IDENTIFYING THE BARRIERS TO ELECTRIC VEHICLE ACCEPTANCE: A CONSUMER PREFERENCE SURVEY IN IZMIR

ARSEN GONCA

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IDENTIFYING THE BARRIERS TO ELECTRIC VEHICLE ACCEPTANCE: A CONSUMER PREFERENCE SURVEY IN IZMIR

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Approval of the Graduate School of Social Sciences

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I certify that this thesis satisfies all the requirements as a thesis for the degree of Master of Arts in Sustainable Energy.

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This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Master of Arts in Sustainable Energy.

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ABSTRACT

IDENTIFYING THE BARRIERS TO ELECTRIC VEHICLE ACCEPTANCE: A CONSUMER PREFERENCE SURVEY IN IZMIR

Gonca, Arsen

Master of Arts

In

Sustainable Energy

Supervisor: Assoc. Prof. Dr. Mehmet Efe Biresselioğlu

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Despite the proven positive environmental consequences of the electric vehicles (EVs), the number of EVs in use is still insignificant. One reason for the low adoption figures is that the public acceptance of EVs to a large extent is dependent on consumers' perception of EVs. Izmir is one of the most environmentally friendly cities in Turkey. With trying to increase the use of electric buses, Izmir Municipality promotes the reduction of carbon emissions from internal combustion engines. So, due to the characteristics of the city, Izmir is very appropriate for this study. The indicators were obtained after an in-depth literature review by examining 63 articles related with EVs and 10 indicators were collected. The study is based on the exploration of nine suppositions relating to the indicators. The methodology was decided according to the literature review because the questionnaires are often used in other similar studies. The Izmir based questionnaire contains questions related with the electric vehicle acceptance and tests the nine suppositions. The questions are designed according to the indicators. Besides, questions are multiple-choice and on a Likert scale based. In addition, the survey

was also pre-tested by applying it to 55 different individuals and 11 experts. Also, Cronbach's Alpha reliability test was applied to final version of the survey in the SPSS Statistics Software. Finally, 416 people with different demographics participated in the survey. As a result, consumers prefer to spend less money but they wants to utilize more.

Keywords: Electric Vehicle; Social Acceptance; Survey Study

ÖZET

ELEKTRİKLİ ARAÇLARIN KABULUNÜN ÖNÜNDEKİ ENGELLERİN BELİRLENMESİ: İZMİR'DE BİR TÜKETİCİ TERCİH ANKETİ

Gonca, Arsen

Sürdürülebilir Enerji
Yüksek Lisans Programı

Tez Yöneticisi: Doç. Dr. Mehmet Efe Biresselioğlu

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Elektrikli taşıtların (EV) kanıtlanmış olumlu çevresel sonuçlarına rağmen, kullanımda olan elektrikli taşıt sayısı hala düşük seviyededir. Düşük benimseme rakamlarının bir nedeni, elektrikli araçların toplumsal kabulünün büyük ölçüde tüketicilerin elektrikli araç algısına bağlı olmasıdır. İzmir, Türkiye'nin en çevre dostu şehirlerinden biridir. Elektrikli otobüslerin kullanımını arttırmaya çalışarak, İzmir Belediyesi içten yanmalı motorlar sebebiyle oluşan karbon emisyonlarının azaltılmasını teşvik etmektedir. Dolayısıyla, şehrin özellikleri nedeniyle, bu çalışma için İzmir çok uygundur. Göstergeler, elektrikli araçlar ile ilgili 63 makaleyi inceleyerek kapsamlı bir literatür taramasından sonra elde edilmiş ve 10 gösterge toplanmıştır. Çalışma, göstergelerle ilgili dokuz önermenin araştırılmasına dayanmaktadır. Metodolojiye, literatür taramasına göre karar verilmiştir, çünkü anket çalışması diğer benzer çalışmalarda sıklıkla kullanılmaktadır. İzmir merkezli anket, elektrikli araçların kabulü ile ilgili soruları içermektedir ve dokuz önermeyi test etmektedir. Sorular göstergelere göre tasarlanmıştır. Ayrıca, sorular çoktan

seçmeli ve Likert ölçeği tarzında tasarlanmıştır. Anket, 55 farklı kişiye ve 11 uzmana da uygulanarak ön kontrolü yapılmıştır. Ayrıca, SPSS istatistik yazılımında anketin son versiyonuna Cronbach's Alpha güvenilirlik testi uygulanmıştır. Son olarak, ankete farklı demografik özelliklere sahip 416 kişi katılmıştır. Sonuçlar doğrultusunda, tüketiciler daha az para harcamayı tercih etmektedirler ancak daha fazla fayda sağlamaya meyillidirler.

Anahtar Kelimeler: Elektrikli Araç; Toplumsal Kabul; Anket Çalışması

To My Family

ACKNOWLEDGMENTS

I would like to express my sincere gratitude to my advisor Assoc. Prof. Dr. Mehmet Efe Biresselioğlu for the continuous support of my master study and related research, for his patience, motivation, and immense knowledge. His guidance helped me in all the time of research and writing of this thesis. Also, I would like to thank my parents and to my whole family for supporting me spiritually throughout writing this thesis.

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1 INTRODUCTION

Turkey as a country is dependent on energy import, with respect mainly to oil and natural gas. In 2015, 75% of Turkey's energy usage was imported from other countries (World Bank, 2018). Also, according to the BP Statistical Review (2017), Turkey on average consumed eight hundred and eighty six thousand barrels per day in 2016. According to data in 2010, half of Turkey's oil consumption is utilised by the transportation sector. The Industrial sector and the commercial/agriculture sector consumed a total oil amount of 24% and 14%, respectively (IEA, 2013). On the other hand, Turkey does generate electricity from natural gas and coal. In 2013, Turkey generated electricity from coal with 25,4% and natural gas with 44% of its total requirement. The amount of electricity generated using oil was only 1,7% (IAEA, 2014). One of the major reasons for air pollution is the use of fossil fuels. By burning these fossil fuels, such as natural gas, oil and coal, for electricity generation, transport, and industry they cause air pollution (EEA, 2017). In 2014, the total CO2 emission from transportation was 19% in Turkey, which is lower than the world average (World Bank, 2014).

It is known that electric vehicles have the potential to significantly reduce fossil fuel dependence and CO2 emissions so they have a massive positive effect. According to the terminology, electric vehicles are any vehicle that uses the energy drawn from the electric grid and is in the vehicle for some or all of its propulsion power. Battery electric vehicle are vehicles that run solely on electricity and store the energy in a battery pack in the vehicle which is generally re-charged through plug-in (She et. al., 2017).

According to these definitions it is clear to infer that electric vehicles do not produce greenhouse gas emissions during the operation because they use electricity (Li et. al., 2017). Sadly, the market share of electric vehicles in Turkey is very low. The highest market share was in 2015, which was 0.03%. In 2016 and 2017 it decreased to only 0.01% (EAFO, 2018). Also, this market share is extremely low in comparison with other countries such as Norway. In 2017, the market share of electric vehicles in Norway was 39,2%. Therefore, the major question is 'Why is the adoption of electric vehicles so slow and difficult in Turkey?'. There are several reasons for this. However, it is mainly dependent on the consumer preferences and

choices. So this study aims to determine consumer preferences for electric vehicles with an in depth questionnaire study undertaken in Izmir Turkey. The reason and logic Izmir was preferred to conduct the survey are also related to the current real-time scenario. All of the 416 participants in the survey are currently living in Izmir, Turkey. There are several reasons for choosing this city. Firstly, Izmir is Turkey's third largest city and Izmir has one of the largest ports in Turkey (Britannica, 2017). The first electric bus fleet established was in Izmir (ESHOT, 2016). Izmir Metropolitan Municipality is trying to integrate electric public transport into people's lives. Also, the municipality promotes and supports this kind of transportation development. So as a result, this electric bus fleet could be the basis for a charging infrastructure in Izmir. As a further efficiency and development, ESHOT has been working on using solar power to obtain the electricity to charge their buses (ESHOT, 2006). Also, Izmir has great renewable energy potential and a general focus on green generation seems to be evolving. The estimated wind energy potential of Izmir is 11.854 MW. In addition, Turkey's annual solar energy distribution is 1.100 to 1.600 kWh/m^2 while Izmir is well above the average, at 1.680 kWh/m^2 annually (IZTO, 2015). Due to these reasons, Izmir has been highlighted as the most suitable and appropriate city to undertake this study. Hopefully, due to renewable the energy potential and the tendency towards public electric transport, Izmir can be a pilot city for electric vehicles.

This paper is organized as follows. Section one is a literature review. In this section 63 articles were reviewed about electric vehicles and then major indicators selected and explained. Section two is the methodology. This section explains the methodology of the study, which is survey study. Section three is empirical results. In this section, the results that were gathered through the questionnaire have been examined in detail. Section four, is the conclusion. In this section, the consumer preferences are interpreted with respect to the results and then recommendations are given.

2 LITERATURE REVIEW AND INDICATOR SELECTION

The establishment of the indicators that would support and organize the survey questions was collected through a literature review. During this process, 63

articles, which are mainly focusing on the acceptance of electric vehicles, from Science Direct and Google Scholar were analysed to determine the barriers to the acceptance of electric vehicles. These 63 articles found by using the keywords ‘electric vehicle’, ‘battery electric vehicle’, ‘electric vehicle acceptance’, ‘electric vehicle barriers’ and ‘electric vehicle adoption barriers’ in Science Direct and Google Scholar. The search mainly focused on the studies after 2009. However, there were a few articles pre 2009.

As a result of the literature review, 10 main indicators were obtained. These are 1.driving range, 2.purchasing price, 3.charging infrastructure and time, 4.maintenance cost, 5.demographic variables, 6.government subsidies or incentives, 7.environmental concerns, 8.performance, 9.operational cost, and 10.battery life and cost.

They are all contained in three main groups. These are 1.technological factors, 2.consumer characteristics and 3.contextual factors (He and Zhan, 2018). The technological factors are driving range, charging time, battery lifetime and performance. Consumer characteristics are demographic variables, purchasing price, and environmental concerns. Finally the contextual factors are charging infrastructure, government subsidies or incentives, operational cost, battery price and maintenance cost.

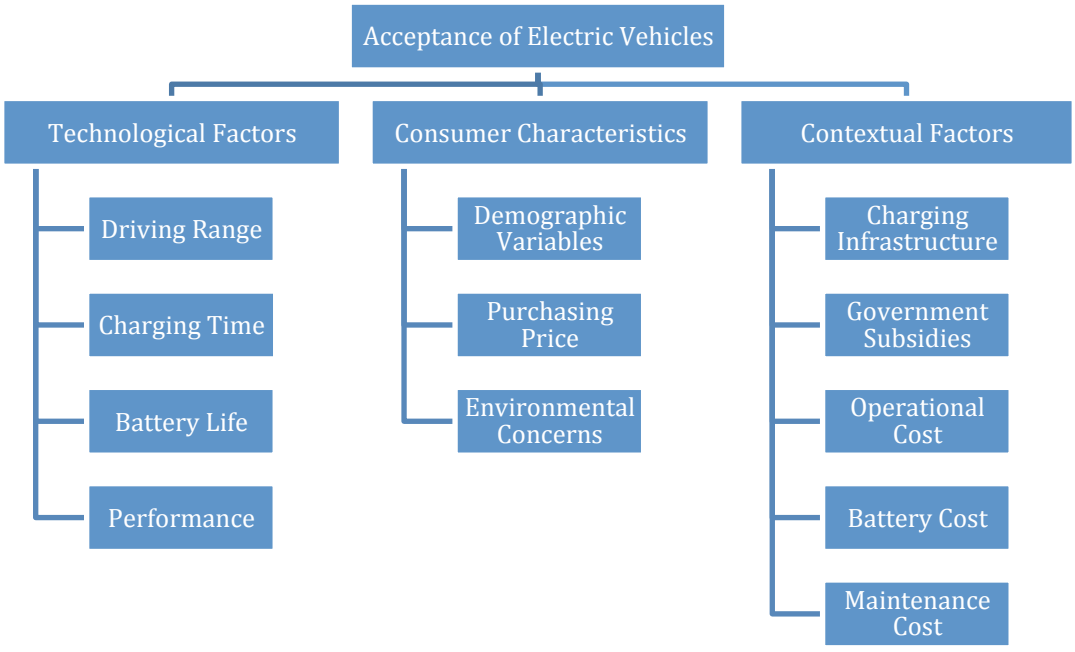

Figure 1: Factors of the indicators

Authors	Keywords	Objective	Methodology	Indicators
Barth et. al. (2016)	Electric vehicle adoption; Collective efficacy; Norms	Explore the current perspective of potential EV users from Germany on electric mobility	Expert interview, questionnaire, hierarchical regression analyses	Driving Range, Purchasing Price, Charging Time and infrastructure, Maintenance Cost, Government Subsidies/ incentive, Demographic Variables
Biresselioglu et. al. (2018)	Electric mobility; Electric vehicles; Europe; Decision making process; Motivators; Barriers	Identifying and mapping the motivators and barriers for the diffusion of electric mobility through three levels of decision-making	State-of-art review	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost
Brownstone et. al. (2000)	-	the choice of vehicle purchased to investigate aspects of using mixed logit models for SP/RP estimation	Mixed logit models and RP/SP joint estimation, Wave 1-2 interviews	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Performance, Operational Cost
Carley et. al. (2013)	Electric vehicles; Transportation; Technological competition; Public policy; Policy incentives	early consumer interest in plug-in electric vehicles	Online survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns
Clark-Sutton et. al., 2016	Electric vehicles; Incentives; Innovation adoption	Understand whether participation in Zero Emission Vehicle program has a meaningful impact on PEV readiness.	Weighted scoring	Driving Range, Purchasing Price, Charging Time and Infrastructure, Government Incentives/Subsidies, Operational Cost
Daina et. al., (2017)	Electric vehicles use; Activity based models; Charging behaviour	Systematic review of diverse approaches using a twofold classification of electric vehicle use representation, based on the time scale and on substantive differences in the modelling techniques	Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance, Operational Cost

Degirmenci and Breitner, (2017)	Electric vehicles; Environmental performance; Price value; Range confidence; Purchase intention; Structural equation modeling	Investigates consumer purchase intentions for electric vehicles.	Interview, survey, structural equation model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns
Egbue and Long, (2012)	Electric vehicles; Consumer attitudes; Socio-technical barriers	Characterize potential EV owners in order to elucidate knowledge, interests, perceptions, attitudes, and barriers pertaining to EVs as well as views on sustainability	Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Battery Life and Cost
Ewing and Sarigollu, (1998)	Vehicle fuel-type choice; economic instruments; discrete choice experiment; multinomial logit regression; vehicle choice simulator	The factors likely to influence the demand for lower emission and zero emission vehicles	Survey, discrete choice modelling, random utility theory	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Government Incentives/Subsidies, Performance, Operational Cost
Fazeli et. al., (2017)	Multi-Criteria Decision Analysis; Energy System; Fiscal Incentives; Electric Vehicle; TOPSIS method	Link an energy system model and multi-criteria decision to assess the impacts of fiscal policies for EV adoption in Iceland on consumers and government	MCDA Model,Energy System Model	Purchasing Price, Charging Time and Infrastructure, Government Incentives/Subsidies
Ferguson et. al.,(2018)	Electric vehicles; Stated preferences; Latent class choice model; Attitude; Willingness-to-pay	Understand the preferences for the two primary types of electric vehicles; Plug-in Hybrid Electric Vehicles and Battery Electric Vehicles	Survey, Stated Preference exercise, latent class choice model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Operational Cost
Franke and Krems, (2013)	Electric vehicle; Field trial; User experience; Self-regulation	Increase understanding of factors that influence users' range utilization behavior	Field trial	Driving Range, Demographic Variables, Performance

Franke et. al., (2011)	-	Provide alternative ways of dealing with the generally perceived barrier imposed by the experience of range, aside from exclusively improving battery performance	Field study	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables
Franke et. al., (2012)	-	Understanding user acceptance and behavior in terms of electric vehicle	Field study	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance, Battery Life and Cost
Franke et. al., (2017)	Battery electric vehicles; Range; User satisfaction; Acceptance; Field study	Understand factors contributing to individually perceived range satisfaction in daily BEV usage	Field study	Driving Range, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns
Hackbarth and Madlener, (2013)	Discrete choice models; Alternative fuel vehicles; Vehicle adoption policies; German transport	Assess the relative impact of vehicle attributes	Multinomial logit model, mixed logit model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Operational Cost
Haddadian et. al., (2015)	-	Identifying the barriers associated with the large-scale adoption and deployment of EVs	Qualitative	Driving Range, Charging Time and Infrastructure, Maintenance Cost, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Hagman et. al., (2016)	Battery electric vehicles; Total cost of ownership; TCO; Diffusion of innovation; Sustainability	Discuss the results potential implication of the diffusion of BEVs	Total cost of ownership calculation method	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Environmental Concerns, Performance

Han et. al., (2017)	Electric vehicles; Functional values; Non-functional values; Attitude; Adoption intention	How the EVs adoption intention is influenced by the perceived functional and non-functional values and how these effects are mediated by consumers' attitude towards EVs	Survey, Chi-square test, T-test	Driving Range, Purchasing Price, Charging Time and Infrastructure, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost
He and Zhan, (2018)	Electric vehicles; Adoption intention; Extended norm activation model; Personal norms	Propose an extended norm activation model to study the relationship between personal norms and consumers' intention to adopt EVs, and to explore how such relationship is influenced by external costs and the antecedents of personal norms	Survey, Common method bias analysis, Norm activation model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost
Heidrich et. al., (2017)	Cities; Strategies; Technology; Cars; Infrastructure; Electric vehicles	Effectiveness of climate change mitigation strategies and the provision of infrastructures in 30 UK cities	Urban Audit Methodology	Driving Range, Purchasing Price, Charging Time and Infrastructure, Government Incentives/Subsidies
Hidrue et. al., (2011)	Electric vehicles; Stated preferences; Discrete choice	Potential consumer demand for electric vehicles and whether or not they might become economic	Discrete choice model, online survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Ivan and Penev, (n.d.)	China, consumer attitudes, Electric Vehicle, behavior, acceptance	Find coherence between the theory of consumers‟ attitudes and the challenge of product acceptance.	Quantitative methods	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance

Jabeen, (2011)	Choice modelling, Electric Vehicle, Stated preferences, Zero tailpipe emissions	Explore the individual behaviour with respect to Electric Vehicles. People's acceptance of new fuels and vehicles are determinants of the EV's place in the ensemble of vehicle technologies.	Choice modelling	Driving Range, Purchasing Price, Charging Time and Infrastructure, Environmental Concerns, Performance, Operational Cost
Jansson et. al., (2017)	Consumer behavior; Interpersonal influence; Sustainable consumption; Eco-innovation adoption; Flexfuel vehicles; Electric vehicles	Analyze the influence of norms (personal and social), ecological attitudes, and opinion leading as well as opinion seeking on alternative fuel vehicle (AFV) adoption.	Survey, Binary logistic regression model	Charging Time and Infrastructure, Demographic Variables, Environmental Concerns
Jensen et. al., (2013)	Consumer preferences; Discrete decisions; Vehicle purchases; Electric vehicles	The extent to which individual preferences and attitudes change after individuals experience an EV in their daily life.	Joint hybrid choice model, Willingness to pay (WTP)	Driving Range, Purchasing Price, Charging Time and Infrastructure, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Junquera et. al., (2016)	Electric vehicle; Consumer attitudes; Logit model; Survey	Discover to what extent some issues are key to explain consumers' willingness to buy an electric vehicle.	Logit model, Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Environmental Concerns
Kim et. al., (2015)	Electric vehicle; Car sharing; Satisfaction; Ordered probit; Factor analysis	The implications on the findings and provides recommendations for future research and policies.	Ordered probit model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Performance, Operational Cost, Battery Life and Cost

Kodjak, (2012)	-	Assess future demand for EVs.	Interviews with executives from major auto companies	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Kuppusamy et. al., (2017)	Supply chain management; Logistics; Electric vehicles; Taxicabs; Sustainable operations	Practical implications on the attractiveness (or lack thereof) of EV taxicabs / swap stations and on the impact of various government or R&D improvement actions on EV adoption.	Consumer choice model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Government Incentives/Subsidies, Operational Cost, Battery Life and Cost
Kurani et. al., (1996)	-	How households incorporated EVs into their on-going management of multiple vehicle purchases over time.	Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance
Langbroek et. al., (2017)	Electric vehicle; Travel behaviour; Trip production; Mode choice; Rebound effect	Investigate how people perceive the electric vehicle's environmental friendliness, to explore the travel behaviour of EV users and to investigate whether electric vehicle users have significantly different travel behaviour patterns than non-electric vehicle users, with regard to the number of trips they make, the distance travelled and the performance based modal split of the car.	Survey, Poisson regression models, Tobit-models	Driving Range, Purchasing Price, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Operational Cost

Li et. al., (2017)	Intention to adopt; Battery electric vehicles; Influencing factors; Literature review	Explore and review the important factors that influence the intentions to adopt BEVs.	Literature Review	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Battery Life and Cost
Lieven et. al., (2011)	Uptake of electric cars; Electric vehicle uses; Vehicle market shares	In a survey among German consumers, purchase-relevant vehicle criteria of two categories (type and use) are prioritized and iteratively consolidated to identify barriers of consumers' buying intention in the EV market.	Stated preference method	Driving Range, Purchasing Price, Environmental Concerns, Performance
Lin and Wu, (2018)	Electric vehicle; Purchase intention; Attitude factor; Demographic characteristics	Examines the factors that may affect the public's purchasing intention of electric vehicles via a survey.	Survey, electric vehicle purchasing intention model	Driving Range, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Battery Life and Cost
Liu and Cirillo, (2017)	Dynamic discrete choice models; Consumer stopping problem; Auto-regressive process; Green vehicle adoption; Electric vehicle	It proposes a generalized dynamic discrete choice approach that models purchase behavior and forecasts future preferences in a finite time horizon setting.	Dynamic discrete choice models	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Performance, Operational Cost

Martínez-Lao et. al., (2017)	Electric vehicle; Grid to vehicle charging; Spain; Electric charging system	Analyze the charging of electric vehicles in Spain and to assess the current situation to be able to propose potential improvements or implementation strategies.	Battery Management System (BMS)	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost
Mohamed et. al., (2016)	Electric vehicle; Theory of planned behaviour; Segmentation; Structural equation model	Investigate the intention to buy plug-in electric vehicles including both plug-in hybrid (PHEV) and battery electric (BEV).	Survey, Structural equation model (SEM)	Driving Range, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Battery Life and Cost
Namdeo et. al., (2014)	Charging infrastructure; Electric vehicle; GIS; Public charging; Socio-demographic	Develop a methodological approach for multi-dimensional spatial analysis addressing the aforesaid knowledge gap, combining the underlying socio-economic traits and trip characteristics (journey types and origin–destination) for prioritizing the demand-based public charging hotspots	Multi-dimensional spatial analysis,	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns

Neumann et. al., (2010)	-	Examine the user acceptance and the impact of EVs on user's daily mobility behavior using psychologically founded methods.	Questionnaires, Interviews, Conjoint analysis, Trip decision task, Travel and Charging Diaries	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance
Noppers et. al., (2015)	Electric vehicle; Adoption of innovations; Early adopters; Electric car; Symbolic attributes; Costly signal	Investigated differences in motivations to adopt a sustainable innovation between potential earlier and later adopters.	Online Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Environmental Concerns, Performance, Operational Cost
Peters et. al., (2018)	Motivation; Electric vehicle; Environmental self-identity; Sustainable energy behaviour	Examine which factors affect the likelihood that the adoption of EV results in sustainable use of the EV as well as engagement in a wide range of sustainable energy behaviours.	Survey	Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns
Ralston and Nigro, (2011)	-	Provide a foundation for overcoming some of the major hurdles to PEV deployment in the United States both currently and in the future.	Literature Review	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Government Incentives/Subsidies, Environmental Concerns, Performance, Battery Life and Cost
Rezvani et. al., (2015)	Consumer behavior; Electric vehicles; Adoption behavior; Intention; Literature review	Identify reasons, antecedents, drivers for and barriers against consumer EV adoption behavior, or intentions to adopt plug-in EVs.	Literature Review	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost

Sang and Bekhet, (2015)	Electric vehicle; Usage intentions; Public acceptance; Regression model; Malaysia	Conduct an exploration to determine the key predictors affecting the usage of electric vehicles acceptance in Malaysia.	Descriptive analysis, reliability test, inter-correlation test, linear regression-stepwise test	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Environmental Concerns, Performance, Operational Cost
Schmalfuß et. al., (2017)	Battery electric vehicle; Experience; Theory of planned behavior; Acceptance; Test trial; Online survey	Investigates the role of experience for explaining the evaluation of different BEV attributes, attitude and purchase intention.	Online Survey, Theory of planned behavior	Driving Range, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance
Schuitema et. al., (2013)	Electric vehicle; Perception of vehicle attributes; Pro-environmental self-identity	How perceptions of instrumental, hedonic, and symbolic attributes may influence the adoption of EVs by private consumers?	Survey, OLS linear regression analyses, Multiple mediation models	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance
Shafiei et. al., (2018)	Vehicle choice; Vehicle tax; Electric vehicle; Fiscal incentives; Government revenue; Consumer cost	Compare the macroeconomic cost responses to different fiscal incentives aimed at promoting EVs.	system-dynamics, regression models, mixed logit model, surveys	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Government Incentives/Subsidies, Operational Cost, Battery Life and Cost
She et. al., (2017)	Battery electric vehicles; Barrier; Incentive policy; Public perception; China	How consumers perceive EVs and the possible barriers?	Survey, Structural equation model, Chi-square test	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Singer, (2016)	-	Investigating aspects of the respondents' vehicle purchasing behaviors that are independent of a specific vehicle technology.	Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Environmental Concerns, Operational Cost

Skippon and Garwood, (2011)	Electric vehicles; Recharging electric vehicles; Symbolic; Personality	Attitudes towards BEVs among the participants, after direct experience of driving one.	Attitudinal survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Environmental Concerns, Performance, Operational Cost
Smith et. al., (2017)	-	Explores the responses to the attitudinal items to uncover possible reasons for the non-trading behaviour in the stated choices, before assessing the impact of the inclusion of non-traders in choice models on taste parameters and therefore willingness-to-pay (WTP).	Conceptual model, survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Environmental Concerns, Performance, Operational Cost
Soltani-Sobh et. al., (2017)	Electric vehicle; Panel data modelling; Public policy; Technology adoption	Examine and analyze the significance and strength of state incentives and other significant socioeconomic factors in promoting EV adoption.	Cross-sectional/time-series (panel) analysis	Driving Range, Charging Time and Infrastructure, Government Incentives/Subsidies
Sovacool, (2017)	Unified Theory of Acceptance and Use of Technology (UTAUT); Automobility; Actor Network Theory; Electric vehicles	Provide an integrated framework—centered on motile pleasure, sociality, commensurability, and momentum—that can explain electric mobility preferences across individual, interpersonal, socioenvironmental and network scales.	Semi-structured research interviews	Driving Range, Purchasing Price, Charging Time and Infrastructure, Performance
Steinhilber et. al, (2013)	Electric vehicles; Transitions management; Socio-technical systems	Understanding the key tools and strategies that might enable the successful introduction of new technologies and innovations by exploring the key barriers to electric vehicles encountered in UK and Germany	Semi-structured interviews	Driving Range, Charging Time and Infrastructure, Environmental Concerns, Operational Cost, Battery Life and Cost

Vassileva and Campillo, (2017)	Electric vehicle; Consumer behavior; Market uptake; Smart grid; Distributed energy resources	Identify the main factors responsible for motivating the use of EVs and to understand the thought process of early EV adopters, in order to shape the strategies and define better incentives that could help increase the market penetration of electric vehicles in Sweden.	Survey, simulation model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns
Wang et. al., (2017a)	Electric vehicles; Policy measures; Environmental concern; Adoption intention	Explore how policy measures influence EVs adoption intention.	Survey, Harman's one-factor test, Partial least squares (PLS) structural equation analysis, Cronbach's alpha and composite reliablity test	Driving Range, Purchasing Price, Charging Time and Infrastructure, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Wang et. al., (2017b)	Government policy; Discrete choice; Mixed logit model; Electric vehicles	Investigates the effectiveness of several potential policy incentives except subsidization policies, as well as the influence of socio-psychologist determinants.	Multinomial logit model, mixed logit model, Willingness-to-pay	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost
Wang et. al., (2018)	Electric vehicles; Public acceptance; Influencing factors; Factor analysis method; Structural equation model; Promotion solutions	Analyze the key influencing factors of EV public acceptance based on a questionnaire survey of EV potential consumers in Shanghai, which has the largest ownership of EVs in China.	Descriptive statistical analysis, Factor analysis, Structural equation model	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost, Battery Life and Cost

White and Sintov, (2017)	-	Investigating the roles of symbolic and instrumental attributes in low-emission vehicle adoption, focusing exclusively on EVs to better understand perceptions associated with their unique technical capabilities.	Survey, Drop-out analyses	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost
Wieland, (2017)	-	Acceptance and expectations of full-electric vehicles	Survey	Driving Range, Purchasing Price, Charging Time and Infrastructure, Maintenance Cost, Performance
Xue and Gwee, (2017)	Electric vehicles; charging standard; fleet electrification	Details the various pilot projects under Phase 2 including the adoption of a national public charging standard to increase the inter-operability for EV proliferation.	Literature Review	Driving Range, Purchasing Price, Charging Time and Infrastructure, Environmental Concerns
Zhang et. al., (2011)	Electric vehicle; Willingness to pay; Logistic regression model	Analyze consumers' awareness towards electric vehicle (EV) and examine the factors that are most likely to affect consumers' choice for EV in China	Survey, Stated preference, binary logistic regression model	Driving Range, Purchasing Price, Maintenance Cost, Demographic Variables, Government Incentives/Subsidies, Environmental Concerns, Performance, Operational Cost

Table 1: Literature Review List

2.1 Driving Range

The driving range is the most common of the 10 indicators. It is mentioned in 59 out of 63 articles. Driving range limit is an important consideration in purchasing the electric vehicle. According to the Franke et. al. (2017), the key indicator of the general acceptance of the EV is driving range. First generation electric vehicles could travel between 64km to 160km (40 to 100 miles) (Egbue and Long, 2012). However, in 2014, the Tesla Model S electric vehicle travelled 270 miles (434 km) with a single charge (Hardman et. al., 2016). In 2018, the Tesla Model S range is now 335 miles (539 km) with a single charge (Tesla Inc., 2018). However, range anxiety is also connected with the charging infrastructure. Extensive charging infrastructure can decrease the range anxiety (Lin and Wu, 2018). Also, some studies show that experience and usage was able to decrease range anxiety (Barth et. al., 2016). However, according to the study of Bonges III and Lusk (2016), the owner of a regular internal combustion engine car, with 482km (300 miles) range, is willing to travel 241km (150 miles) to the nearest gas station. On the other hand, the owner of plug-in electric vehicle, with 160 km (100 miles) range, does not want to drive more than 80 km (50 miles) to the nearest charging station. Another study shows that, range diversity varies by country. For instance, the U.K's average is 40 km; Poland's is 80 km but in the U.S, 96 km is acceptable for 83 per cent of householders, while 128 km is suitable for 90 per cent of drivers and 193 km for 95 per cent of them (Junquera et. al., 2016).

According to the Vassileva and Campillo's (2017) study, 60 per cent of the Europeans drive less than 160 km a day. However, they would not accept a driving range less than 160 km. Many articles show that low range has a negative impact on the purchasing decision. In addition, low cruise range can cause range anxiety while driving (Wang, Tang and Pan, 2018; Barth et. al., 2016). Confirmed by, 59 out of 63 articles directly refer to driving range.

2.2 Charging Time and Infrastructure

Long charging time and insufficient charging infrastructure are further barriers to electric vehicle acceptance. Some studies show that consumers are willing to charge their car at their home. That means internal infrastructure is more important than public for some consumers (Li et. al., 2017). Integration of charging behaviour to a daily routine is harder than expected for some drivers. Additionally,

after using electric vehicles, the benefits of charging at home became more evident (Schmalfuß et. al., 2017). However, both internal and public infrastructures are not sufficient as yet (Li et. al., 2017). On the other hand, as an example in Newcastle, there are a significant number of charging stations. However, still some drivers think that more stations are needed (Heidrich et. al., 2017).

The U.S.A has many gas stations with 157.393 all around the country. In comparison, there are only a total of 6.883 charging stations in the U.S. In addition, there are more than 6 different types of charging stations. So these already scarce charging stations get even scarcer for different types of cars (Bonges III and Lusk, 2016). The charging infrastructure is under the contextual factors title. However, charging infrastructure also affects the driving range. It can reduce range concerns; also it encourages electric vehicle sales (Ralston and Nigro, 2011).

The European Union goal is to build one charging station per 10 electric vehicles. The main aim is that electric vehicle owners can recharge their electric vehicle everywhere in the European Union without any difficulty. These charging stations are planned to be set up near parking lots, business locations and public transport stations such as airports, railway stations. Several European countries have chosen the public sector to establish a charging facility network. These include Denmark, the Netherlands, Germany, the U.K. and France. On the other hand, countries like Germany are focusing more on the support of R&D to improve the efficiency of charging technologies. They also encourage local authorities to install a charging infrastructure.

In 2016, every European Union member countries had to establish an implementation plan for its country under the Alternative Fuels Infrastructure Directive. This directive is about charging infrastructure to reduce consumer concerns towards electric vehicles and therefore, spur and develop the growth of the market. According to the directive there are three important areas. These are increasing the number of private charging units, expanding the number of publicly accessible charging stations, and determining a standard technical specification for recharging and refuelling stations (Biresselioglu et. al., 2018).

Another important issue is the charging duration. The short duration to refuel the conventional gasoline car is obvious. However, the fully recharging duration of Tesla Model S is a minimum 75 minutes in a Tesla Supercharge Station (Hardman et. al., 2016). On the other hand, the Kia Ray electric vehicle, which has

driving range of approximately 138 km, has a charging time of about six hours in a standard charging station. For a fast charge it takes 25 minutes (Kim et. al, 2015). Long charging times and cost have negative impact. (Junquera et. al., 2016). That means long recharging time have a negative effect on acceptance (Barth et. al., 2016). This topic is referred to in 57 articles out of 63.

2.3 Purchasing Price

Another important issue is the purchasing price of the vehicle. High prices can be a deterrent to purchasing. According to the study of Carley et. al. (2013), more than 50 per cent of the sample group believe that purchasing price is the major consideration in a purchasing decision. Moreover, Zhang et. al.'s (2011) study shows that for 22,2 per cent of the participants, vehicle price is very important and for 60,5 per cent it is important. Another study indicates that the majority of the respondents, which is 70 per cent, are willing to pay up to 30.000 USD for their next vehicle. However, 51 per cent of the respondents were willing to pay more for a plug-in electric vehicle, that decreased the fuel cost by 33,3 per cent. On the other hand, 26 per cent of the respondents would not (Singer, 2016). Some experts believe that the lack of knowledge about electric vehicles create purchasing price as a restriction. If consumers were able to calculate the real price of the electric vehicle and its payback time in comparison to an internal combustion engines the vehicle, purchase price would not be a problem for buyer (Rezvani et. al., 2015). However, according to the Egbue and Long's (2012) study, purchasing price of the electric vehicle is significantly higher than that of internal combustion engine cars. The study compares 4 different cars in 2 different scenarios but the purchasing prices are the same. A Chevy Cruze purchasing price is 16.800 USD and the Nissan Leaf, which is also a battery electric vehicle, has a purchasing price of 35.200 USD. As mentioned above the overall price of a battery electric vehicle is lower than that of an internal combustion engine car. However, the internal combustion engine vehicles initial price is 46.381 and the battery electric vehicle price is 58.710 USD. Even with incentives still the battery electric vehicle is more expensive than internal combustion engine vehicle. The difference is nearly 5.000 USD. Purchasing price, incentives and maintenance cost are strongly related. However, purchasing price belongs in consumer characteristics section, incentives and maintenance costs are contextual factors. As it was stated before, the

purchasing price has a negative effect in every section. The utility decreases when the purchasing price increases. According to the Ferguson et. al. (2018), internal combustion engine owners are the most price sensitive class. So, this class has lower motivation to pay for an electric vehicle.

Also, maintenance costs have negative impact on utility. However, the results show that electric vehicle owners accepted a 1.124 USD rise in the purchasing price to save 100 USD of maintenance cost per year. In terms of non-cash incentives, consumers are willing to pay between 1.000 and 2.000 USD for exemptions on parking fees or road tolls or the access to special driving lanes.

Because of these reasons above, purchasing price is another major indicator and 51 out of 63 articles mentioned purchase price directly effect consumer behaviour.

2.4 Environmental Concerns

Electric vehicles have a considerable positive impact on environmental issues; for instance decreasing greenhouse gas emissions and air pollution (Wang, Tang and Pan, 2017; She et. al., 2017). Some of the owners choose electric vehicles because of these environmental concerns. It is obvious that electric vehicles that emit less greenhouse gas emissions than internal combustion engine vehicles (Han et. al., 2017). Electric vehicles are also promoted because of fossil fuel dependency and emission pollution control (Li et. al., 2017; She et. al., 2017). The environmental advantages are strong driving factors for the consumer acceptance of electric vehicles. For example, environmental protection is becoming an important factor to attract consumers to buy electric vehicles.. For this reason, the publicity of electric vehicles should not just focus on the energy saving of the vehicles. The protection of the environment also helps to increase public acceptance of the electric vehicles (Li et. al., 2017). However, some consumers have opposite opinions on the environmental protection feature of electric vehicles for purchasing. For some consumers, it is not clear what they do with old batteries or how the batteries are made. Also another question is ‘What is the actual footprint of the electric vehicles?’ (Graham-Rowe et. al., 2012) The reason behind this is the life cycle of the batteries and the electricity generation sources. All of these activities create some air pollution and environmental issues (Li et. al., 2017).

One of the studies shows that environmental concerns are more important than range, price and value of the electric vehicle for some consumers (Degirmenci and Breitner, 2017). According to White and Sintov (2017), electric vehicles represent two characteristics, they are environmentalist and innovative. Image has a relationship between environmental concern and buying an electric vehicle. In the U.K, 40 people experienced using electric vehicles for one week. The participants felt less guilty because of the environmental benefits of the car (Schuitema et. al., 2013). Environmental concern is under the heading of consumer characteristics. Also, it is strongly related to demographics. For example, middle-age male consumers who are living with multi-person households are interested in driving environmental friendly vehicles (Vassileva and Campillo, 2017). Environmental concerns are referred in 48 articles out of 63.

2.5 Performance

The performance of the car is an important issue for some drivers. During the literature review, performance includes several sub-topics such as, acceleration, comfort, top speed, low noise, safety etc. (Skippon, 2014). Performance has an important impact for some drivers buying electric vehicles. However, sadly, people think that electric vehicles performance is worse than the conventional cars.

Again, the reason for this is a lack of experience and knowledge about electric vehicles. Actually, electric vehicles acceleration performance is better than the conventional gasoline vehicles (Lin and Wu, 2018). For instance, Tesla Roadster's acceleration from 0 to 60 mph (approximately 0 to 100 km/h) is only 1.9 seconds (Tesla Inc., 2018). On the other hand, 2018 Ferrari 812 Superfast's acceleration from 0 to 60 mph is 2.9 seconds (Florea, 2017). However, drivers of electric vehicles are less interested in car performance but they showed more positive attitudes towards environmental concerns (Schmalfuß et. al., 2017). In contrast, another study shows that if the person focuses on the performance of the vehicle they will have a lower acceptance of the electric vehicle (She et. al., 2017).

Also, compared with the combustion engine cars, the electric vehicle has less noise emissions (Martínez-Lao, 2017). On the other hand, less noise makes the drivers feel that the car is less secure because other drivers and pedestrians cannot hear the car (Biresselioglu et. al., 2018). The survey study from Zhang et. al.(2011), shows that 45,5 per cent of the 399 participants 'definitely would consider' and

52,2 per cent of them 'would consider' the performance of the car as an influencing factor. However, performance is very important for the off-roaders, leisure and sports car models (Lieven et. al., 2011). In the U.K., some consumers who experienced electric vehicles and their attributes of performance such as acceleration, less noise and smoothness were very positive. However, some other U.K consumers after experiencing electric vehicle safety and the performance of electric vehicles were negative (Rezvani et. al., 2015).

In addition the top speed is another important feature that changes after they experienced the electric vehicle. According to the Jensen et. al.(2013), the effect of top speeds lower than 120 km/h is higher and it increases 100 per cent after they experienced electric vehicles. Also, the willingness to pay and accept top speeds lower than 120 km/h almost doubles after trying the electric vehicles. Also the results show that top speeds below 120 km/h are not tolerable and have a major impact on the demand for electric vehicles.

The highest elasticity belongs to the top speed lower than 120 km/h. When the statisticians tested the relation between the top speed and the willingness to pay they found that consumers are willing to pay 38 € per km/h for purchasing new, mini car class, 85 € km/h for a medium 2-class car and 140 € km/h for the largest car class market. Performance belongs in technological factors. However, performance is strongly related to other indicators in the technological area. Some studies group the charging time and driving distance under the performance heading (Sang and Bekhet, 2015; Jensen et. al., 2013). That indicator is mentioned in 39 articles.

2.6 Demographic Variables

Demographic variables are an important issue for adopting any new technology. This includes gender, age, education level, and income. The lifestyle of the consumer and their personal preferences are a significant variable for the acceptance of electric vehicles (Biresselioglu et. al., 2018). Demographic variables are useful for determining target groups. For example, in large U.S cities, men are 11,5 per cent more interested than women. Also, lower educated people are less interested in buying electric vehicles. A positive impact of a high school degree is 17,15 per cent and some colleges are 5,6 per cent less involved (Carley et. al., 2013). Another example shows that for car sales the target group are baby boomers

(age 30 to 50) and seniors (Ivan and Penev, n.d). In addition to this, Carley et. al.'s survey in 2013 shows that, everything else constant, for each additional age band, the respondent's interest in an electric vehicle decreased by 0,42 per cent. Also, according to the Hardman et. al. (2016), early adopters are highly educated, have a high economic status and mostly male and in the young to middle age bracket. Another survey study in Sweden shows that early adopters are well-educated and high-income people. In a survey applied to 247 electric vehicle owners.

However, the gender mix was unbalanced, 48 were female (19%) and 199 were male (81%). and most of the respondents were between 40 and 45 years old.

Not surprisingly, like previous studies, male drivers are typically the early adopters of an electric vehicle. This survey study also contains question about income, which have three different levels: lower than 50.000 SEK (approximately 5.350 €), 50.000-100.000 SEK (approximately 10.700 €) and more than 100.000 SEK. 53 per cent of the sample group's monthly salaries were between 50.000-100.000 SEK and 26 per cent of the electric vehicle driver's monthly salaries were higher than 100.000 SEK. Additionally, participants were asked about educational levels of their household members over 18 years of age. 76,5 per cent (189 people) of the 247 respondents had a university degree, which shows that the high education level leads to the early adoption of electric vehicles (Vassileva and Campillo, 2017). However, some studies show that income is not an important factor for the acceptance of electric vehicles (Lin and Wu, 2018; Li et. al., 2017; She et. al., 2017). Demographic variables are also connected to environmental concerns. Studies show that income and environmental behaviour have a positive relationship. The reason behind this is high-income level can cover the increased cost margin, related to a green product (Sang and Bekhet, 2015). Also, according to the Sang and Bekhet's study (2015) women are more concerned than men in terms of the use of environmental products. In contrast, demographic variables are also connected to each other. For example, income level is related to age and educational level (Lin and Wu, 2018). Demographic variables are mentioned in 39 articles.

2.7 Government Subsidies and Incentives

Government subsidies and incentives are key to encouraging support for electric vehicles. The incentive policies main target is decreasing the electric

vehicles purchasing cost and operational cost. Direct subsidies, tax exemption and road tolling exemption policies have been used to achieve these goals (Wang, Li and Zhao, 2017). In China, the government presented several policies to promote electric vehicle usage. These incentives are mainly financial and it attracts attention because of the higher initial cost of electric vehicles compared to conventional cars (Wang, Tan and Pan, 2017). The Chinese government provides direct subsidies for the purchase of an electric vehicle. Due to the driving range of the vehicle, the consumer gets a subsidy between 25.000-55.000 CNY from the central government. Also many local governments provide additional incentives. This direct incentive can be up to 110.000 CNY related to the type of electric vehicle. The subsidies are between 25 – 60 per cent of the price of the electric vehicle. Tax reduction and exemption is applied in the electric vehicle trades. The central government has exempted the purchase tax of electric vehicles and that may account for 10 per cent of the sales price. Some local authorities also have some additional policies like exempt vessel tax and toll charge exemption. Some Chinese cities applied a license plate lottery in an attempt at decreasing traffic congestion and limiting traffic. So also as a way of promoting electric vehicle usage, electric vehicle owners were not included in the licensed plate lottery. Also in Beijing, the government did limit buying battery electric vehicles. Additionally, in Shanghai green cars can also get a licence plate free, which is worth approximately 80.000 CNY compared to other vehicle types. On heavy smog days, temporary traffic control applies in the cities to reduce the vehicles on the road. However, it is not applicable to electric vehicles (Lin and Wu, 2018). Studies show that fuel, vehicle incentives and tax exemptions are drive people to adopt electric vehicles (Shafiei et. al., 2018). In Europe countries set target levels for electric vehicle sales. For example France wanted to reach 2 million electric vehicles. Also, Netherlands, Spain and Germany aim to reach 1 million cars each. The most remarkable country is Norway in Europe because in autumn 2013 electric vehicles are are already the highest selling car type. Also, in 2009 the country expanded the charging infrastructure and supported citizens purchase with financial incentives. In Norway, the government offers 17.000 € for buying a new electric vehicle. Also, electric vehicle owners have the chance to charge and park for free at public stations. In addition EV owners have purchase tax exemption and are exempt from paying toll road charges (Vassileva and Campillo, 2017). Government subsidies and incentives

belong to contextual factors. However, it is also related to purchasing price, so it also has an impact via consumer characteristics.
Government incentives and subsidies have been mentioned in 35 articles.

2.8 Operating Cost

Operational costs of the electric vehicles are mentioned in 32 articles. However, it mentioned as fuel cost or price, electricity cost or price and operational cost or price. The studies show that comparison between the gasoline price and electricity price are one of the important indicators to the adoption of electric vehicles. The price of electricity is relatively low compared to the gasoline prices. The reason behind this is some government incentives and also lower electricity prices during the night in some markets (Haddadian et. al., 2015)

As previously mentioned the high upfront cost of electric vehicles is a barrier to acceptance. On the other hand, the low operational cost of electric vehicles encourages people to buy electric vehicles (Rezvani et. al., 2015; Smith et. al., 2017; Wang, Tang and Pan, 2018). According to the Egbue and Long's study,the 10-year cost of ownership table shows the differences between the consumption prices of an electric vehicle and a gasoline vehicle. The researchers created two different price scenarios in terms of gasoline prices. One was with the price of 3,52 USD per gallon (3,78 litres) and the other one is 5,42 USD per gallon. However, electricity price fixed was fixed at 11,9 cents per kilowatt-hour. In the first scenario, the conventional vehicle, which was a Chevy Cruze, cost 17.605 USD for gasoline in 10 years. In the second price scenario, which is 5,42 USD per gallon, the same car cost 27.100 USD for fuel. The Nissan Leaf was used as a the electric vehicle in the sample. This car spent 4.284 USD for electricity to charge vehicle in a 10 year period. Also, the paper mentions the range of the cars. For instance, the conventional vehicle's range is 30 miles per gallon, which equals to 12,77 km per litre, the electric vehicles rang was 160,9 km. The study also includes a hybrid electric vehicle and a plug-in hybrid electric vehicle, which are the Toyota Prius and the Chevy Volt respectively. The results showed, the total electricity price so the fuel price are lower than the conventional car's consumption in both scenarios.

Another survey study shows the importance of the fuel price while buying a new car. According to the Zhang et. al.'s (2011) survey, the researchers sent a

questionnaire to two different driving schools in Nanjing, China, 50,8 per cent of the 299 participants were marked it as important and 40,8 per cent marked as very important.

2.9 Maintenance Cost

Another important indicator is the maintenance cost. The cost of maintenance and other related costs directly affect to the consumer's decision to buy an electric vehicle (Sang and Bekhet, 2015). Zhang et. al.'s (2011) study shows that consumer's are attracted to purchase an electric vehicle of a higher price if the safety is higher and maintenance cost is lower than that of a conventional car. Due to the misconception, that electric vehicles maintenance cost is higher than internal combustion engine cars However as a benefit electric vehicles have advantages in terms of fuel and maintenance costs (Langbroek et. al., 2017; She et. al., 2017; White and Sintov, 2017). According to the Shafiei et. al. (2018), a battery electric light-duty vehicle's maintenance cost is 500 USD per year. On the other hand, owners of internal combustion engine vehicles with gasoline fuel, needs to pay 657 USD per year for maintenance. Another study also mentions the low maintenance cost of electric vehicles also decrease the the cost over a lifetime compared to conventional cars (Ralston and Nigro, 2011). One of the surveys shows that 55,5 per cent of respondents think that the maintenance cost is important and 35,2 per cent think it is very important. Again, the same study states that electric vehicles have low maintenance costs. However, many consumers have less information about the performance and maintenance cost of the electric vehicles (Zhang et. al., 2011). That can be an important barrier to the adoption of electric vehicles if the consumers have less knowledge. Another study shows the difference between battery electric vehicle's and gasoline vehicle's maintenance cost, which are Chevy Cruze and Nissan Leaf respectively. The electric vehicle's 10 years maintenance cost is equal to 4.846 USD and gasoline vehicle's 10 years maintenance cost is 6.496 USD. The difference is obvious and more than 1.500 USD (Egbue and Long, 2012). The importance of maintenance cost is underlined in 25 articles out of 63.

2.10 Battery Life and Cost

The last indicator is battery life and the cost of vehicles. This indicator is mentioned in 17 articles out of 63. Battery related costs are an important financial

barrier for the public's acceptance of an electric vehicle (Egbue and Long, 2012; Haddadian et. al., 2015; Hidrue et. al., 2011; Kodjak, 2012; Kuppusamy et. al., 2017; Lin and Wu, 2018; She et. al., 2017; Wang, Tang and Pan, 2018). Advanced batteries cost have an estimated price between 800 to 1.000 USD per kilowatt-hour. However, U.S's Vehicle Technology Program reduced the high cost of the batteries, which are high-energy and high-power batteries. So therefore the price reduced from 1200 USD per kilowatt-hour to 300 USD per kilowatt-hour between 2008 and 2014 (Egbue and Long, 2012). As planned, the U.S Department of Energy achieved this target in 2014 (U.S Department of Energy, 2017). Car manufacturers guaranteed a battery lifespan of 8 to 10 years or until the car reaches between 100.000 km and 150.000 km (Casals et. al., 2017). The battery lifetime belongs to technological factor section and battery cost is a contextual factor. In addition, battery related barriers are also related to driving range and charging time. If the battery technology developed, and battery lifetime increased then costs will drop (Mohamed et. al., 2016). Also, development leads to extend driving range. Therefore, if battery related concerns could be solved, it will decrease the range and charging time concerns.

3 METHODOLOGY

According to the Pinsonneault and Kraemer (1993), a survey is 'gathering information about the characteristics, actions, or opinions of a large group of people, referred to as a population'. There are three different characteristics of a survey.

The first objective of the questionnaire is to produce quantitative explanations of some aspects of the study population. Secondly, the key way of collecting information is by asking people pre-designed questions. These answers create the data to be analysed. Lastly, the study collects information about only a part of the total population. Typically, so the sample should be large enough to allow comprehensive statistical analysis. Survey research is used for three different purposes, which are exploration, description, or explanation (Pinsonneault and Kraemer, 1993). In this study, the survey research focused on description is used. The main purpose of survey research using description is to find out what situations, events, attitudes or opinions are occurring in a population (Pinsonneault

and Kraemer, 1993). The survey is a common method in exploratory studies. When it is applied properly, it provides a valid and remarkable analysis of the collected data (Biresselioglu et. al., 2017).

During the literature review, it is obvious that survey studies are common in searching electric vehicles, consumer attitudes and adoption (Barth et. al., 2016; Carley et. al., 2013; Daina et. al., 2017; Degirmenci and Breitner, 2017; Egbue and Long, 2012; Ewing and Sarigollu, 1998; Ferguson et. al., 2018; Han et. al., 2017; He and Zhan, 2018; Hidrue et. al., 2011; Jansson et. al., 2017; Junquera et. al., 2016; Kurani et. al., 1996; Langbroek et. al., 2017; Lin and Wu, 2018; Mohamed et. al., 2016; Neumann et. al., 2010; Noppers et. al., 2015; Peters et. al., 2018; Schmalfuß et. al., 2017; Schuitema et. al., 2013; Shafiei et. al., 2018; She et. al., 2017; Singer, 2016; Skippon and Garwood, 2011; Smith et. al., 2017; Vassileva and Campillo, 2017; Wang, Li and Zhao, 2017; White and Sintov, 2017; Wieland, 2017; Zhang et. al., 2011).

The main purpose of this study is to determine the expectations from electric vehicles and the reasons for choosing or not choosing the electric vehicles. Therefore, the survey is the most suitable method for this study. 10 variables collected through a literature review, which are driving range, purchasing price, charging time and infrastructure, maintenance cost, demographic variables, governments incentives and subsidies, environmental concerns, performance, operating cost, battery life and cost. As in the study of He and Zhan (2018), these 10 indicators were divided into 3 different groups, which are technological factors, consumer characteristics and contextual factors.

The survey designed in Turkish in respect to the 10 indicators. The survey was pre-tested 3 times by applying it to 55 different individuals and 11 experts. In the pre-test phase, 9 different propositions based on the indicators were constructed according to the literature review. The final English version of the survey shown in Appendix A and contains 19 items, which are 5 demographic questions, 3 multiple-choice questions and 11 Likert scale type questions (1: Strongly Disagree, 2: Disagree, 3: Undecided, 4: Agree, 5: Strongly Agree). The distribution of the questions according to the indicators are as follows; first 5 is related to demographics, Q1 is related to driving range, Q2 is related to purchasing price, Q3, 4 and 5 are related to charging infrastructure and time, Q6 is related with maintenance cost, Q7 is related to government incentives/subsidies, Q8 and 9 are

related to environmental concerns, Q10 and 11 are related to performance, Q12 is related to operating cost and Q13 and 14 are related to battery life and cost. The reliability test applied to the final version of the survey using SPSS statistical software.

In this article, Cronbach's α coefficients are used to check the consistency between the items. Reliability analysis is a method that measures the stability and reliability of an evaluation system. 0.70 and above is an acceptable limit of the Cronbach's α. The reliability analysis result is shown in Table 2. This test is applied only to the Likert Scale type questions. The Cronbach's α for the overall scale of each factor is within 0.756 which means the survey is acceptable. Figure 2, shows the triangulation method dimensions. Literature review, expert opinion and pre-test of survey were used to increase the reliability of the questionnaire and to reduce the bias. According to the Olsen (2004), in social sciences triangulation is defined as the mixing of data or methods so that diverse viewpoints or standpoints cast light upon a topic.

Element	Cronbach's Alpha	Item
Entire Sample	0,756	11

Table 2: Result of the reliability analysis

After all this, the final version of the survey was sent out to the participants by online survey website, Survey Monkey and a hard copy. This survey applied to participants between March 1st and April 1st 2018 in Izmir. Also, during this monthly period USD/TRY average is 3,89 (Investing, 2018). Survey was sent to 654 people. Participants were selected based on whether they are over 18 years old and whether they have a driving license. This selection based on Patton's (1990) criterion sampling. This system's logic is examining all cases that meet the criteria with some predefined qualifications. As a result, 416 people participated in the survey, which represents a 63,6% participation rate. The gender distribution is close to each other. 238 of the participants are male and 178 of them are female. The percentages are 57,2% male, 42,8% female. In respect to the age, 32,4% of the

participants were in the 26-35 age range, with 27,4% in the 18-25 age range, 20,7% in the 46-55 age range, 13% in the 36-45 age range, 5% in the 56-60 age range, and 1,4% in the +60 age range.

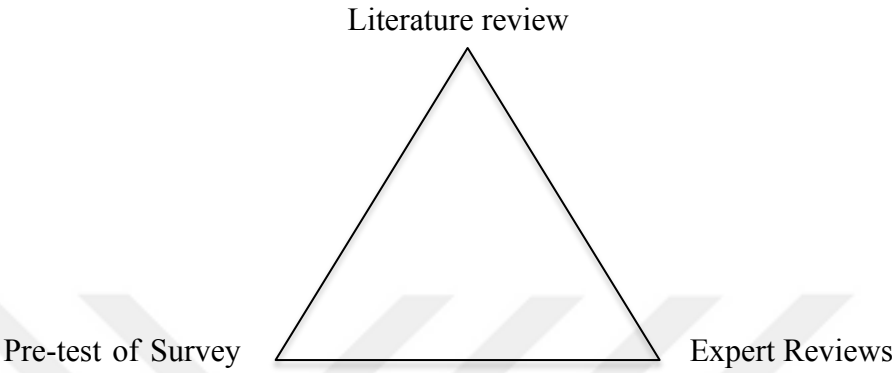

Figure 2: The dimensions of the triangulation method

On the point of education level, the survey contains 7 different levels, which are primary school, middle school, high school, associated degree, Bachelor's, master and PhD. However, these education levels are divided into 3 groups. Primary and middle school are group 1, high school and associate are degree group 2 and Bachelor's, master and PhD are group 3. The education level of the sample is therefore quite high. More than half of the participants belong to group 3 with 75,5%. 21,6% of the participants are in the group 2 and only 2,9% in the group 1. There were 7 options for income level in the survey. However most of the participants do not want to specify their monthly income level 23,6%. 22,1% of the participants' income level is between 1.601 – 2.500 TRY, 19,7% is earn higher than 5.500 TRY, 11,5% is in between 2.501 – 3.500 TRY, 11% earn less than 1.600 TRY, 7,7% is in between 3.501 – 4.500 TRY, and 4,3% is in between 4.501 – 5.500 TRY.

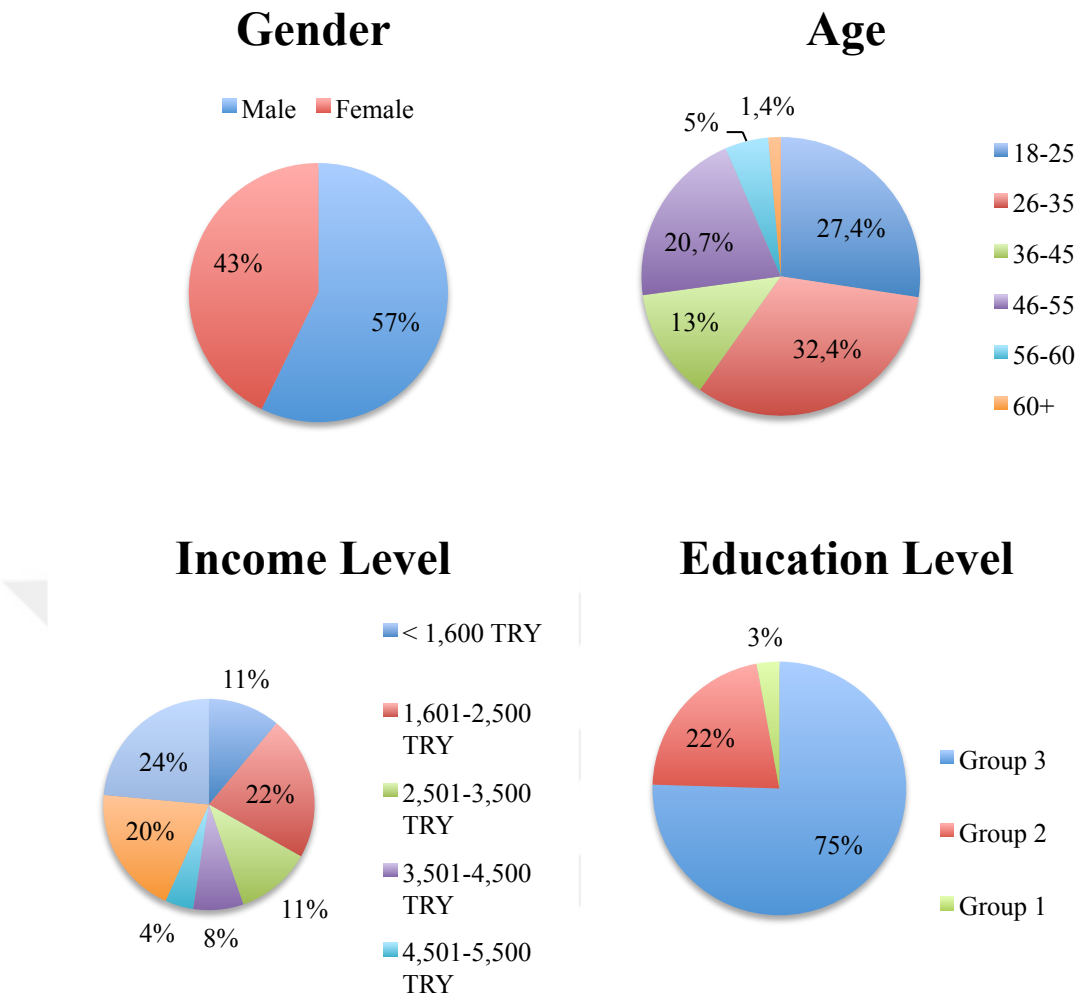

Figure 3: Distribution of the demographic variables of the sample

Three questions are the multiple-choice type, which are Q1, 2 and 3. In the first question, the majority of the participants find the driving distance of 401 to 500 km suitable by more than 30%. Almost 26% of the participants tend to travel more than 600 km. Only 5,8% of the sample find less than 300 Km is suitable. The second question is related to the purchasing price of the electric vehicles. More than 50% of the participants almost 60% find that 100.000 TRY - 120.000 TRY price range is suitable for electric vehicles. 25,5% of the sample tends to pay 120.001 TRY - 140.000 TRY for electric vehicles. While only 2,9% finds that more than 180.001 TRY is suitable for a purchasing level. As stated before, question 3, 4 and 5 are related to charging infrastructure and time.

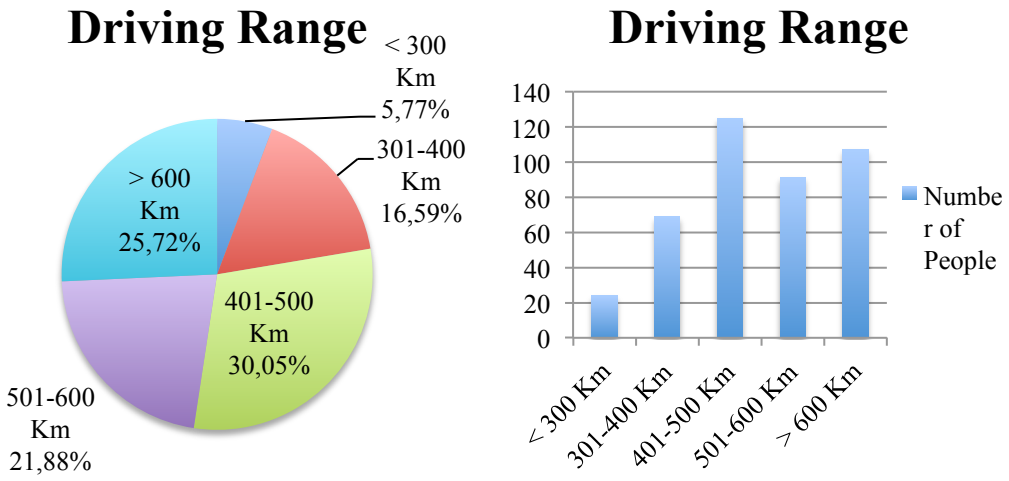

Figure 4: Distribution of the driving range choices of the sample

In question 3, the majority of the participants are distributed equally between less than 2 hours and 2 – 3 hours by 24,3%. Only 9,4% of the participants chose the more than 5 hours option. In question 4, 45,2% of the participants agree that charging time is worrying if it is longer than it is advertised. 29,3% of them strongly agree, only 4,1% strongly disagree. Question 5 is related to charging infrastructure. According to the majority of the participants, they would tend to buy an electric vehicle if the charge stations were as common as the gas stations. More than 50% chose the strongly agree option in this question. Only 3,1% of the sample strongly disagree.

Purchasing Price	Percentage	Frequency
100.000 TRY – 120.000 TRY	56,5%	235
120.001 TRY – 140.000 TRY	25,5%	106
140.001 TRY – 160.000 TRY	11,8%	49
160.001 TRY – 180.000 TRY	3,4%	14
> 180.001 TRY	2,9%	12

Table 3: Distribution of the purchasing price choices of the sample

For maintenance cost, 42% of the sample strongly agree that they would consider buying an electric vehicle if the maintenance expense was lower than that of the

conventional (gasoline or diesel) cars. 41,1% of the participants agree and only 3,6% strongly disagree.

Question 7 is related to government incentives. The majority of the sample find that government incentives are not enough to promote electric vehicles. 37% and 35,3% of the participants chose the strongly disagree and disagree respectively. 20,7% of them are undecided, 4,6% agree and only 2,4% are strongly agree.

Figure 5: Distribution of the sample by question 3, 4, and 5

Question 8 and 9 are related to environmental concerns. According to the sample, 34,4% of the participants agree that they would consider buying the electric vehicles because people see them as an environmentalist.

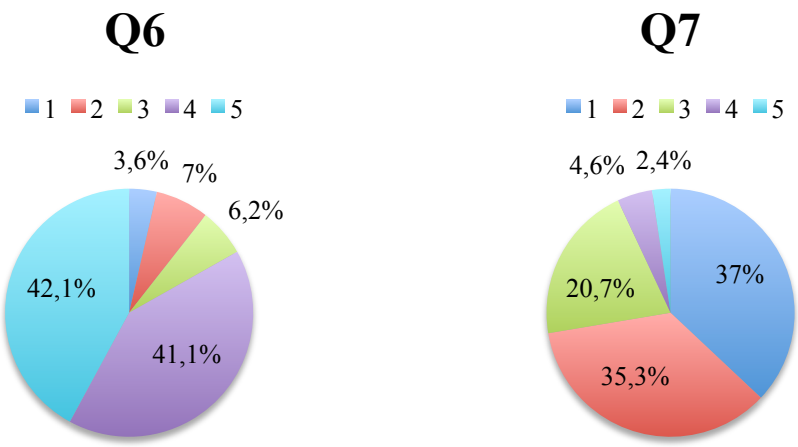

Figure 6: Distribution of the sample by question 6 and 7

On the other hand, 30,5% of the sample strongly agree. 14,7% chose undecided, 12,7% chose disagree and 7,7% chose strongly disagree.

Question 9 covers the subject about nature friendliness and national energy saving. Almost, 70% of the participants agree that they will consider buying an electric car because it is nature friendly and it contributes to the role of national energy saving. 11,8% of them chose undecided, 9,6% chose strongly agree, 5,8% chose disagree, and 3,6% chose strongly disagree.

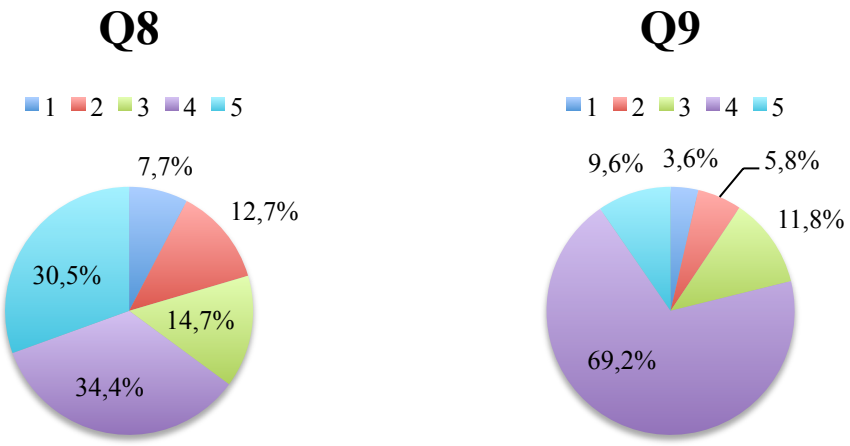

Figure 7: Distribution of the sample by question 8 and 9

Question 10 is related to the safety of the electric vehicle in the case of an accident. The majority of the participants agree and strongly agree that electric vehicles should be safer than the conventional cars in case of an accident with 35,1% and 31% respectively. Only 13 people chose strongly disagree for that question.

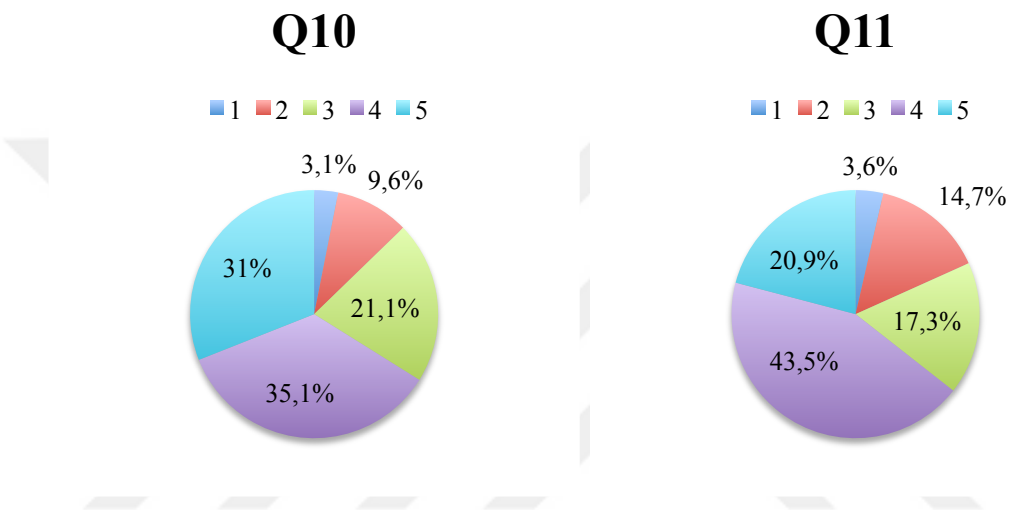

Figure 8: Distribution of the sample by question 10 and 11

Question 11 is related to speed limits and the acceleration of the electric vehicle. 43,5% of the participants chose agree option. 20,9% chose strongly agree, 17,3% chose undecided 14,7% chose disagree, and 3,6% chose strongly disagree.

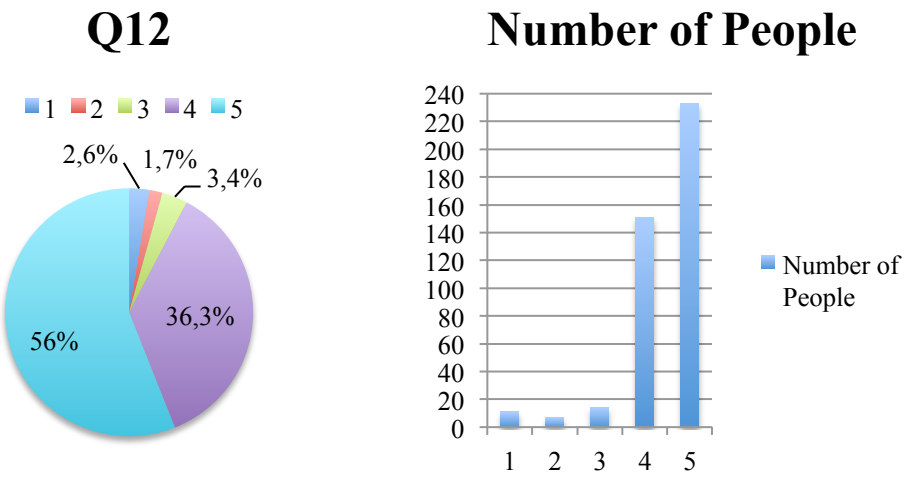

Figure 9: Distribution of the sample by question 12

Question 12 is trying to establish the effect of fuel cost difference between electric vehicle and conventional car onthe purchasing decision. 56% of the participants strongly agree that their decision can be effected if the electric vehicles fuel (electricity) was cheaper than conventional vehicles fuel (diesel or gasoline). Questions 13 and 14 were asked after a short briefing. This briefing gives information about battery capacity, warranty, life, and replacement price of an imaginary electric vehicle, which was designed after the literature review and expert reviews.

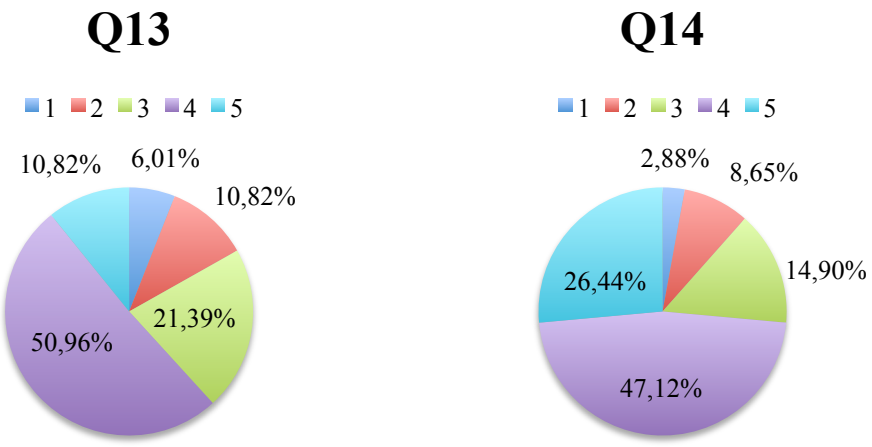

Figure 10: Distribution of the sample by question 13 and 14

Question 13 asks whether the battery life is sufficient at 8-10 years. More than 50% agree that 8 to 10 years battery life is acceptable for electric vehicles. Only 6% chose the option strongly disagree.

Question 14 asks whether the cost of the battery affects the buying preference. 47,1% of the sample agrees that the replacement cost of the battery affects the purchasing decision. 26,4% chose strongly agree option, a minority of 2,9% opted for the strongly disagree.

4 EMPRICAL RESULTS

4.1 Demographics

Table 6 shows the demographic data of the respondents in this study. 238 (57,2%) of the respondents were male and 178 (42,8%) were female.

There are 6 main age ranges, which are 18 – 25, 26 – 35, 36 – 45, 46 – 55, 56 – 60, and +60. The majority (32,4%) of the participants were between the ages of 26 – 35. The second most populated group is the 18 – 25 age groups, with 114 people. These two groups could be the potential consumers for electric vehicles (Wang et. al., 2018). The least dense group is over age 60 with only 6 people. The average age of the group is 35,4.

Table 4 shows the age and gender ratio. As it shown on the table, the male participant's average age is lower than the females. The 26 – 35 age group is the most populated group in both genders. The second major group is 18 – 25 age range in both genders with 26,9% male and 28,1% female.

Age	Percentage (Male)	Number of Male	Number of Female	Percentage (Female)
18-25	26,9%	64	50	28,1%
26-35	35,3%	84	51	28,6%
36-45	11,3%	27	27	15,2%
46-55	20,2%	48	38	21,3%
56-60	4,6%	11	10	5,6%
60+	1,7%	4	2	1,1%
Total	100,00%	238	178	100,00%
Average Age		35,26	35,71	

Table 4: Age and gender ratio of the sample

The education level of the participated group is quite high. 75,5% of the respondents are highly educated, which means 314 people are Bachelor's, Master or PhD students or graduates. The proportion of respondents who have High School or Associate degrees is 21,6%. There are only 12 people who are graduated from primary or middle school. If the education levels of male and female are compared, it seems that females are more educated than males. With 144 people, 80,9% of the females are at least university student. Only 2 females are primary or middle school graduate, while with males it is 10.

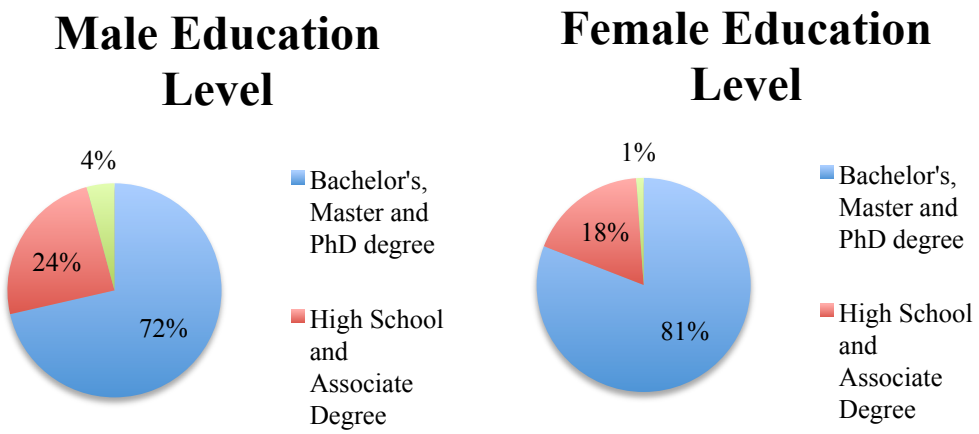

Figure 11: Education levels of the sample by gender

There are 11 main occupations, which are student, health sector, engineer, finance sector, taxi driver, retired, education sector, business manager, designer, housewife, and other. The highest ratio belongs the other sectors with 34,4%. However, specific sector groups will be useful for interpretation. The highest ratio belongs to students in the determined groups with 15,1%. The second largest group with 53 people belongs to health sector employees.

Table 5 shows the distribution of the occupations in terms of gender. As it seems, student are the most common occupation for both. The percentage is almost the same for both male and female, 15,5% and 14,6% respectively.

The health sector is the second most common occupation for both male and female. Similar with student, frequencies and ratios are very close to each other. 13% of the males and 12,4% of the females are working in health sector.

Taxi driver are exclusively male, and by definition housewife is available only in female. Engineering is a more popular occupation for males. It is the third most preferred occupation; engineering is a more popular occupation for males, while the finance sector is also more popular with females.

Gender	Occupation	Frequency	Percentage
Male	Student	37	15,5%
	Health Sector	31	13%
	Engineer	29	12,2%
	Taxi Driver	26	10,9%
	Finance Sector	15	6,3%
	Business Manager	6	2,5%
	Education Sector	4	1,7%
	Retired	3	1,3%
	Designer	1	0,4%
	Housewife	0	0%
	Other	86	36,1%
Female	Student	26	14,6%
	Health Sector	22	12,4%
	Finance Sector	18	10,1%
	Retired	12	6,7%
	Housewife	11	6,2%
	Designer	10	5,6%
	Engineer	9	5,1%
	Education Sector	8	4,5%
	Business Manager	5	2,8%
	Taxi Driver	0	0%
	Other	57	32%

Table 5: Distribution of the occupations by gender

When it comes to monthly income most of the participants (23,6%) do not want to specify their earnings. The most frequent income level among the responding individuals is between 1.601 – 2.500 TRY with 22,1%. The second highest proportion (19,7%) belongs to people who earn more than 5.500 TRY monthly. The least populous income level is 4.501 – 5.500 TRY with 4,3%. Income is one of the important factors for living standard. Therefore, people between the ages of 18-35

are potential electric vehicle users. The target audience corresponds to almost 60 percent of the participants a total of 249 people.

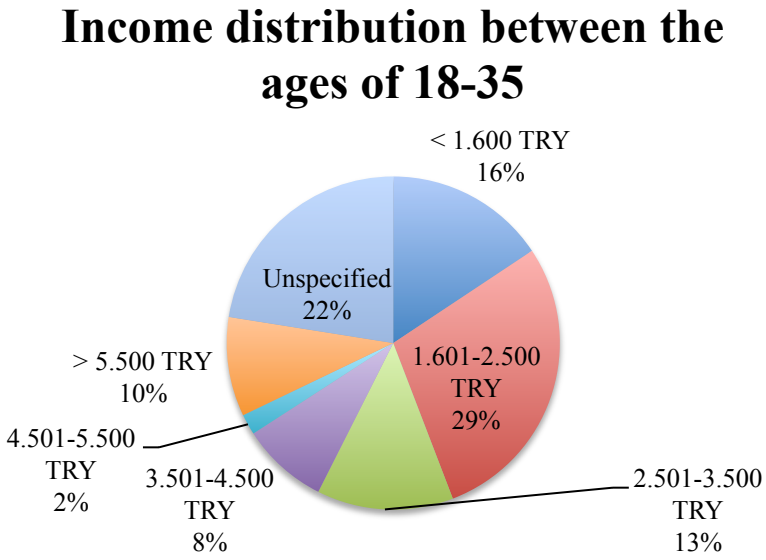

Figure 12: Income distribution between the ages of 18 – 35

During the survey study, the lowest new electric vehicle prices determined between 100.000 TRY to 120.000 TRY. So this price corresponds to 62 – 75 months of salary of someone who receives 1.600 TRY monthly. Results show that, 22 % of the potential consumers preferred not to mention their monthly income. People between the ages of 18-35 that earn 1.601 – 2.500 TRY per month is 29 percent. With only 10% of the potential buyers earning more than 5.500 TRY. This could be an indicator that the purchasing power of the consumer in terms of electric vehicles can be increased if the prices of an electric vehicle decrease. As it mentioned in Table 6, 98 participants preferred not to mention their monthly income. 75 of them belong to the Bachelor's, Master and PhD group, 22 of them belong to High School and Associate Degree group and only one from the primary or middle school degree band.

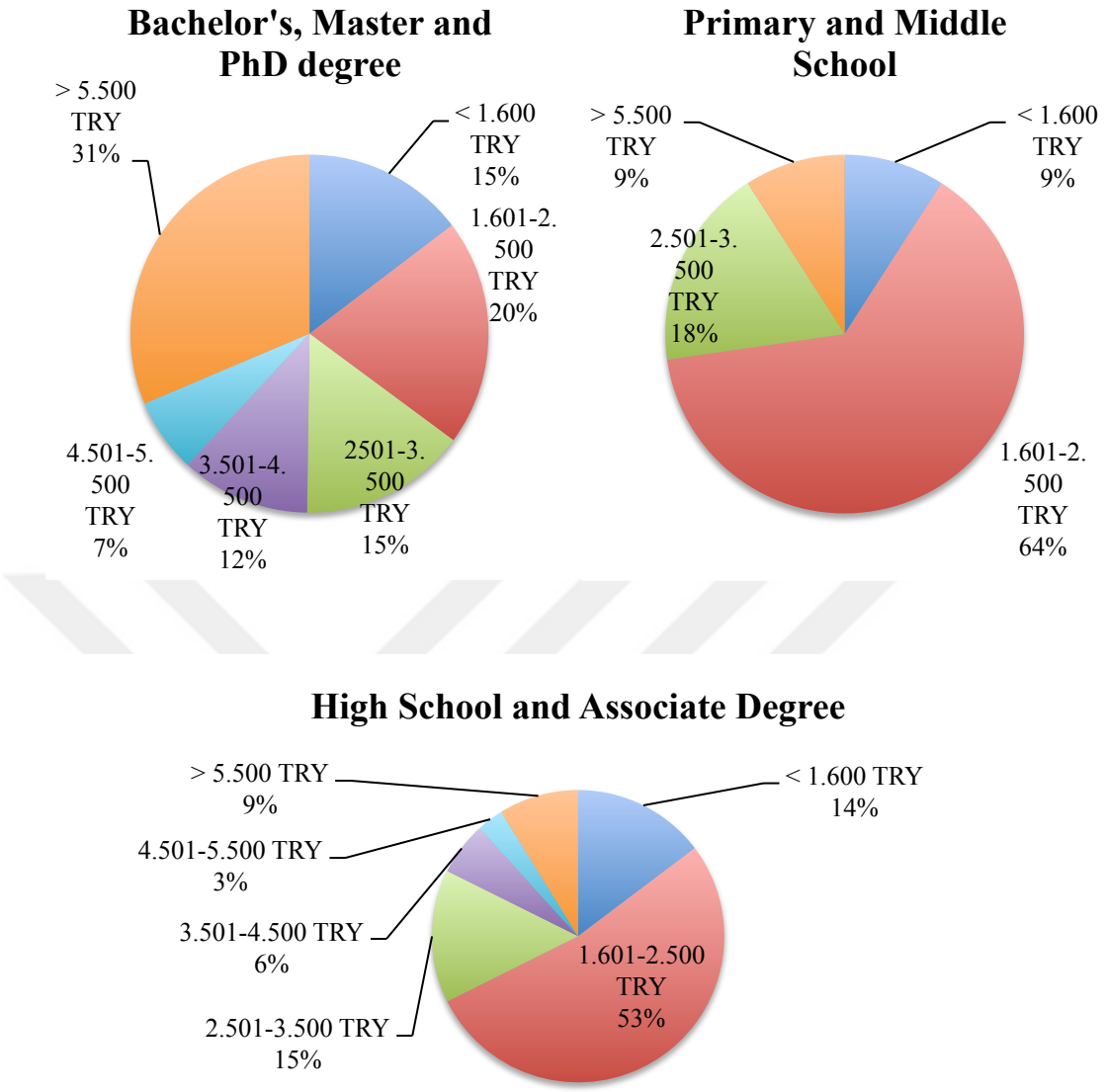

Figure 13: The distribution of the education levelsby income level

Figure 13 was formed without the 98 people who did not specify their income. Obviously, as the level of education increases, the monthly income also increases. 64% of the primary and middle school group earn between 1.601 to 2.500 TRY monthly. Only, 20% of Bachelors, Master and PhD group earn 1.601 to 2.500 TRY monthly. Therefore the highest rate in this group is 31% and belongs to participants who earn more than 5.500 TRY per month.

Sample Characteristic		Frequency	Percentage
Sample Size		**416**	**100,00%**
Gender	Male	238	57,2%
	Female	178	42,8%
Age	18-25	114	27,4%
	26-35	135	32,4%
	36-45	54	13%
	46-55	86	20,7%
	56-60	21	5%
	60+	6	1,4%
Education Level	Bachelor's, Master and PhD degree	314	75,5%
	High School and Associate Degree	90	21,6%
	Primary and Middle School	12	2,9%
Occupation	Student	63	15,1%
	Health Sector	53	12,7%
	Engineer	38	9,1%
	Finance Sector	33	7,9%
	Taxi Driver	26	6,2%
	Retired	15	3,6%
	Education Sector	12	2,9%
	Business Manager	11	2,6%
	Designer	11	2,6%
	Housewife	11	2,6%
	Other	143	34,4%
Monthly Income	< 1.600 TRY	46	11,1%
	1.601-2.500 TRY	92	22,1%
	2.501-3.500 TRY	48	11,5%
	3.501-4.500 TRY	32	7,7%
	4.501-5.500 TRY	18	4,3%
	> 5.500 TRY	82	19,7%
	Unspecified	98	23,6%

Table 6: Demographic distribution of the sample

4.2 Driving Range

During the survey study, there was only one question related with the driving range. The question measures the expected distance that an electric car can travel with one full charge. The results showed that the highest was 401 – 500 km by 30%. 125 participants stated that it would be sufficient to drive 401 – 500 km with electric vehicles. Also, 26 percent of participants are inclined to the opinion that electric vehicles should travel more than 600 kilometers.

Driving Range	Frequency
Less than 300 km	24
301-400 km	69
401-500 km	125
501-600 km	91
More than 600 km	107

Table 7: Frequency of the sample by driving range

Only, 24 participants stated that electric vehicles distance should be less than 300 km and that is equal to only 6% of the total. 69 people (16%) mentioned that 301-400 km distance is enough for them. For 22% (91 people) of the participants the electric vehicles shouldtravel between 501 to 600 km.

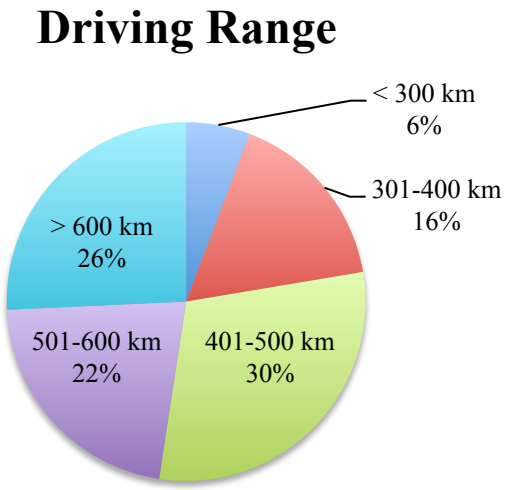

Figure 14: Percentage distribution of the sample by driving range

From a gender, driving distance perspective, women are approach the lower driving ranges positively. 29% of male participants want to travel more than 600 km with electric vehicles whereas this rate is less only 21% for female participants. With the actual numbers, 69 male and 38 female participants preferred to travel more than 600 km. According to the majority of females (with 33%) 401 – 500 km travelling distance is enough for them. For males that same distance is less 28%.

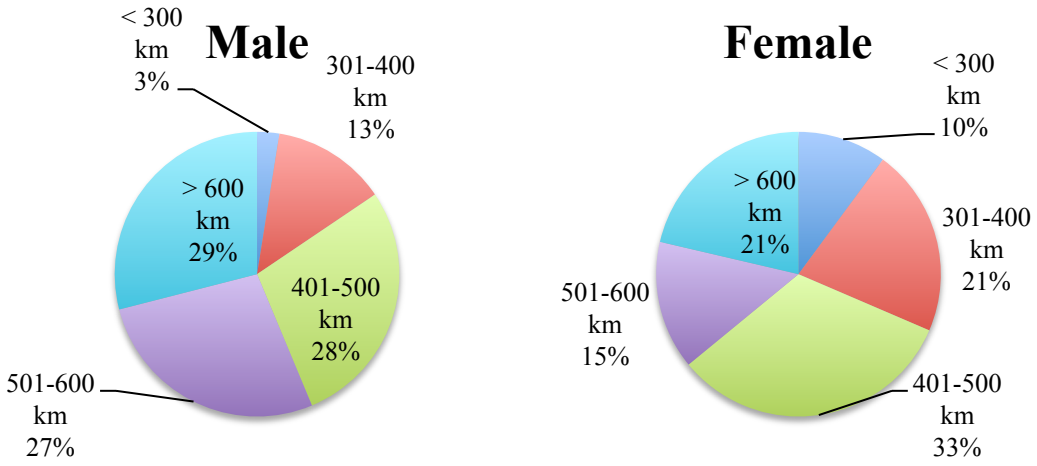

Figure 15: Percentage distribution of the genders by driving range

As it is shown clearly in Table 8, the males travelling demand is higher than the females in terms of kilometres. The reason behind is the number of male and female drivers. In 2013, the total number of drivers is 24.778.712 in Turkey, and 5.412.759 (21,8%) are female, 19.365.953 (78,2%) are male (Generali, 2014).
Another reason behind this is the annual driving distance by gender. According to the Sivak's study, (2012) he stated that average kilometres for males are higher than the females. Therefore, male's driving distance expectancy is higher than female's.

Gender / Driving Range	Male	Female
Less than 300	6	18
301-400 km	31	38
401-500 km	67	58
501-600 km	65	26
More than 600 km	69	38
Total	238	178

Table 8: Distribution of the genders by driving range

An additional reason behind this is the occupation distribution in terms of gender and driving range. We know taxi drivers are exclusively males and housewives are females as expected. Predictably, taxi drivers drive more than the housewives.
This statement is consistent within the results. A 100% of the taxi drivers do not prefer less than 300 km and the 301 – 400 km options. 54% (14 people) of the taxi drivers prefer more than 600 km and 42% (11 people) of them choose 501 – 600 km distance ranges. That means, taxi drivers expected driving range is higher than the overall average. Only 4% (1 person) of the drivers choose 401 – 500 km distance. From the perspective of housewives, 37% of them prefer 301 – 400 km and 27% choose less than 300 km travelling distance. Both 501 – 600 km and 401 – 500 km distances are preferred by only 9%. Surprisingly, 18% of the housewives did prefer more than 600 km as the driving distance.

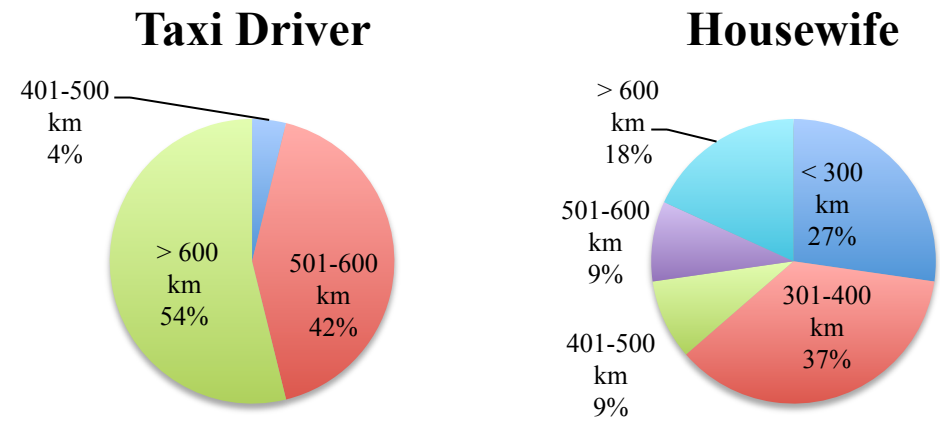

Figure 16: Percentage distribution of the taxi drivers and housewives by driving range

In terms of health sector, the male and female distribution is close to each other. 58% (31 people) are male and 42% (22 people) are female. Reflecting the same as the last comparison, the male health sector employees driving range expectations is higher than the female health sector employees. 35% of the males preferred the 501-600 km driving range while 36% of the females preferred 401-500 km. 9% of the females choose less than 300 km driving range.

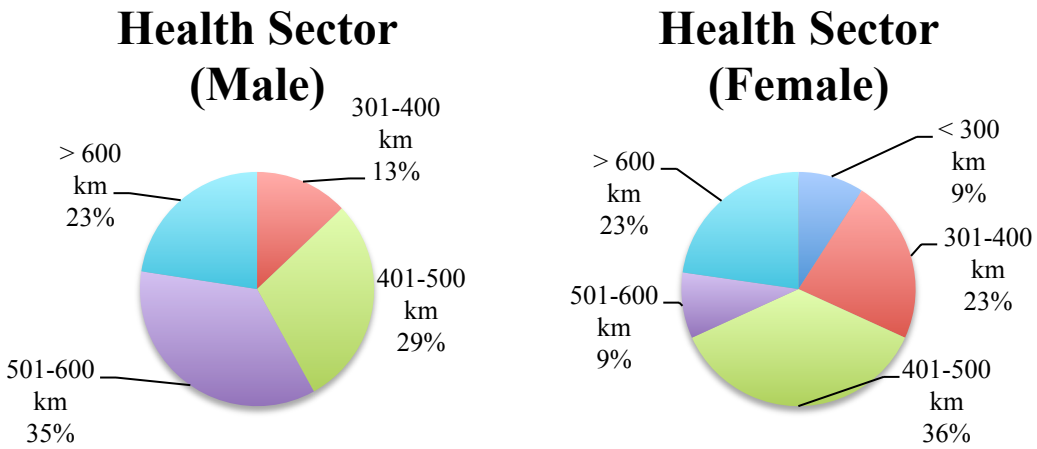

Figure 17: Percentage distribution of health sector employees genders by driving range

In contrast, none of the male employees preferred less than 300 km alternative. Surprisingly, both preferred the more than 600 km option 23%. Also, females choose 301-400 km 23%. This range is 13% for males. If the retired people and the students are compared, the students' driving distance expectations are higher. Both groups did not choose the less than 300 km option.

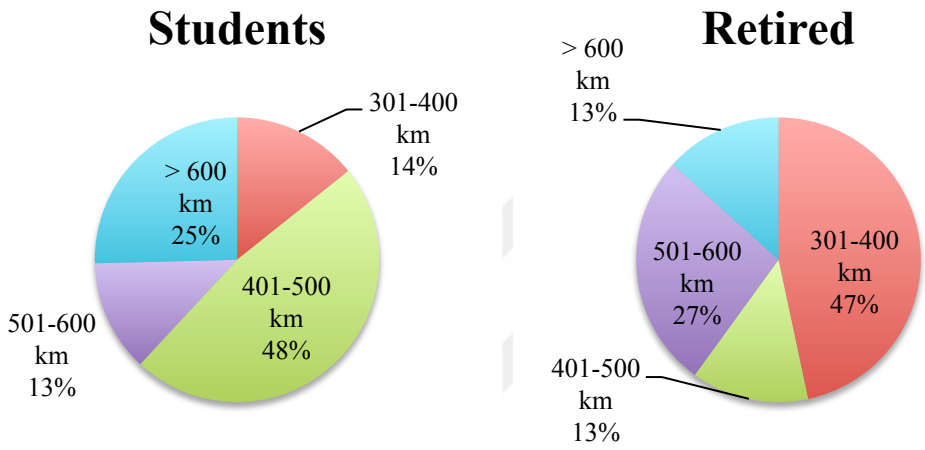

Figure 18: Percentage distribution of the students and retired people by driving range

The majority of the students (48%) expected to drive 401-500 km, with electric vehicles. In terms of retired people, the majority of them (47%) preferred to travel between 301-400 km. An important part of the students (16 student) preferred more than 600 km driving range. In comparison this range is only 13% for retired people with 2 participants. The average age of the retired people is 55 and the students are 22,41. Surprisingly, in terms of age and driving range distribution, age 46-55 preferred more than 600 km driving range by 31,4% and 501-600 km by 19,8%. This is the highest ratio for more than 600 km among all age distribution. These ratios are 18,4% and 15,8% in the 18-25 age group respectively. Between 26-35 ages they both increase significantly by almost 10% and equate to 28,1% and 25,2% respectively. Then, these ratios increased in 36-45 age group by more than 1% and 4% respectively and equal 29,6% for both.

Range / Age	< 300 km	301-400 km	401-500 km	501-600 km	> 600 km
18-25	5 (4,4%)	24 (21%)	46 (40,3%)	18 (15,8%)	21 (18,4%)
26-35	10 (7,4%)	13 (9,6%)	40 (29,6%)	34 (25,2%)	38 (28,1%)
36-45	2 (3,7%)	7 (13%)	13 (24,1%)	16 (29,6%)	16 (29,6%)
46-55	6 (7%)	16 (18,6%)	20 (23,3%)	17 (19,8%)	27 (31,4%)
56-60	0 (0%)	8 (38,1%)	5 (23,8%)	4 (19%)	4 (19%)
60+	1 (16,7%)	1 (16,7%)	1 (16,7%)	2 (33,3%)	1 (16,7%)

Table 9: Distribution of the age groups by driving range

For 18-25 and 26-35 ages, the majority preferred 401-500 km with 40,3% and 29,6% respectively. Therefore, retired people preferred less driving range than students but in terms of age, driving range expectancy increase until the age group 56-60. Then, it starts to decrease again.

Range / Education	< 300 km	301-400 km	401-500 km	501-600 km	> 600 km
Bachelor's, Master and PhD degree	15 (4,8%)	51 (16,2%)	107 (34,1%)	66 (21%)	75 (23,9%)
High School and Associate Degree	9 (10%)	17 (18,9%)	17 (18,9%)	22 (24,4%)	25 (27,8%)
Primary and Middle School	0 (0%)	1 (8,3%)	1 (8,3%)	3 (25%)	7 (58,3%)

Table 10: Distribution of the education levels by driving range

In respect of the education level's effect on driving range, when education level decreases, demand for driving range increases. As it shown in Table 10, 58,3% of the primary and middle school graduates and 27,8% of the high school and associate degree group preferred to travel more than 600 km with a single charging. On the other hand, Bachelor's, Master and PhD degree group preferred more than

600 km was only 23,9%, they mostly preferred the 401 – 500 km driving range with 34,1%.

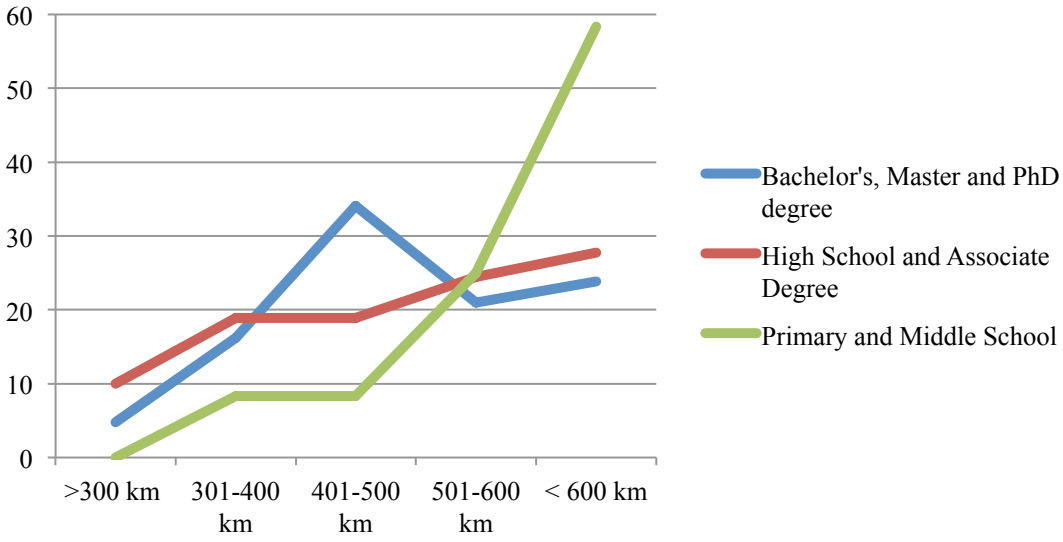

Figure 19: Percentage distribution of the education levels by driving range

4.3 Purchasing Price

The questionnaire contains one question related to purchasing price to measure the participant's allocated budget for buying a new electric vehicle. There were 5 different price ranges in the survey, which are shown in Table 11. The results show that majority of the participants with almost 57% (235 people) chose the lowest price that is between 100.000 TRY to 120.000 TRY.

Purchasing Price	Frequency
100.000 TRY – 120.000 TRY	235
120.001 TRY – 140.000 TRY	106
140.001 TRY – 160.000 TRY	49
160.001 TRY – 180.000 TRY	14
> 180.001 TRY	12

Table 11: Frequency of the sample by purchasing price

Secondly, 25,5% (106 people) of the participants prefers between 120.001 TRY to 140.000 TRY. 49 people chose the price range between 140.001 TRY and 160.000 TRY. 14 people chose 160.001 TRY to 180.000 TRY and only 12 people are willing to pay more than 180.000 TRY. Figure 20, shows the price distribution by percentage. It is clear to see that cheapest price is more affordable for the majority.

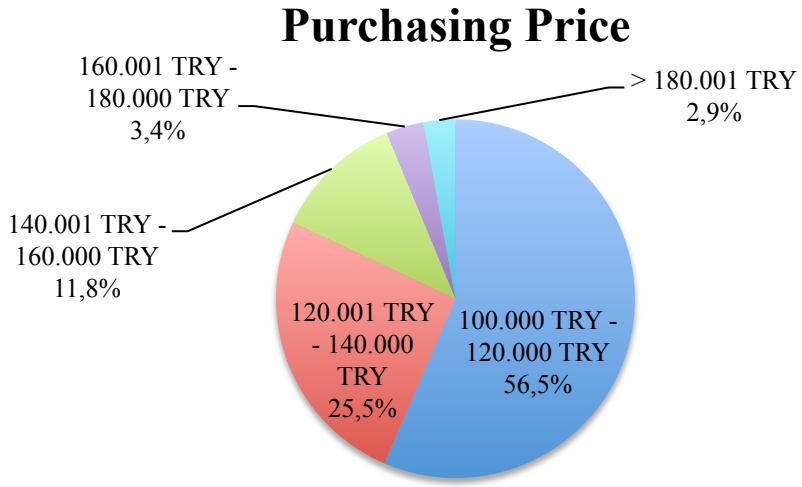

Figure 20: Percentage distribution of the sample by purchasing price

In terms of gender, for both genders, the cheapest price range is more preferred than the other price ranges. 55% of the males and 58% of the females chose the cheapest price range. For the highest price range, males are more willing to pay more than females in the 120.001 TRY to 140.000 TRY price range it is 26% for males and 25% for females.

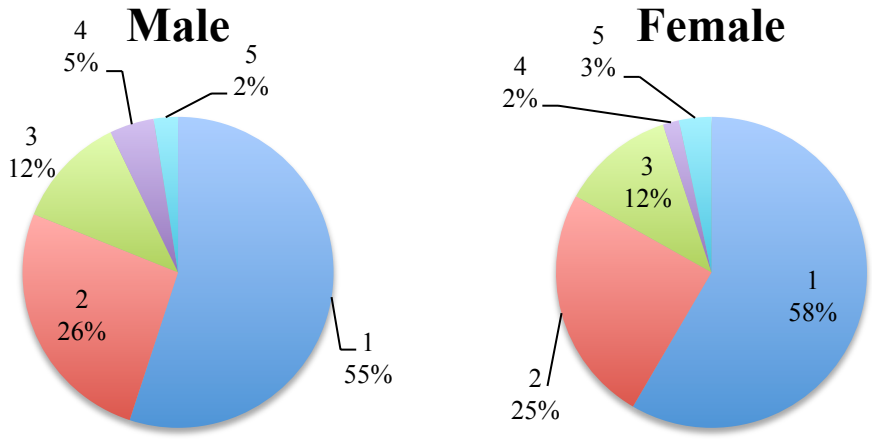

Figure 21: Percentage distribution of the genders by purchasing price

The reason why the lowest price range is preferred is likely to be due to the low-income level of the sample group. As it seems in Table 12, people from different income levels mostly preferred the lowest price range, except in 4.501 – 5.500. In this income level, 100.000TRY – 120.000TRY and 120.001TRY – 140.000TRY have an equal amount of people.

Price / Income	1	2	3	4	5
< 1.600 TRY	27	12	4	0	3
1.601 – 2.500 TRY	61	22	8	1	0
2.501 – 3.500 TRY	26	18	3	0	1
3.501 – 4.500 TRY	22	7	2	0	1
4.501 – 5.500 TRY	7	7	2	1	1
> 5.500 TRY	36	18	15	8	5
Unspecified	56	22	15	4	1

Table 12: Distribution of the income levels by purchasing price (1- 100.000 TRY – 120.000TRY, 2- 120.001 TRY – 140.000TRY, 3 140.001TRY – 160.000TRY, 4- 160.001TRY – 180.000TRY, 5- >180.001TRY)

However, as income level increases, the allocated budget is likely to be more evenly distributed compared to the low-income level. None of the people chose the price range between 160.001 TRY to 180.000TRY in lower than 1.600 TRY income level. Almost 60% of the lowest income level people preferred the lowest price range. This price range represents 44% in the highest income level. On the other hand, the 120.001 TRY – 140.000TRY price range preferred to a higher degree in the lowest income level. The highest income level preferred this range with a result of 22% while the lowest income is higher 26%. Surprisingly, both income levels equally preferred the highest price range by 6%. For the third price range, the highest income level preferred it double compared to the lowest income level as a percentage.

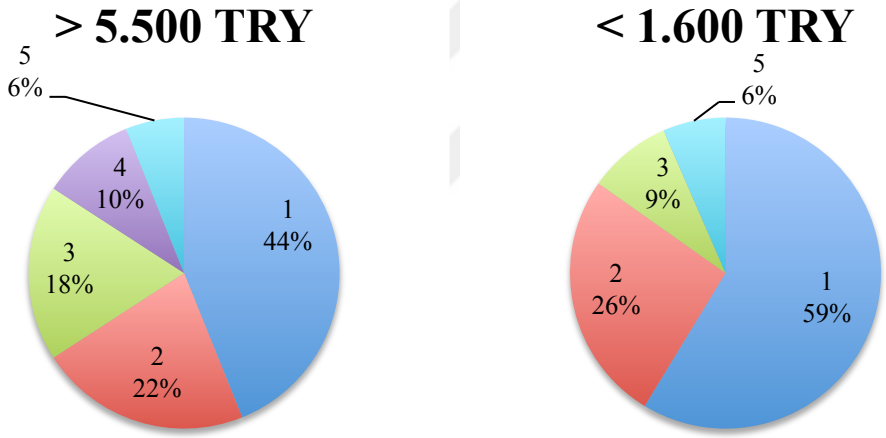

Figure 22: Percentage distribution of the low and high income levels by purchasing price

According to the age in terms of purchasing price, all age groups tended to allocate the lowest budget. However, the preference for the lowest budget is the lowest in the 18 – 25 age group and the highest in +60 ages. In contrast, the 18 – 25 age group preferred the 120.001 TRY to 140.000TRY budget more than the other age groups and this price range is preferred the most by this age group. Also, the

preference of this budget range decreases as the age increases. For instance, +60 age group did not prefer this price range.

Age / Purchasing Price	18-25	26-35	36-45	46-55	56-60	60+
100.000 TRY – 120.000TRY	54(47%)	81 (60%)	31 (57%)	53 (62%)	12 (57%)	4 (67%)
120.001 TRY – 140.000TRY	43 (38%)	32 (24%)	11 (20%)	17 (20%)	3 (14%)	0 (0%)
140.001TRY – 160.000TRY	11 (10%)	15 (11%)	9 (17%)	9 (10%)	3 (14%)	2 (33%)
160.001TRY – 180.000TRY	4 (3%)	2 (1%)	3 (6%)	3 (3%)	2 (10%)	0 (0%)
>180.001TRY	2 (2%)	5 (4%)	0 (0%)	4 (5%)	1 (5%)	0 (0%)

Table 13: Distribution of the age groups by purchasing price

Among the age groups, the 36 to 45 group mostly preferred the 140.001 TRY to 160.000 TRY price range with 17%, in the 56 to 60 age they mostly chose 160.001 TRY to 180.000 TRY with 10%, and the highest price range is mostly preferred by 46 – 55 and 56 – 60 age group with 5%. It can be clearly stated that low prices attract all age groups. However, high price preferences, over 140.000 TRY, are higher as the age increases in comparison with the younger ages.

Education Level / Purchasing Price	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
100.000 TRY – 120.000TRY	167	58	10
120.001 TRY – 140.000TRY	84	21	1
140.001TRY – 160.000TRY	42	7	0
160.001TRY – 180.000TRY	10	3	1
>180.001TRY	11	1	0

Table 14: Distribution of the education levels by purchasing price

With reference to the education level, same as age, income, and gender, the lowest price range has the highest portion. In terms of primary and middle school, more than 80% of the sample preferred the 100.000TRY to 120.000TRY price range. Only 2 people chose different price ranges, one of them chose 120.001TRY – 140.000TRY and the other one chose 160.001TRY – 180.000TRY. According to the Figure 23, high school and associate degree group chose the 100.000TRY – 120.000TRY price range with 65% and Bachelor's, Master and PhD degree group chose with 53%.

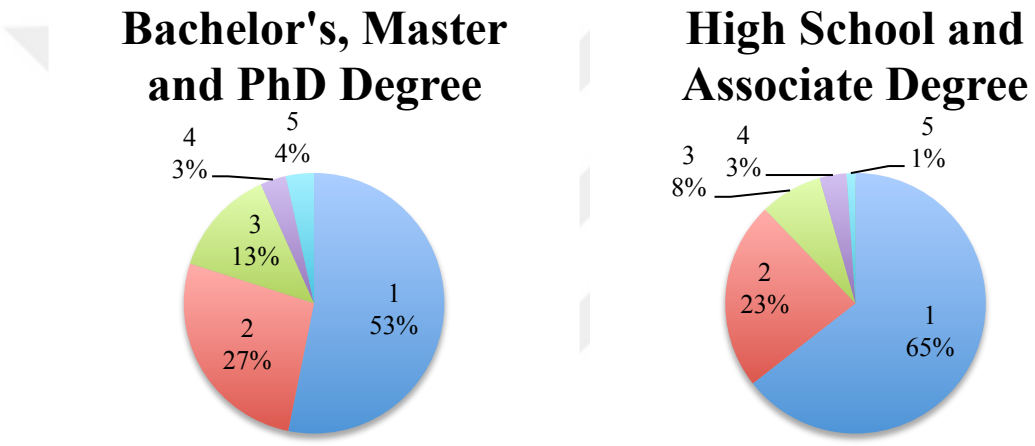

Figure 23: Percentage distribution of the Bachelor's, master and PhD degree and high school and Associate degree (1- 100.000 TRY – 120.000TRY, 2- 120.001 TRY – 140.000TRY, 3 140.001TRY – 160.000TRY, 4- 160.001TRY – 180.000TRY, 5- >180.001TRY)

The high school and Associate degree group chose 120.001TRY – 140.000TRY with 23% while it is 27% in the Bachelor's, master and PhD group. In terms of price ranges higher than 100.000TRY – 120.000TRY, high school and Associate degree group's price range rates are less than Bachelor's, Master and PhD group except in the price range 160.001TRY – 180.000TRY. In this range, the rate is the same for both groups and it is 3%. For the highest price, the high school and associate degree sample group rate is only 1% while it is 4% in the Bachelor's,

Master and PhD group. According to the Figure 23, it is clear to see that as the education level increases, the price range that can be paid increases.

4.4 Charging Infrastructure and Time

The survey study contains 3 questions related to charging infrastructure and time. Two questions are about charging time and other question is about charging infrastructure. One of the questions related with charging time is multiple-choice and another one is Likert scale type. The multiple-choice question measures the expected charging time for electric vehicle with regular household plugs.

Q3	Percentage	Frequency
Less than 2 hours	24,3%	101
2 - 3 hours	24,3%	101
3 - 4 hours	21,1%	88
4 - 5 hours	20,9%	87
More than 5 hours	9,4%	39

Table 15: Frequency of the sample by charging time

As it shown in Table 15, 48,6% of the participants chose the less than 2 hours and 2 – 3 hours options. The ratio of these 2 options is the same and is 24.3% for each.

Only 39 participants preferred the more than 5 hours option. 3 – 4 hours and 4 – 5 hours charging time options were preferred by 88 people with 21,1% and 87 people with 20,9% respectively.

It is clear to say that less charging time is more preferred than the higher durations. However, the ratios are distributed closely except with the more than 5 hours.

In terms of gender, males expect electric vehicles to charge faster. Males chose less than 2 hours' time range with 26% while females chose with 22%. Females preferred more than 5 hours charging time option with 13% and males preferred with 7%.

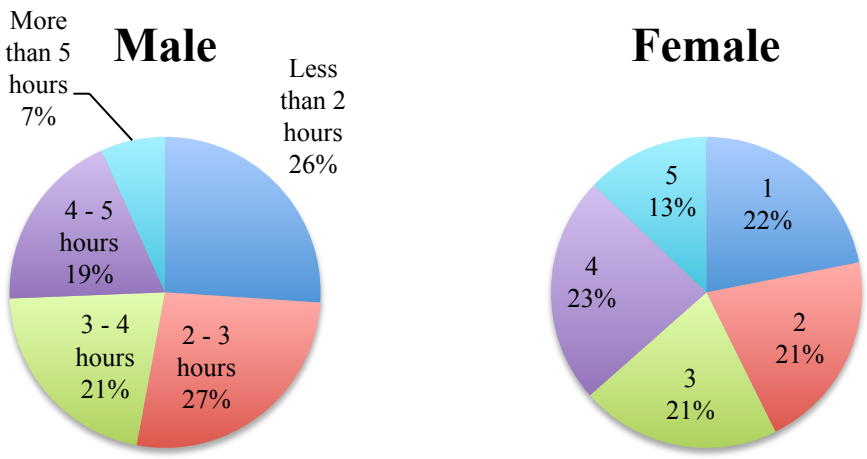

Figure 24: Percentage distribution of the genders by charging time

According to the Figure 24, males demand less time to charge electric vehicles than females.

Table 16 shows the age and charging time relations. For 18 – 25 age group the optimal charging time is 2 to 3 hours with 25,4%. Also, the same age group chose 3 – 4 hours charge duration with 23,7%. Therefore, 2 – 3 and 3 – 4 hours charging durations are suitable for 18 – 25 years old.

However, more than 5 hours option is chosen by only 14% of the participants. The 26 – 35 age group chose 4 – 5 hours charging time with almost 26%. This age group chose 2 – 3 and 3 – 4 hours charging time with 22,2% and 21,5% respectively. The 36 to 45 years old range mostly preferred 2 to 3 hours charging time. Secondly, they chose 3 – 4 hours. The 46 – 55 age group mostly preferred less than 2 hours charging time with almost 40%. 23,3% of this group chose 2 – 3 hours. There was 33,3% of the 56 – 60 years old participants who chose 4 to 5 hours charging time. Finally the over 60 years group chose less than 2 hours option with 50%. So according to these results, only 46 – 55 and over 60 years old participants preferred less than 2 hours charging time. On the other hand, 2 – 3 and 3 – 4 hours charging duration is acceptable for the other age groups. In terms of occupation, 31% and 35% of the taxi drivers preferred less than 2 hours and 2 – 3 hours option.

Age / Time	18-25	26-35	36-45	46-55	56-60	60+
Less than 2 hours	23 (20,2%)	28 (20,7%)	9 (16,7%)	34 (39,5%)	4 (19%)	3 (50%)
2 - 3 hours	29 (25,4%)	30 (22,2%)	16 (29,6%)	20 (23,3%)	4 (19%)	2 (33,3%)
3 - 4 hours	27 (23,7%)	29 (21,5%)	15 (27,8%)	14 (16,3%)	3 (14,3%)	0 (0%)
4 - 5 hours	19 (16,7%)	35 (25,9%)	12 22,2%)	13 (15,1%)	7 (33,3%)	1 (16,7%)
More than 5 hours	16 (14%)	13 (9,6%)	2 (3,7%)	5 (5,8%)	3 (14,3%)	0 (0%)

Table 16: Distribution of the age groups by charging time

None of the taxi drivers chose more than 5 hours option. 23% preferred 3 – 4 hours and only 11% preferred 4 – 5 hours. In comparison, housewives preferred the less than 2 hours option with 28%. 3 – 4 hours and 4 – 5 hours preferred with 27% for both charging durations. Finally, the 2 – 3 hours and the more than 5 hours options chosen by 9% for each option. So it seems, housewives have more time than the taxi drivers. Probably the taxi driver drives more than housewives in a day.

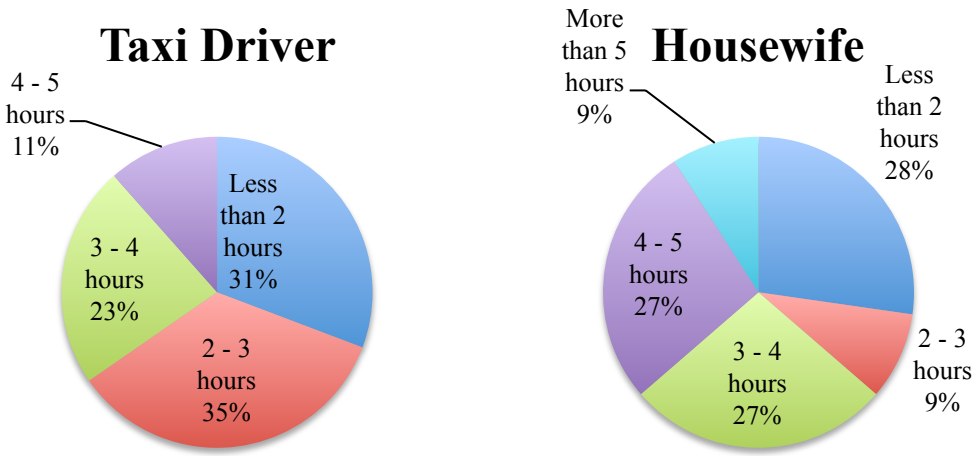

Figure 25: Percentage distribution of the taxi drivers and housewives by charging time

That is an obvious reason why taxi drivers need less charging time than housewives. Figure 26, shows the number of the education sector members number in terms of the their preference in charging time of electric vehicles. Education sector employees chose less than 2 hours and 3 – 4 hours options with 17%. For the most of the education sector employees 2 – 3 hours charging duration is suitable for them. However, the education sector is the occupation group that has the highest preference for the more than 5 hours charging time option with 25%.

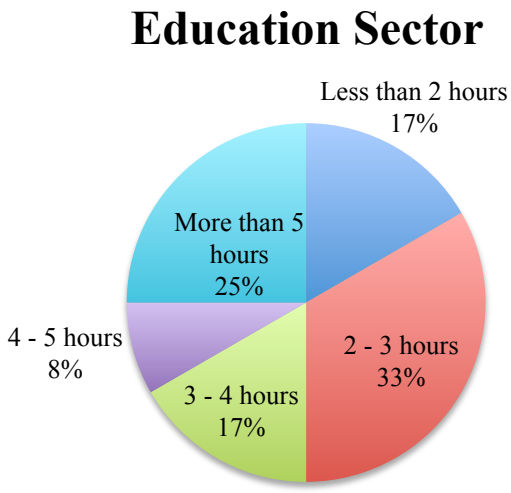

Figure 26: Percentage distribution of the education sector employees by charging time

If the education levels are compared, the high school and associate degree group chose the less than 2 hours option at most with 26,7%. Also,the same group chose 3 – 4 hours option with the same percentage. The primary and middle school group mostly expect to charge electric vehicles between 2 to 3 hours with 41,7% and the Bachelor's, master and PhD degree group's charging time distribution are so close to each other. Only the more than 5 hours option is low. However, it is the highest rate compared with other education levels. The bachelor's, master and PhD degree group expected to charge electric vehicles in less than 2 hours or 2 – 3 hours. The percentage for these two charging time is the same at 23,6%. With the same result,

less charging duration is expected from the electric vehicles. However, as the level of education increases, tolerance to long charging times increases.

Time \ Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
Less than 2 hours	74 (23,6%)	24 (26,7%)	3 (25%)
2 - 3 hours	74 (23,6%)	22 (24,4%)	5 (41,7%)
3 - 4 hours	63 (20,1%)	24 (26,7%)	1 (8,3%)
4 - 5 hours	71 (22,6%)	14 (15,6%)	2 (16,7%)
More than 5 hours	32 (10,2%)	6 (6,7%)	1 (8,3%)

Table 17: Distribution of the education levels by charging time

Another question related with charging time is question 4, which measures the anxiety level of charging time if it would take longer than it is advertised. This question is a Likert scale type. A total of 45.2% of the participants choose the 4 which means they agree. Then 29,3% of the sample thinks that longer charging duration is a worrying issue. Almost 15% of the participants are undecided about longer charging duration. Only 4% of them think that this is not a very important issue.

Q4	Percentage	Frequency
1	4,1 %	17
2	6,5%	27
3	14,9%	62
4	45,2%	188
5	29,3%	122

Table 18: Frequency of the sample by anxiety level of charging time

In terms of gender, for both longer charging time than is advertised is a worrying situation. Males and females chose 4 with 44% and 46% respectively. 30% of the males think that longer charging durations are an important issue. In contrast, only

3% of them chose option 1 while with females it was 5%. For females, long charging durations are not as an important issue compared with males. Females are more undecided than males. 14% of the males selected the undecided option while 17% of the females responded that they are undecided. Among the age groups, the group with the highest preference of 5 is between the ages of 18 and 25 with 34,2%. The lowest preference of 5 belongs to 56 – 60 years old group. The 18 – 25 years old age group chose mainly 4 with 43,9%. Additionally, the 36 – 45 age group also preferred this with more than 50%. The 4 and 5 options are both high in all age groups except with over 60 years old.

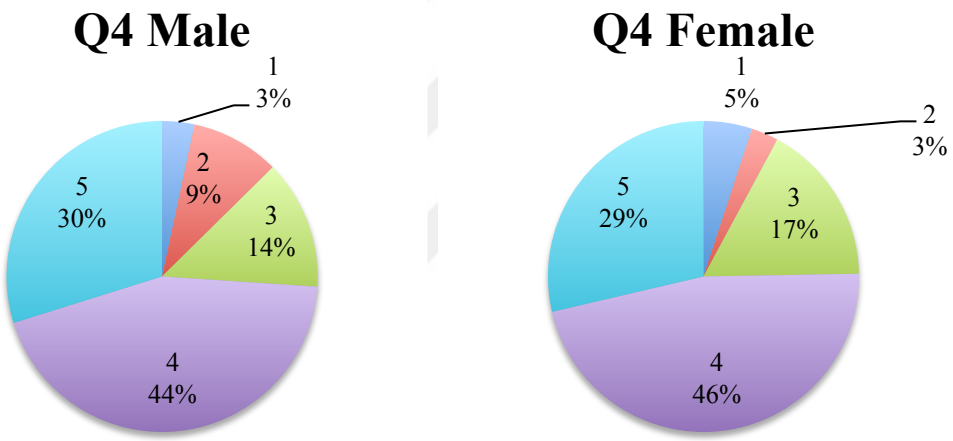

Figure 27: Percentage distribution of the genders by anxiety level of charging time

High anxiety level decreases after the age of 56. At over 60 years of age, the level of anxiety falls even further. In this age range, 1 and 2 are chosen by 33,3% of each group. When this is examined with respect to the level of education, Bachelor's, master and PhD degree and high school and associate degree have anxiety about charging time.

Age	1	2	3	4	5
18 - 25	5 (4,4%)	4 (3,5%)	16 (14%)	50 (43,9%)	39 (34,2%)
26 - 35	4 (3%)	9 (6,7%)	20 (14,8%)	60 (44,4%)	42 (31,1%)
36 - 45	3 (5,6%)	3 (5,6%)	7 (13%)	29 (53,7%)	12 (22,2%)
46 - 55	1 (1,2%)	6 (7%)	15 (17,4%)	39 (45,3%)	25 (29,1%)
56 - 60	2 (9,5%)	3 (14,3%)	3 (14,3%)	10 (47,6%)	3 (14,3%)
+60	2 (33,3%)	2 (33,3%)	1 (16,7%)	0 (0%)	1 (16,7%)

Table 19: Distribution of the age groups by anxiety level of charging time

Both education levels chose 4 with 46,2% and 44,4% respectively. Surprisingly, the primary and middle school group were undecided with anxiety about longer charging duration with a result of 33,3%. According to the Table 20, high anxiety level decreases when the education level decreases. Bachelor's, master and PhD degree group have a high anxiety level with 31,2%, the high school and Associate degree group have 24,4%, the primary and middle school group have only 16,7% high anxiety level. Only 2,2% of the Bachelor's, master and PhD group did not worry about long charging duration. This ratio increases when education level decreases.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	7 (2,2%)	8 (8,9%)	2 (16,7%)
2	19 (6%)	7 (7,8%)	1 (8,3%)
3	45 (14,3%)	13 (14,4%)	4 (33,3%)
4	145 (46,2%)	40 (44,4%)	3 (25%)
5	98 (31,2%)	22 (24,4%)	2 (16,7%)

Table 20: Distribution of the education levels by anxiety level of charging time

The third question related to charging infrastructure is to measure how important it is by asking will you buy electric vehicles if the charge stations were as common as the gas stations.

More than 50% of the pariticipants preferred to buy electric vehicles if it is as common as the gas stations. 33,2% of the sample also preferred option 4 which

means they agree to purchase in a defined situation. 34 people were undecided which equals 8,2%. 5% disagree and 3,1% strongly disagree to purchasing electric vehicles.

Q5	Percentage	Frequency
1	3,1%	13
2	5%	21
3	8,2%	34
4	33,2%	138
5	50,5%	210

Table 21: Frequency of the sample by charging infrastructure demand

In terms of gender, distribution is harmonious for both of them. Males and females are willing to purchase electric vehicles if the infrastructure is as good as current gas stations by 51% and 50%, respectively. 32% of the males agreed to buy while females agreed with 35%.

The ratio of undecided in males and females is so close to each other and it is 8% and 9%, respectively. Females disagreed by 3% while males disagree by 6%.

Strongly disagree ratio for both gender is same and it is 3%.

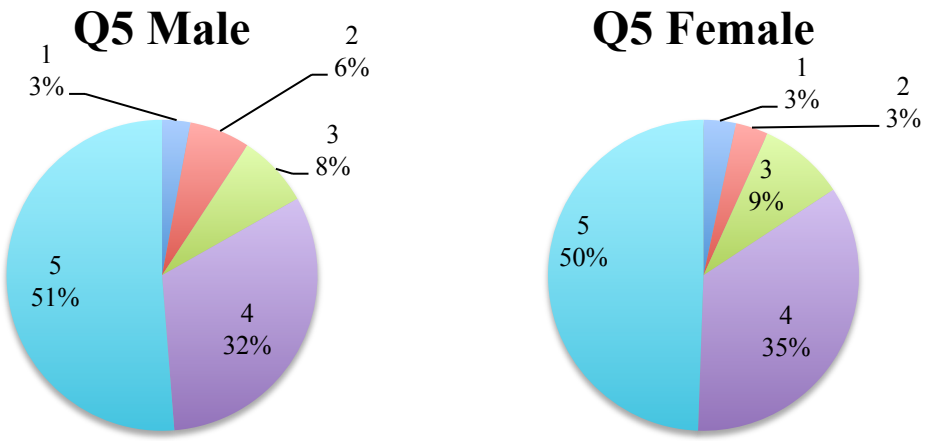

Figure 28: **Percentage distribution of the genders by charging infrastructure demand**

According to the Figure 28, it is clear to say that both genders are willing to puchase an electric vehicle if the charging infrastructure is as well distributed as gas stations.

Age	1	2	3	4	5
18 - 25	6 (5,3%)	2 (1,7%)	11 (9,6%)	37 (32,5%)	58 (50,8%)
26 - 35	1 (0,7%)	7 (5,2%)	9 (6,7%)	39 (28,9%)	79 (58,5%)
36 - 45	0 (0%)	1 (1,8%)	6 (11,1%)	20 (37%)	27 (50%)
46 - 55	3 (3,5%)	9 (10,7%)	6 (7%)	34 (39,5%)	34 (39,5%)
56 - 60	1 (4,8%)	1 (4,8%)	1 (4,8%)	8 (38,1%)	10 (47,6%)
60+	2 (33,3%)	1 (16,7%)	1 (16,7%)	0 (0%)	2 (33,3%)

Table 22: Distribution of the age groups by charging infrastructure demand

From the age groups perspective, 18 – 25, 26 – 35, and 36 – 45 groups strongly agree to purchase electric vehicles with 50,8%, 58,5%, and 50%, respectively. The 26 – 35 age group is the most willing to purchase electric vehicles in defined scenario. The 46 – 55 age group chose 4 and 5 in the same ratio, which was 39,5%. The group of between 56 to 60 years old participants strongly agree to buy electric vehicles with 47,6%. The over 60 years old group strongly agree and strongly disagree to this with 33,3% each. Also, they are undecided by 16,7%.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	6 (1,9%)	6 (6,7%)	1 (8,3%)
2	16 (8,3%)	5 (5,6%)	0 (0%)
3	24 (7,6%)	8 (8,9%)	2 (16,7%)
4	108 (34,4%)	25 (27,8%)	5 (41,7%)
5	160 (51%)	46 (51,1%)	4 (33,3%)

Table 23: Distribution of the education levels by charging infrastructure demand

It is clear to say that for all age groups distribution of charging infrastructure is extremely important and it will increase the adoption of electric vehicles if it was as common as gas stations. In terms of education level, more than 50% of Bachelor's, master and PhD degree and high school and associate degree strongly preferred to buy electric vehicles if the infrastructure is well equipped.

Primary and middle school group strongly preferred it with 33,33%. Also, 108 (34,4%), 25 (27,8%), and 5 (41,7%) people were willing to purchase. The undecided people ratio is low in the Bachelor's, master and PhD degree and high school and associate degree. It is 7,6% and 8,9%, respectively. The strongly disagree option is the lowest in Bachelor's, master and PhD degree by only 1,9%.

This ratio increases when education level decreases. Therefore, it is clear to say that more educated people would tend to purchase electric vehicles if the charging infrastructure was like that of current gas stations. According to the sample, the student group is the group that would most prefer to purchase electric vehicles if it is the case that the infrastructure is spread like the current gas stations. Almost 60% of the group strongly preferred to purchase. Only 6% of them strongly disagree to buy. 10% are undecided about the situation.

Results show that student group age is 18 to 27. Age range and student preference distribution are similar to each other. The 5-occupation sector did not choose the strongly disagree option at all. These are retirees, engineers, education sector, business managers, and finance sector.

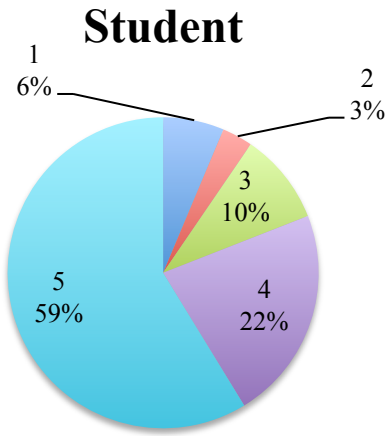

Figure 29: Percentage distribution of the students by charging infrastructure demand

4.5 Maintenance Cost

There was only one question related to maintenance cost in the survey study. This question measures the importance of maintenance cost compared with conventional vehicles such as gasoline and diesel vehicles. The item is designed in Likert Scale style.

Table 24, shows the total distribution of the results of the question related to the maintenance cost. As it shows, 42,1% and 41,1% of the sample chose 5 and 4, respectively, which means that more than 80% of the participants thinks that maintenance cost of the electric vehicles need to be lower than the conventional vehicles. 6,2% of the sample are undecided about the maintenance cost.

Q6	Percentage	Frequency
1	3,6%	15
2	7%	29
3	6,2%	26
4	41,1%	171
5	42,1%	175

Table 24: Frequency of the sample by maintenance cost

Almost 7% chose the disagree option, which means it is not very important that maintenance cost is lower than or not. Also, 3,6% of participants did not decide with reference to the cost of maintenance when purchasing an electric vehicle.

In terms of gender, both males and females preferred electric vehicles if the maintenance cost is lower than conventional vehicles. 42% of the males chose 5, which means they strongly preferred that electric vehicles maintenance cost should be lower than the conventional vehicles. This ratio is the same in females.

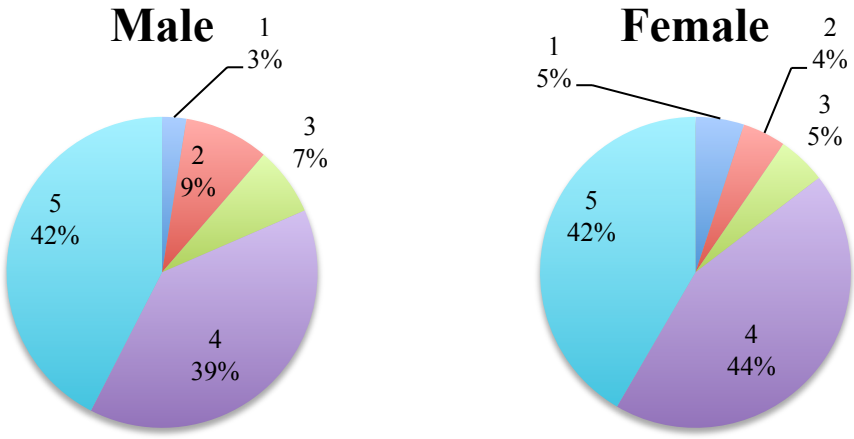

Figure 30: Percentage distribution of the genders by maintenance cost

However, the majority of the females chose 4 on the Likert Scale with 44%, which means females are less strict than males about maintenance cost. Also, males are more undecided than the females. 7% of the males preferred to be undecided while only 5% of women are undecided.

Age	1	2	3	4	5
18 - 25	6 (5,3%)	8 (7%)	11 (9,6%)	44 (38,6%)	45 (39,5%)
26 - 35	1 (0,7%)	6 (4,4%)	3 (2,2%)	53 (39,3%)	72 (53,3%)
36 - 45	2 (3,7%)	6 (11,1%)	4 (7,4%)	20 (37%)	22 (40,7%)
46 - 55	4 (4,6%)	5 (5,8%)	5 (5,8%)	44 (51,2%)	28 (32,6%)
56 - 60	1 (4,7%)	3 (14,3%)	1 (4,7%)	9 (42,9%)	7 (33,3%)
60 +	1 (16,7%)	1 (16,7%)	2 (33,3%)	1 (16,7%)	1 (16,7%)

Table 25: Distribution of the age groups by maintenance cost

In the 18 – 25 age group they strongly preferred that electric vehicles maintenance cost should lower than conventional vehicles with 39,5% and they also preferred that with 38,6%. This age range is second highest undecided group after the over 60 years old with 9,6%. Only 5,3% of this age did not decide according to the maintenance cost. Among the age groups, 26 – 35 they give the highest importance to the maintenance cost. 53,3% and 39,3% of this group chose 5 and 4,

respectively, on the Likert scale. 2,2% of the participants were undecided in 26 – 35 group. Only 1 person did not give priority to maintenance cost in this group. Therefore, it can be said that people between the ages of 26 and 35, prefer to have low maintenance costs when choosing a vehicle. For people age between 36 and 45, the importance given to maintenance costs falls. Compared with the 26 – 35 age group, ratio of 'strongly agree' and 'agree' decreased by almost 7% and more than 2%, respectively. Undecided people ratio increased to 7,4%. Also, 'strongly disagree' and 'disagree' ratios increased by 3% and almost 7%, respectively.

Table 26 shows the maintenance cost preferences in terms of income level. Participants with monthly income less than 1.600 TRY preferred lower maintenance cost for electric vehicles with 41,4%. Also, they highly preferred it with 34,8%. 6,5% of the participants with monthly income less than 1.600 TRY were undecided. Only 8,7% of this group did not give importance about maintenance cost. The group of monthly income between 1.601 to 2.500 TRY mostly preferred 'strongly agree' with more than 50% which means this group give high importance to low maintenance cost. 8,7% of this group were undecided about the maintenance cost while the maintenance cost is insignificant for adopting a vehicle for only 2,2% of this group.

Income	**1**	**2**	**3**	**4**	**5**
< 1.600 TRY	4 (8,7%)	4 (8,7%)	3 (6,5%)	19 (41,3%)	16 (34,8%)
1.601 – 2.500 TRY	2 (2,2%)	5 (5,4%)	8 (8,7%)	29 (31,5%)	48 (52,2%)
2.501 – 3.500 TRY	2 (4,2%)	1 (2,1%)	2 (4,2%)	15 (31,2%)	28 (58,3%)
3.501 - .500 TRY	0 (0%)	2 (6,2%)	1 (3,1%)	17 (53,1%)	12 (37,5%)
4.501 – 5.500 TRY	0 (0%)	1 (5,6%)	0 (0%)	8 (44,4%)	9 (50%)
> 5.500 TRY	1 (1,2%)	8 (9,7%)	7 (8,5%)	37 (45,1%)	29 (35,4%)
Unspecified	6 (6,1%)	8 (8,2%)	5 (5,1%)	46 (46,9%)	33 (33,7%)

Table 26: Distribution of the income levels by maintenance cost

The group that gives the most importance to the maintenance costs is the group with monthly income of 2.501 – 3.500 TRY with 58,3%. None of the participants

from 3.501 – 4.500 TRY and 4.501 – 5.500 TRY chose option 1 which is strongly disagree. Surprisingly, participants with monthly income more than 5.500 TRY highly preferred lower maintenance cost for electric vehicles with 35,4%. This ratio is higher than the participants with monthly income less than 1.600 TRY. In addition, the lowest income group gives less importance on maintenance costs than other income groups. In terms of education, the high school and Associate degree group gives more importance than other education levels to maintenance cost with 43,3%. For this group it is important with 33,3%. However, they were undecided with 7,8%. The maintenance cost is less important for primary and middle school group with 8,3%. For Bachelor's, master and PhD degree, maintenance cost is highly important with 41,7% and important with 43,9%. It is insignificant with 7%, which is second among all education levels, and 2,2% highly insignificant, which is the least among all groups. 5,1% of this group is undecided about maintenance cost. On the other hand, the primary and middle school group is highly undecided with 25%.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	7 (2,2%)	7 (7,8%)	1 (8,3%)
2	22 (7%)	7 (7,8%)	0 (0%)
3	16 (5,1%)	7 (7,8%)	3 (25%)
4	138 (43,9%)	30 (33,3%)	3 (25%)
5	131 (41,7%)	39 (43,3%)	5 (41,7%)

Table 27: Distribution of the education levels by maintenance cost

4.6 Government Subsidies and Incentives

The study contains one item related to government incentives and subsidies. This item measures the level of competence of the incentives and subsidies in terms of the participant's point of view. The item is designed in Likert Scale style. Table 28 shows the distribution of the total participants by percentage and frequency. However it seems, that most of the participants think that incentives and subsidies are not enough to adopt electric vehicles. 37% of the sample strongly disagree and

35,3% disagree with the item. 20,7% of them are undecided about the incentives and subsidies. Only 2,4% of the participants think that government incentives are enough to purchase electric vehicles.

Q7	Percentage	Frequency
1	37%	154
2	35,3%	147
3	20,7%	86
4	4,6%	19
5	2,4%	10

Table 28: Frequency of the sample by government subsidies and incentives

Figure 31, shows the distribution of the incentives and subsidies in terms of gender. Government incentives are not satisfactory for both genders. It is highly unsatisfactory for 39% of the males and 35% of the females. Females are more undecided than the males with 23% and 19%, respectively.

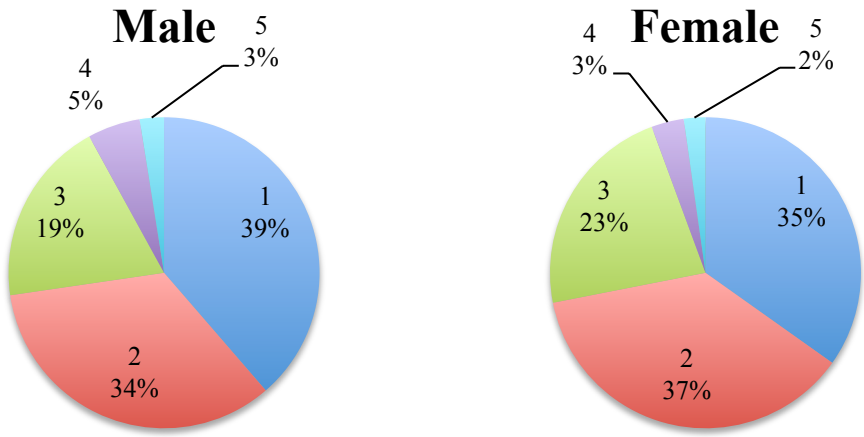

Figure 31: Percentage distribution of the genders by government subsidies and incentives

According to the 3% of the males, government support are enough to adopt electric vehicles while only 2% of the females think this support is enough. It is clear to say that, females find that support is not enough. Also, they are more undecided than males about the incentives and subsidies. On the other hand, males are more satisfied with the government support than females.

Age	1	2	3	4	5
18 - 25	37 (32,5%)	45 (39,5%)	25 (21,9%)	4 (3,5%)	3 (2,6%)
26 - 35	55 (40,7%)	40 (29,6%)	31 (23%)	8 (5,9%)	1 (0,7%)
36 - 45	19 (35,2%)	19 (35,2%)	13 (24,1%)	2 (9,3%)	1 (7,4%)
46 - 55	30 (34,8%)	34 (39,5%)	13 (15,1%)	5 (5,8%)	4 (4,6%)
56 - 60	9 (42,9%)	7 (33,3%)	4 (19%)	0 (0%)	1 (4,8%)
60+	4 (66,7%)	2 (33,3%)	0 (0%)	0 (0%)	0 (0%)

Table 29: Distribution of the age groups by government subsidies and incentives

In terms of age, the most of the age groups are highly unsatisfied about government incentives. 18 – 25 age group unsatisfied with 39,5% and highly unsatisfied with 32,5%. Also, 21,9% of this age group is undecided about the government incentives and subsidies. A total of 40,7% of the 26 – 35 age group agree that government subsidies are not enough to purchase electric vehicles. 23% of this group are undecided whether it is enough or not. Almost 6% of the 26 – 35 age group agree that government incentives are acceptable to purchase electric vehicles. However, only 0,7% strongly agrees that incentives are high enough to adopt electric vehicles. Between 36 - 45 years old, 35,2% of the participants strongly agree that there are not enough incentives for electric vehicles. On the other hand, 7,4% of the 36 – 45 age group was highly satisfied about the government incentives. Also, this is the highest rate among other age groups. The 46 – 55 years old participants are not satisfied about the government incentives with 34,8% while 4,6% of them are satisfied. 15,1% of 46 – 55 years old participants are undecided which makes them the second least undecided group. In the 56 – 60 age group they are unsatisfied by 42,9%, which is the second highest rate among the groups. The over 60 years old

participants has the highest percentage among all age groups that the incentives are inadequate with 66,7%.

According to the Figure 32 both primary and middle school and Bachelor's, master and PhD degree group agree that government incentives and subsidies are not enough with 41%. In contrast, this ratio is 23% for the high school and associate degree group. 17% of the primary and middle school group is undecided while 23% and 20% of the high school and associate degree and Bachelor's, master and PhD degree are undecided, respectively.

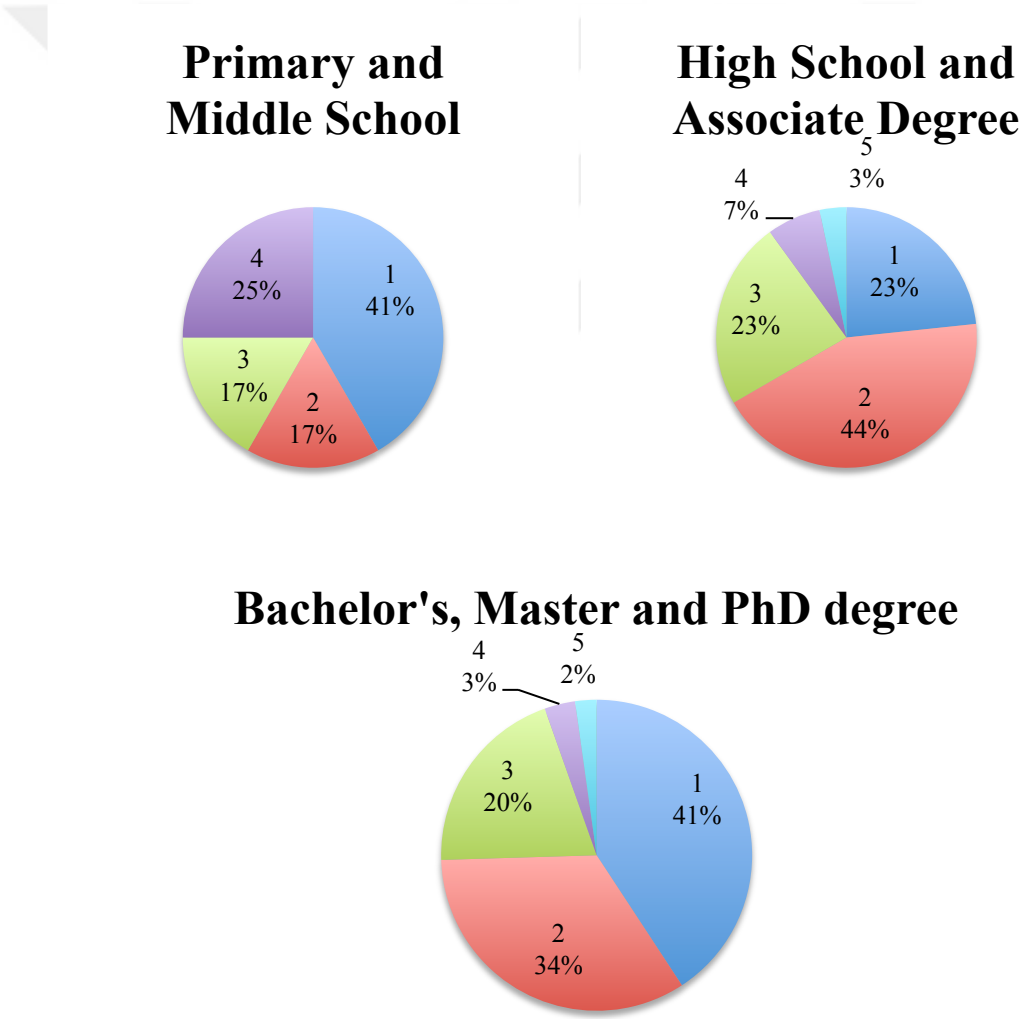

Figure 32: Percentage distribution of the education levels by government subsidies and incentives

None of the primary and middle school group is highly satisfied with government incentives. However, 25% of them are satisfied about these incentives and subsidies. This ratio is only 7% in high school and the associate degree group while it is only 3% in Bachelor's, master and PhD degree. In addition, the high school and Associate degree group find the subsidies highly satisfactory by only 3%. This ratio is lower 2% for the Bachelor's, master and PhD degree group. It is clear to see that the incentives do not seem to be sufficient as the level of education increases. As the education level decreases, the incentives get more satisfactory for people.

Table 30 shows the distribution of the incentives and subsidies in terms of income level of the participants. It is clear to see that all income levels are not satisfied about the government incentives and subsidies. 41,3% of the participants that earn less than 1.600 TRY monthly, were not satisfied with the incentives and subsidies of electric vehicles. Also, 34,8% of this group disagree that incentives are enough. 17,4% of less than 1.600 TRY group is undecided about the government incentives and subsidies. Only, 4,3% of this group is satisfied about the incentives.

In the 1.601 – 2.500 TRY group it has the highest rate of undecided amongst all the groups with 29,3%. Also, their satisfactory about incentives are not as low as other group but 22,8% of them are highly unsatisfied about government subsidies. 7,6% with the 1.601 – 2.500 TRY group they agree that government incentives are enough, which is the highest rate among the groups. In the 2.501 – 3.500 TRY and 3.501 – 4.500 TRY groups they are highly unsatisfied about government incentives with 41,7% and 50%, respectively. Also, none of the participants in these two groups chose the 'strongly agree' option. The 4.501 – 5.500 TRY group strongly disagrees that incentives are not enough with 33,3%. On the other hand, this group strongly agree that incentives are enough with 11,1%, which is the highest rate among the groups. 40,2% of the participants that earn more than 5.500 TRY are not satisfied about the government incentives.

Income	1	2	3	4	5
< 1.600 TRY	19 (41,3%)	16 (34,8%)	8 (17,4%)	1 (2,2%)	2 (4,3%)
1.601 – 2.500 TRY	21 (22,8%)	35 (38%)	27 (29,3%)	7 (7,6%)	2 (2,2%)
2.501 – 3.500 TRY	20 (41,7%)	19 (39,6%)	8 (16,7%)	1 (2,1%)	0 (0%)
3.501 – 4.500 TRY	16 (5%)	8 (25%)	7 (21,8%)	1 (3,1%)	0 (0%)
4.501 – 5.500 TRY	6 (33,3%)	6 (33,3%)	3 (16,7%)	1 (5,6%)	2 (11,1%)
> 5.500 TRY	33 (40,2%)	27 (32,9%)	16 (19,5%)	4 (4,8%)	2 (2,4%)
Unspecified	39 (39,8%)	36 (36,7%)	17 (17,3%)	4 (4,1%)	2 (2%)

Table 30: Distribution of the income levels by government subsidies and incentives

4.7 Environmental Concerns

In the survey study it contains two items related to environmental concerns. One of the items measures the environmentalist characteristic of the participants, the other one measures the adoption level of electric vehicles in terms of nature friendliness and contribution to the national energy saving.

These two items are designed in Likert Scale style. Table 31 shows the environmental characteristics of the sample. 30,5% of them would strongly purchase electric vehicle because it shows their environmentalist characteristics. The majority of the participants chose ‘agree’ option with 34,4%. On the other hand, almost 15% of the participants were indecisive about environmentalism. 53 people, which equals 12,7% of the participants, disagree to buying electric vehicles for environmentalist characteristic while 7,7% strongly disagree. In terms of gender, both genders preferred to purchase electric vehicles because of their environmentalist characteristics. It is clear to see that females are more environmentalists than males.

Q8	Percentage	Frequency
1	7,7%	32
2	12,7%	53
3	14,6%	61
4	34,4%	143
5	30,5%	127

Table 31: Frequency of the sample by environmentalist characteristics

25% of the males strongly preferred electric vehicles because of their environmental friendly characteristics while females strongly preferred with 38%. Also, males and females chose 'agree' option with 32% and 37%, respectively. In addition, males are more undecided than the females. Only, 9% of the females are undecided while 19% of the males are undecided. In terms of age, the majority of the age groups preferred electric vehicles for their environmental characteristics.

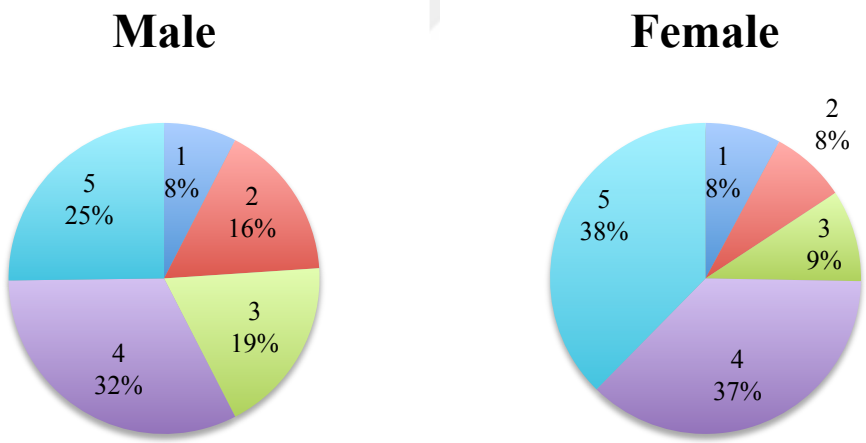

Figure 33: Percentage distribution of the genders by environmentalist characteristics

Majority In the 18 – 25 age group they agree to buy to show they are environmentalists with 40,3%. Also, they strongly agree to buy it with 32,5%. Only 10,5% of 18 – 25 age group is undecided. For 26 – 35 years old, the preference rate

for environmentalism dramatically falls. This group chose electric vehicles for environmentalist characteristics with 28,1%. Also, they have the highest undecided ratio among other groups with 22,2%. The 36 – 45 age group chose 'agree' option with 38,89% and chose 'strongly agree' option with 24,1%. This group disagreed to buy electric vehicles because it shows people as environmentalist with 16,7%. Also, they strongly disagree with that by 9,3%. The 46 – 55 age group also preferred to purchase it with 29,1% and strongly preferred with 38,4%. The 56 – 60 age group have the second highest strongly disagree preference by a margin of almost 10%. However, none of the participants are undecided in this group. Astoundingly, this group preferred to buy the electric vehicle with 47,6% and was strongly preferred by 23,8%. According to the table, 18 - 25 age group is the group who prefer electric cars at the highest level since it shows themselves as environmentalists while in the 26 – 35 age group it has the lowest ratio among the groups. In terms of the education level, when the education level increases, sensitivity to the environment increases.

Age	1	2	3	4	5
18 - 25	9 (7,9%)	10 (8,7%)	12 (10,5%)	46 (40,3%)	37 (32,5%)
26 - 35	8 (5,9%)	21 (15,6%)	30 (22,2%)	38 (28,1%)	38 (28,1%)
36 - 45	5 (9,3%)	9 (16,7%)	6 (11,1%)	21 (38,9%)	13 (24,1%)
46 - 55	6 (7%)	9 (10,7%)	13 (15,1%)	25 (29,1%)	33 (38,4%)
56 - 60	2 (9,5%)	4 (19%)	0 (0%)	10 (47,6%)	5 (23,8%)
+60	2 (33,3%)	0 (0%)	0 (0%)	3 (50%)	1 (16,7%)

Table 32: Distribution of the age groups by environmentalist characteristics

According to the Table 33, the primary and middle school group did not chose 'strongly agree' option. Only 2 people, which is equal to 16,7% of the group, agree to purchase electric vehicles due to their environmentalist characteristics. 50% of the primary and middle school group strongly disagree to purchase these vehicles because of the environmentalist characteristics of the participants. The high school and associate degree group is highly environmentalist with 31,1%. This group is undecided about environmental friendliness by 20%. Unfortunately,

similarly high school and Associate degree group is not environmentalist with only 11,1%, which means it, is not their preferred reason that electric vehicles show them to be environmentally friendly. As a contrast, 31,5% of the Bachelor's, master and PhD degree group highly preferred electric vehicles because it shows their environmentalist characteristics.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	16 (5,1%)	10 (11,1%)	6 (50%)
2	35 (11,1%)	14 (15,6%)	4 (33,3%)
3	43 (13,7%)	18 (20%)	0 (0%)
4	121 (38,5%)	20 (22,2%)	2 (16,7%)
5	99 (31,5%	28 (31,1%)	0 (0%)

Table 33: Distribution of the education levels by environmentalist characteristics

Table 34 shows the environmentalist characteristics of the participants in terms of their income levels. The majority of the income groups preferred to purchase electric vehicles to show their environmentalist characteristics.

Income Level	1	2	3	4	5
< 1.600 TRY	6 (13%)	3 (6,5%)	7 (15,2%)	16 (34,8%)	14 (30,4%)
1.601 – 2.500 TRY	5 (5,4%)	19 (20,6%)	15 (16,3%)	26 (28,3%)	27 (29,3%)
2.501 – 3.500 TRY	5 (10,4%)	5 (10,4%)	10 (20,8%)	15 (31,2%)	13 (27,1%)
3.501 – 4.500 TRY	2 (6,2%)	0 (0%)	7 (21,8%)	10 (31,2%)	13 (40,6%)
4.501 – 5.500 TRY	0 (0%)	0 (0%)	2 (11,1%)	5 (27,8%)	11 (61,1%)
> 5.500 TRY	4 (4,8%)	14 (17,1%)	8 (9,7%)	30 (36,6%)	26 (31,7%)
Unspecified	10 (10,2%)	12 (12,2%)	12 (12,2%)	41 (41,8%)	23 (23,5%)

Table 34: Distribution of the income levels by environmental characteristics

The most environmentalist income level is 4.501 – 5.500 TRY with 61,1%. None of the participants chose ‘disagree’ or ‘strongly disagree’ option in this group. Only, 11,1% of them were undecided which is the second lowest undecided ratio among all the groups. In addition, environmentalist attitude is also high in high-income levels. And the, undecided people ratio decreases in high-income levels. The second item related to environmental concerns measures the adoption level of electric vehicles in terms of nature friendliness and contribution to the national energy saving.

Table 35 shows the distribution of all the participants' choices. It is clear to see that the majority of the participants are influenced by national energy saving and a positive impact on the environment. Almost 70% of the participants are consider buying an electric car because it is nature friendly and it contributes the duty of national energy saving. 11,8% of the sample are undecided and only 3,6% of them are strongly disagree.

Q9	Percentage	Frequency
1	3,6%	15
2	5,7%	24
3	11,8%	49
4	69,2%	288
5	9,6%	40

Table 35: Frequency of the sample by national energy saving and nature friendliness

In terms of the gender choices, females are more responsive to environment and energy savings than males. 12% of the females strongly agreed to purchase electric vehicles because of this while males measure only 8%. Also, males chose to ‘agree’ option to purchase electric vehicle to a margin of 64% and females are at 76%. In addition, males are more undecided than females. The undecided ratio for male is 15% and for females it is 7%. Surprisingly, females ‘strongly disagree’ ratio is 1% higher than the male. However, the total disagree ratio is higher for males.

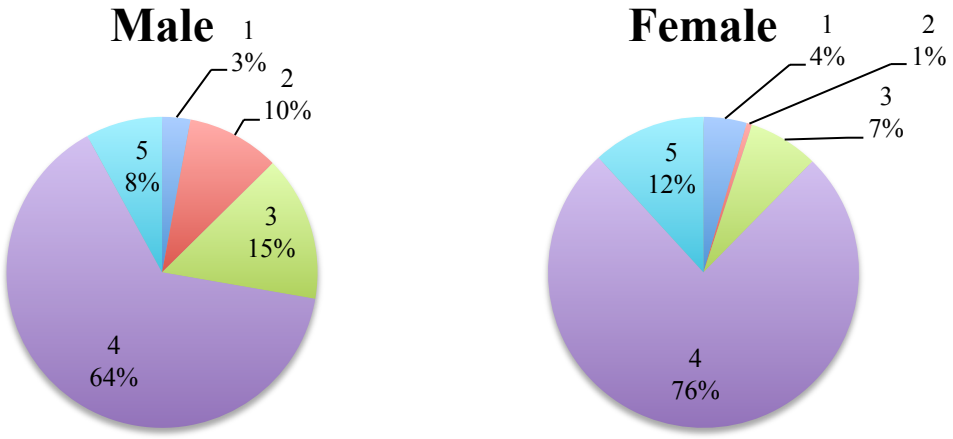

Figure 34: Percentage distribution of the genders by national energy saving and nature friendliness

In terms of the age variables, all the age groups agreed to purchase electric vehicles for it is environmental characteristics and contribution to the energy saving. Therefore it is clear to say that environmental awarness and the desire to contribute to energy saving increases as the age increases. The 18 – 25 age group preferred to purchase electric vehicles by 65% and strongly preferred by 16,7% which is the highest ratio among all age groups. 11,4% of them are undecided whether to purchase or not. Only 4,4% of them are strongly disagree to purchase. While the 26 – 35 age group agree to purchase them with 67,4% and they strongly agree to purchase with 8,1%.

Age	1	2	3	4	5
18 - 25	5 (4,4%)	3 (2,6%)	13 (11,4%)	74 (64,9%)	19 (16,7%)
26 - 35	3 (2,2%)	12 (8,9%)	18 (13,3%)	91 (67,4%)	11 (8,1%)
36 - 45	2 (3,7%)	3 (5,6%)	9 (16,7%)	37 (68,5%)	3 (5,6%)
46 - 55	3 (3,5%)	4 (4,6%)	8 (9,3%)	64 (74,4%)	7 (8,1%)
56 - 60	1 (4,7%)	2 (9,5%)	0 (0%)	18 (85,7%)	0 (0%)
60+	1 (16,7%)	0 (0%)	1 (16,7%)	4 (66,7%)	0 (0%)

Table 36: Distribution of the age groups by national energy saving and nature friendliness

The undecided participant ratio of this group is 16,7% which is the highest rate along with the over 60 years old group. The 46 – 55 age group agree to purchase electric vehicles with 74,4%. However the highest ratio belongs to 56 – 60 group with 85,7%. Table 37 shows the results related to education levels in terms of item 9. All the groups preferred to buy electric vehicles because of its advantage in this point. So it is clear to see that the Bachelor's, master and PhD degree group has the highest ratio among all of the groups. 76,1% of this group agree to purchase electric vehicles because of its contribution to energy saving and environment friendliness.
On the other hand, the high school and associate degree group agree by less with 51,1% and primary and middle school group agree by only 25%. The undecided ratio of this group has the lowest rate among all groups with 9,2%. Primary and middle school are highly undecided to a degree of 50%. Also, the disagree ratio of the Bachelor's, master and PhD degree group is significantly lower than the other two groups. Only 5 people, which equals 1,6%, strongly disagree to purchase. This ratio is 10% for high school and the associate degree group, and 8,3% for the primary and middle school group. Hence, environmental awareness and willingness to contribute to energy saving is increased when education level increases.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	5 (1,6%)	9 (10%)	1 (8,3%)
2	14 (4,5%)	8 (8,9%)	2 (16,7%)
3	29 (9,2%)	14 (15,6%)	6 (50%)
4	239 (76,1%)	46 (51,1%)	3 (25%)
5	27 (8,6%)	13 (14,4%)	0 (0%)

Table 37: Distribution of the education levels by national energy saving and nature friendliness

In relation to monthly income, the higher income levels are more aware of environmental issues and energy saving than the lower income levels.
However, all income levels are positive on purchasing electric vehicles because it saves energy and is environment friendly.

Participants whose income is less than 1.600 TRY monthly agree to purchase electric vehicles with 58,7%. Later this ratio increases with the 3.501 – 4.500 TRY income level. Then, it starts to decrease.

However, the 4.501 – 5.500 TRY and more than 5.500 TRY groups ratios are higher than first three groups. The highest ratio belongs to 3.501 – 4.500 TRY group with 84,4% and the lowest belongs to the less than 1.600 TRY group. The most undecided group is the unspecified group with 16,3%. None of the participants from 3.501 – 4.500 TRY and 4.501 – 5.500 TRY group chose to strongly disagree and the disagree option. Also, the more than 5.500 TRY group did not choose the strongly disagree option.

Income	**1**	**2**	**3**	**4**	**5**
< 1.600 TRY	4 (8,7%)	2 (4,3%)	5 (10,9%)	27 (58,7%)	8 (17,4%)
1.601 – 2.500 TRY	2 (2,2%)	9 (9,8%)	13 (14,1%)	56 (60,9%)	12 (13%)
2.501 – 3.500 TRY	2 (4,2%)	3 (6,2%)	5 (10,4%)	36 (7%)	2 (4,3%)
3.501 – 4.500 TRY	0 (0%)	0 (0%)	3 (9,4%)	27 (84,4%)	2 (6,2%)
4.501 – 5.500 TRY	0 (0%)	0 (0%)	1 (5,6%)	15 (83,3%)	2 (11,1%)
> 5.500 TRY	0 (0%)	7 (8,5%)	6 (7,3%)	66 (80,5%)	3 (3,6%)
Unspecified	7 (7,1%)	3 (3,1%)	16 (16,3%)	61 (62,2%)	11 (11,2%)

Table 38: Distribution of the income levels by national energy saving and nature friendliness

4.8 Performance

The study contains 2 items related to performance. One of the items is safety in case of an accident with the electric vehicles and the second one is related to the acceleration and speed limits of electric vehicles. These two items are designed in a Likert scale. Table 39 shows the distribution of the sample for safety

concerns. The majority of the sample thinks that electric vehicles need to be safer than the conventional cars in case of an accident. 35,1% of the sample agree that electric vehicles should be safer than the conventional cars. In contrast, 31% of the participants strongly agree that and 21,1% are undecided about the safety. A total of 40 participants, which equates to 9,6% of total, disagree with the point and only 3,1% of the participants strongly disagree.

Q10	Percentage	Frequency
1	3,1%	13
2	9,6%	40
3	21,1%	88
4	35,1%	146
5	31%	129

Table 39: Frequency of the sample by safety concerns

With reference to gender, both genders agreed that electric vehicles should be safer than conventional cars. However, females are more sensitive about safety issues. As it seems 27% of the males strongly agree that while females more strongly agree with 36%. Next 35% of the males agree that electric vehicles should be safer than conventional cars. This ratio is 36% for females.

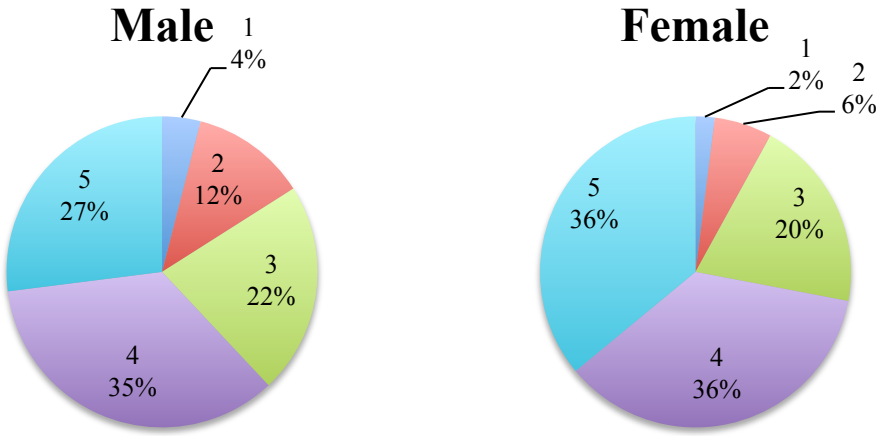

Figure 35: Percentage distribution of the genders by safety concerns

Also, females are less undecided than males. Only 2% of the females strongly disagree with this point while males strongly disagree with double 4%. In respect to the age groups, all the groups think that electric vehicles should be safer than conventional cars. The 18 – 25 age group strongly agree that with 39,5% which is the highest ratio among all groups. The lowest ratio belongs to the over 60 years old participants with 0%. Also, the 18 – 25 age group agree with 23,7%. Moreover, the 18 – 25 age group has the highest undecided ratio with 26,3%. The least undecided group is the 56 – 60 age group with 4,8%. However, the over 60 years old participants agree with the safety issue by a margin of 50%, which is the highest rate among all the groups.

Age	1	2	3	4	5
18 - 25	4 (3,5%)	8 (7%)	30 (26,3%)	27 (23,7%)	45 (39,5%)
26 - 35	4 (3%)	17 (12,6%)	35 (25,9%)	47 (34,8%)	32 (23,7%)
36 - 45	1 (1,8%)	2 (3,7%)	8 (14,8%)	23 (42,6%)	20 (37%)
46 - 55	2 (2,3%)	9 (10,5%)	13 (15,1%)	36 (41,9%)	26 (30,2%)
56 - 60	1 (4,8%)	3 (14,3%)	1 (4,8%)	10 (47,6%)	6 (28,6%)
60+	1 (16,7%)	1 (16,7%)	1 (16,7%)	3 (50%)	0 (0%)

Table 40: Distribution of the age groups by safety concerns

So the demand for a safer vehicle is increasing with age in terms of ‘agree’ option. However, total ‘agree’ and ‘strongly agree’ choices are the highest in the age group 36 – 45.

In terms of education level, all education levels are highly sensitive about safety concerns. However, high-educated people are more susceptible about safety. Primary and middle school group strongly disagree that by 8,3%. This rate gradually decreases as the education level increases. High school and Associate degree group strongly disagree by 6,7% while Bachelor’s, master and PhD degree strongly disagree by only 1,9%. The highest undecided group is primary and middle school by 25% while the lowest undecided group is high school and Associate degree group by 20%. Bachelor’s, master and PhD degree group strongly agree that electric vehicles should be safer than conventional cars by 31,5%, which is the highest rate among all groups. This ratio gradually decreases as the education level

decreases. Surprisingly ‘agree’ option is the lowest in Bachelor’s master and PhD degree group. The highest ratio belongs to primary and middle school group by 41,7%.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	6 (1,9%)	6 (6,7%)	1 (8,3%)
2	35 (11,1%)	4 (4,4%)	1 (8,3%)
3	67 (21,3%)	18 (20%)	3 (25%)
4	107 (34,1%)	34 (37,8%)	5 (41,7%)
5	99 (31,5%)	28 (31,1%)	2 (16,7%)

Table 41: Distribution of the education levels by safety concerns

According to the income level, the less than 1.600 TRY group strongly agree that electric vehicles need to be safer than conventional cars by 40%. However, they agree that by 17,4%. Second highest rate belongs to 3.501 – 4.500 TRY group. This group also chose ‘agree’ option by 53,1%, which is the highest agree ratio among all groups. Also, this group is least undecided group by 6,2%.

Income	1	2	3	4	5
< 1.600 TRY	2 (4,3%)	4 (8,7%)	15 (32,6%)	8 (17,4%)	17 (40%)
1.601 – 2.500 TRY	2 (2,2%)	6 (6,5%)	27 (29,3%)	32 (34,8%)	25 (27,3%)
2.501 – 3.500 TRY	2 (4,2%)	8 (16,7%)	9 (18,7%)	16 (33,3%)	13 (27,2%)
3.501 – 4.500 TRY	0 (0%)	2 (6,2%)	2 (6,2%)	17 (53,1%)	11 (34,4%)
4.501 – 5.500 TRY	0 (0%)	2 (11,1%)	4 (22,2%)	6 (33,3%)	6 (33,3%)
> 5.500 TRY	2 (2,4%)	10 (12,2%)	10 (12,2%)	32 (39%)	28 (34,1%)
Unspecified	5 (5,1%)	8 (8,2%)	21 (21,4%)	35 (35,7%)	29 (29,6%)

Table 42: Distribution of the income levels by safety concerns

The highest undecided group is less than 1.600 TRY. In addition, none of the participants from 3.501 – 4.500 TRY and 4.501 – 5.500 TRY groups chose 'strongly disagree' option. It is clear to say that all income levels are sensitive about safety issues.

The other item, which is related to performance, is the acceleration and speed limits of the vehicle. Table 43 shows the distribution of all participants in terms of this item 11. Speed limits and acceleration time affected the majority of the participants purchasing decision. 43,5% of the sample agreed that acceleration time and the speed limit of electric vehicles are important factors for purchasing. Also, for 20,9% of the participants these features are strongly important. 72 people are undecided which equals 17,3% of total. It is not important for only 3,6% of the participants.

Q11	Percentage	Frequency
1	3,6%	15
2	14,7%	61
3	17,3%	72
4	43,5%	181
5	20,9%	87

Table 43: Frequency of the sample by speed limits and acceleration time

In terms of gender, acceleration time and speed limits are an important factor for the purchasing decision. However, it is more important for males than the females. 22% of the males strongly agree that these features are important factors for electric vehicles. According to the females this ratio is lower 19%.

The majority of the males and females chose 'agree' option with 44% and 43%, respectively. On the other hand, females are more undecided than males. The 'strongly disagree' ratio is very close to each other. However, the male's ratio is 1% more than female's. Therefore, it is clear to say that acceleration time and speed limits are important factor for males.

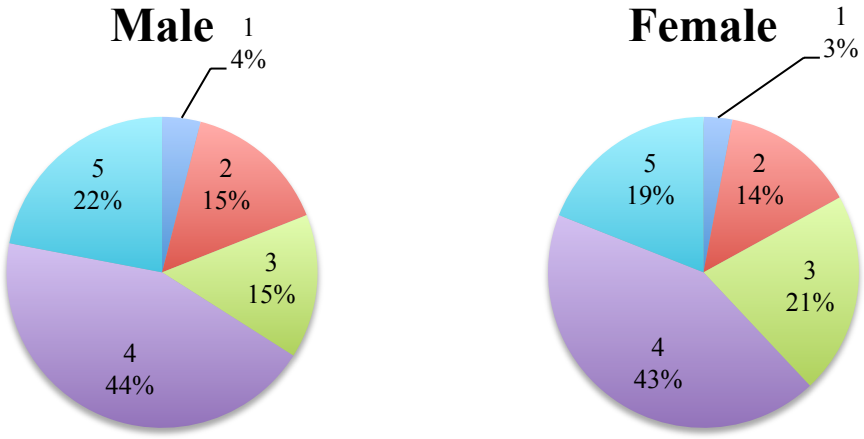

Figure 36: Percentage distribution of the genders by speed limits and acceleration time

With reference to the age, all the age groups are concerned with performance-based issues. Surprisingly, most of the the 56 – 60 years old people agreed that acceleration time and speed limit affects their purchasing decision with 52,4%. However, in terms of total 'agree' and 'strongly agree' choices, the 18 – 25 age and 36 – 45 age groups are sharing the highest rates. Which ares 70,2% and 70,4%, respectively.the 56 – 60 age group has the highest undecided ratio with 23,8%. The undecided ratio is high in elders except in the over 60 years old participants. Participants over 60 years old have the highest strongly disagree ratio with 16,7%. the lowest strongly disagree ratio belongs to 26 – 35 age group with only 0,7%.

Age	1	2	3	4	5
18 - 25	7 (6,1%)	13 (11,4%)	14 (12,3%)	43 (37,7%)	37 (32,5%)
26 - 35	1 (0,7%)	26 (19,3%)	24 (17,8%)	61 (45,2%)	23 (17%)
36 - 45	1 (1,8%)	6 (11,1%)	9 (16,7%)	26 (48,1%)	12 (22,2%)
46 - 55	4 (4,6%)	13 (15,1%)	20 (23,3%)	38 (44,2%)	11 (12,8%)
56 - 60	1 (4,8%)	2 (9,5%)	5 (23,8%)	11 (52,4%)	2 (9,5%)
60+	1 (16,7%)	1 (16,7%)	0 (0%)	2 (33,3%)	2 (33,3%)

Table 44: Distribution of the age groups by speed limits and acceleration time

In terms of education level, the acceleration time and speed limits are mainly important for the Bachelor's, master and PhD degree group and the high school and Associate degree group. While the Primary and middle school group agree that these features are important for purchasing decision with 25%.

However, the same group think that it is not important by the same percentage. Also, this group is highly undecided about the performance. 'Strongly disagree' option is the highest in primary and middle school with 8,33%. This rate gradually decreases as education level increases.

In contrast, the Bachelor's, master and PhD degree group agree that the performance is important for purchasing decision with 45,2% which is the highest ratio among all education level groups. In conclusion the rate of participants, who agreed that the acceleration time and speed limits are influential on purchasing decision, increases as the level of education increases.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	9 (2,9%)	5 (5,6%)	1 (8,3%)
2	46 (14,6%)	12 (13,3%)	3 (25%)
3	55 (17,5%)	14 (15,6%)	3 (25%)
4	142 (45,2%)	36 (40%)	3 (25%)
5	62 (19,7%)	23 (25,6%)	2 (16,7%)

Table 45: Distribution of the education levels by speed limits and acceleration time

Depending on the level of participants' income, the 'strongly agree' option is the highest in the less than 1.600 TRY income level. The 4.501 – 5.500 TRY income level agree that acceleration time and speed limits are important factors for a purchasing decision with 50%, which is the highest ratio in all income levels. The 3.501 – 4.500 TRY level also agree on that with 46,9%. However, compared with the other groups, the 3.501 – 4.500 TRY income level has the highest total ratio in terms of choosing 'agree' and 'strongly agree'. The second highest ratio belongs to more than 5.500 TRY group. Therefore, it is clear to say that the high-income level

participants are more affected than the low-income level participants with regard to acceleration time and speed limits for purchasing decision of electric vehicles.

Income	1	2	3	4	5
< 1.600 TRY	3 (6,5%)	7 (15,2%)	7 (15,2%)	16 (34,8%)	13 (28,3%)
1.601 – 2.500 TRY	1 (1,1%)	13 (14,1%)	16 (17,4%)	40 (43,5%)	22 (23,9%)
2.501 – 3.500 TRY	2 (4,2%)	7 (14,6%)	9 (18,7%)	20 (41,7%)	10 (20,8%)
3.501 – 4.500 TRY	0 (0%)	5 (15,6%)	5 (15,6%)	15 (46,9%)	7 (21,9%)
4.501 – 5.500 TRY	0 (0%)	4 (22,2%)	3 (16,7%)	9 (50%)	2 (11,1%)
> 5.500 TRY	2 (2,4%)	12 (14,6%)	12 (14,6%)	37 (45,1%)	19 (23,2%)
Unspecified	7 (7,1%)	13 (13,3%)	20 (20,4%)	44 (44,9%)	14 (14,3%)

Table 46: Distribution of the income levels by speed limits and acceleration time

4.9 Operating Cost

There is only one item related to operating cost. It measures the purchasing decision of electric vehicles in terms of fuel cost. This item designed with the Likert scale. Table 47 shows the results of the operation cost choice by the participants. It seems, the majority of the sample preferred that the electric vehicle's fuel cost should be lower than the conventional vehicle's. 56% of the participants strongly preferred that. Also, 36,3% of the participants chose agree for that item. Namely, more than 90% of the sample's purchase decision was affected by the operating cost. Only 3,4% were undecided about this item. 1,7% of the participants chose 'disagree' option and 2,6% of the participants think that electric vehicle's fuel cost does not need to be lower than conventional vehicle's fuel cost. In terms of gender, both the genders preferred lower fuel cost for electric vehicles. For 59% of the males, fuel cost is strongly important factor that affect their purchasing decision while it is 53% for females.

Q12	Percentage	Frequency
1	2,6%	11
2	1,7%	7
3	3,4%	14
4	36,3%	151
5	56%	233

Table 47: Frequency of the sample by operating cost

Also, males and females chose the 'agree' option with 34% and 39%, respectively. None of the female participants preferred the 'disagree' option. The males preferred this option with 3%. Both the genders were undecided by 3%, which equals 8 people for male and 6 people for female. It seems that the cheaper fuel prices are a more important factor for males. With the age groups, it is clear to see that operating cost is extremely important for all the groups. However, the h level of importance is decreasing when the age is increasing.

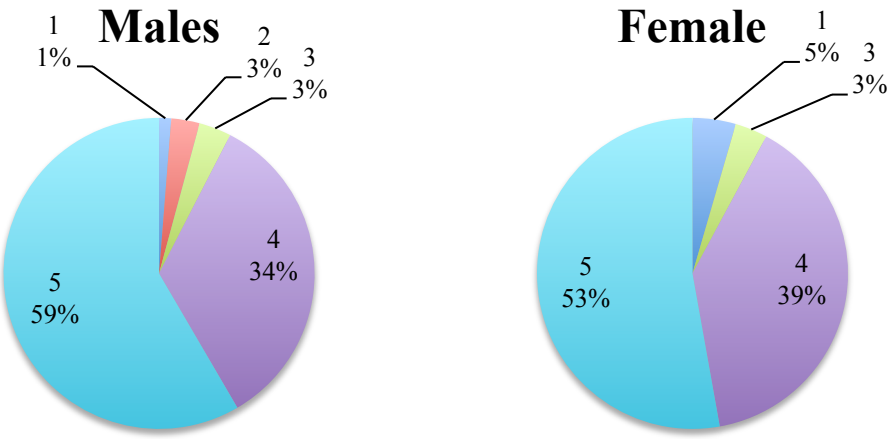

Figure 37: Percentage distribution of the genders by operating cost

For 18 – 25 age group it is highly important with almost 60% and this age group chose the 'agree' option with almost 30%. For the 26 - 35 age group is also highly important with 60%. After this age group, the high importance level decreases gradually. For the 36 – 45 age group it is 57,4%, for 46 – 55 age group it is 51,16%,

for 56 – 60 age group it is 38,1% and the over 60 years old participants it is 16,7%. However, the total ratio of 'agree' and 'strongly agree' options are the highest in the 26 -35 age group, the second highest ratio belongs to the 46 – 55 age group with 96,30% and 94,2%, respectively. On the other hand, the lowest ratio belongs to the over 60 years old participants with 83,3% still high.

Age	1	2	3	4	5
18 - 25	4 (3,5%)	2 (1,7%)	6 (5,3%)	34 (29,8%)	68 (59,6%)
26 - 35	1 (0,7%)	1 (0,7%)	3 (2,2%)	49 (36,3%)	81 (60%)
36 - 45	1 (1,8%)	2 (3,7%)	3 (5,6%)	17 (31,5%)	31 (57,4%)
46 - 55	3 (3,5%)	1 (1,2%)	1 (1,2%)	37 (43%)	44 (51,2%)
56 - 60	1 (4,8%)	1 (4,8%)	1 (4,8%)	10 (47,6%)	8 (38,1%)
60+	1 (16,7%)	0 (0%)	0 (0%)	4 (66,7%)	1 (16,7%)

Table 48: Distribution of the age groups by operating cost

It can be clearly said that in respect of the electric car's operating cost if it were cheaper than conventional car's operating cost, it would affect the purchasing decision of the target audience. In terms of education level, low operating cost requirment increases when education increases. For Bachelor's, master and PhD degree group, it is extremely important with 57,3%. This ratio decreases to 52,2% in high school and the Associate degree group. For the primary and middle school group, the high importance level decreases to 50%.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	3 (1%)	7 (7,8%)	1 (8,3%)
2	3 (1%)	4 (4,4%)	0 (0%)
3	10 (3,2%)	2 (2,2%)	2 (16,7%)
4	118 (37,6%)	30 (33,3%)	3 (25%)
5	180 (57,3%)	47 (52,2%)	6 (50%)

Table 49: Distribution of the education levels by operating cost

Given the total 'agree' and 'strongly agree' ratios, the low operating cost demand is high for participants with a high level of education. The total rate is almost 95% for Bachelor's, master and PhD degree group, 85,5% for high school and Associate degree group and 75% for primary and middle school group. With regard to aggregate disagree choices, the lowest ratio belongs to Bachelor's, master and PhD degree group. The second lowest rate belongs to primary and middle school group. Also, this group is highly undecided about the operating cost with 16,7%, which is the highest ratio among all groups. The lowest undecided rate belongs to high school and Associate degree group with 2,2%.

Income	**1**	**2**	**3**	**4**	**5**
< 1.600 TRY	2 (4,3%)	1 (2,2%)	1 (2,2%)	12 (26,1%)	30 (65,2%)
1.601 – 2.500 TRY	1 (1,1%)	1 (1,1%)	5 (5,4%)	31 (33,7%)	54 (58,7%)
2.501 – 3.500 TRY	2 (4,2%)	0 (0%)	0 (0%)	21 (43,7%)	25 (52,1%)
3.501 – 4.500 TRY	0 (0%)	0 (0%)	0 (0%)	16 (50%)	16 (50%)
4.501 – 5.500 TRY	0 (0%)	0 (0%)	0 (0%)	5 (27,8%)	13 (72,2%)
> 5.500 TRY	0 (0%)	3 (3,7%)	5 (6,1%)	31 (37,8%)	43 (52,4%)
Unspecified	6 (6,1%)	2 (2%)	3 (3,1%)	35 (35,7%)	52 (53,1%)

Table 50: Distribution of the income levels by operating cost

With reference to the income level of the participants, the operating cost is highly important for all levels. For the 4.501 – 5.500 TRY and 3.501 – 4.500 TRY groups, the purchase decision of all participants is affected by the cost of fuel. 72,2% of the 4.501 – 5.500 TRY group strongly agrees that fuel costs effect their decision. This is the highest strongly agree ratio among all income levels. The lowest ratio belongs to the 3.501 – 4.500 TRY group, which is 50%. The general level of indecision is low and the highest value belongs to more than 5.500 TRY group, which is 6,1%.

4.10 Battery Life and Cost

The survey study contains two items related to battery life and cost. Both the items are designed on the Likert scale. These items were prepared based on exemplify decisions. Before these items were asked, a case was demonstrated and the items were asked to the participants according to this specific situation. In this case example, the battery capacity, warranty and replacement cost were specified. Participants need to answer these items according to this scenario. The first item measures the acceptable battery life and second item measures the effect of battery replacement cost on purchasing decision. Table 51 shows the distribution of the battery life expectations of the participants. As it seems, 50% of the participants think that 8 to 10 years of battery life is acceptable.

Q13	Percentage	Frequency
1	6%	25
2	10,8%	45
3	21,4%	89
4	51%	212
5	10,8%	45

Table 51: Frequency of the sample by battery lifespan

Almost 11% of the sample strongly agrees that 8 – 10 years of battery life is enough. On the other hand, almost 11% thinks that this time period is not acceptable. Only 6% of the participants strongly disagree that the example time interval is not acceptable. 21,4% of the sample is undecided about the battery life.

So it is fair and clear to say that 8 to 10 years of battery life is acceptable for the majority of the participants. In terms of gender, both genders think that 8 to 10 years of battery life is acceptable.

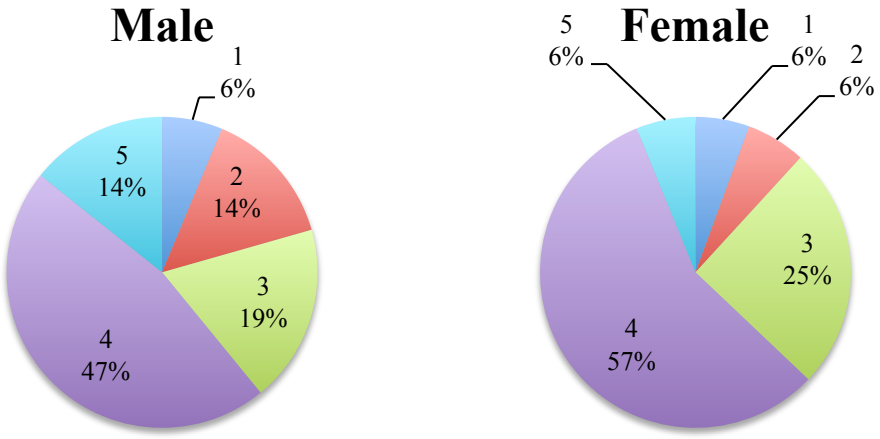

Figure 38: Percentage distribution of the genders by battery lifespan

However, males strongly agree with that life span with 14%, the females strongly agree with 6%. In contrast, females chose the 'agree' option with 57%,the males chose with 47%. With regard to the total agree choices, the female's rate is higher than males. In addition, the female participants are more undecided than the male participants. With regard to age, all the groups agree that 8 to 10 years is acceptable for battery life. 18 – 25 age group agree that battery life span is acceptable by 50%. The other age groups' agree at the level around 47% to 53% except over 60 years old participants. This age group chose 'agree' option with only 33%. Also, this group is highly undecided about battery life with 33,3%, which is the highest undecided rate. The 18 – 25 age group is undecided by 17,5% which is the lowest undecided ratio among all the groups.

In terms of aggregate agree ratios, the highest ratio belongs to 18 - 25 age group with 64% total. The Second highest ratio belongs to 46 – 55 age group with 61,6%. Also, the 26 – 35 age group's total agree ratio is 61,5% which is the third highest ratio. These ratios are very close to each other and it is clear to say that for target audience 8 to 10 years battery life is acceptable.

Age	1	2	3	4	5
18 - 25	10 (8,8%)	11 (9,6%)	20 (17,5%)	57 (50%)	16 (14%)
26 - 35	4 (3%)	19 (14,1%)	29 (21,5%)	68 (50,4%)	15 (11,1%)
36 - 45	3 (5,6%)	4 (7,4%)	14 (25,9%)	29 (53,7%)	4 (7,4%)
46 - 55	6 (7%)	7 (8,1%)	20 (23,3%)	46 (53,5%)	7 (8,1%)
56 - 60	1 (4,8%)	4 (19%)	4 (19%)	10 (47,6%)	2 (9,5%)
60+	1 (16,7%)	0 (0%)	2 (33,3%)	2 (33,3%)	1 (16,7%)

Table 52: Distribution of the age groups by battery lifespan

In terms of education level of the sample, the acceptance of the battery life increases when education level increases. Primary and middle school strongly agree that 8 to 10 years of batter life is acceptable with 8,3%. The high school and Associate degree find it acceptable by 5,6% and the Bachelor's, master and PhD degree group strongly agree with 12,4%. The bachelor's, master and PhD degree group agree to example time interval with 52,2%. This ratio decreases gradually when the education level decreases. The 'Agree' ratio is 48,9% in high school and Associate degree group and 33,3% in the primary and middle school group. The undecided participant ratio decreases when education level increases.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	14 (4,5%)	9 (10%)	2 (16,7%)
2	35 (11,1%)	9 (10%)	1 (8,3%)
3	62 (19,7%)	23 (25,6%)	4 (33,3%)
4	164 (52,2%)	44 (48,9%)	4 (33,3%)
5	39 (12,4%)	5 (5,6%)	1 (8,3%)

Table 53: Distribution of the education levels by battery lifespan

In respect of the income level of the participants, the majority of all the income levels agree that 8 to 10 years battery life is acceptable. The highest agree rate belongs to the 4.501 – 5.500 TRY group with 72,2% and the second highest rate is 57,3% this belongs to the more than 5.500 TRY group. For the two highest income groups, battery life of 8 to 10 years is quite acceptable. On the other hand, the

lowest agree ratio belongs to the 3.501 – 4.500 TRY group with 50%, which is also still a significant level.

Income	1	2	3	4	5
< 1.600 TRY	5 (10,9%)	2 (4,3%)	12 (26,1%)	21 (45,6%)	6 (13%)
1.601 – 2.500 TRY	4 (4,3%)	13 (14,1%)	19 (20,6%)	48 (52,2%)	8 (8,7%)
2.501 – 3.500 TRY	4 (8,3%)	3 (6,2%)	15 (31,2%)	22 (45,8%)	4 (8,3%)
3.501 – 4.500 TRY	1 (3,1%)	8 (25%)	7 (21,9%)	12 (37,5%)	4 (12,5%)
4.501 – 5.500 TRY	0 (0%)	1 (5,6%)	3 (16,7%)	13 (72,2%)	1 (5,6%)
> 5.500 TRY	1 (1,2%)	6 (7,3%)	16 (19,5%)	47 (57,3%)	12 (14,6%)
Unspecified	10 (10,2%)	12 (12,4%)	17 (17,3%)	49 (50%)	10 (10,2%)

Table 54: Distribution of the income levels by battery lifespan

The last item measures the effect of battery replacement cost on purchasing decision. Table 55 shows the distribution of the participant's choices. It seems clearly, that the majority of the sample indicates that replacement cost effects their purchasing decision with 47,1%. 26,4% of the sample highly affected by replacement cost. Almost, 15% are undecided about that. With only 2,9% of the participants specifying that replacement cost does not effect their purchasing decision.

Q14	Percentage	Frequency
1	2,9%	12
2	8,6%	36
3	14,9%	62
4	47,1%	196
5	26,4%	110

Table 55: Frequency of the sample by battery cost

Related to gender, it seems males give more importance to the battery replacement cost than females. 27% of the males specify that replacement cost is highly important while 26% of the females specify that. However, the aggregate agree ratio is the same for both genders. Therefore, it can be said that the male importance level is higher than females by 1% but from a general perspective their importance level is almost the same. On the other hand, females are more undecided than males. While 17% of females are undecided, only 14% of males are undecided about the issue.

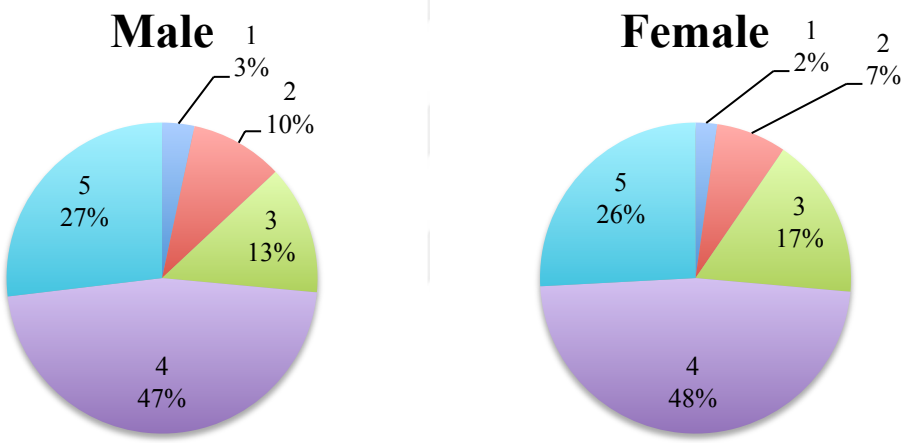

Figure 39: Percentage distribution of the genders by battery cost

Related to age levels, the battery replacement cost is highly important for all age groups. However, 46 – 55 age group gives the highest importance. Their aggregate 'agree' and 'strongly agree' ratios are more than 82%. The highest 'strongly agree' ratio belongs to over 60 years old group with 33,3%. However, the 56 – 60 age group agree that replacement costs effects their purchasing decision with 57,1%, which is the highest ratio among all age groups. With regard to target age groups, the 18 – 25 age group agree that with 45,6% and strongly agree with 21,9%. For the 26 – 35 age group, they agree by almost 43% and strongly agree by almost 32%. However, both these groups' undecided ratio is quite high.

Age	1	2	3	4	5
18 - 25	6 (5,3%)	17 (14,9%)	14 (12,3%)	52 (45,6%)	25 (21,9%)
26 - 35	1 (0,7%)	8 (5,9%)	25 (18,5%)	58 (43%)	43 (31,8%)
36 - 45	1 (1,8%)	5 (9,3%)	11 (20,4%)	25 (46,3%)	12 (22,2%)
46 - 55	1 (1,2%)	4 (4,6%)	10 (11,6%)	47 (54,6%)	24 (27,9%)
56 - 60	2 (9,5%)	1 (4,8%)	2 (9,5%)	12 (57,1%)	4 (19%)
60+	1 (16,7%)	1 (16,7%)	0 (0%)	2 (33,3%)	2 (33,3%)

Table 56: Distribution of the age groups by battery cost

In terms of the education level, 48,7% of the Bachelor's, master and PhD degree group agree that battery replacement cost is important. Also, this group's 'strongly agree' ratio is 27,4%. But 13,7% of this group are undecided about the replacement cost. The undecided level of the groups increases when the education level decreases. High school and Associate degree group's undecided ratio is 17,8% and the primary and middle school's is 25%. The total agree ratios of the Bachelor's, master and PhD degree group is more than 75%, which makes them the group that gives the highest priority to the cost of battery replacement. For the high school and Associate degree group, the total agree ratios are more than 66%. In addition, the 'strongly disagree' ratio increases when the education level decreases. For the Bachelor's, master and PhD degree group this ratio is 1,9%, for high school and Associate degree group it is 5,6% and for primary and middle school group it is 8,3%.

Education	Bachelor's, Master and PhD degree	High School and Associate Degree	Primary and Middle School
1	6 (1,9%)	5 (5,6%)	1 (8,3%)
2	26 (8,3%)	9 (10%)	1 (8,3%)
3	43 (13,7%)	16 (17,8%)	3 (25%)
4	153 (48,7%)	40 (44,4%)	3 (25%)
5	86 (27,4%)	20 (22,2%)	4 (33,3%)

Table 57: Distribution of the education levels by battery cost

In respect of the income level of the participants, all the groups gave high importance to the battery replacement cost. The less than 1.600 TRY group strongly agree that replacement cost effects their purchasing decision with 37%. This ratio is 23,9% for 1.601 – 2.500 TRY group, 14,6% for the 2.501 – 3.500 TRY group and 46,9% for the 3.501 – 4.500 TRY group. The 3.501 – 4.500 TRY group give the highest importance among all the groups. In contrast, the lowest ratio belongs to the 2.501 – 3.500 TRY group. In terms of the aggregate agree levels, surprisingly the lowest ratio belongs to the lower than 1.600 TRY group with 65,2%. The highest ratio belongs to the 3.501 – 4.500 TRY group with 87,5%. With regard to undecided ratio of the groups, the highest undecided ratio belongs to the 4.501 – 5.500 TRY group and the lowest rate belongs to the 3.501 – 4.500 TRY group. So with reference to the Table 58, it is clear to say that lower income levels give less importance to the battery replacement cost.

Income	1	2	3	4	5
< 1.600 TRY	1 (2,2%)	7 (15,2%)	8 (17,4%)	13 (28,3%)	17 (37%)
1.601 – 2.500 TRY	1 (1,1%)	11 (12%)	14 (15,2%)	44 (47,8%)	22 (23,9%)
2.501 – 3.500 TRY	1 (2,1%)	3 (6,2%)	10 (20,8%)	27 (56,2%)	7 (14,6%)
3.501 – 4.500 TRY	1 (3,1%)	0 (0%)	3 (9,4%)	13 (40,6%)	15 (46,9%)
4.501 – 5.500 TRY	0 (0%)	1 (5,6%)	4 (22,2%)	7 (38,9%)	6 (33,3%)
> 5.500 TRY	2 (2,4%)	5 (6,1%)	11 (13,4%)	47 (57,3%)	17 (20,7%)
Unspecified	6 (6,1%)	9 (9,2%)	12 (12,2%)	45 (45,9%)	26 (26,5%)

Table 58: Distribution of the income levels by battery cost

5 CONCLUSION

Nine assertions were established designed from an extensive literature review. A total of nine assertions seem to be the major factors in the determination of the consumer's expectations from electric vehicles. Also these items are interrelated factors, which affect the consumers purchasing decision.

Table 59 summarises the results of the propositions and the assessment of each proposition. According to the Table 59, as a result of the survey, the result of 6 out of 9 propositions are the expected result, including consumer budget limit, charging time and infrastructure concerns, government incentives or subsidies awareness, environmental concerns, effect of operating cost and battery life and cost concerns. There is only one unexpected result, which is importance of driving range. In addition, two propositions have both expected and unexpected results which are importance of the maintenance cost and importance of performance.

Proposition	Expected Result	Unexpected Result	Both
P1: Importance of driving range		+	
P2: Consumer budget limit	+		
P3: Charging time and infrastructure concerns	+		
P4: Importance of the maintenance cost			+
P5: Government incentives/subsidies awareness	+		
P6: Environmental concerns	+		
P7: Importance of performance			+
P8: Effect of operating cost	+		
P9: Battery life and cost concerns	+		

Table 59: Results of the propositions

As stated in Proposition 1, driving range would be of high importance for younger participants. However, the majority of the 18 – 25 age group preferred the 401 – 500 km range. Expected driving range is higher for older ages. Results show that driving range expectancy increase until the age group 56 – 60. Then it starts to decrease. On the other hand, this unexpected result can be useful for the car manufacturers. As it was mentioned many times the potential consumers age range is 18 – 35 and in this age range the driving range expectations are low, compared with the other age groups. Consequently, car manufacturers can focus the driving range of the electric vehicles at target groups.

According to the Proposition 2, the preferred budget is the minimum for all the participants. 56,5% of all participants preferred the minimum budget. This result may be due to the low-income level of the majority of the surveyed group.
On the other hand, the proposition mentions that the expected budget would increase according to the income level. This assertion is partially correct. According to the results, as income level increases, the allocated budget is likely to be more evenly distributed compared to the low-income level. For example, none of the participants from the lower than 1.600 TRY group preferred the 160.001 TRY – 180.000 TRY price range while 10% of the more than 5.500 TRY group preferred this price range. As a result of this proposition, a low price range is more suitable for this type of sample.

According to the Proposition 3, participant's expectations will be the shortest charging duration. However, a group that will not be underestimated is pleased with higher charging times. 3 – 4 hours and 4 – 5 hours charging durations preference rate is also high. Nevertheless, results show that the majority of the sample preferred less than 2 hours and 2 to 3 hours charging duration. It is clear to say that people tend to fill their vehicles fuel in as short as conventional vehicles.
Therefore, according to the results if an electric vehicles charging duration is short, the preference for this vehicle will be higher.

Another assertion according to the Proposition 3 is longer charging duration than it advertises will cause anxiety. The results show that a significant majority of the sample worry if the charging duration takes longer than it is advertised. Therefore, car manufacturers should strictly control and measure charging duration of the electric vehicles. The anxiety of the consumer can decrease the attractiveness of the vehicle. The last assertion of the Proposition 3 mentioned the distribution of charging stations. Participants give high importance to distribution of the charging stations. According to the results, 50,5% of the participants highly agree that charging stations need to be distributed in a manner as common as the gas stations.
Also, 33,2% of the sample agreed with that assertion. With the results that are related to the charging infrastructure and time, participants have several suspicions about the technology. Participants expect a short charge time, a charge in the time, and a well-formed infrastructure. If these barriers are adjusted according to the consumer's demand, the current demand for electric vehicles is likely to rise.

According to the Proposition 4, maintenance cost is highly important for all participants and it is significant for low-income level while it is less important for high-income level. The results reflected that expected result. The majority of the sample gives high importance to low maintenance cost. 42,1% of the sample chose 'strongly agree' and 41,1% of the sample chose the 'agree' option. Therefore, electric vehicles maintenance cost should be lower than conventional vehicles maintenance cost. In contrast, the expected importance of maintenance cost for low-income level is low. Surprisingly, according to the results, high-income level participants give more importance than the low-income level participants. People at high incomes are more likely to have luxury cars than people at low incomes. Maybe due to this reason, the higher income class expect to pay higher vehicle maintenance costs. Therefore, the high-income level may be demanding lower vehicle maintenance costs.

The fifth proposition mentions that most of the participants are aware that there are not enough government subsidies and incentives. As expected, 37% of the participants strongly thinks that government subsidies and incentives are not enough. In addition, 35,3% of the sample thinks that the government subsidies and incentives are not enough. However, this opinion is not as intense as the group of 37%. Therefore, the government should improve to promote electric vehicles. Norway can be the appropriate target model for government supports. Norway has electric vehicle incentives since 1990. For example, electric vehicle owners have value added tax exemption, free parking opportunity, zero annual road tax etc. (Elbil, 2018) According to the studies, electric vehicles account for 39,2% of the entire market in Norway (Lambert, 2018). If the Turkish government improve and take Norway as an example for incentives and subsidies, it is likely that the rate of electric vehicle usage will dramatically increase.

Proposition 6 is related with environmental concerns of the participants. In this proposition the expected result is that the environmental concerns would be of high importance for the participants. In addition, the other expected result is that as education level increases, environmental awareness will increase. The survey result shows that majority of the participants pay attention to being environmentally friendly with a result of 34,4%. Additionally, 30,5% of the sample attach great importance to being environmentalist. Also, environmentalist behavior increases when education level increases. The 38,5% of the Bachelor's, master and PhD

degree group pay attention to being environmentalist while just 22,2% of the high school and Associate degree group and only 16,7% of the primary and middle school group attach importance to being environmentalist. In terms of energy saving awareness, almost 70% of the participants consider that they will contribute to national energy saving when they opt for electric cars. In line with other results the awareness of energy saving increases when the level of education increases. More than 75% of the Bachelor's, master and PhD degree group agree that they consider energy saving while purchasing an electric vehicle. This ratio is 51,1% for high school and Associate degree group and 25% for primary and middle school group. By using these results, it is important to pay attention to the environmental aspect and energy saving of these vehicles in order to promote the use of electric vehicles.

As stated in Proposition 7, vehicle performance would be of high importance for participants. The results show that 31% of the participants strongly agree that electric vehicles need to be safer than conventional cars and 35,1% of the sample agree that electric vehicles need to be safer than conventional cars. In terms of acceleration and the speed limit, as expected, 43,5% of the sample mentioned that these features can effect their purchasing decision. On the other hand, another assertion of this proposition is while speed limits and acceleration are important for young males and females, safety elements are important for older ages. However, the results show that the highest safety importance level belongs to 36 – 45 age group. The sample has older ages. Therefore, this result counts as an unexpected. In addition, acceleration and speed limits are highly important for young ages. So according to these results, car manufacturers need to pay attention to all age's demands or market these vehicles by age groups.

According to the Proposition 8, operating cost would be of high importance for majority of the participants. The results show that 56% of the participants highly preferred lower operating costs. Therefore, electric vehicle's operating cost is lower than the conventional car. One of the studies shows that the annual average operating cost of the electric vehicle is 485 USD while the average for conventional vehicle is 1.117 USD in U.S.A (McMahon, 2018). This feature of electric vehicles should be strongly marketed and advertised more also it should be a target to further reduce the operating cost. In Turkey, the fuel cost is higher than in the U.S.A. As of May 14, 2018, in Turkey one liter of gasoline price is 1.41 USD and

in the U.S.A. it is 0,83 USD (Global Petrol Prices, 2018). Therefore, the price gap between operating cost of electric vehicles and conventional vehicles should be much higher in Turkey. If the manufacturers emphasize that the operating cost of electric vehicles are lower than the conventional cars, it will contribute to increasing the choice of electric vehicles.

Proposition 9 related to battery life and cost concerns. As stated in Proposition 9, the 8 to 10 years battery life is acceptable for most of the participants. 51% of the participants agree that the range is acceptable. Also, almost 11% of the sample thinks that the lifespan of the battery is highly acceptable. Therefore, if the battery technology improves and lifespan expands, the unhappy minority's approach to battery life is also going to change. Another assertion according to the Proposition 9 is battery replacement cost is highly important for the majority of the participants. According to the 26,4% of the sample, battery replacement cost is highly important. Fortunately, the results also show that the majority of the sample agrees that battery replacement cost would affect their purchasing decision by 47,1%. However, this ratio is still high, which means people, may not purchase because of the high replacement cost. According to these results, if the battery technology develops and battery prices decrease, adoption of electric vehicles will also increase.

Finally, electric vehicle adoption is a complicated topic because it contains several variables. According to the survey study, the perfect and the mostly acceptable electric car should travel 401 – 500 km with a single charge and purchasing price is not more than 120.000 TRY. Also, the charging time needs to be as short as possible. Additionally, the charging infrastructure needs to be well distributed. Also, maintenance costs and operating costs need to be lower than conventional cars. Performance is another important topic and factor for the potential buyers. The cars need to be safer than conventional cars and their acceleration and speed limits need to be at least as same as conventional cars. The battery technology needs to develop in order to increase the demand of electric vehicles. The battery replacement cost should decrease and the lifespan needs to be increased. Along with all these contributing factors, the environmental protection and energy saving awareness must also be increased. In addition if the government incentives and subsidies are expanded and developed, many of the barriers to

acceptance will be overcome and a dramatic increase in demand for electric vehicles will be the result.

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APPENDICES

A: Survey Study

The Survey study of Preference of Electric Vehicles

This survey has been prepared to gather information about the disruptor facts of proliferation of the electric cars.It is totally anonymous and will be used for a thesis in Department of Sustainable Energy, Izmir University of Economics. The average duration of the questionnaire is 4-5 minutes.

Age ……

Gender Male □ Female□

Education Level ……

Occupation …….

Average Income

Less than 1,600 TRY (411.3 USD) □

1,601 – 2,500 TRY (411.5-642.67 USD) □

2,501 – 3,500 TRY (642.9-899.7 USD) □

3,501 – 4,500 TRY (900-1,156.8 USD) □

4,501 – 5,500 TRY (1,157-1,413.8 USD) □

More than 5,500 TRY (1,413.8 USD) □

Do not want to specify □

Survey Questions

1) What do you think it should be the distance that an electric car can travel with one full charge?

a) Less than 300
b) 301-400 km
c) 401-500 km
d) 501-600 km
e) More than 600 km

2) What would be the proper budget that you would spare to get a brand new electric car for yourself?

a) 100.000 TRY - 120.000 TRY (25,706.9-30,848.3 USD)
b) 120.001 TRY - 140.000 TRY (30,848.5-35,989.7 USD
c) 140.001 TRY - 160.000 TRY (35,989.9-41,131.1 USD)
d) 160.001 TRY - 180.000 TRY (41,131.3-46,272.4 USD)
e) More than 180.001 TRY (46,272.7 USD)

3) How long should it take to charge an electric car with regular household plugs?
a) Less than 2 hours
b) 2 - 3 hours
c) 3 - 4 hours
d) 4 - 5 hours
e) More than 5 hours

Please indicate at which level suits for you the best in the following questions between 4 and 14.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
4) I would worry if the charging time would take longer than it is advertised.					
5) I would consider buying an electric car if the charge stations were as common as the gas stations.					

6) I would consider buying an electric car if the maintenance expense was lower than the conventional (gasoline or diesel) cars.					
7) I find the government incentives and subsidies enough for advertising and buying the electric cars.					
8) I would conisder buying the electric cars because people would see me as an environmentalist.					
9) I would consider buying an electric car because it is nature friendly and it contributes the duty of national energy saving.					
10) I think the electric cars should be safer than the conventional cars in case of an accident.					
11) The speed limits and the acceleration time of the electric cars would effect my decision to buy an electric car.					
12) It would effect my decision to buy an electric car if the electric cars fuel (electricity) was cheaper than conventional car fuel (diesel or gasoline).					
Car A works with electric 100%. The battery capacity of this car produced between 2011 and 2015 is 24kWh. The warranty covers a battery for 8 years against manufacturing defects and 5 years for capacity loss which also equals to 161.000 kms (60.000 miles). According to the latest news in 2017, the battery replacement price is 5.499$ (19.000-21.000 Turkish Liras). Please answer the following questions according to the scenario above.					
13) 8 to 10 years of battery life is acceptable for electric vehicles.					
14) The battery replacement price effects the decision to buy an electric car.					

THANK YOU FOR YOUR TIME.

B: Propositions

Propositions	Explanation	Question(s)
P1: Importance of driving range	The expected driving range would be of high importance for participants between 18-25 years old.	Q1: Expected driving range with full charge
P2: Consumer budget limit	The preferred budget will be minimum for all groups, and it is expected to increase according to the income level.	Q2: Allocated budget to buy a new electric vehicle
P3: Charging time and infrastructure concerns	Longer charging duration causes stress. The expected charging duration is as short as possible. Distribution of the charging stations would be of high importance for the participants.	Q3: Expected charging duration Q4: Longer charging time than it is expected Q5: Distribution of charging stations
P4: Importance of the maintenance cost	Maintenance cost would be of high importance for all participants. It is significant for low-income people while high-income group does not consider maintenance cost.	Q6: Maintenance cost as an important factor while buying an electric vehicle
P5: Government incentives/subsidies awareness	The majority of the participants are aware of insufficient government support.	Q7: Sufficiency of government incentives/subsidies
P6: Environmental concerns	Environmental concerns would be of high importance for the participants. The attention for environmental concerns rises as the level of education increases.	Q8: A symbol of environmental friendly behavior Q9: Contribution to the national energy saving
P7: Importance of performance	Vehicle performance would be of high importance for participants. While speed limits and acceleration are important for 18-35 years old males/females, safety elements are important for age +45.	Q10: Safety-related concerns in case of an accident Q11: Acceleration and speed limits as important factors while buying electric vehicles
P8: Effect of operating cost	Operating cost would be of high importance for all participants.	Q12: Impact of operating cost on purchasing decision
P9: Battery life and cost concerns	Expected battery life span between 8 to 10 years is satisfactory for the majority. Also, battery cost would be of high importance for all participants.	Q13: Appropriate battery life span Q14: Impact of battery cost on purchasing decision