WILLINGNESS TO PAY FOR GREEN ENERGY DEVELOPMENT: A CASE OF GEORGIA

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Abstract
The transition to green energy is considered a necessary condition for sustainable and inclusive development. In this regard, it is necessary to intensify the efforts of the entire society. Household decisions are particularly important as they are the end users of green transformation and have the power to facilitate or hinder the process. The purpose of the study is to identify the awareness and willingness of households to participate in green transformation in Georgia. A study of the willingness and amount of payment for the development of green electricity was chosen as a specific tool. The survey results show that out of 508 data collected, 67.7% of respondents are willing to pay an additional monthly fee along with their existing electricity bill and average WTP value was GEL 15.86 (approx. $6) per month. Based on the results of the research, policy recommendations for the development of green energy were developed, among which the activities of the media and the government implementation of mass propaganda activities are of particular importance.

Key words: *Contingent valuation method; Georgia; Green energy; Logit; Multiple regression model; Willingness to pay*

JEL Classification: *P28, Q28, Q48, Q51, Q58.*

I. INTRODUCTION

Global warming and environmental degradation have a negative impact on human health and well-being. According to the International Energy Agency (IEA, 2016), approximately 18,000 people die every day due to air pollution. Additionally, the World Health Organization has reported that environmental degradation (especially air pollution) causes far more deaths each year than fatal diseases (WHO, 2016).

Considering the current situation in the world, replacing fossil energy sources (coal, oil, gas) with clean, green, safe and efficient energy supply systems have become the main goals of sustainable development around the world. In order to reduce the negative impact on the environment, various international negotiations, including the Paris Agreement, are discussing the replacement of traditional fossil fuels with renewable – green energy resources (JOVANOVIĆ & Ilić, 2017). In addition, the transition to green energy is considered a necessary condition for sustainable and inclusive development.

Observing the processes taking place in the world recently, one can see two main determining factors for the need for green transformation: environmental and economic-political. From an environmental perspective, global warming caused by environmental pollution threatens people's lives, and from a political perspective, the issue of economic energy dependence threatens the security of sovereign states.

Since the 1980s, despite multiple global climate agreements, carbon dioxide emission levels have continued to rise, with the exception of disruptions caused by the COVID-19 pandemic ((Ray, Singh, Singh, Acharya, & He, 2022; GERADZE, 2024). An important fact is that under international climate agreements, emissions reduction commitments are largely voluntary and performance-based (POPESCU, 2017). Consequently, such policies brought neither benefits in terms of reducing carbon dioxide emissions nor any punitive measures for states that violated the agreement (Behera, Haldar, & Sethi, 2023).

It is therefore unrealistic to expect that international policy can achieve a green transformation on its own. In addition to the participation of governments, there is a need to develop policies that integrate non-state actors. These include environmental non-governmental organizations, as well as other forces operating in the economy, including businesses, investors and households. It will be interesting to see what factors influence the decisions of the mentioned forces to promote green transformation (ANGHELUȚĂ, CRISTU, & CRISTU, 2017). Household decisions are especially important because they are the end users of the green transformation and have the power to facilitate or hinder the process. Therefore, the purpose of the article is to identify the awareness and willingness of households to participate in the green transformation in Georgia.

II. EMPIRICAL ESTIMATION METHODOLOGY

In this article, the Contingent Valuation Method (CVM) has been used and the awareness and attitude of the society towards environmental pollution and green energy has been identified. More specifically, household willingness to pay (WTP) for green electricity development was studied. In early CVM studies, scientists preferred to use the face-to-face survey method (Arrow, et al., 1993; Guo, et al., 2014). However, modern studies show that more and more researchers use online survey methods (Murakami, Ida, Tanaka , & Friedman, 2015; Gamel, Menrad, & Decker, 2017; Tan & Lin, 2019). Moreover, Nielsen (2011) compared the results of an online survey and a face-to-face survey and concluded that the two survey methods did not have a statistically significant difference in mean and median scores (Nielsen, 2011). In addition, it worth noting that an online survey is much more flexible and cost-effective. In addition, using an online survey, it is possible to eliminate the possibility of the interviewer influencing the answers. Therefore, the present survey was administered online from June 2023 to September 2023. An open-ended question technique was used to investigate WTP. The data was analyzed using the statistical program SPSS-26.

Survey Design. At the beginning of the questionnaire, the purpose and goal of the research were explained to the respondents. The survey was divided into three main parts. The first part investigated the respondents' attitude towards environmental issues. Also, studied their beliefs on how effectively the government managed environmental issues. In this section, questions regarding the awareness of green energy were presented too; in order to determine whether the respondents knew what the term "green energy" was and if they knew the types of renewable energies.

The main research question was presented in the second part of the survey. Respondents were presented with a specifically selected hypothetical situation. After that the respondents were asked the following question:

"In order to fully replace polluting electricity with green electricity, would you pay a certain amount extra with your monthly utility bill?"

In order to reduce the strategic inaccuracy, it was explained to the respondents that they should take into account their monthly income and that participating in the project would reduce the number of other products or services they consume. The part of the respondents who answered the above question positively; after that, were asked to indicate the maximum amount (in GEL) that they could pay every month. Since the open-ended method of obtaining answers was used in the questionnaire, the amount provided by the respondents can be interpreted as the willingness to pay (WTP) of the respondents to receive green electricity.

The third part of the questionnaire collected the sociodemographic data of the respondents. For example, they were asked about their gender, age, education level, number of family members and monthly disposable income of the family. Table 1 presents the general characteristics of the respondents.

Table 1: Statistical characteristics of the interviewed respondents

		N	(%)
Gender	Male	220	43.3
	Female	288	56.7
Age	<15	12	2.3
	15-24	61	12.0
	25-44	326	64.2
	45-59	76	15.0
	>59	33	6.5
Education	High school and below	84	16.5
	Bachelor	271	53.4
	Master or above	153	30.1
Household monthly income (GEL)	<800	71	14.0
	800-1400	105	20.7
	1401-2000	73	14.4
	2001-2600	72	14.2
	2601-3500	58	11.4
	>3500	129	25.4

III. RESULTS AND DISCUSSIONS

As a result of the survey, a total of 521 data were collected, of which 508 data were suitable for research, with the effectiveness rate of 97.5%. The main reason why some data were omitted was because of conflicting responses. Table 2 presents the descriptive statistics of the dependent and independent variables used in the study. To analyze the collected data the following econometric models were used: binary logistic (Logit) and multiple

linear (MLR) regression analyses. Logistic regression was used to determine whether the Household was willing to participate in green electricity development and what factors determined the likelihood of participation. While multiple linear regression was used among respondents with a positive answer to determine the factors that significantly explained the amount of money paid (WTP) for green energy development. From the Table 2, 48.8% of respondents know what green energy means and can distinguish between types of renewable energy. Nevertheless, 67.7% of the respondents (344 people) are ready to provide some financial support for the development of green electricity in Georgia. In addition, the monthly average indicator of financial support among the respondents was 15.86 GEL, which is equivalent to 6.05 US dollars. In the case of Georgia, this figure is 1.09% of the average monthly household income.

Table 2: Descriptive Statistics of dependent and independent variables

Variable	Definition	Mean	Std. Dev.	Min.	Max.
Dependent Variables					
WTPYN	Dummy variable, 1 = if willing to pay for green electricity development; 0 = if does not want	0.677	0.468	0	1
WTP	Amount of payment for the development of green electricity (in GEL)	15.856	29.955	0	300
Independent Variables					
ENVIMP	Interest in environmental issues	3.462	1.250	1	5
GOVB	Trust in government to manage environmental issues	3.24	1.406	1	5
KNOW	Dummy variable, 1= if knows about renewable energy types; 0 = if does not know.	0.488	0.500	0	1
GEN	dummy variable, 1= male; 0= female	0.433	0.496	0	1
AGE	Age of respondents	3.112	0.783	1	5
FS	Family size	3.738	1.216	1	6
EDU	Educational level	2.135	0.670	1	3
HINC	household monthly income level	3.645	1.800	1	6

Initially, a binary logistic regression (Logit) was conducted to study what factors determined the probability of a positive response to financial participation in a green electricity development project. Chi-square test of the regression showed that the model is statistically significant and adequately described the data(χ^2 (8, N=508) = 137.68, P < 0.001). In the second stage, multiple linear regression analysis (MLR) was performed. The selection of the MRL model was represented by the part of the respondents who gave a positive answer to the financial participation in the green electricity development project; 344 respondents in total. The MLR regression model was statistically significant (ANOVA, F(8, 335) = 26.23, p<0.001). Table 3 presents the coefficients of both regressions and their statistical significance levels at 10 percent, 5 percent, and 1 percent.

The results show that environmental concern (ENVIMP), trust in government (GOVB) and age (AGE) have statistically significant effects on WTP in both regressions. Public belief in the government's ability to control air pollution is not only positively related to public attitudes toward green electricity, but also positively affects their willingness to pay (WTP). A similar attitude has been confirmed in China, specifically in Liu et al.'s (2013) study (Liu, Wang, & Mol, 2013), according to which the more respondents trust the government, the higher their payment amount. Regarding age (AGE), the coefficient in the logistic regression positively explains the willingness to pay, while in the MLR model it inversely explains the amount of payment. More specifically, as people get older, they are more supportive of green electricity development, which can be explained by their higher

awareness of family and health-related issues. However, the exact opposite relationship was observed in the MLR model, which can be explained by the fact that older respondents have a more cautious attitude towards financial resources. That is, their WTP decreases with age, even though they support the development of green electricity. A similar attitude was found, for example, in studies conducted in China and South Africa (Kim, Park, Kim, & Heo, 2012; Chan, Oerlemans, & Volschenk, 2015).

Table 3: Comparison of results of logistic and MLR models

Variables	Logit model	MRL model
ENVIMP	0.194**	3.932***
GOVB	0.645***	5.618***
KNOW	1.434***	-0.553
GEN	-0.140	5.154***
AGE	0.406***	-4.071***
FS	0.213**	-0.307
EDU	0.145	1.850
HINC	-0.129	2.830***
Constant	-4.284	-17.458
Pseudo R^2/Adjusted R^2	0.332	0.354
Total	508	344
* Significance at 10 % level, ** Significance at 5 % level, *** Significance at 1 %.		

Knowledge of renewable energies (KNOW) and number of family members (FS) statistically significantly explain respondents' financial participation in the logit model, but these variables do not statistically significantly explain the amount of their financial participation (WTP) in the MRL model. As Table 3 shows, respondents who know about renewable and green energies are more likely to participate in a green electricity project, although according to the second model, their level of knowledge does not statistically significantly explain the amount of payment. Similarly, the number of family members (FS) has a positive effect on the probability of participating in a green electricity development project, but their WTP is not statistically significantly different from the mean WTP. A similar result was obtained by Guo et al. (Guo, et al., 2014) and Lee and Heo (Lee & Heo, 2016), although a different result was found by Bigerna and Polinori (Bigerna & Polinori, 2014) and Chan et al. (Chan, Oerlemans, & Volschenk, 2015).

In multiple linear regression (MLR), respondents' gender (GEN) and monthly household income (HINC) statistically significantly explain the amount of payment (WTP) for green electricity project, but these factors in logistic regression do not give us statistically significant results. Specifically, men's WTP for green electricity development is higher than women's. Also, the higher the household income, the higher the willingness to pay (WTP). Regarding education level (EDU), we did not obtain statistically significant results in any of the models.

Differences between willingness to pay and amount to pay for green electricity development can be partially explained by the fact that logistic regression, which examines the probability of willingness to pay, does not need to consider the respondent's budget constraints in the answer, while multiple linear regression, which examines payment quantity, requires respondents to be guided by their monthly household income (Uehleke, 2016).

IV. CONCLUSION

The paper examines the attitude of Georgian household to the green transformation process in order to identify effective policy tools to increase their involvement. The paper used the contingent valuation method (CVM) and open-ended question (OE) technology to study the willingness to pay (WTP) of the population of Georgia to stop climate change and improve the ecological situation. The study of the willingness and amount of payment for the development of green electric energy was selected as a specific tool.

Initially, the likelihood of financial participation in the green electricity development project was investigated by means of logistic regression - "Does Georgian society have a willingness to pay (WTP)?", and then, by using the multiple linear regression, the amount of financial participation was studied - "What amount does Georgian society is a willingness to pay (WTP)?". The monthly income of the family and trust in the government can be separated from the given results. Monthly income and the degree of trust in the government, both determine of financial participation in a green electricity project. Of the two, raising trust in government is usually easier to achieve than raising revenues.

Based on the study, mainly two recommendations were developed for economic policies promoting the development of green energy in Georgia:

1. The results of this study showed that more than half of the respondents do not know what the characteristics of renewable energy sources mean. We take into account that knowledge of the renewable resources had a statistically significant positive impact on the willingness to participate in the green energy development process. Therefore, active measures need to be taken to increase public awareness about green energy and promote its benefits. Women and relatively elderly people can be selected as the target group, since they have a relatively lower average level of willingness to pay and payment amounts (WTP). One effective way to raise awareness is through the media, but in Georgia media representatives themselves do not have adequate level of awareness (Pignati 2022). This can be explained by the lack of demand for green products. It should be noted that global interest in green energy is not yet driven by economic efficiency, and without appropriate political intervention, the market will not be able to carry out the "green revolution" on its own (Erkomaishvili & Khurtsia, 2023).

2. Increasing beliefs in the government's activities in environmental matters will significantly increase the desire of the population to participate in the development of green energy and the amount of financial participation on their part. One way to achieve this goal is through further improvement of Government transparency, which means increasing public awareness of all completed or planned projects, including regular training of government officials to provide environmental performance reports to the public. The commitment of government decisions, widespread advertising and promotion of green energy and other types of events are highly effective. Increasing the transparency of government decisions can encourage more people to contribute and actually participate in green energy development.

Research limitations and future recommendations. The study was conducted from June 2023 to September 2023. During this period, one of the biggest tragedies of recent years took place in Georgia, specifically in Shovi, and climate change was named as one of the main causes in the report prepared by the National Environment Agency of Georgia (National Environment Agency 2023). Taking this into account, it is likely that there was an increased sensitivity of the population to the mentioned issue, which could have caused an overestimation of the willingness to pay and the amount. Also, the Contingent Valuation Method (CVM) is used in the research, but the results obtained using other methods are also relevant; for example, the Choice Experiment (CE). In addition, the present study used an open-ended question to determine the amount of payment (WTP), but it is not known what the results of using a closed-ended question would be; so future empirical studies of the households' willingness to pay (WTP) for the development of green energy in Georgia are needed, which will compare the results obtained by different methods and fill the existing gap.

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