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Time for Change? The Analysis of Citizens' Preferences for Energy Investment Alternatives in Turkey

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Abstract

Despite hopes for 'dematerialisation' of economies, Turkey, as a developing country, with a growing population and economy, finds it difficult to avoid moving towards the use of higher levels of direct material and energy inputs, one manifestation of which is her highest CO2 emissions growth rate in the world. Yet, the Turkish government, instead of attempting to reduce the energy demand and restructure its energy supply towards renewable sources (such as solar and wind), seems to be headed for nuclear energy, as an attractive solution with added connotations of "modernization", "scientific advancement", and "energy independence."

It is a truism that in any attempt to restructure the energy supply towards renewable sources and facilitate people's adaptation towards them, it is of importance to know citizens' alternative energy preferences. Motivated by this, we aim to explore and explain the energy preferences of urban population in Turkey through a survey with a size of 2,422, where respondents were first asked to specify their most and least preferred energy sources and then were questioned whether they would change their answers after being informed about the possible negative consequences of their choices (such as higher energy bills and environmental impacts). The analyses of the results together with respondents' answers to follow-up questions about the underlying reasons of their choices enhance our understanding of energy preferences of the public at large. As such, the survey results are hoped to provide inputs in developing a bottom-up policy-making style for energy restructuring/reform for countries similar to the case of Turkey.

Keywords

energy preferences; renewable energy; nuclear opposition; energy policy

1 Introduction

Rising energy demand and growing environmental concern are two coinciding issues in Turkey's political and economic arena. On the one hand, Turkey, as a developing country, with a growing population and economy, is in the pursuit of new energy supplies and seems to be finding itself at the crossroads of large-scale natural gas and hydroelectric projects, the latter being a major developmental goal of the government so far since the establishment of the DSI ("State Hydraulic Works").

On the other hand, Turkey has increasingly been facing the challenge of global climate change in international agreements and EU accession negotiations. Aware of the fact that Turkey has the highest carbon emission growth rate in the world, Turkish government seems to be leaning towards nuclear energy option as a means of facing a future energy gap and the challenge of global climate change. In fact, this option is an attractive one because of the added connotations of "modernism", "scientific advancement" and "energy independence". All in all, restructuring the energy mix towards a stronger reliance on renewable energy alternatives is not emphasized much in the Turkish political discourse. Nor is it known how the public would respond to such a restructuring/reform of the energy mix.

In such a setting, this paper aims to explore and explain the energy preferences of urban population in Turkey through a survey with a size of 2,422, where respondents were first asked to specify their most and least preferred energy sources and were then questioned whether they would change their answers after being informed about the possible negative consequences of their choices (such as higher energy bills and environmental impacts).

Providing an exhaustive list of possible energy investment alternatives and evaluating the public's perceptions and preferences regarding these alternative investments were rarely undertaken in the world literature. The way the citizens in Turkey perceive different energy alternatives has not been investigated, either. Instead public perception studies mainly focused on isolated cases of nuclear energy or renewable sources, and as such, sought to measure the extent of public support for such investment alternatives.

Overall, this study focuses on five energy investment alternatives, namely coal, natural gas, hydroelectric power (dams), renewable sources (such as wind and solar) and nuclear energy, which might be relevant for both Turkey and other developing countries with similar demographic and economic characteristics. We specifically ask the question of what the preferences for different energy investment alternatives are, and check the determinants of those preferences given the set of energy options for Turkey. In the literature, potential determinants of energy preferences are typically stated as demographic characteristics of individuals, their cost and harm perceptions of different energy alternatives and their environmental knowledge levels (Ansolabehere, 2007; Greenberg, 2009; Ansolabehere and Konsiky, 2009). However, the results of these studies provide mixed results that cannot be generalized to all energy alternatives nor to all countries faced with the same types of decisions. Hence, this study is specifically designed to incorporate the determinants expected to be relevant for the Turkish setting.

The research design makes it possible to analyze citizens' preferences both descriptively and econometrically by making use of the survey data created and collected in 2007 from those 2422 respondents representative of urban Turkey. Econometric analysis of the survey data enables us to identify what factors affect energy preferences of the individuals, which subgroups of the population with which characteristics are supportive or against different energy alternatives, and what underlying reasons individuals state for explaining their energy preferences. . The survey results are hoped to provide inputs in developing policies for energy restructuring/reform for countries similar to the case of Turkey.

The study is structured as follows: The second section provides the main findings of the related studies in the literature and introduces and describes the general research methodology such as the survey and sampling design, the relevant variables incorporated in the study, and the type of econometric analysis conducted. The third section provides the descriptive statistics and econometric results. The fourth

section discusses the main findings, and the fifth section concludes.

2 Material and Methods

Numerous public opinion polls and surveys on energy policies have been undertaken both in the US and Europe in order to measure and understand the public support for different energy alternatives (Special Eurobarometer, 2006; Farhar, 1993; Bolsen and Cook, 2008; Greenberg, 2009; Ansolabehere, 2007).

Most of them did not incorporate all relevant energy alternatives and focused instead on a specific type of energy alternative, such as nuclear or renewable sources. However, such an approach cannot differentiate between the support/opposition of the respondents originating from the energy source itself and the support/opposition to any type of new investment in their country (Ansolabehere and Konsiky, 2009).

Among the surveys and polls which have provided an exhaustive list of energy investment alternatives to the respondents, a common finding is that a large share of the respondents in both the US and Europe adopt a supportive position for renewable energy sources (Farhar, 1996; Batley et al., 2001; Ek, 2005). Nuclear energy is seen by the public mostly as undesirable and is supported by only a small share of the respondents (Poortinga et al., 2006; Ansolabehere, 2007). However, MIT study of 2007 (Ansolabehere, 2007) indicates that this opposition trend towards nuclear energy seems to be reversing and instead there is now increasing support.

Most of the studies in the literature have included socio-economic factors such as age, education, gender and income levels as independent variables, that is, as potential explaining variables of the energy preferences, but it is important to note that other energy- and environment-related factors such as environmental knowledge, risk perception, energy conservation concern, technology optimism, environmental optimism, location may also account for the variation in the energy preferences of the respondents.

The results of the previous studies on the effect of the demographics on the energy preferences have provided mixed findings (Ansolabehere and Konsiky, 2009). MIT study of the year 2007 (Ansolabehre, 2007) demonstrates that individuals with higher levels of education and income are more inclined to show support for both the renewable sources and the nuclear energy. A similar finding was presented by Greenberg (2009) by showing that more educated individuals are more supportive of renewable energy sources, whereas age was a significant predictor of the support for the nuclear energy in his sample of 2101 respondents in the US.

With respect to the predictors other than socio-demographics, two very recent studies provide interesting results. Greenberg (2009) demonstrates that perceptions of harm are strongly related to the preferences of fossil fuels, nuclear energy and renewable sources. Further, those respondents who are stating that they are environmentally active are more inclined to support renewable sources and to oppose fossil fuels whereas the effect of environmental activism on the preferences for nuclear energy remains inconclusive. An important predictor of the energy preferences might be environmental knowledge, but this is apparently not included into the analysis.

Ansolabehere (2007) emphasizes the effect of perceived environmental harms and economic costs on energy preferences. Assuming that the public mostly does not have the accurate information regarding the economic costs and environmental harms related with each type of energy source, Ansolabehere asks the respondents to indicate their "perceived" levels of costs and harms. He finds out that the public is strongly responsive to economic costs, and more specifically, preferences regarding the renewable sources and hydroelectric power are very sensitive to the perceived costs of these energy sources.

This section will first introduce the survey design and the sampling procedure, and then will describe and

explain the survey items by categorizing them into dependent and independent variables of the study. Further, the econometric model used to analyze the survey data will be introduced.

2.1 Research Design and Sampling

As already mentioned, the study is based on a questionnaire which was administered in person to a total of 2,422 respondents, representative of the urban population in Turkey. Prior to finalizing the questionnaire, a set of pre-tests was conducted. The fieldwork was carried out from July 4 to August 21, 2007, by a professional research company (whose interviewers were given a full day of training about the specificities of the survey). Random stratified sampling was employed, and the research was conducted in 26 cities representative of urban Turkey at the NUTS II level[1]. The household was taken as the unit of analysis, and respondents from each household were determined randomly among those aged 18 years and above. If the selected person was unavailable at the time of visit, an appointment was made and the household was visited a second time. (If the person was still unavailable then, a new household was randomly selected.)

The sample represents urban Turkey at the household level within a confidence interval of 95 percent, and an error margin of ±2.8 percent. Each survey took approximately 40 minutes. Total rejection rate was 12 percent, 80 percent of which declined to be a part of the survey at the first visit (most indicating time pressure) while the remaining decided to withdraw during the interview after initially agreeing to it (all indicating time pressure). The fact that interviewers presented an official letter from the university that showed this was a scientific research study and that all answers would be kept confidential helped reduce the rejection rate. Approximately one-third of the survey respondents were randomly phone-checked to make sure the interviews were administered appropriately.

The survey is structured as follows: First, a set of questions on the general problems of the country were asked, after which the respondents were first asked about their opposition against each energy investment alternative. Based on the literature (Ansolabehere and Konisky, 2009; Ansolabehere, 2007), we decided to present a list of energy options that may be relevant for Turkey's energy investment alternatives to the respondents. The respondent could select his/her most vetoed energy investment(s) among the following alternatives: coal, natural gas, dams, renewable sources and nuclear energy. For each type of energy investment the respondent was asked to indicate the underlying reason behind his/her opposition. Then, the respondent was asked whether he/she would still oppose this energy investment if an investment into this type of energy would reduce the electricity bill by 25%.

The next question was designed to gather information about which type of energy investment the respondent is supportive of, that is, which type of energy investment should be given first and then second priority in the country. Again, the same set of energy investment options were presented to the respondent, and the respondent was to choose two mostly preferred alternatives among them, indicating which one is the first and which one is the second mostly favoured energy investment. An open-ended follow-up question was asked about the underlying reason here as well. Afterwards, for each type of preferred energy investment, one potential negative consequence was presented to the respondent such as higher electricity bill for coal, dams, and renewable sources, energy dependence of the country for the natural gas, and waste disposal near to the home of the respondent for the nuclear energy.

Following modules aimed at gathering information regarding the more specific energy-related behavior/attitudes of the respondents followed by another part asking for socio-demographics.

A more thorough definition of each variable follows below.

[1] NUTS (the Nomenclature of Territorial Units for Statistics) is a geocode standard, developed and regulated by the European Union, for referencing the subdivisions of countries for statistical purposes. Turkey recently adopted this classification system, and is comprised of 26 NUTS II level regions. Apart from self-representing cities, as in the case of Istanbul, we randomly (weighted according to population figures) chose one city from each region—thus the grand total of 26 cities.

2.2 Dependent Variables

Dependent variables of the study are based on energy preferences, namely the opposition and support for each type of energy source. The dependent variables are categorized as follows:

- The opposition against coal, natural gas, dams, renewable sources (such as wind, solar), nuclear energy
- The underlying reason of the opposition against each chosen energy type
- The presence/absence of persistent opposition after having received the information about the positive consequence (ie. 25% lower electricity bill) of the chosen energy type
- The support for coal, natural gas, dams, renewable sources (such as wind, solar), nuclear energy
- The underlying reason of the support for each chosen energy type
- The presence/absence of persistent support after having received the information about the negative consequence of the chosen energy type

2.3 Independent Variables

As already mentioned, our aim is to econometrically estimate the determinants of the energy preferences of the urban population in Turkey. Based on the literature, we have constructed a set of independent variables which may explain the energy preferences in Turkey. In line with the literature we can categorize these independent variables into two groups: Socio-economic variables and individual energy-related behavior/attitudes.

2.3.1 Socio-economic variables

- Gender (male, female)
- Age (18-82)
- Education (categorized as no diploma, primary education, secondary education, or university education)
- Urbanity (a normalized variable indicating the percentage of time spent in the urban setting, a scale between 0 and 1, 0 representing no time and 1 full time spent in an urban setting)
- Household wealth as measured by ownership of a number of items (factor loadings of possessing a personal computer, internet access, a car, a dishwasher, a credit card, and the possibility of taking a holiday in a foreign country, a greater value corresponding to higher wealth) [2]

2.3.2 Individual energy-related behavior/attitudes

- Environmental knowledge (factor loadings based on the items of: knowledge of Kyoto Protocol, knowledge of the primary gas causing global climate change, knowledge of recycle sign; a higher value corresponding to higher levels of environmental knowledge)
- Nature-friendliness (factor loadings of going-on nature hikes, having pets, feeding street animals,

[2] We opted not to use an income parameter on the grounds that due to the high prevalence of informal economic activities (note that of the labour force, half is known to be working in undeclared work), people would not easily reveal their true income level; in addition, since a significant amount of goods and services are exchanged on a reciprocity basis, outside the market mechanism, people might have difficulties in estimating their real income, which would have been another complication for us.

spending time with gardening/agricultural activities either as a hobby or as a job, and participating in outdoor activities; a higher value corresponding to higher levels of nature-friendliness)

- Recycling habits (factor loadings of recycling plastics, paper, glass materials)
- Environmental activism (factor loadings of participation in a signature campaign to protect nature, and individual petition to help prevent the destruction of the nature, and membership of an environmentalist group/NGO; a higher value corresponding to higher levels of environmental activism)
- Environmental concern (a dummy variable for identification of the environmental problems as one of the first two most important problems of the country)
- Energy conservation concern (factor loadings of using energy efficient light bulbs and of switching-off the unnecessary lights at home; a higher value corresponding to higher levels of energy conservation concern)
- Environmental optimism (the respondents were asked how the environment in Turkey will look like in 10 years compared to today, 1 indicating much worse, 5 indicating much better)
- Technology optimism (the respondents were asked whether it is possible to solve all environmental problems through technological advancement, 0 indicating No, 1 indicating Yes)
- Economy-orientation (a dummy variable for the respondents who prioritize economic objectives of the country over the environmental objectives)

2.4 Econometric Analysis

Given the binary nature of the dependent variables and in line with the literature (Ek, 2005) we chose a binary logit model for the analysis of the determinants of the energy preferences. The binary logit model is used to estimate qualitatively dependent variables as it is the case with the energy preferences in our study; 1 indicating support/opposition for an energy investment, and 0 indicating the opposite. By estimating a binary logit model separately for each type of energy option, we identify the determinants of the energy preferences related with each energy type. For instance, the results of the analysis enable us to make statements like “the probability of an average individual to be in support of hydroelectricity increases/decreases with age”, etc.

However, given the survey design, we are able to say more about the relativities between the five different energy investment options as perceived by the respondents by estimating a multinomial logit model. The multinomial logit model necessitates a categorical dependent variable, as it is the case with the dependent variable of the strongest support for different energy alternatives. This kind of analysis enables us to make statements like “in comparison to the base line energy option of natural gas, the respondents having a larger degree of environmental knowledge are more inclined to support renewable energy sources”, etc. This analysis of relativities reveals crucial information about the relative preferences of the respondents, and it is an aspect that had not been investigated in the literature so far.

3 Results

This section will first briefly introduce the important descriptive statistics of the study in order to provide an overall understanding of the survey data at hand. After the descriptive statistics, we will provide the results of the econometric analysis.

3.1 Descriptive Statistics

The main descriptive statistics are provided in **Table 1** and **Table 2**.

Table 1
Socio-economic variables

Gender (%)	**Male**	**Female**				
	49.7	50.3				
Age (%)	18-24	25-34	35-44	45-54	55+	
	23.1	27.6	20.2	15.0	14.1	
Education (%)	No diploma	Primary	Secondary	University		
	8.0	49.0	32.0	12.0		
Urbanity rate (%)	less than 0.3	between 0.3 and 0.6	between 0.6 and 0.9	more than 0.9		
	6.0	15.0	21.0	58.0		
Parenthood status (%)	With child	Without child				
	64.5	35.5				
Household Wealth (%)	Personal Computer	Car	Credit Card	Internet access	Dishwasher	Holiday abroad
	38.1	30.1	43.8	28.4	41.9	6.6
Social Security (%)	Covered	Not covered				
	81.9	18.1				

The first part of **Table 1** provides the sample's socio-demographic characteristics, which conform to census data compiled by TUIK (Statistical Institute of Turkey) indicating that the randomization process was successful. **Table 2** reflects respondents' positions vis-à-vis the environment and their energy-related attitudes/behavior.

Table 2
Energy-related behavior/attitudes

Environmental knowledge (%)	Knowledge of the primary gas causing climate change	28.8
	Knowledge of the recycling sign	32.1
	Knowledge of Kyoto Protocol	5.2
Nature-friendliness (%)	Nature hike	64.3
	Having pets	43.2
	Feeding street animals	51.0
	Outdoor activities	41.3
	Gardening/agricultural activities as hobby or job	49.3
Recycling habits (%)	Keeping glass materials for reuse	25.1
	Keeping papers for reuse	31.1
	Keeping plastics for reuse	19.6
Environmental ctivism (%)	Participation in signature campaign for nature	12.4
	Individual petition for nature	3.7
	Membership in an environmentalist group/NGO	2.2
Environmental concern (%)	Environment is one of the first two most important problems of the country	23.5
Energy conservation (%)	Using energy efficient light bulbs	68.9
	Turning-off unnecessary lights at home	98.4
Environmental optimism (%)	Environment in Turkey will be worse in 10 years	63.3
	Environment in Turkey will be the same in 10 years	12.4
	Environment in Turkey will be better in 10 years	24.3
Technology optimism (%)	All environmental problems can be solved by technological advancement	30.6
Economy-orientation (%)	Prioritization of economic objectives over environmental objectives	22.9

The **Tables 3 and 4** provide an understanding of the dependent variables, ie. the energy preferences.

As can be seen from **Table 3**, a large share of the respondents (82.9 %) is stating that they are opposing any coal power plant investment in Turkey. However, when provided with an hypothetical price reduction information, 26.7 % of those opposing coal power plants accept an investment in coal in Turkey. **Table 3** can be interpreted with respect to other energy options in a similar manner.

A striking result is that opposition is directed mostly against coal and nuclear (82.9% and 62.5%, respectively), followed by natural gas investments (17.6%), hydroelectric power (6%) and renewable sources (4%). That means, opposition against renewable sources is the weakest one.

Another important result that can be derived from **Table 3** is that the respondents opposing renewable investments and nuclear power plants are the most persistent group of respondents, that is, the share of the respondents who give up opposing their initially indicated choice is the smallest for these two groups (20% and 23.5% for renewable and nuclear, respectively). The least persistent group is the group opposing dams with a share of 37.1% of respondents giving up their initial choice.

Table 3 Opposition against energy investment options of Turkey

Against coal power plant investments		**Against coal power plant investments even if electricity bill were to be 25% lower**		**Accepts coal power plant investments if electricity bill is 25% lower**	
Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1855	82.9	1360	73.3	495	26.7
Against natural gas power plant investments		**Against natural gas power plant investments even if electricity bill were to be 25% lower**		**Accepts natural gas power plant investments if electricity bill is 25% lower**	
Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
394	17.6	273	69.3	121	30.7
Against hydroelectric power plant investments		**Against hydroelectric power plant investments even if electricity bill were to be 25% lower**		**Accepts power plant investments if electricity bill is 25% lower**	
Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
135	6.0	85	63.0	50	37.0
Against investments in renewables		**Against investments in renewables even if electricity bill were to be 25% lower**		**Accepts investments in renewables if electricity bill is 25% lower**	
Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
90	4.0	72	80.0	18	20.0
Against nuclear power plant investments		**Against nuclear power plant investments even if electricity bill were to be 25% lower**		**Accepts nuclear power plant investments if electricity bill is 25% lower**	
Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
1399	62.5	1070	76.5	329	23.5

Table 4 indicates that the least supported energy type is coal (3.6% of the respondents), followed by the nuclear energy (7.2%) whereas the most supported type of energy investment is renewables (70.2%) followed by the dams (65.2%).

Another result derived from **Table 4** is that the most persistent group of supporters is the pro-renewable group, since only 14.7% of the respondents initially supporting renewable sources change their minds after having received the hypothetical information that the electricity bill is 25% higher. The least persistent group is the pro-nuclear group; 57.1 % of all pro-nuclear respondents change their mind after the hypothetical information that the nuclear wastes are going to be buried in a region near their home.

Table 4 Support for energy investment alternatives in Turkey

Favors coal power plant investments			**Favors coal power plant investments even if electricity bill were to be 25% higher**		**Does not favor coal power plant investments if electricity bill were to be 25% higher**	
Frequency	Percentage		Frequency	Percentage	Frequency	Percentage
86	3.6		52	60.5	34	39.5
Favors natural gas power plant investments			**Favors natural gas power plant investments even if this leads to energy dependence**		**Does not favor natural gas power plant investments if this leads to energy dependence**	
Frequency	Percentage		Frequency	Percentage	Frequency	Percentage
881	37.3		602	68.3	279	31.7
Favors hydroelectric power plant investments			**Favors hydroelectric power plant investments even if electricity bill were to be 25% higher**		**Does not favor hydroelectric power plant investments if electricity bill were to be 25% higher**	
Frequency	Percentage		Frequency	Percentage	Frequency	Percentage
1539	65.2		1220	79.3	319	20.7
Favors investments in renewable			**Favors investments in renewables even if electricity bill were to be 25% higher**		**Does not favor investments in renewables if electricity bill were to be 25% higher**	
Frequency	Percentage		Frequency	Percentage	Frequency	Percentage
1657	70.2		1414	85.3	243	14.7
Favors nuclear power plant investments			**Favors nuclear power plant investments even if the wastes were to be buried near to his/her home**		**Does not favor nuclear power plant investments if the waster were to be buried near to his/her home**	
Frequency	Percentage		Frequency	Percentage	Frequency	Percentage
170	7.2		73	42.9	97	57.1

3.2 Econometric Results

As discussed in **Section 2**, we have estimated binary logit models for each type of energy option twice, first for opposition towards an energy investment alternative, and then for support for any energy investment option. The results are provided in **Table 5**.

We have estimated binary logit models for each dependent variable. As can be seen from **Table 5**, ten dependent variables were used, for each type of energy investment two dependent variables were created: One for the initial choice, namely the response to the question "Which type of energy investment do you oppose?" and one for the persistent choice, which is the response to the question "Would you still oppose this energy investment if your electricity bill were to be 25% lower?". That way, we were able to eliminate the respondents who were primarily concerned about the economic cost of the energy type chosen. As such, we have focused on the determinants that are of importance for energy preferences other than the price.

The most striking results are obtained from the regressions run for the renewable sources and nuclear energy. The likelihood of the opposition against renewable energy sources increases as respondents' environmental knowledge and recycling habits decrease, but as household wealth, optimism about the future of the environment and about technological solutions to environmental problems increases. Being

female decreases the likelihood of opposition against renewable energy. Further, a con-renewable person is likely to prioritize economic objectives over environmental objectives. The persistent con-renewable group has very similar characteristics as can be seen from **Table 5**.

Table 5 Binary logit results of opposition against energy investment alternatives[a]

Share of the total sample	82.8%	62.4%	17.6%	12.5%	6.0%	3.9%	4.0%	3.3%	62.5%	49.1%
	Coal		**Natural gas**		**Dams**		**Renewable**		**Nuclear**	
	Initial choice	Persistent choice	Initial choice	Persistent choice	Initial choice	Persistent choice	Initial choice	Persistent choice	Initial choice	Persistent choice
Env. knowledge							**, -	**, -		
Nature-friendliness			***, +	***, +	**, +	**, +				
Recycling							**, -	**, -		
Env. activism		**, -								
Env. concern									**, +	**, +
Energy conservation		**, +								
HH wealth			**, +	**, +			***, +	***, +	**, +	**, +
Env. optimism			*, +	*, +			***, +	***, +	***, -	***, -
Technology optimism							*, +		**, -	**, -
Economy-orientation		**, -					***, +	***, +		
Age		*, +			**, -	**, -				
Urbanity									**, +	**, +
Women		*, -					*, -	**, -		
Education		**, +		*, +		**, +				
Pseudo R2	-	0.022	0.033	0.045	0.047	0.072	0.176	0.210	0.031	0.030
	p=0.32									

[a]Dependent Variable: Probability of opposing energy options. Two sets of regressions: One for the initial choice, another for the persistent choice, that is, for the responses of the individuals after being presented with the hypothetical positive consequence. The signs *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent, respectively. The "+" sign after comma indicates a positive estimated coefficient; the "-" sign after comma indicates a negative estimated coefficient.

As already mentioned, the opposition against renewable sources is very persistent. Almost 80% of the con-renewable group still opposes the renewable even when they are provided with a hypothetical reduction of 25% in their electricity bill. Hence, it is important to underline the fact that the main motive of opposition is not related with cost considerations. Rather, as revealed by the open-ended follow-up questions, a large part of the con-renewable individuals do not perceive the renewable energy sources as expensive, but rather, as inefficient and unable to meet a future energy gap of the country.

The opponents of the nuclear energy seem to be persistent in their position as well. Regardless of a hypothetical decrease in the energy prices, the con-nuclear group is likely to be wealthy, less optimistic

about the future of the environment and about technological solutions to environmental problems. They are more likely to have been living in urban centers of the country and are likely to be more concerned about the environmental problems of the country.

These findings indicate that the opposition against coal power plants is so common and so often stated by the respondents (82.9% of the whole sample) that the model as a whole for the initial choice does not provide any relevant information about the determinants of these preferences (as can be seen from the large p-value of the model). But the model for the persistent choice provides significant results: The probability of finding an average person opposing persistently against coal investments gets higher, the less the respondents' environmental activism, the higher the concern for energy conservation, and the higher the age and level of education. However, being female decreases the likelihood of persistent opposition against coal. The respondents persistently opposing coal investments are also unlikely to prioritize economic objectives over environmental objectives.

Respondents opposing hydroelectric power generation are likely to be older and to be more nature-friendly. Respondents persistently opposing hydroelectricity are, in addition to these characteristics, more likely to be better educated. It is interesting to note that age of the respondents matters almost only for the con-hydroelectricity group. That might be related to the fact that older generations have been exposed to the developmentalist discourse of the 1950s-60s of which an important element has been hydroelectricity investments more than the younger generations. However, the younger generations might be more informed about the negative environmental impacts of large dams, and, without having lived in the developmentalist period of the country, they might be more open to such information.

The respondents opposing natural gas power plants are also likely to be more nature-friendly, more wealthy, and more optimistic about the future of the environment in the country. Respondents persistently opposing natural gas investments are also more likely to have achieved a higher educational level.

As can be seen from **Table 6**, the logit model is estimated twice, once for the initial choice and once for the persistent choice for each type of energy investment alternative. Again, the model cannot say anything about the respondents supporting coal investments, but open-ended questions of the underlying reason of this choice reveal the fact that the main motive of the respondents is job creation, having enough resources in the country and low price. But these respondents only account for a small share of the total sample (3.6% and 2.2%, for the initial choice and for the persistent choice, respectively).

The strongest explanatory power of the models can be observed for the renewable sources and the nuclear energy here as well. The likelihood for a person to be a pro-nuclear or a pro-renewable person increases with the level of environmental knowledge. Both groups are probably more aware of the global climate change and of the Kyoto agreement. But the pro-renewable respondent is more likely to be pessimistic about the future of the environment in Turkey, whereas a pro-nuclear person is rather optimistic.

Table 6 Binary logit results of support for energy investment alternatives[a]

Share of the total sample	3.6%	2.2%	37.3%	25.8%	65.2%	52.3%	70.2%	60.4%	7.2%	3.1%
	Coal		**Natural gas**		**Dams**		**Renewable**		**Nuclear**	
	Initial choice	Persistent choice	Initial choice	Persistent choice	Initial choice	Persistent choice	Initial choice	Persistent choice	Initial choice	Persistent choice
Env. knowledge			**, -				***, +	***, +	***, +	**, +
Nature-friendliness									*, +	
Recycling										
Env. activism							**, -			
Env. concern							*, +	**, +	**, -	
Energy conservation										
HH wealth							*, -			
Env. optimism						**, -	***, -	**, -	**, +	**, +
Technology optimism						**, +				
Economy-orientation					**, +	**, +	**, -	**, -		
Age					**, +	**, +				
Urbanity			*, +						**, -	
Women									**, -	
Education										
Pseudo R2	-	-	0.014	-						
	p=0.451	p=0.316		p=0.21						

[a]Dependent Variable: Probability of supporting energy options. Two sets of regressions: One for the initial choice, another for the persistent choice, that is, for the responses of the individuals after being presented with the hypothetical negative consequence. The signs *, **, and *** indicate statistical significance at 10 percent, 5 percent, and 1 percent, respectively. The "+" sign after comma indicates a positive estimated coefficient; the "-" sign after comma indicates a negative estimated coefficient.

An interesting result related with the renewable energy sources is that the pro-renewable individuals are likely to be less wealthy and less environmentally active in addition to higher environmental concern. This rather unexpected result can only be explained after having analyzed the characteristics of the persistent pro-renewable individuals. The persistent pro-renewable individuals do not possess these counter-intuitive characteristics such as less wealth and less environmental activism. Instead, they are more likely to be more knowledgeable about the environment and less optimistic about the future of the environment, more concerned about the present environmental problems and unlikely to prioritize economic objectives over environmental objectives as expected. These results combined with the respondents' answers to open-ended follow-up questions imply that pro-renewable group consists of a sub-group which is less wealthy and less active ib environmental matters, and perceives the renewable sources as abundant in huge amounts in the nature, and hence, as very cheap. That is, underlying reason for their support is rather the perceived low prices. But after they are presented the hypothetical increase in the electricity bill due to utilization of renewable sources, they cease to support the renewables.

In line with the previous results, the likelihood of supporting hydroelectric power investments increases as the respondent gets older. Again, this may be related to the fact that hydroelectricity has been emphasized since the 1950s as a developmental goal of Turkey but is not that emphasized in the last decade, meaning that the older generations perceive hydroelectric power generation as an important energy investment alternative whereas the younger respondents do not evaluate hydroelectricity in a similar manner. Further, persistent support for dams is likely to come from individuals who prioritize economic objectives over environmental objectives, who are less optimistic about the future of the environment, and more optimistic about technological solutions to environmental problems.

The analysis further indicates that with increasing environmental knowledge the likelihood of supporting natural gas investments decreases, whereas with increasing environmental knowledge the likelihood of support for renewable sources and nuclear energy increases.

Table 7 Multinomial logit model for support for energy investment alternatives[a]

[a] The variables are significant at 90% (at least) significance level.
[b] Dependent Variable: Probability of supporting energy investment alternatives as a categorical variable. The multinomial logistic regression allows pairwise comparisons between a base category of the dependent variable (one type of energy investment alternative) and other categories, and shows whether an independent variable significantly increases or decreases the probability of choosing another alternative over the alternative used as the base category. This method therefore enables us to compare support groups separately among themselves.

Respondent Characteristics[a]	Preference Ordering[b]
More environmental knowledge	nuclear ≻ renewables≻ coal, dams, natural gas
More nature-friendliness	renewables ≻ natural gas
More recycling habits	nuclear ≻ natural gas
Less environmental activism	dams, renewables ≻ coal
More concern for energy conservation	nuclear ≻ all other investments
More optimism for the environment	nuclear ≻ renewables
Being more urban	all other investments ≻ nuclear
Being female	renewables, dams, natural gas ≻ nuclear
More environmental concern	renewables, dams ≻ nuclear
Prioritization of economic objectives	natural gas, dams ≻ renewables

The multinomial logit analysis in **Table 7** provides the results for the categorical dependent variable "support for each type of energy investment". The multinomial logit model enables us to compare the likelihood of each type of energy investment relative to each energy investment alternative. For instance, we are able to compare the likelihood of supporting renewable sources with the likelihood of supporting nuclear energy investments as environmental knowledge increases.

Prior to estimating the multinomial model, we run Hausman tests for independence of irrelevant alternatives assumption. The categorical dependent variable, namely the support for energy investments, has to present the respondents independent alternatives, otherwise a multinomial logit model cannot be estimated. The results of the Hausman tests confirm that the alternatives coal, natural gas, dams, renewables, and nuclear are, indeed, perceived by the respondents to be independent of each other.

As can be seen from **Table 7**, the higher the degree of environmental knowledge, the likelier it becomes that an average respondent supports nuclear energy rather than renewable sources, and renewable energy rather than coal, natural gas and hydroelectricity investments. This is an interesting result, since it means that knowledge about global climate change leads people to choose nuclear energy rather than the renewable energy sources although both of them may be utilized as a successful strategy to decrease carbon emissions.

Another result that may be derived from the analysis is that respondents who score higher on the nature-friendliness dimension are more likely to choose renewable energy rather than natural gas investments. The respondents more willing to recycle are more inclined to support nuclear energy rather than natural gas investments. Hence, recycling habits seem to be another distinguishing characteristic of the pro-nuclear respondents along with the energy conservation concern as to be seen in **Table 7**.

Respondents who are less active in environmental matters are likely to support dams and renewable sources rather than coal investments. Intuitively, we might suggest that these rather passive respondents might be the individuals with lower income levels who have had to use coal for heating their houses over longer periods; they are likely to be fed up with the difficulties of heating with coal and are now demanding cleaner and maybe more convenient and cheap resources.

The more optimistic the respondents are about the future of the environment, the more unlikely it gets that respondents support renewable sources. Instead, they seem to be supporting nuclear and natural gas. Respondents prioritizing economic objectives of the country over the environmental objectives are also unlikely to support renewable sources, instead, they are more likely to support natural gas and hydroelectricity investments.

Being more urban, being female and expressing more concern for the environment all reduce the probability to support nuclear energy investments. Instead, being female increases the likelihood of supporting "soft" energy investments such as renewables, dams, and hydroelectricity. More environmental concern increases the probability of supporting renewable sources and dams.

5 Conclusion

Our analysis of the citizens' energy preferences in Turkey revealed the fact that energy preferences are strongly shaped by environmental attitudes and energy-related behavior rather than socio-demographics, although in some cases like dams, indeed, age of the respondents matters, or for nuclear, gender matters. However, the most important determinants or predictors of the energy preferences are to be found in energy- and environment-related characteristics of the respondents. One of the most important determinants of energy preferences is environmental knowledge, which can heavily be influenced by media, education, and informative campaigns of the NGOs or the government.

Our analysis was able to eliminate the impact of the prices on the preferences and analyzed the remaining predictors of citizens' energy preferences. This is undertaken due to the fact that the government may eliminate the price effect to some extent by subsidizing each energy alternative, although from a market-efficiency perspective this is not always desirable. We found out that the price effect was not that strong for the opposition against nuclear and renewable sources; the strongest persistent opposition was to be seen for both types of these energy alternatives. The most persistent support was observable for the renewable sources, which remained largely unaffected by a hypothetical price increase scenario compared to the other types of energy investments. Instead, the open-ended follow-up questions revealed the tendency that the con-renewable group's motive for opposition is not much related with prices, but with perceived inefficieny of the renewable energy sources and their perceived inability to meet future energy gap of the country. Hence, we can optimistically conclude that there might be room for creating a larger base for the renewable energy sources by informing the public about the huge renewable energy potential of the country and about the recent advancements in terms of renewable energy technology.

A striking result that has to be emphasized is that the respondents supporting nuclear energy and/or supporting renewable energy do possess a high level of environmental knowledge. That is, being informed about environmental pollution and global climate change may lead the respondents to support either of these two energy options. This reflects the divide between the "environmentalists" related to nuclear energy debate for Turkey.

One of the most important strengths of the study is adoption of a multinomial logit analysis, which has not been utilized in the energy preferences literature so far, despite the fact that it is very useful to make rankings among energy alternatives based on the characteristics of the respondents. One important result that may be derived from the multinomial logit analysis is that, as already mentioned, more environmental knowledge leads people to prefer nuclear energy over all other alternatives, including renewable energy. Further, as may be expected, women are more inclined to prefer "softer" energy sources such as natural gas, dams and renewable sources over nuclear energy, which may be perceived to be more risky.

All in all, our study has been a first exploratory research into the analysis of the energy preferences in Turkey, in which we were able to construct a scientific base for the energy-related discussions present in

the country. The analysis revealed many interesting results which can provide new insights into the preference formation regarding energy investment preferences of citizens. By incorporating more individual-specific independent variables related with environmental attitudes and behavior, we were able to explain citizens' preferences for energy investment alternatives more thoroughly and were able to demonstrate a possible call for a "time for change" in the energy investment alternatives of the government. A bottom-up energy policy of the government would require a restructuring of the energy mix towards renewable sources, but, of course, the rather wealthy and possibly politically more influential opponents of the renewable energy have to be convinced of the efficiency and other advantages of the renewables as well. When the percentages of support and opposition for nuclear energy are considered, it is clear that the government's emphasis on the necessity of the nuclear energy as the only feasible option towards the solution of climate change and a possible future energy crisis is likely to continue creating much controversy.

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References

Aitken, M., 2010. Why we still don't understand the social aspects of wind power: A critique of key assumptions within the literature. Energy Policy, 38, 1834-1841

Ansolabehere, S. and Konisky, D. M., 2009. Public attitudes toward construction of new power plants. Public Opinion Quarterly, 1-12

Ansolabehere, S., 2007. Public attitudes toward America's energy options: Insights for nuclear energy. MIT Center for Advanced Nuclear Energy Systems, MIT-NES-TR-008

Batley S. L., Colbourne, D., Fleming, P. D., Urwin, P. 2001. Citizen versus consumer: challenges in the UK green power market. Energy Policy 29, 479-487

Bolsen, T. and Cook, F. L. 2008 The polls-trends. Public Opinion on Energy Policy: 1974-2006. Public Opinion Quarterly, 72 (2)364-388

Ek, K. 2005. Public and private attitudes towards "green" electricity: the case of Swedish wind power. Energy Policy 33, 1677-1689

Farhar, B. 1993. Trends in public perceptions and preferences on energy and environmental policy. National Renewable Energy Laboratory

Farhar, B. 1996. Energy and the environment: the public view.REPP issue brief number 3

Greenberg, M. 2009. Energy sources, public policy, and public preferences: Analysis of US national and site-specific data. Energy Policy, 37, 3242-3249

Ladenburg, J., 2010. Attitudes toward offshore wind farms – the role of beach visits on attitude and demographic and attitude relations. Energy Policy, 38, 1297-1304

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