Forman Journal of Economic Studies
Vol. 18(2), 2022 (July–December), pp. 01-20 DOI: 10.32368/FJES.20221806

Willingness to Pay for Fixed Charged Electricity Connection in Azad Jammu and Kashmir

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Abstract

The study's objective is to investigate the willingness of consumers to pay for alternate fuel sources, such as fixed charge electricity connections, in the Neelum district of Azad Jammu and Kashmir, Pakistan. The data was collected through a survey using questionnaires from four villages in the Neelum district in 2018. Questionnaires were collected from three hundred and fifteen household representatives, out of which two hundred and twenty-five questionnaires were selected. Thirty questionnaires were excluded as household representatives were not permanently residing in the area. Neelum district of Azad Jammu and Kashmir is blessed with natural resources such as forest, water, minerals, etc. Households generally use wood as a fuel source. Using exploratory analysis and a binary logistic model, the study revealed that consumers with higher income and expenditure on fuel are more inclined to pay for fixed charged electricity connections. Furthermore, households with a high level of education were also ready to pay for fixed charged electricity connections. We also concluded that old and young consumers have almost the same preferences. Government should initiate awareness campaigns to educate residents about the conservation and protection of the forest.

Keywords: Energy, Willing to pay, Consumer behavior

JEL Classification: P28, Q51, Q42

1. Introduction

Human life is somehow dependent on the consumption of fuel. People have adopted several choices for fuel consumption to meet their daily requirements, which can be classified based on the type of fuel available and the purpose of consumption. The most common purpose of fuel consumption is domestic usage. In northern areas of Pakistan, especially in Azad Jammu and Kashmir, households

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rely on forest wood or timber to meet their domestic fuel requirements due to easy access compared to other fuel sources. According to the Global Forest Watch report, "Azad Jammu and Kashmir have lost 395ha of tree cover from 2000 to 2020, equivalent to a 0.16% decrease in tree cover". Continuous usage of these natural resources without any sustainable plan will have environmental implications and resource scarcity in the future, but it will also have severe consequences on human life and the natural ecosystem.

To analyze future resource scarcity and propose a viable solution, it is essential to target an area like Neelum valley to analyze people's willingness to pay for alternate fuel sources. Neelum valley is a mountainous terrain along the control line between Pakistan and India and is sensitive to landslides and cross-border flares up from the other side. Moreover, the valley is also cut off from the world due to snowfall. These three factors make the valley vulnerable regarding food and energy security. Therefore, natives are dependent on indigenous resources to meet their needs.

Consequently, it is crucial to have a local fuel alternative to forest wood in this scenario. As the valley has abundant water resources and hydroelectric power plants such as the Neelum Jhelum Hydropower plant (969 MW) built on river Neelum downstream, Jagran-1 (30.4MW) and other small hydropower projects have been established on the water resources in the valley, which indicates the considerable potential of electricity generation in the area that can be used to provide a local alternative to an energy security issue in the area. Such a solution will also help protect the forest, a valuable natural resource. But on the other hand, water resources such as rivers depend on glaciers melting. Forest in the region keeps the temperature down, resulting in glacier formation. The decline in forest cover will severely impact the ecosystem of the region.

Therefore, this study has been designed and executed to understand the willingness of households to pay for alternate solutions such as Fixed Charged Electricity Connection (FCEC) and the factors that affect their willingness, which will help present a viable policy solution. Very few studies have analyzed environmental and resource concerns in developing countries. This study is one of the initial studies examining willingness to pay in Azad Jammu and Kashmir.

Willingness to Pay (WTP) is a widely used indicator of public attitude towards environmental and natural resource concerns. This method helps devise a policy to divert consumers towards a more sustainable option. Most studies regarding willingness to pay have been conducted in developed countries.

Baltas and Doyle (2001) stated that random utility models best describe discrete choice behavior. However, in our analysis, willingness to pay has yes/no choices, making it a discrete variable. As per the Fishbein-Ajzen model, attitudes are determined by beliefs, impacting behavior. Identifying preferences and options are related to random utility theory, as in the work of Abdullah and Jeanty (2011). Furthermore, willingness to pay for alternate fuel sources indicates demand for that fuel source. Consumer theory suggests that willingness to pay is the starting point for the demand curve. The marginal benefit of the consumer reflects the consumer's willingness to pay. Moreover, the consumer's rational behavior makes him choose the most preferred bundle, maximizing a consumer's utility. Therefore, the amount consumed is willing to pay for increased utility is their willingness to pay.

Three hypotheses regarding willingness to pay are tested with the help of the collected data:

- Households have some willingness to pay for Fixed Charged Electricity Connections.
- Well-off individuals have a higher willingness to pay for FCEC.
- Willingness to pay for FCEC is higher among educated households.

This work is divided into six sections. A review of the previous literature is presented in Section 2. Data collection and limitations have been discussed in Section 3. Section 4 presents the descriptive analysis of the variables. An econometric analysis has been shown in Section 5. Finally, the study is concluded in Section 6.

2. Literature Review

Studies have been conducted in different countries to analyze consumer behavior, and willingness to pay for sustainable alternatives to natural resources Consumers were willing to pay for renewable energy sources in Japan (Nomura and Akai, 2004), England (Longo et al., 2007; Scarpa and Willis, 2010), Greece (Damigos et al., 2009; Ntanos et al., 2018; Karasmanaki and Tsantopoulos, 2019), Crete (Zografakis et al., 2010), Cambodia (Yoeu and Pabuayon, 2011), U.S. (Murakami et al., 2014), South Korea (Lee et al., 2017), China (Ali et al., 2019), Poland (Pyzalska, 2019), Turkey (Muhammad et al., 2020), Nigeria, (Ayodele et al., 2021), Myanmar (Numata et al., 2021), Netherlands (Pleeging et al., 2021), Aguascalientes, Mexico (Martinez and Nunez, 2021). In Pakistan, (Ifat et al., 2020; Iqbal et al., 2020) concluded that people are willing to pay for renewable or green energy sources. Affordability and cost-saving factor significantly impact the

decision of the household. But generally, cost to produce renewable energy is relatively higher than production through other sources (Nomura and Akai, 2004).

In particular, household decisions regarding solar, wind, biomass, and other renewable energy sources have been studied. Numata et al. (2021) and Borchers et al. (2007) have compared various renewable energy sources. Both studies indicate that people prefer solar energy to other renewable energy sources. Moreover, they were less willing to pay for biomass and hydropower resources. On the other hand, Entele et al. (2020) summarised that households preferred grid line electricity over solar electricity irrespective of payment method, whereas residents were more inclined to pay monthly installments than lump-sum amounts. Reed and Scott (2014) identified that people were reluctant to use large windmills to generate renewable energy through the wind. People are willing to use microgeneration technology to produce renewable energy but not ready to adopt it as a policy, as Scarpa and Willis (2010) suggested.

Furthermore, Adekunle (2006), Gatto et al. (2014), Hjerpe and Hussain (2016) suggested that individuals were willing to make a monetary payment for forests and the plantation of trees because of their benefits. However, the decision depends on the awareness of individuals regarding the issue. Yoeu and Pabuayon (2011) suggested that respondents were willing to pay for the conservation of forests. Consumers were ready to pay through a mutual community fund headed by the village leader, and farmers were ready to contribute monthly to commodity mutual funds. Gatto *et al.* (2014) analyzed that respondents were willing to pay for carbon sequestration for the forest ecosystem. Furthermore, individuals were unwilling to pay for landscape and other ecosystem services.

Education and awareness regarding the importance of renewable energy are major factors driving consumers' decisions. (Guo et al., 2014; Lee et al., 2017; Ntanos et al., 2018; Jin et al., 2019; Karasmanaki and Tsantopoulos, 2019; Ayodele et al., 2021; Iqbal et al., 2022). People who were more hopeful and didn't deny the severity of the issue were more willing to pay for sustainable energy usage. Awareness regarding the issue and worry were positively related to WTP, whereas lack of concern and understanding were negatively linked to the WTP (Pleeging et al., 2021). People with environmental awareness are willing to pay more for a 20% share of renewable energy sources. (Zografakis et al., 2010; Iqbal et al., 2020; Muhammad et al., 2020; Ayodele et al., 2021) have emphasized the role of income in consumers' decisions regarding willingness to pay.

Renewable energy initiatives by the government are also an important factor in people's choices regarding renewable energy (Lee et al. 2017). Ali et al. (2019)

assessed that households were ready to conserve energy and pay for renewable energy with an efficient reward system initiated by the government. However, there are more chances for people to be more willing if the contribution by the people is mandatory rather than voluntary, as suggested by Akcura (2013). Analyzing the willingness to pay for renewable fuel sources in resource-rich areas, particularly Pakistan, is critical to preserve natural resources. Therefore, the Neelum district of Azad Jammu and Kashmir is a feasible targeted area where the forest is essential for maintaining an ecological balance. We intend to examine consumers' willingness to pay for alternative fuel sources other than wood to protect the forest in the Neelum district of Azad Jammu and Kashmir. Using wood as a fuel at the current rate may bring irreparable loss to the ecosystem.

3. Data Collection

Primary data has been collected from 315 households in four villages of the Neelum district of Azad Jammu and Kashmir. Two hundred twenty-five questionnaires were selected, but 30 were excluded because the respondents were not permanently residing in the area. Therefore, 195 questionnaires were considered for the study. Previous literature has also taken such respondents (Entele, 2020). The questionnaire was divided into two parts. In the first part, respondents were asked about general information, including age, the income of all household members, gender and employment status of each member, and sources of income from rent, agriculture, transport, profit, and pension. These attributes of the respondents are essential to analyze the different trends in the decision-making to pay for fixed charge electricity connections. The second section of the questionnaire comprised seven questions and inquired about people's willingness to pay for fixed charge electricity connections. The information asked in this section was related to the current fuel source and acceptance of FCEC. Furthermore, respondents were also inquired about their willingness to pay an additional amount compared to the current cost of the fuel.

The questionnaire was designed carefully to encompass the individuals' characteristics in the area. Efforts were made not to include any question irrelevant to the life of the respondents. The questionnaire was designed in English, and many people in the area were unfamiliar with the language. Therefore, interviews were conducted in Urdu and Pahari language. Initially, people were reluctant to disclose their choices. But after realizing the importance of the survey, they freely stated their preferences. The study was restricted to a small area due to various constraints such as funds, time, and accessibility to remote areas of the valley.

4. Descriptive Analysis

In this section, data has been analyzed descriptively using cross-tabulation and chi-square statistics to examine the relationship between the attributes of individuals and their willingness to pay. Initially, we explore factors influencing wood consumption and willingness to pay decisions. Factors that may affect the fuel choice are income, energy expenditure, the household head's age, and household members' education. Table 1 presents the relationship between income (monthly per capita) and fuel choice (whether to consume electricity or not), and willingness decisions, i.e., willingness to accept FCEC as a suitable alternative to a wood, willingness to stop consuming wood on the provision of FCEC, willingness to pay equal to current fuel expense and the willingness to pay an additional amount over and above current fuel expenditure. Statistics in column 1 of Table 1 indicate that respondents with low per capita income are more inclined to use wood as a fuel source, whereas respondents with high capita income preferred to use alternate fuel sources. This trend indicates that the poor economic status of the household compels them to use wood as fuel. During the survey, it was observed that most low-income families use wood because the only cost incurred is the time required to collect branches from the forest to the home. Furthermore, chi-square statistics are significant at a 5% level of significance, indicating an association between per capita income and decisions regarding fuel choice.

Table 1. Relationship of Income with Choice of Fuel Type and Willingness Decision

Per capita monthly income of a household in rupees	The user of the fuel type			Willingness to accept FCEC as a Suitable alternative to wood			Willingness to stop consuming wood on the provision of FCEC			Willingness to pay equal to current fuel expense			Willingness to pay an additional amount over and above current fuel expenditure		
	Non-wood	Wood	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total
Below 5000	5 (15)	27 (85)	32	4 (15)	22 (85)	26	4 (17)	20 (83)	24	5 (19)	21 (81)	26	1 (5)	23 (95)	24
5000 to 9999	36 (55)	29 (45)	65	10 (34)	19 (66)	29	8 (26)	23 (74)	31	9 (31)	20 (69)	29	1 (3)	32 (97)	33
10000 to 14999	24 (53)	21 (47)	45	7 (46)	9 (54)	15	7 (34)	14 (66)	21	7 (33)	14 (67)	21	2 (10)	17 (90)	19
15000 to 19999	15 (71)	6 (29)	21	3 (33)	6 (66)	9	2 (34)	4 (66)	6	1 (17)	5 (83)	6	0 (0)	6 (100)	6
20000 and above	23 (71)	9 (29)	32	5 (38)	8 (62)	13	5 (50)	5 (50)	10	4 (40)	6 (60)	10	1 (10)	9 (90)	10
Total	103	92	195	29	63	92	26	66	92	26	66	92	5	87	92
P-value of $\chi 2$		0.000			0.001			0.008			0.002			0.009	

Note: Brackets indicate percentages from row totals.

Table 2. Relationship between Energy Expenditure and Choice of Fuel Type

Per capita monthly energy expenditure in rupees	Non-wood user	Wood user	Total
Below 500	5	27	32
	(15)	(85)	
500 to 999	36	29	65
	(55)	(45)	
1000 to 1499	24	21	45
	(53)	(47)	
1500 to 1999	15	6	21
	(71)	(29)	
2000 and above	23	9	32
	(71)	(29)	
Total	103	92	195
P-value of $\chi 2$ statistic	0.000		

Note: Values in parentheses indicate percentages from row totals.

Table 3. Relationship of Age of Household Head with Choice of Fuel Type and Willingness Decision

Years of age of household head	The user of the fuel type			Willingness to accept FCEC as a Suitable alternative to wood			Willingness to stop consuming wood on the provision of FCEC		
	Non-wood	Wood	Total	Yes	No	Total	Yes	No	Total
26-35	17	24	41	9	15	24	8	16	24
	(41)	(59)		(38)	(62)		(33)	(67)	
36-45	40	33	73	8	29	37	7	27	34
	(54)	(46)		(22)	(78)		(20)	(80)	
46-55	37	23	60	7	12	19	6	16	22
	(61)	(39)		(37)	(63)		(27)	(73)	
56-65	8	11	19	4	7	11	4	7	11
	(42)	(58)		(36)	(64)		(36)	(64)	
66-75	1	1	2	1	0	1	1	0	1
	(50)	(50)		(100)	(0)		(100)	(0)	
Total	103	92	195	29	63	92	26	66	92
$\chi 2$ (P-value)		0.287			0.438			0.264	

Note: Values in parentheses indicate percentages from row totals.

Table 4. Relationship of Average Years of Education with Choice of Fuel Type and Willingness Decision

Average Years of schooling of the household	The user of the fuel type			Willingness to accept FCEC as a Suitable alternative to wood			Willingness to stop consuming wood on the provision of FCEC		
	Non-wood	Wood	Total	Yes	No	Total	Yes	No	Total
0	2	1	3	0	1	1	0	1	1
	(67)	(33)		(0)	(100)		(0)	(100)	
1-9	49	71	120	19	48	67	17	52	69
	(40)	(60)		(28)	(72)		(24)	(76)	
10-11	14	5	19	2	3	5	2	2	4
	(73)	(27)		(40)	(60)		(50)	(50)	
12-13	18	4	22	3	4	7	2	3	5
	(81)	(19)		(42)	(58)		(40)	(60)	
14 or above	20	11	31	6	6	12	5	8	13
	(76)	(24)		(50)	(55)		(38)	(62)	
Total	103	92	105	29	63	92	26	66	92
$\chi 2$ (P-value)		0.001			0.034			0.009	

Note: Values in parentheses indicate percentages from row totals.

Table 5. Relationship of Maximum Years of Education with Choice of Fuel Type and Willingness Decision

Maximum Years of schooling of the household	The user of the fuel type			Willingness to accept FCEC as a Suitable alternative to wood			Willingness to stop consuming wood on the provision of FCEC		
	Non-wood	Wood	Total	Yes	No	Total	Yes	No	Total
0	2 (67)	3 (33)	3	0 (0)	1 (100)	1	0 (0)	1 (100)	1
1-9	3 (12)	21 (88)	24	5 (25)	15 (75)	20	4 (18)	18 (82)	22
10-11	10 (43)	13 (57)	23	4 (31)	9 (69)	13	3 (25)	9 (75)	12
12-13	14 (43)	18 (57)	32	6 (31)	13 (69)	19	6 (33)	12 (67)	18
14 or above	74 (65)	39 (35)	113	15 (38)	24 (62)	39	13 (33)	26 (67)	39
Total	103	92	195	30	62	92	26	66	92
$\chi 2$ (P-value)		0.000			0.019			0.003	

Note: Values in parentheses indicate percentages from row totals.

Table 6. Relationship of Years of Schooling of Spouse of Household Head with Choice of Fuel Type and Willingness Decision

Years of schooling of the spouse of the household head	The user of the fuel type			Willingness to accept FCEC as a Suitable alternative to wood			Willingness to stop consuming wood on the provision of FCEC		
	Non-wood	Wood	Total	Yes	No	Total	Yes	No	Total
0	34 (44)	42 (56)	76	14 (32)	29 (68)	43	13 (30)	29 (70)	42
1-9	3 (15)	17 (85)	20	5 (45)	6 (55)	11	4 (23)	13 (77)	17
10-11	16 (69)	7 (30)	23	2 (25)	6 (75)	8	1 (14)	6 (86)	7
12-13	24 (64)	13 (35)	37	5 (33)	10 (66)	15	5 (38)	8 (62)	13
14 or above	26 (66)	13 (33)	39	3 (20)	12 (80)	15	3 (38)	10 (62)	13
Total	103	92	195	29	63	92	26	66	92
$\chi 2$ (P-value)		0.000			0.025			0.005	

Note: Values in parentheses indicate percentages from row totals.

Table 2 indicates the relationship between energy consumption and fuel choice. Chi-square statistics suggest the relationship is statistically significant. The numeric in the Table demonstrates that households with relatively higher energy consumption rely more on alternative fuel sources than wood. However, this pattern does not hold for all the categories. Table 3 indicates the relationship between the age of the household head and wood consumption and willingness to make decisions. Column 1 of Table 3 indicates the relationship between the age of the household head and wood consumption. Chi-square statistics indicate a weak association between the variables. The decision regarding wood consumption as a fuel source is the same across the young and old generations. Education may serve as an important factor in decision-making regarding wood consumption.

Numeric suggests that an increase in households' average years of schooling results in a declining family's dependence on wood, shown in Table 4. This indicates a household shift towards alternate fuel choices. The relationship between the maximum education of the household (total years of schooling household members attained) and the type of fuel choice and willingness decision is presented in Table 5. Estimates suggest that the relationship among these variables is statistically significant. This signifies that an increase in the maximum number of years of education in the household results in a decline in the use of wood as a fuel source. Table 6 presents the relationship of spouse education with a choice of fuel type and willingness decisions, which indicates a declining percentage of non-wood usage with an increase in the education of the household's spouse. This decline in willingness is due to the already usage of other sources such as LPG, etc. Table 7 shows the relationship between the education of household heads and fuel choice and willingness to make decisions. Chi-square statistics in the Table suggest a statistically significant relationship between wood consumption and the education of household heads at a 5% significance level. Results indicate that households with educated heads are more inclined to use alternate energy sources. Education is an important factor that makes individuals aware of the environmental implications of exploiting resources.

4.1. Factors Affecting Willingness to Accept FCEC as a Suitable Alternative to Current Fuel Source

Fixed charge electricity connection (FCEC) has been suggested as a suitable alternative to wood consumption. Various household attributes play a vital role in the decision-making regarding willingness to pay for FCEC. Estimates in Table 1 suggest that the association between FCEC and per capita income is statically significant. Furthermore, estimates indicate that households with higher per capita income for more willing to opt for FCEC as an alternative fuel choice. Households with better economic conditions consider FCEC a suitable option, as they already use electricity for domestic usage. The relationship between the household head's age and willingness to accept FCEC as an alternative to wood consumption is statically insignificant, suggesting that acceptance of FCEC as an alternate is the same across young and old generations. This relationship is presented in Table 3.

Four variables have been included in the study to analyze the impact of education on willingness decisions. Table 4 to Table 7 show four variables of education and their relationship with the willingness decisions. The presence of an educated spouse of the household head makes them less willing to accept FCEC as a suitable alternate, as indicated in Table 6. Furthermore, Table 7 suggests that

households with better-educated heads were less willing to accept fixed-charge electricity connections, whereas those with educated members were more likely to accept FCEC. This finding shows different preferences of household heads and members of the household. Discussions with the respondents revealed that heads of households who were primary earners were more concerned about expensive electrical appliances and a rise in the cost of electricity in the future. At the same time, educated members were more inclined to save natural resources and free themselves from the hassle of collecting wood.

Table 7. Relationship of Education of Household Head with Choice of Fuel Type and Willingness Decisions

Years of schooling of the household head	The user of the fuel type			Willingness to accept FCEC as a Suitable alternative to wood			Willingness to stop consuming wood on the provision of FCEC			Willingness to pay equal to current fuel expense			Willingness to pay an additional amount over and above current fuel expenditure		
	Non-wood	Wood	total	Yes	No	Total	Yes	No	Total	Yes	No	Total	Yes	No	Total
0	6	14	20	4	10	14	3	11	14	3	11	14	0	11	11
	(30)	(70)		(40)	(60)		(22)	(78)		(22)	(78)		(0)	(100)	
1-9	3	22	25	6	15	21	6	14	20	4	17	21	0	20	20
	(12)	(88)		(40)	(60)		(30)	(70)		(20)	(80)		(0)	(100)	
10-11	20	11	31	2	9	11	2	9	11	5	6	11	1	10	11
	(64)	(35)		(22)	(78)		(19)	(81)		(46)	(54)		(9)	(91)	
12-13	18	12	30	5	8	13	5	7	12	5	7	12	2	10	12
	(60)	(40)		(38)	(62)		(42)	(58)		(42)	(58)		(17)	(83)	
14 or above	56	33	89	12	27	39	10	23	33	9	25	34	2	31	33
	(62)	(37)		(30)	(70)		(31)	(69)		(27)	(73)		(6)	(94)	
Total	103	92	195	29	63	92	26	64	90	26	66	92	5	72	77
P-value of $\chi 2$	0.000			0.010			0.004			0.001			0.006		

Note: Values in parentheses indicate percentages from row totals.

4.2. Factors Affecting Household Willingness to Stop Current Fuel on the Provision of FCEC

Few respondents were unsure about their decision regarding willingness to pay. Therefore, a particular question was asked to analyse their opinion, i.e., willingness to stop current wood consumption on the provision of the FCEC. The relationship between income per capita and the household decision is presented in Table 1, which indicates that households earning higher per capita income were more willing to switch to FCEC if provided than lower-income per capita households. The age of the household head has a statistically insignificant relationship with the willingness to make a decision presented in Table 3. This insignificance indicates that consumption decision is not dependent on the age of the household head.

Furthermore, estimates of four variables for education suggest that the presence of educated members in the family will decline the usage of wood as a fuel source. Education households were willing to switch to FCEC.

4.3. Factors Affecting Willingness to Pay for FCEC Equal to Current Fuel Price

One of the major factors affecting the willingness to pay for FCEC is the income per capita of the household. Estimates in Table 1 suggest a statistically significant association between per capita income and willingness pay for FCEC equal to the current fuel price. Furthermore, percentages suggest that households with higher per capita income are willing to pay the amount for FCEC equal to the amount spent on wood. Age has been dropped from further analysis as the relationship between the willingness decision and age is statistically insignificant. Table 4 shows the relationship between the education of household heads and willingness to pay for FCEC equal to the current fuel expense. Statistics in the Table indicate that as the year of schooling of the respondents' increases, their willingness to pay the amount for FCEC equal to the wood consumption also increases. This estimate is statistically significant at a 5% level of significance.

4.4. Factors affecting willingness to pay for FCEC more than the current fuel price:

To further analyze consumer behavior regarding FCEC, factors associated with the willingness to pay more than current fuel expenditure are discussed, considering the same variables. The income per capita has a statistically significant link with the willingness of the consumer to pay more for FCEC. The estimates in Table 1 suggest that an increase in household income results in a decline in the percentage of households unwilling to pay a higher amount for FCEC. Moreover, the rate of households willing to pay extra amounts increases with the income increase. The association between the education of household heads and willingness to pay an additional amount for FCEC is presented in Table 7. The values in the Table suggest that households, where the education of the head is below 10^{th} grade are not ready to pay an additional amount for FCEC. On the other hand, improving the head qualification makes the household more willing to pay an additional amount for FCEC, indicating that families with educated heads are more willing to pay an amount than the current fuel price. Education brings awareness regarding the importance of natural resources and maintaining the balance of the ecosystem. Therefore, educated households are more inclined towards FCEC than less educated ones.

5. Econometric Analysis

According to consumer theory, the demand for a good or service is the amount they are willing and able to buy. A consumer's willingness to pay is the

starting point of the demand. A rational consumer always opts for the consumption bundle with the highest utility. This makes room for consumer surplus. An extra amount an individual is ready to pay for the enhanced utility is their willingness to pay (Hanley et al., 1998). According to Wedgwood and Sansom (2003), the willingness to pay (WTP) of a consumer can be estimated in three ways:

"…(1) *Observe the prices that people are willing to pay for goods in various markets. (2). Observe individual expenditure of time, money, labor, etc. to obtain goods and avoid their loss. This method might involve an assessment of coping strategies and involve observation, focus group discussion and even household surveys. (3). Ask people directly their willingness to pay for goods and services in the future. First two approaches are based on observation of behavior and are called REVEALED PREFERENCES techniques and third technique is based on STATED PREFERENCES…"*

This study used the stated preferences method, in which people were asked directly about their preferences regarding wood consumption and switching to Fixed Charged Electricity Connection. Studies have used a binary logistic model to evaluate the willingness to pay consumers. (Ntanos et al. 2018). The binary logit model has been used, which is the most suitable method because the dependent variable in the study is in binary form (Yes/No). The model is presented in Equation (1):

$$WTP_{(FCEC)} = \frac{1}{1+e^{-(\alpha+\beta X+\varepsilon)}} \quad (1)$$

Equation 1 represents the cumulative probability when a dependent variable can have binary values, i.e., 0 and 1. If the consumer is willing to pay for FCEC, then $WTP_{(FCEC)} = 1$. If the consumer is not willing to pay, then $WTP_{(FCEC)} = 0$.

There are four dependent variables in the analysis:

1. Willingness to accept FCEC as an alternative to wood ($WILL_1$) is a binary variable with a value of one of the consumers considering FCEC the most suitable alternative and, otherwise, zero.
2. Willingness to stop wood consumption by getting a fixed charge electricity connection. ($WILL_2$) is a dependent variable with a value of one of the respondents willing to stop using the current fuel source and, otherwise, zero.
3. The willingness to pay for FCEC equals the amount spent on the current fuel source. ($WILL_3$), having value one when an individual is willing to pay

for a fixed charge electricity connection equal to the amount spent on the current fuel source or zero.

4. Willingness to pay more for FCEC than the current fuel source. ($WILL_4$) is a dependent dummy variable with value one when the household is willing to pay an extra amount for FCEC compared to the current fuel source and, otherwise, zero.

Equation 2 shows the regression equation for the willingness decision $WILL_1$.

$$WILL_1 = \beta_\circ + \beta_1 income + \beta_2 age + \beta_3 emp.spouse + \beta_4\, average.edu + \varepsilon \quad (2)$$

The above model presented in Equation 2 is also estimated using a binary logit model with $WILL_2$, $WILL_3$ and $WILL_4$ as dependent variables. Various other variables have been selected in this study to analyze WTP for FCEC. These variables and the rationale for picking them are presented below:

- Income: Income is an important variable that influences the willingness to pay decisions by the consumer. Previous studies have also used income in their analysis, such as Akcura (2013). In our analysis, income reflects the monthly per capita income of the household. It also includes rent, pension, transport, profits, and other sources.
- Age: Various studies in the past have taken age as an essential variable (Adekunle et al., 2006; Abdullah and Jeanty, 2011). In our analysis variable of age reflects the age of the household head.
- Employment of spouse of head: Employment of the spouse of the head is another important variable for the analysis. It is a binary variable that takes value one when the spouse of the head is employed and otherwise zero.
- Education: Education is one of the crucial determinants of a respondent's WTP, as discussed in previous studies (Abdullah and Jeanty, 2011). With more education comes more awareness and a positive attitude toward natural resources. Average education in our regression analysis is taken. While education of the household head, spouse, and maximum education by any household member has been presented using the cross-tabulation method in the descriptive analysis section.

Table 8 presents estimates of the marginal effects of independent variables, i.e., per capita income, household head age, spouse employment status, and average years of schooling, on the dependent variables, i.e., willingness to accept FCEC as a suitable alternative to a wood, willingness to stop consuming wood on the

provision of FCEC, willingness to pay equal to current fuel expense and the willingness to pay an additional amount over and above current fuel expenditure. On the dependent side, Equation 2 takes the willingness to accept FCEC as a suitable alternative to wood in the first analysis. The impact of the income per capita is positive and statistically significant at a 1% significance level. It further indicates that Pak-Rs. 1000 increase in per capita income is likely to increase the acceptability of FCEC by 1.53 percent as an alternative. Thus households with higher economic status have higher acceptability to select alternate choices such as FCEC. These results parallel previous studies suggesting that income impacts consumer decisions (Zografakis et al., 2010; Iqbal et al., 2020; Muhammad et al., 2020; Ayodele et al., 2021). The second variable in the analysis is the age of the household head. Variable has a statistically insignificant impact on the willingness decision at a 10% significance level. Per descriptive analysis, willingness to divert consumption from word to electricity is equally spread across young and old generations.

The spouse's employment status of the household head is another variable considered in the study. Estimates reveal that households, where the household head's spouse is employed were 21.6% less willing to accept FCEC than a household where women were not working. Informal discussion with the respondents revealed that employed women were concerned about a possible increase in electricity usage expenditure, including the high cost of electrical appliances, installment, and periodical subscription fees. They were also concerned about the uninterrupted electricity supply and reliance on electrical appliances. The average years of schooling of household members is the fourth variable considered in our study to analyze willingness to accept FCEC. Marginal effects indicate that one additional year of household members' education results in a 4.4% increase in chances to accept FCEC.

In the second analysis, the dependent variable takes the willingness to stop wood consumption on the provision of FCEC. Marginal effects based on binary logistic regression to analyze the willingness of consumers to stop consumption of current fuel on the provision of FCEC show that estimates of independent variables are the same as in the previous analysis of willingness to pay. Per capita income has a positive and statistically significant impact on the willingness to make a decision. An increase in the per capita income of the household by Pak-Rs. 1000 is more likely to result in 1.53% higher chances of stopping wood consumption on the provision of FCEC. Furthermore, the age of the household head has an insignificant impact on the willingness to make a decision, which is aligned with descriptive analysis that older and young generations have the same preferences.

However, previous literature suggested that young consumers were more willing to pay for renewable energy (Iqbal et al., 2020).

Table 8. Marginal Effects of Independent variables on Willingness Decisions

Variable	Willingness to accept FCEC as a suitable alternative to wood		Willingness to stop consumption of wood on the provision of FCEC		Willingness to pay for FCEC equal to the current fuel expense		Willingness to pay an additional amount over and above the current fuel cost	
	Marginal effects	P-value	Marginal effects	P-value	Marginal effects	P-value	Marginal effects	P-value
Per capita income	0.0153	0.010	0.0153	0.010	0.0142	0.013	0.0123	0.010
Age of household head	0.0046	0.383	0.0065	0.189	-0.0025	0.639	-0.0059	0.080
Employment status of spouse	-0.2156	0.020	-0.1524	0.092	-0.1944	0.043	-0.1491	0.007
Average years of schooling	0.0440	0.005	0.0477	0.001	0.0369	0.013	0.0219	0.022

On the other hand, the employment status of the household head's spouse has a statistically significant impact on the willingness to stop using would the provision of FCEC. Marginal effects estimate suggests that households, where spouses are employed are 15.2% more likely to stop wood consumption when provided with FCEC than households where the spouse is not employed. As used in previous willingness decision analysis, household members' average years of schooling have a positive and statistically significant impact on the dependent variable. Estimates of the impact of education are the same as suggested by existing literature. (Guo et al., 2014; Lee et al. 2017; Ntanos et al. 2018; Jin et al., 2019) Households with one additional year of education are 4.8% more likely to stop the usage of wood on the provision of FCEC.

The third analysis takes the willingness to pay for FCEC as the dependent variable equal to the current fuel expense. Estimated marginal effects of studying willingness to pay for FCEC equal to current fuel consumption reveal that Pak-Rs. 1000 additional household income may result in 1.4% more chances of the family to be willing to pay an amount for FCEC equal to current fuel expenditure. Conversation with the respondents revealed that most wood users are poor, whereas wealthy households have alternate fuel sources. Therefore, consumers may be willing to switch to FCEC from wood consumption if income increases. Estimates of the age of the household head are consistent with previous analyses.

Furthermore, results indicate that employed spouses are 19.4% less likely to pay for FCEC. Employed women reveal that they find other sources, such as natural gas and LPG, more convenient than electricity. The continuous provision of electricity and dependency on FCEC is also a concern in far-flung areas.

Results for the willingness to pay for FCEC more than current fuel expenditure, which is the fourth dependent variable, suggest that a Pak-Rs.1000 increase in per capita income may result in 1.23% more willingness of the consumers to pay more for FCEC than current wood consumption. However, consumers are more willing to pay an equal amount for FCEC than more than current consumption. Furthermore, the age of the household head has a statistically significant impact on the decision. The independent variable's coefficient is negative, indicating that the older generation is less willing to pay more than current consumption than the young generation. Estimates suggest that ten-year-older household heads are 5.9% less willing to pay an additional amount for FCEC. In all previous analyses, the impact of age was insignificant, indicating that the young and old generations have the same preferences. However, the older generation seems less likely to pay a higher price for FCEC. Estimates of the spouse's employment status are the same as the previous analysis, i.e., significant and negative. Further, household members' average years of schooling substantially and positively impact the willingness to pay more for FCEC. However, the relationship among the variables is not as strong as in the previous analysis.

6. Concluding Remarks and Policy Implications

The prime objective of the study was to investigate the willingness to pay for fixed charge electricity connections in the Neelum district of Azad Jammu and Kashmir. Neelum district of AJ and K is rich in natural resources, i.e., forest wood, water, and minerals. Reliance on fuel consumption on wood has resulted in a decline in forest cover in the region. This decline will have severe implications for the ecosystem of the region. Therefore, the study was carried out to present residents with alternate choices and their willingness to switch and pay for the alternate fuel source, i.e., Fixed Charged Electricity Connection. The data for the analysis was gathered through a survey from four villages of district Neelum, i.e., Lowat, Kundal Shahi, Islampura, and Kuton. The data obtained from the survey has been analyzed using descriptive and econometrics models for the binary choice variable. In addition, four willingness decisions have been studied by using the logistics approach. These decisions include (1) Willingness to accept FCEC as a suitable alternative to wood, (2) Willingness to stop consumption of current fuel on provision of FCEC, (3) Willingness to pay for FCEC equal to the current fuel expenditure, and (4) Willingness to pay for FCEC more than the current fuel expenditure.

Our results suggest that households with higher income and spending on fuel are more willing to pay for FCEC. Similarly, education is an important

determinant in the analysis. Educated consumers realize the importance of the protection of natural resources. Therefore, they are willing to switch to and pay for FCEC. Furthermore, residents have a few concerns that include cost and dependency on electrical appliances, a potential increase in electricity prices in the future, and continuous provision of electricity in far-flung areas. Due to such concerns, working women in the household, who are well aware of the future consequences, were reluctant to pay for FCEC.

Moreover, the analysis suggests that fuel choice is almost the same across young and old generations. However, old age is less willing to pay more than the current expense. In this regard, fixed-charged electricity connections may be initially provided to higher-income consumers. Once it is initiated, other members of the society will also realize the importance of conserving natural resources and switching to alternate fuel sources such as FCEC. Further, future studies can analyze willingness behavior towards renewable energy sources such as solar, biomass, and wind to protect the forest in the Neelum district and other areas.

Based on our findings, the study has the following implications:

- As per analysis, educated consumers are more inclined to conserve natural resources and protect the forests. Therefore, there is a dire need to initiate an awareness campaign to educate people on the importance of natural resources, particularly forests.
- Higher-income consumers with a higher willingness to pay can be attracted to FCEC. Further, other households will be inclined to choose FCEC for domestic usage.

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