
Variable	Percentage
Male	71.74%
Female	28.26%

Figure 2: Gender of Respondent



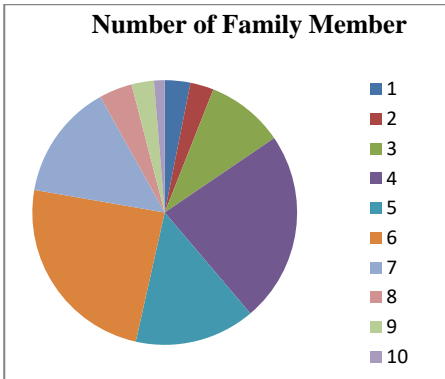
Variable	Percentage
Students	36.72%
Government Servant	17.06%
Private Sector	33.59%
Businessman	12.63%

Figure 3: Occupation of Respondent



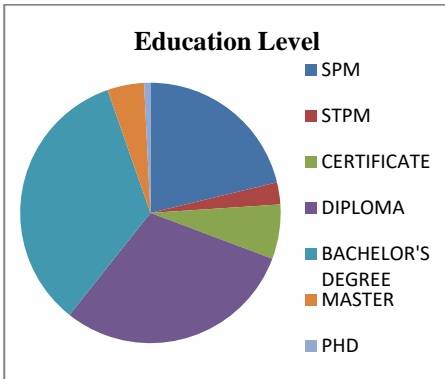
Variable	Frequency
< 2000	36.72%
2001-3000	30.99%
3001-4000	19.01%
4001-5000	10.29%
5001-6000	2.34%
> 6001	0.65%

Figure 4: Household Income / Income of Respondent



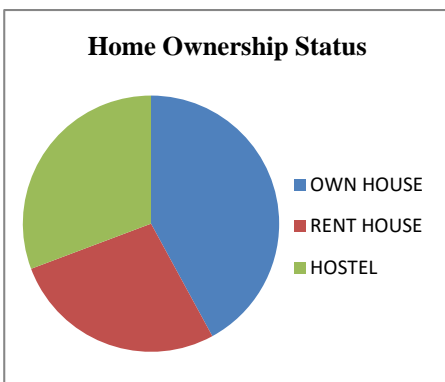
Variable	Frequency
1	3.13%
2	2.86%
3	9.51%
4	23.31%
5	14.71%
6	24.22%
7	14.19%
8	4.04%
9	2.73%
10	1.30%

Figure 5: Number of Family Member of Respondent



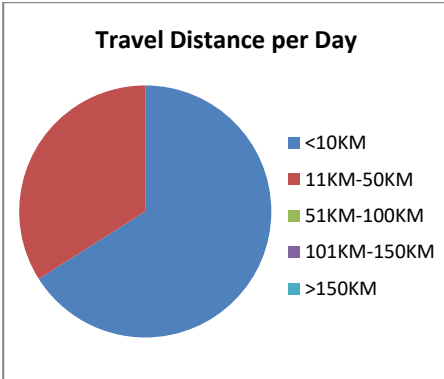
Variable	Frequency
SPM	21.22%
STPM	2.73%
Certificate	6.77%
Diploma	29.95%
Bachelor's Degree	33.98%
Master	4.56%
PHD	0.78%

Figure 6: Education Level of Respondent



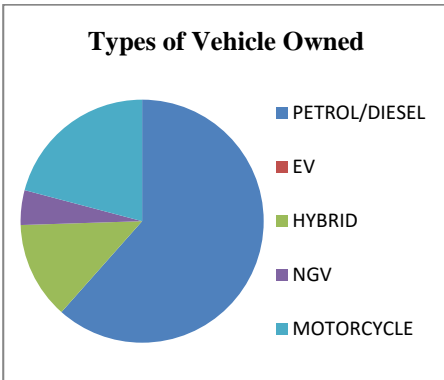
Variable	Frequency
Own house	42.06%
Rent house	27.21%
Hostel	30.73%

Figure 7: Home Ownership Status of Respondent



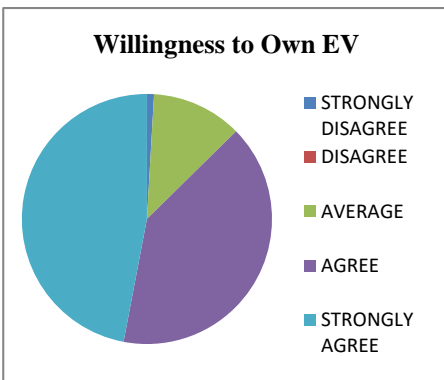
Variable	Frequency
< 10km	66.02%
11km-50km	33.98%
51km-100km	0%
101km-150km	0%
> 150km	0%

Figure 8: Travel Distance/Day of Respondent



Variable	Frequency
Petrol/Diesel	333
EV	0
Hybrid	70
NGV	25
Motorcycle	113

Figure 9: Types of Vehicle Owned by Respondent



Variable	Frequency
Strongly Disagree	0.91%
Disagree	0%
Average	11.72%
Agree	40.36%
Strongly Agree	47.01%

Figure 10: Willingness to own EV

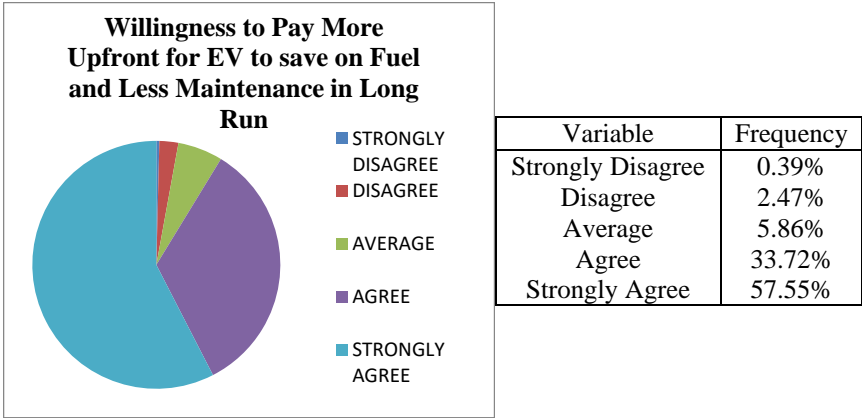


Figure 11: Willingness to Pay More Upfront for EV to save on Fuel & Less maintenance in Long Run

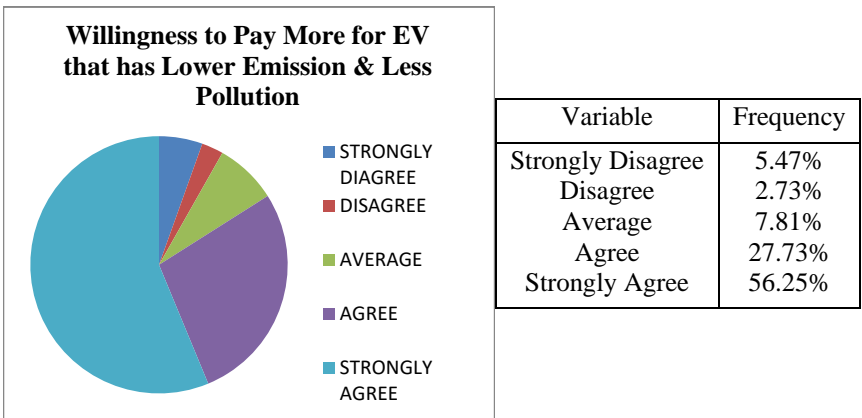


Figure 12: Willingness to Pay More for EV that has Lower Emission & Less

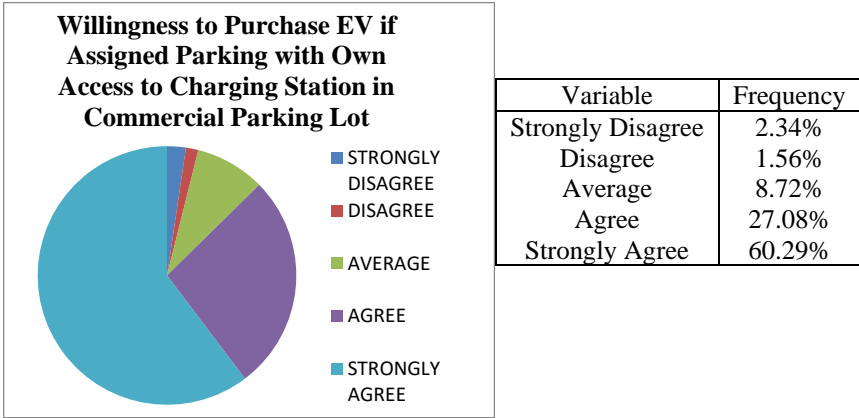


Figure 13: Willingness to Purchase EV if Assigned Parking Spot with Own Access to Charging Station

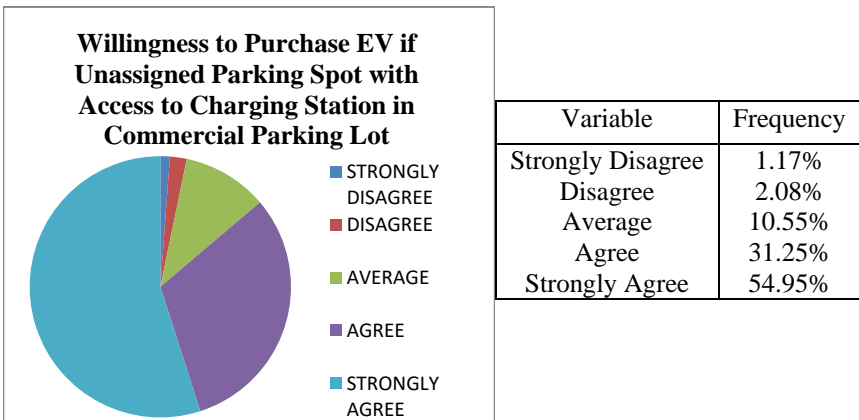


Figure 14: Willingness to Pay for an Unassigned Parking Spot with Access to Charging Station in Commercial Parking Lot

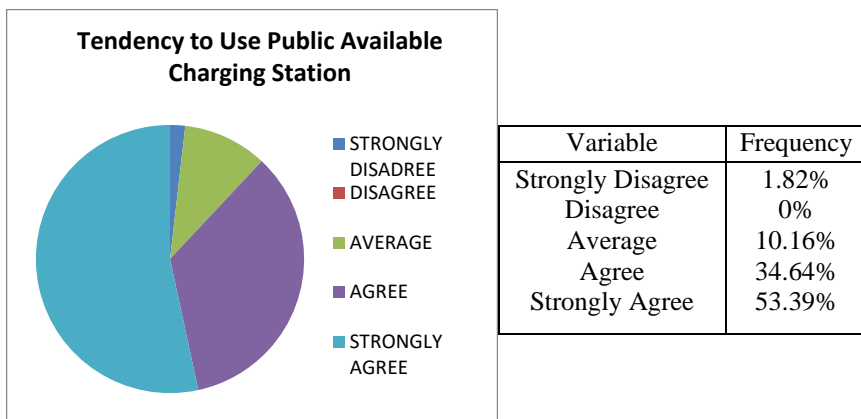


Figure 15: Tendency to Use Public Available Charging Station

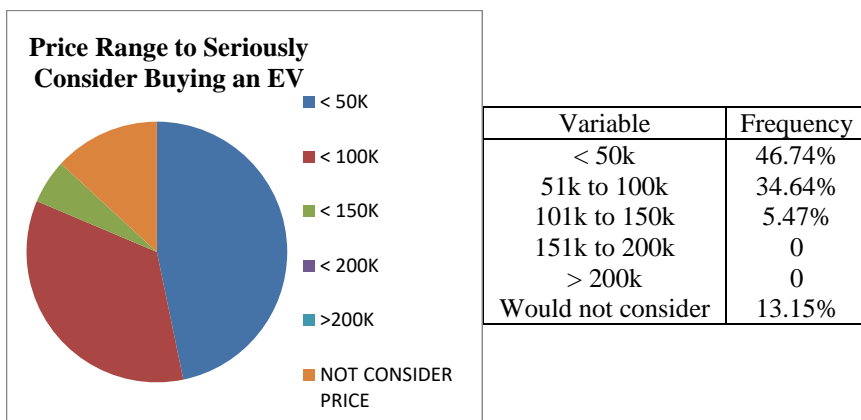


Figure 16: Price Range to Seriously Consider Buying an EV

Figure 1 shows the distribution of age among respondents. Most of them are between 26 and 45 years old, indicated that they are graduated and already have careers. This fact is supported by Figure 3, whereby 63.28% of the respondents are working. The level of thinking of the people is different as their profession are also different. Respondents occupation also affect their awareness on current issues such green technology and electric vehicle Equally, vehicle is a necessity for working individuals in Malaysia. From Household Expenditure survey (HES) conducted by Department of Statistics Malaysia, the average monthly expenditure of Malaysian in 2014 is MYR 3,578 [8]. Based on Figure 4, the average household income of most

respondents is quite low because about 67.71% of them has household income of below MYR 3,000. Majority of the respondents are youth who are still students or just started working. This fact signified that the purchasing power of a family is below average. For most respondents, higher percentage of number of family members lies between 4 and 7 (see Figure 5). It indicates that each of this family probably will buy second car to accommodate the needs of their families. From the survey, none of the respondents owned an EV (see Figure 9). This will be the best time to promote the need of EV to the users. About 87.37% of them showed willingness to buy an EV (see Figure 10) although their income is below average. The percentage showed a very good sign whereby respondents realized the importance of EV.

Concerning price, about 91.27% of respondents willing to pay more upfront to save on fuel and vehicle maintenance. This result means that respondents are willing to spend more for the sustainable development in the future for long term benefits. Approximately 83.98% willing to pay more for EV that has lower emission and less polluting. Again this result support that most of the respondents already have awareness in 87.37% is willing to purchase EV if parking spot was assigned with access to charging station at commercial parking lot. 86.20% willing to purchase EV with unassigned parking spot with access to charging station. 88.03% tend to use public available charging station. These percentages indicated that easy access to charging station plays important role towards influencing respondents in buying EV. 46.74% of respondents willing to buy EV if the price is MYR 50,000 or below. 34.64% willing to buy if the price is between MYR 50,000 and MYR 100,000. Only a very small percentage of the respondents are willing to buy if the price exceed MYR 100,000. The results must be considered carefully by the car manufacturers because if they are selling EV to the low, they will hardly achieve the break even.

Conclusions

In general, people acceptance of EV in Malaysia is considered as low. After the respondents have been told about the importance of using EV, they still refuse to spend on EV given that the price is more than MYR 100,000. For this reason, the role of government is very important in supporting the use of electric vehicle. For instance execute tax reduction as a first step. However, most of them agreed that the existence of charging station whether at assigned or unassigned parking spot is vital. It shows that charging station facilities must be available as much as the existing petrol stations because people do not want to get stuck during driving if their EV runs out of battery.

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