

Effect of Environmental Awareness on Willingness to Pay for Renewable Energy

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ABSTRACT: *While world population is increasing and consumption is depleting resources rapidly, it has caused environmental disruption, air pollution and climate change. Scientists and environmentalists try to change energy resources as renewable and nature friendly when they produce ideas about climate change and environmental issues. Although production from renewable energy resources are defined as sustainable and nature friendly by comparison with fossil energy resources, change would have costs. Costs will response to consumers naturally even though investors and governments defray. Consumer adaptation process to the renewable energy market which is formed by the changing production resources should be managed efficiently. In this paper, an empirical study has been done on the measure effect of consumers' attitude towards environment on willingness to pay for electricity that produces by renewable energy resources. Also, effect of financial capability of consumers on willingness to pay is evaluated. Descriptive analysis on responsibility of increasing renewable energy production and fighting against climate change and global warming; perceived environmental and climate change impact of the energy resources; perceived investment and production costs of the different energy resources are aimed to conclude.*

Keywords: *renewable energy, willingness to pay, consumer behavior, energy market, green power*

I. INTRODUCTION

Climate change and global warming pose a significant risk to the future of the world. Scientists and researchers believe that rapid changes in the global climate in recent years are often caused by increasing greenhouse gas emissions. Human activities are the biggest reason of the increase in greenhouse gas emissions. Air pollution and acid deposition due to the use of fossil energy sources affect both environment and human health with an increase in respiratory diseases and decrease in expected life span (Longo, Markandia & Petrucci, 2008).

Concerns about energy security and climate change cause significant changes and improvements in the production, transmission and consumption of energy and electricity (Moula et al., 2013). Especially, European Governments have made renewable energy one of the most important priorities due to climate change and growing concern about the inadequacy of fossil fuels (Smith, 2013). This has led to increased studies, investments and interest in green energy which has been generated by using renewable energy sources such as solar panels, wind farms, geothermal projects, hydroelectric power and biomass projects.

Adapting to climate change and reducing the negative impact of climate change is considered a challenging process for scientists, decision-makers and the public (Hagen & Pijawka, 2015). In recent years consumers are concerned about whether they will be able to sustain the standard of their accustomed life particularly energy consumption with the world's resources. Energy consumption is an alarming environmental issue for consumers, but it also offers an economic opportunity for marketers (Bang et al., 2000). An ever-increasing consumer segment intend to reward companies who deal with environmental concerns in their organizations and marketing practices, or to penalize firms with low environmental sensitivity (Carlson, Grove, & Kangun, 1993).

Researchers are well informed about the sensitivity of consumers to a market that contains undifferentiated products. However, the demand for payment for rising prices is not very clear because of energy production with environmental sensitivity. Thus, support policies for renewable energy have been established in many countries. In addition to energy support policies, for green marketing of the renewable energy, consumers' awareness should be created for the environmental aspects of renewable energy in order to be willing to pay more for less environmental impact (Roe et al., 2001). In today's competitive retail electricity market, some marketers have begun offering "green power" options and energy efficiency support to differentiate themselves from other retail electricity suppliers (Zarnikau, 2003). On the other hand, significant speculations are being made about the future of renewable energy due to the high costs of renewable energy sources investments (Roe et al., 2001).

Because of the rapid increase in energy demand in Turkey, investment of energy production facilities has been increasing rapidly in recent years (Yaniktepe, Savrun & Koroglu, 2013). Especially in the last decade,

renewable energy is on the agenda for increase of energy prices, reduction of external dependency on energy and security of energy supply. As of October 2016, there are 78434 MW of installed power for total electricity generation in the country, 42% of which belongs to renewable energy plants (Turkish Electricity Transmission Company, 2016). 37.9% of the electricity were produced from natural gas, 29.1% from coal, 25.6% from hydraulic, 4.5% from wind, 1.3% from geothermal, 1.6% from other resources in Turkey in 2015 (Turkish Ministry of Energy, 2016).

Greenhouse gas emissions are also rising rapidly due to increased energy demand and the production of renewable energy that can not grow at this rate. Greenhouse gas emissions in Turkey reached 467.6 million tons of CO₂ equivalent in 2014 with an increase of 125%, while it was 207 million tons in 1990. Approximately 72.5% of this release is energy related (TURKSTAT, 2016). The conversion and energy sector are responsible for 40% of this.

Establishment of coal and natural gas plants to meet rising energy demand, increases greenhouse gas emissions. Also, it might get reaction from environmentalists and some parts of the population. These reactions and media reflections can reason people to think about the environment and be informed. Informing about climate change and environmental pollution by environmental organizations also cause increase on environmental awareness. At the same time, the government's work on energy efficiency and renewable energy issues in the last decade have caused the public to be conscious. Nevertheless, the number of people consider that these studies are not enough.

However, the efforts of marketers to promote green products can often have more influence on consumers. While the consumers who have high environmental conscious are getting closer to the brand, environmental awareness of other consumers is also increasing as a result of these efforts. With increasing environmental awareness, the desire to pay for green products may be increased.

II. HYPOTHESES

2.1. Environmental Awareness and Willingness To Pay

Today, consumers take into account external factors such as social responsibility as well as satisfaction in the purchase decision process. Consumers feel that they can realize the change with buying a product through a company which has ability to make change, they can not make it individually. Therefore, it may thought that consumers' environmental awareness have an impact on the willingness to pay for renewable energy (Kassarjian, 1971). The fact that renewable energy investments are still too expensive, retail prices of energy that is generated from renewable energy resources are expensive for the consumers (Aravena, Hutchinson & Longo, 2012). The consumer may be in a dilemma between environment and his economic situation. While environmental sensitivity increases, consumers' behavior change toward environment and they might be willing to pay more. Thus:

H1: Consumers with high environmental awareness are willing to pay more for renewable energy.

2.2. Financial Situation and Willingness to Pay

Financial difficulties may affect consumer purchasing behaviors. So, in the first part of the study, the respondents were asked whether they had struggle to pay their expenses/household bills. Respondents were asked to give one answer to this question as always, generally, sometimes, almost never and never. Instead of the income level, the question was asked in this way because of it would be more accurate to understand the economic situation. If one has a better economic situation, willingness to pay increase:

H2: Being economically comfortable increases willingness to pay for electricity generated from renewable energy resources.

2.3. Living/Grew Up Place and Environmental Awareness

The situation where the consumer lives in urban or rural can affect his environmental awareness. Environmental awareness of a person who faces environmental and air pollution in the city may be differ environmental awareness of a person who grew up or living in a natural environment. In the questionnaire, the place where the people were grown up and lived was asked separately as villages, towns, cities and metropolises. After that the relationship between answers given to these questions and environmental sensitivity is examined. In this case:

H3: There is a relationship between the place where the person is living and grew up and the environmental awareness.

III. SURVEY

The study was conducted to measure participants' opinions about climate change and renewable energy, their environmental sensitivities and their willingness to pay for electricity generated from renewable energy. Participants in the study are students who study in different departments at the faculty of economics and

administrative sciences. The research was conducted on university students in turkey. Of the 200 distributed surveys, 161 were used in the analysis.

Initially, it was asked who has the primary responsibility of increasing the production of renewable energy and fighting climate change.

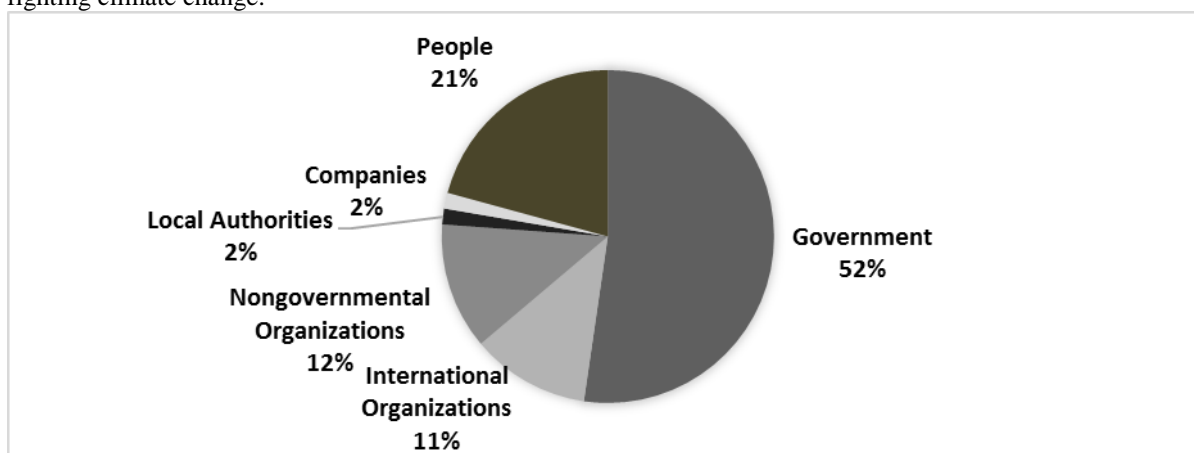


Figure 1. Primary responsible for tackling climate change and increasing renewable energy production

As seen in Figure 1, more than half of the participants think that the government is primarily responsible for tackling climate change and renewable energy production. 20% of the participants think that the first responsibility is the individuals. The business world/investors and local governments are primary responsible in the opinion of very few participants.

Then participants were asked who else is responsible for tackling climate change with a multi-choice question (up to 3 more). By combining answers from this and previous question, the following figure is obtained.

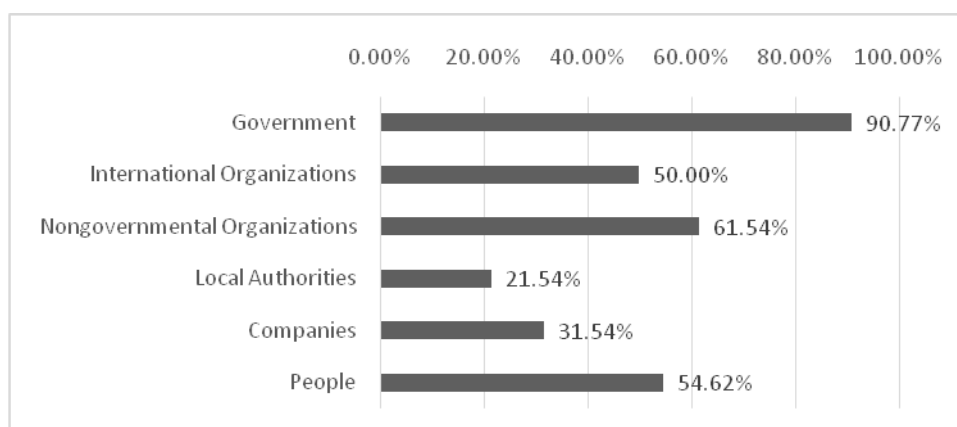


Figure 2. Responsible for tackling climate change and increasing renewable energy production

Figure 2. Responsible for tackling climate change and increasing renewable energy production As seen from the Figure 2, more than 90% of the participants think that government has responsibility. It is a fact that, regulations made and promotions given by the government will increase the production of renewable energy and therefore will support to the fight against climate change. At least half of the participants think that international organizations (UN, EU), civilian organizations (Greenpeace) and individuals have responsibility. Local governments have seen as the least responsible by respondents.

At the following part of the study, participants were asked 4 questions about 6 different energy sources (nuclear, wind, photovoltaic -solar-, thermic -coal-, hydro -water- and oil/natural gas) used in electricity production. The aim of the questions is to understand the perception level of these energy sources. The questions are designed for measuring; perceived negative impact of the energy source on climate change and global warming, perceived harmfulness to the environment, perceived investment and production costs. 5-point scale was used for this measurement.

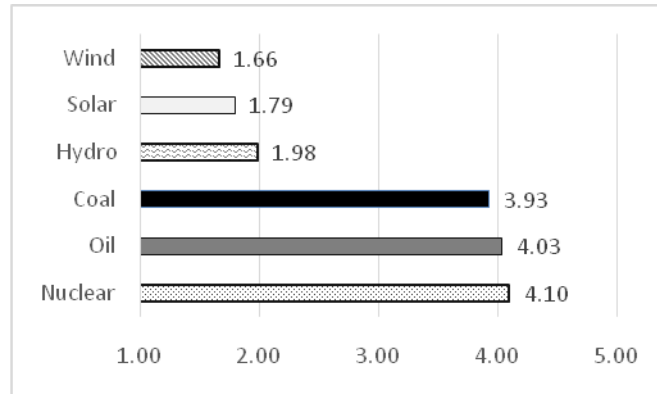


Figure 3. Perceived effects of energy resources on climate change

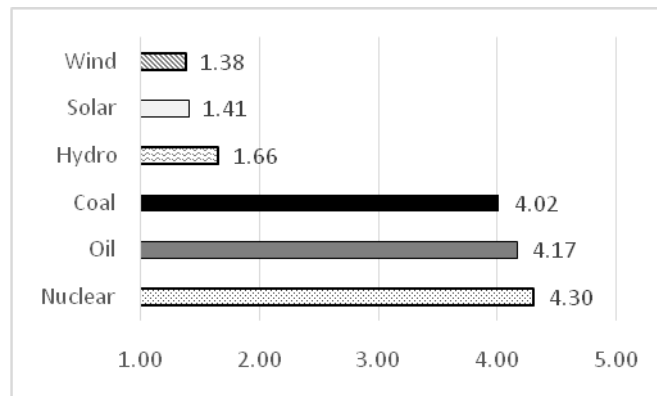


Figure 4. Perceived effects of energy resources on environment

Figure 3 and Figure 4 show that respondents think the effect of solar, hydro and wind energy on the environment and climate change is low. Contrary to common belief, participants think that nuclear energy is also the effect to global warming. The environmental impact of nuclear energy sources has been perceived slightly more high than coal and oil. This result can be interpreted that global effect of nuclear power plant accident happened in Fukushima after an earthquake occurred in 2011. Also, it is possible to think that the nuclear disaster happened in Chernobyl, which is very close to Turkey, 30 years ago has influence on people's perception of nuclear energy.

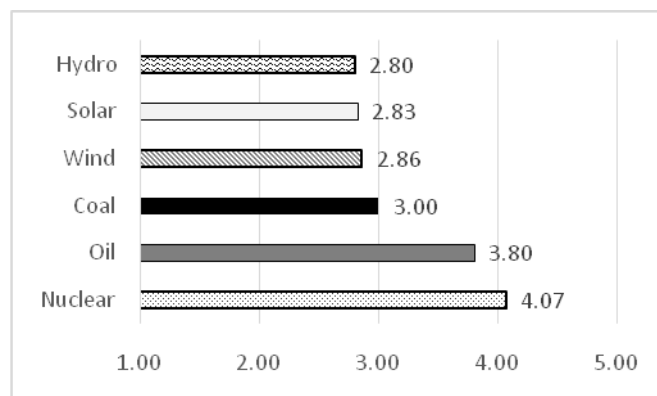


Figure 5. Perceived investment costs of energy resources used for generating electricity

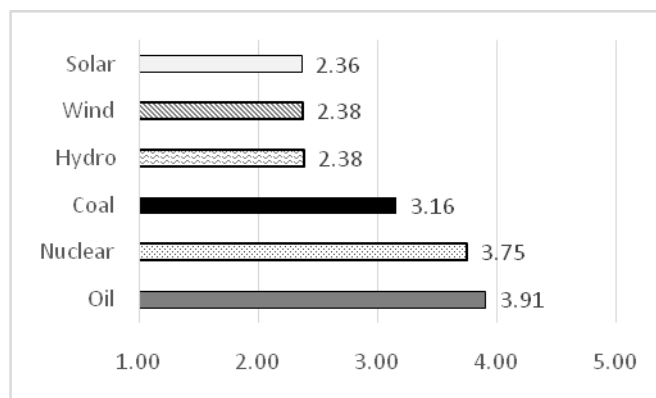


Figure 6. Perceived production costs of energy resources used for generating electricity

Figures 5 and 6 show the mean of the responses to the question of perceived costs of energy sources used in electricity generation. Respondents think that the investment costs of nuclear power and petroleum/natural gas plants are high. They think coal, wind, water and solar energy investments are lower than nuclear and petroleum/natural gas plants that used for electricity power generation. At the same time, consumers think that the cost of producing electricity through renewable energy sources will be low. The economic perception of consumers on renewable energy sources is positive. This means, economic reasons based reactions to the investment of renewable energy sources will be less than fossil and nuclear energy investments.

At the last part of the study, 11 questions were asked. In order to measure the degree of environmental perception, 8 of these questions were identified as the result of factor analysis as “attitude toward environment and renewable energy”. In the factor analysis phase, the result of the KMO test was found 0.824. Bartlett's Test of Sphericity is also statistically significant. Determined 8 variables are listed in Table 1. Cronbach alpha value is 0.794 for this factor.

Table 1. Variables, means, standard deviations and factors

Variable	Mean	SD	Factor
Climate change is a big problem	4.52	0.89	0.827
Renewable energy reduces foreign dependency	4.35	0.98	0.768
Worry about leaving a livable world for children	4.27	1.05	0.688
Renewable energy causes employment increase	4.15	0.97	0.666
Pollution is one of the most important problem of Turkey	4.09	1.09	0.599
Reducing fossil fuel consumption has positive effects on Turkey's environment	3.97	1.18	0.594
Contribute to protect the World with reducing consumption	3.88	1.06	0.532
Taxes should be boosted for renewable energy production (reversed)	3.6	1.11	0.482

Items were measured on a five-point Likert scale. Environmental attitude score between 8-40 points was obtained according to the responses of the participants to the factor group derived with 8 variables. Then, cluster analysis was applied to these 8 variables. It was seen that consumers were grouped in 2 clusters. Consequently, participants were divided into two groups, those with high and low environmental awareness (EA). Means of the willingness to pay (WtP) of both groups are also given in Table 2.

Table 2. Consumer groups according to environmental awareness

Group	N	Mean (EA)	SD (EA)	Mean (WtP)	SD (EA)
Low environmental awareness	78	29.35	5.55	90.94	6.94
Environmentally sensitive	83	36.10	2.09	108.20	12.78

When the willingness to pay is measured, average household electricity consumption¹ of Turkey is given 100₺² as a reference point. If the electricity is generated from completely renewable energy sources, how much will participant be willing to pay the monthly electricity bill is asked. 75% of the answers given to this question are between 90₺ and 110₺. Mean of the willingness to pay of respondents was found 99.84₺ and the standard deviation was calculated 13.49.

Non-parametric tests were applied because of the data did not fit the normal distribution. The effect of the environmental attitude on the willingness to pay was examined by the Kruskal-Wallis test and the Mann-

¹ 0,4124₺ per kWh with an average consumption of 250 kWh (Republic of Turkey Energy Market Regulatory Authority, 2016)

² ₺: Turkish Liras.

Whitney U test for the differences between of the consumer groups' willingness to pay about electricity that generated from renewable energy sources. Both test results are statistically significant and environmental attitude has a positive effect on the willingness to pay.

At the next stage, it was examined whether the financial situation of the participants had an effect on the willingness to pay. Distribution per financial situation and means of willingness to pay are given in Table 3.

Table 3. Financial situation and willingness to pay

Financial difficulty	N	Mean (WtP)	SD (WtP)
Always	9	104,28	18.13
Usually	21	97,35	11.74
Sometimes	65	98,61	12.89
Almost never	25	99,74	11.06
Never	41	102,17	15.63

No statistically significant difference was found between the groups in the Kruskal-Wallis test. Thus, hypothesis 2 can be rejected and it can say that the financial situation has no effect on the willingness to pay.

As a final step, it was examined whether the environmental awareness is effected by the place where the participant is lived and was grown up.

Table 4. Living/grew up place and environmental awareness

Place	Living		Grew Up	
	N	Mean (EA)	N	Mean (EA)
Village/town	3	33.00	9	32.78
County	26	33.66	16	29.80
City	64	31.19	43	31.85
Metropolis	68	34.05	93	33.81

The statistical analysis did not reveal a significant relationship between growth and living place and environmental awareness. Hence, hypothesis 3 will be rejected.

IV. CONCLUSION

Taking some precautions in the context of global warming and climate change reality is important for the future of our world. It is also believed that some of actions to be taken to reduce emissions will have some economic implications. Situations such as investments, economic growth, increasing energy demand in emerging market economies such as Turkey can affect environmental thinking. For this reason, technological developments and cost reductions in renewable energy investments are important for many countries in the world. The increase in environmental awareness as well as economic conditions is one of the factors to consider for sustainable energy supply and sustainable growth.

In this paper, it is seen that environmental awareness has an effect on the willingness to pay about electricity that generated from renewable energy resources. Marketing departments can make it possible to increase willingness to pay of consumers with promotional activities that raise environmental awareness (Laroche, Bergeron and Barbaro-Forleo, 2001). When the environmental conscious consumer is between the economic situation and the environmental impact, he will consider environmental impact. Moreover, he will prefer green not only in energy consumption but also in other product groups. In addition, consumers' energy saving tendency will increase with the increase of environmental awareness.

Public informing about new employment opportunities to be created through renewable energy investments, the decline in energy production costs in the mid-term, the level of pollution to be reduced as a result of the use of clean energy resources instead of fossil fuels, the reduction of external dependence on energy and the possibility of stopping climate change will affect people's opinions about renewable energy.

Extending the scale used in the study with literature support and applying the survey to a wider group could make the results more effective. The increase in the number of observations can lead to differentiation, especially in the conclusions between the financial difficulty and the willingness to pay.

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