Innovations

Assessment of the aggregate amount of money that households' are willing to pay for improved electricity supply in Debre Markos Town, Amhara Region, Ethiopia

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Abstract : *This study was undertaken to assess the total amount of money that households' are willing to pay for improved electric power supply. By applying the double bounded elicitation format with follow up open-ended question, the study used the Contingent Valuation Method (CVM). Despite the study used both primary and secondary data, it was mainly used primary and cross-sectional for the year 2021/22. Both non-probability and probability sampling were used to select the study area and the sampled households from the town respectively. This study used well-designed questionnaire as best instrument for collection of the primary data from these sampled households. The study used cross-sectional data collected from 404 randomly selected households from Debre Markos town and the Contingent Valuation (CV) surveyed responses were analyzed through descriptive analysis. The CV surveyed result revealed that 393 (97.28%) of the respondents were willing to pay a positive amounts for improved electric supply services per Kilo Watt (KW). The CV surveyed result also showed that the mean WTP of the household for the proposed improved electricity service is between 1.24 Ethiopian Birr (ETB) and 1.32 ETB from the closed-ended and open-ended question responses respectively which is much higher than the current electric bill tariff of the town which is 0.0044 ETB for the electricity consumption brackets of 0-50 KW. Thus if the proposed electricity development scheme is implemented, in addition to satisfying the electricity needs of the households, the town's electric utility management can collect more revenue from the sale of this improved electricity supply. Furthermore the total amount of birr those 49,023 households in Debre Markos town are willing to pay was found to be ETB 375,877.8525 per day or ETB 137,195,416.2 birr per year which is much higher than the current total revenue of ETB 97,213,171.55 collected by the utility management for the average daily electric consumption per day of 6.15 KW.*

Key Words:-*1. Willingness to Pay 2. Uninterrupted Electricity 3. Total Revenue 4. Aggregate Money 5. Ethiopia*

1. Introduction

Even though the United Nation's Sustainable Development Goals (SDG) plan was to provide universal access to affordable, modern and reliable energy services and great efforts have been made to deploy renewable energy technology for electricity generation and to improve energy efficiency across the world in 2030,

currently the world population is falling short of meeting these attributes of electricity supply (International Energy Agency, 2019). At global level primary energy intensity improvement rate is still below its expected level and having a significant slowdown in 2017 and 2018, even if strengthening mandatory energy efficiency policies, providing targeted fiscal or financial incentives, leveraging market-based mechanisms, and providing high-quality information about energy efficiency will be central to meet universal, affordable, reliable and modern energy services to the world population (World Bank, 2019). More than 95% of the estimated 1.2 billion people who live without electricity are in Sub- Saharan Africa (SSA) and developing Asia, predominantly in rural areas. Two-third of the SSA population lacks access to electricity and 35% electrification rate in SSA countries is the lowest in the world, which has been recognized as a fundamental challenge for development (Meles, 2017). Ethiopia is such a country, facing serious challenges of limited access to modern energy, high rate of power outages and heavy reliance on traditional biomass energy sources constituting the most crucial bottlenecks for manufacturing firms and slowdowns in energy transition from solid fuel to electricity which generates both direct costs for alternative sources of electricity and indirect costs such as inconvenience experience during power outages (World Bank, 2015). According to the information obtained from the town electric supply service office, there is frequent power outage. The basic reason for the town's frequent interruption in electricity supply are poor electricity infrastructure (distribution and transmission challenges),low tariff which is below the recovery cost, illegal connections by customers, non-payment of bills and increasing electricity demand of the town's users due to increasing population along with the overall development of the town in terms of expansion of housing investments, medium and small scale enterprise, development of government and non government organizations including university and colleges which have a direct and indirect consequences for increasing electricity demand in the town and will be even worse than the current high electric outages (Debre Markos Town Electricity Supply Office, 2021).Besides, the electricity generation development projects require a high monetary and human capital investment, which is difficult particularly in developing countries like Ethiopia to undertake the investment by the government only due to shortage of monetary fund and skilled (trained) man power, which enforces electricity investment costs must be shared by the utility users' particularly domestic users. Furthermore, though there are few empirical studies to value households' (individual's) Willingness to Pay (WTP) for improved electricity supply based on Contingent Valuation Method (Adenikinju, A, et. al(2005), Carlsson and Martinson (2004) Farhar (1999); Serra and Fierro (1997); Wiser (2007)) no study is conducted in Debre Markos town, Ethiopia. Therefore assessing the aggregate amount of money that households are 'willing to pay for the development of improved electricity supply is always important and sometimes is a must for developing countries like Ethiopia, in which there is a serious problem of reliable electricity supply and frequent interruption to fulfill the needs of the population.

2. Literature Review

Due the reason that the Stated Preference Methods such as CVM relayed on hypothetical market surveys, they have the following advantages over Revealed Preference approaches (Carson, 2000).They are good to measure people's preferences for government policies or programs to changes in the quality of environmental goods. They are the only method that can be used to estimate non-use values and they can be prospective and used where there is no availability of related market data for estimating use values.

Furthermore, Mitchell and Carson (1989) also concluded that if the method is applied in a way that address the potential sources of bias and errors, the CVM can obtain valid valuation information on public goods. The CVM is preferred to Revealed Preference methods due to the fact that it deals with both use and non- use

values and survey responses to WTP or Willingness to Accept (WTA) hypothetical questions go directly to the monetary measures of utility change (Perman et al, 2003, p. 420). Further the CVM is only technique theoretically capable of estimating the benefits produced by electricity quality improvements, including non use values due the fact that it has easy of flexibility nature. Thus based on the reasons mentioned above CVM is employed for this study.

In Least Developed Countries (LDCs) including Sub-Saharan Africa and Asia, a significant number of studies have been used CV to estimate the WTP for improved electricity supply. Some of the CVM studies done on improved electricity supply services in Developing Countries and finding residents WTP amount and its determinant factors for providing improved electricity supply, which are examined by some empirical studies are discussed below**.**

Adenikinju and the Center for Economics and Allied Research (2005) conducted a study in Nigeria by using CVM to investigate the cost of power outages to the country's business sector. The study reported that that poor supply of electricity has come at great costs through expensive back-up generators and shut down production to the business sector. Therefore to minimize this cost of power outages, respondents had more willingness to pay than that period of electricity bill prices in Nigeria.

Another study conducted by Carlsson and Martinson (2004) in Sweden to investigate their WTP to avoid power outages showed that households were willing to pay 6.30 SEK (Swedish Krona) for an hour outage compared to 189.25 SEK for a 24 hour outage for planned outages. The study also showed that households were willing to pay 9.39 SEK which is compared to 223.01 SEK for unplanned outages. This result showed that households had more willingness to pay for planned outages in order to minimize the indirect cost of power outages which happened without prior notification by the utility managers.

Farhar (1999) conducted a study by using the utility market survey to assess residents' WTP for renewable energy. The study reported that willingness to pay for renewable energy follows a predictable pattern with an average 38% of the respondents were willing to pay at least $10 per month more, and 21% were willing to pay at least $15 per month more and an average majority of 70% willing to pay at least $5 per month more for electricity from renewable sources.

Serra and Fierro (1997) conducted a study by using CVM to examine the households WTP to minimize the electricity outage costs in Chile's industrial sector. The study result showed that outage costs were between US$ 0.5 and US$ 83.5 with the lower costs applying to firms with back up facilities for a 10% restriction of electricity in a month.

By using a split-sample, dichotomous choice contingent valuation survey, Wiser (2007) conducted a study in USA by taking a total sample of 1574 to investigate residents' WTP for renewable energy under collective and voluntary payment vehicles with government and private provision of the good. The study revealed that the private provision of the good elicits higher WTP than government provision, due to the fact that private provision of renewable energy was more efficient. The result also showed some evidence that, when confronted with a collective payment mechanism, respondents state somewhat higher WTP than when voluntary payment mechanisms are used.

From this we can say that the CVM can be successfully applied on electricity quality improvement and other non-marketable environmental goods and services. Therefore this study has also employed the CVM empirical studies that are relevant to understand the existing electricity supply situation of the town and

determining the total amount of money households are willing to pay for improved electricity supply projects in the study area.

3. Research Methodology

The research design of this study followed a mixed method approach that allowed the enquiry to draw freely from both quantitative and qualitative information. The major parts of the research analysis is taken by quantitative data, which provides statistical data about households' WTP for the electric supply service and qualitative approach was, therefore, be used to grasp people's opinion and values they gave to the improved electricity supply in the study area. Hence, qualitative analysis is done to support the quantitative analysis to draw sufficient conclusion. The CVM, which is one of the standard methods of measuring values of environmental public goods and some private goods like electricity, is used in this study. The data used in this study was mainly primary and cross-sectional for the year 2021/22 which was obtained from contingent valuation survey conducted in Debre Markos town. For collection of the primary data from the sample households, this study used well-designed closed ended dichotomous choice with follow up open-ended questionnaire to generate the necessary information in eliciting the responses of the domestic users. The study is also supplemented by secondary data which would be collected from Ministry of Water and Energy (MoWE), Debre Markos Town Electric Supply Office, National and Regional Electric Supply Office Website, Zonal Reports, Files, Pamphlets, Office Manuals, Circulars and Policy Papers to provide additional information. Besides, variety of books, published and/or unpublished Government Documents, and Newsletters review was used to make the study fruitful. Purposive sampling was employed to select the study area, where as multistage sampling methods of probability sampling technique were used in order to obtain the sample households from the town. In the first stage, Simple Random (lottery) Sampling (SRS) technique was used to select sampled kebeles for the study. In the second stage, Systematic Sampling (SS) was used to select 422 respondents, since the towns' residents have homogeneous socioeconomic activities and topography. However, due to incomplete and misused answers, only 404 usable responses were used in this study

4. Results and Discussions

The data from the contingent valuation survey were analyzed and discussed in descriptive analysis using percentages, tables and frequencies and thus an over view of the surveyed households' attitudes towards the existing electricity supply situation in the town is presented.

4.1. Descriptive Analysis

4.1.1. Demographic and Socio-Economic Characteristics of Households

Table 1:- Demographic and Socio-Economic Characteristics and Electric Power Use Profiles of Surveyed Households

Variable	Description	Mean	Std. Dev	Min	Max
SORC	Household main electric power source, dummy variable 1 if hydroelectric source of power, 0 otherwise	0.772277	0.419883	0	1
BILL	Households monthly payment in birr per monthly electric consumption	230.5718	153.6463	0	1000

OUTT	Electricity outage time per day, dummy variable 1, if there is high electric interruption; 0 otherwise	0.856436	0.351082	0	1
QTTY	Quantity of electricity used, dummy variable 1 if low; 0 otherwise	0.792079	0.406323	0	1
RLTY	Reliability of the existing electricity being used, dummy variable 1, if is not reliable; 0 otherwise	0.861386	0.345972	0	1
LSAT	Level of satisfaction with the existing service, dummy variable 1 if not satisfied, 0 otherwise	0.794555	0.404528	0	1
GNDR	Gender of respondents, dummy variable 1 if male, 0 otherwise	0.59901	0.490707	0	1
HHDR	Household head of the respondent, dummy variable 1 if head, 0 otherwise	0.566832	0.496128	0	1
AGER	Age of the respondents in years	39.84158	5.086805	26	61
EDUR	Education level of respondents, dummy variable 1 if literate, 0 otherwise	0.883663	0.321026	0	1
OCCR	Occupation of the respondent, dummy variable 1 if formal sector salary employment, 0 otherwise	0.579208	0.494298	0	1
INCM	Household average monthly income in birr	6851.097	1647.164	2750	12730
EXND	Household average expenditure per month in birr	5957.574	1383.062	2500	10200
FAMS	Respondents' family size in number	2.740099	0.738368	1	5
HOSR	House ownership of the respondent, dummy variable 1 if have own home, 0 otherwise	0.571782	0.495434	0	1
MASR	Marital status of respondents, dummy variable 1 if married, 0 otherwise	0.79703	0.402709	0	1
REYS	Respondents years of stay in the town in years	8.742574	3.773102	2	27
RESP	Responsible organ for provision of improved electricity supply, dummy variable 1 if government, 0 otherwise	0.433168	0.496128	1	0
CONSN	Average Kilo Watt of electric service used by household per day	6.148515	3.070345	0	20
PWR24	The average that a household gets electricity within 24 hours	7.712871	3.187558	3	18
INTRT	Households' interest to participate in electricity improvement program, dummy variable 1 if yes, 0 otherwise	0.972772	0.547271	0	1
IB	Initial bid offered to the respondent	0.928218	0.363224	0.5	1.5
YES/NO_1	Household WTP for initial bid, dummy variable 1 if yes, 0 otherwise	0.759901	0.427673	0	1
HB	Higher bid offered to the respondent (2X of initial bid)	1.812539	0.727148	1	3
YES/NO_2	Household WTP for this higher bid amount, dummy variable1 if yes,0 otherwise	0.418319	0.392471	0	1
LB	Lower bid offered to the respondents (0.5X of the initial bid)	0.456219	0.394281	0.25	0.75

YES/NO_3	Household WTP for this lower bid amount, dummy variable1 if yes,0 otherwise	0.178219	0.091936	0	1
MWTP	Households maximum willingness to pay	1.315124	1.190114	0	3

Source: Computed from surveyed data, 2022

Note that the mean estimates of dummy variables should be interpreted as percentage. For example the mean value of the respondents' educational level was 0.883663 which means that 88.37% of them were literate.

The surveyed results regarding to family size showed that, the average family size per household is 2.7 with a minimum of 1 household member to a maximum of 5 household members. The surveyed households earn an average income of 6851.1 ranging from a minimum of birr 2750 ETB to a maximum of 12730 ETB and spent an average income of ETB 5957.8 with a minimum of ETB 2500 to a maximum of ETB 10,200 for satisfying different household consumption needs such as for electricity, water, food, schooling, social services and so on. From such household needs, the surveyed household paid an average income of ETB 230.57 for their monthly consumption of electricity power or 6.79 ETB per day when the mean household electric power consumption was 6.15 Kilo Watt (KW) of electric power per day. Based on this information, it is revealed that the per month average electric power consumption of households was 184.5 KW. Further the monthly minimum electric power consumption tariff for the electric consumption bracket of 101 to 200 KW in the town is 1.3436 ETB, and therefore the average households' electricity power consumption expenditure is ETB 247.89 which accounts 3.6% of the surveyed households' average monthly income of ETB 6851.1, and thus it is far below the World Bank's recommendations which shows that a household must spend at least 5% of their monthly income. Therefore this result suggests that the sampled households can spend more for improved, reliable and uninterrupted electricity power supply services in the town. The surveyed result also showed that 346 (85.6%) of the total 404 respondents said that there is more electricity interruption (outage) time per day and power outage is the most serious problem in their households. 320 (79.21%) of the surveyed household said that the existing electricity power quantity in KiloWatt (KW) is low, and from their common experience they got electricity power supply with an average of 7.71 hours within 24 hours, which shows the electricity power shortage is a serious problem in the town. Regarding with the reliability of the town's electric power supply, 348 (86.14%) of the surveyed respondents said that unreliability problem of the existing electric service supply is the most serious problem to their households and 321 (79.46%) of the total surveyed respondents were not satisfied with the existing electricity supply in the town. Of those, who were not satisfied with this existing electricity services, 179 (44.31%) said that frequent electric power interruption is the most serious problem to the households, 71 (17.57%) said that unreliability of the existing electric power supply is the most serious problem, 54 (13.37%) said that power shortage is the most serious problem of the existing electricity supply in the town which made them dissatisfied and the rest of the unsatisfied surveyed households with the existing electricity supply of the town 17 (4.21%) said that higher bill payment is the most serious problem for their dissatisfaction with the existing electricity supply situation of the town. Furthermore ,regarding with the attitudes of the respondents towards who is responsible for the provision of electricity supply services,175 (43.32%) of the total surveyed respondents said that government should be responsible to provide and administer the electric power supply, 207 (51.24%) of the respondents said that community should be responsible for electric power supply, 14 (3.47%) said that electricity power supply should be the responsibility of both society and the government and the remaining 8 (1.97%) said that private sector should be responsible for electric power supply in the town.

4.1.2. Household Willingness to Pay for Improved Electricity Services

In a closed-ended dichotomous choice format questionnaire, from the total of 404 surveyed respondents 307 (75.99%) had said 'Yes' to pay the average initial bid amount of 0.93 Ethiopian Birr (ETB) per KW electric power supply which ranges from a minimum of 0.5 ETB to a maximum of 1.5 ETB and the rest 97 (24.01%) had refused to pay these initial bid amount. From those 307 who said 'Yes' for the initial bid, 169 respondents who accounts 41.83 % of the total respondents were further accepted higher average bid price of 1.81 ETB per KW of electric power which ranges from 1 birr to 3 ETB and the remaining 138 who accounts 34.16% of the total surveyed respondents were refusing to pay this higher bid amount. In addition from 97 surveyed households who refused to pay the initial bid, 72 of them had said 'Yes' to pay an average bid price of 0.47 ETB per KW which ranges from a minimum of 0.25 ETB to a maximum of 0. 75 ETB which is a lower amount than the initial bid, that is 0.93 ETB and the rest 25 of the surveyed respondents still refused to pay this lower bid amount per KW of electricity usage which represents 17.82 % and 6.18% of the total surveyed households respectively

Furthermore from the open-ended questions, the surveyed result showed that 393 (97.28%) of the respondents gave positive amounts as they were willing to pay for improved electric supply services per KW in ETB and the rest 11 (2.72%) were had zero willingness to pay (WTP)

Table 2:- Summary of Surveyed Households' Maximum WTP (in birr)

Reported maximum WTP	Number of Surveyed Households	Percentage	Cumulative Percentage
0-0.5 (0≤WTP≤0.5)	43	10.64	10.64
0.51-1.00 (0.51≤WTP≤1.0)	97	24.01	34.65
1.1-1.5 (1.1≤WTP≤1.5)	162	40.10	74.75
1.6-2.0 (1.6≤WTP≤2.0)	51	12.62	87.37
2.1-2.5 (2.1≤WTP≤2.5)	34	8.42	95.79
2.6-3.0 (2.6≤WTP≤3.0)	17	4.21	100

Source: Computed from own survey, 2022

From the above table, we can see that 43 (10.64%) of the surveyed households were willing to pay within the range of 0 and 0.5 ETB which is approximately 0.25 ETB, 97 (24.01%) said that they are willing to pay an approximate average of 0.755 ETB, 162 (40.10%) of them were willing to pay an average bid price of 1.3 ETB, 51 (12.62%) of them expressed their willingness to pay an approximate average of 1.8 ETB, 34 (8.42%) were willing to pay within the range of 2.1 ETB and 2.5 ETB which is an approximate average of 2.3 ETB, and 17 (4.21%) of those surveyed respondents were willing to pay an average amount of 2.8 ETB per KW of their household electric power consumption. In addition to this for the whole sampled households, the surveyed result showed that the mean willingness to pay from the open-ended question is approximately 1.32 ETB per KW of electric consumption which ranges from a minimum of 0 ETB to a maximum of 3 ETB and 1.24 ETB from the closed-ended dichotomous choice format per KW electric power supply and these amounts are much higher than the current electricity tariff structure of the town which are 0.0044 ETB per KW for the electricity consumption brackets of 0-50 KW. This shows that the surveyed households were willing to pay more than the current electric power tariff rate for the improved electricity supply services in the town.

Therefore if the improved electricity service scheme in introduced, in addition to addressing the electric power needs of the town, the town's electricity utility management can also collect more funds from selling electricity which can be used for electricity improvement and expansion projects. The average amount of the households' maximum WTP represents the mean WTP for the open-ended CV survey responses of the maximum WTP figures reported by households. Thus Mean WTP = μ = ∑Ti/n, where 'Ti' is the reported maximum WTP amount by surveyed households and 'n' is the sample size and thus the mean WTP = μ =532.02/404 = 1.3168811881 ETB per KW.

Thus, the results from the overall results of the valuation indicate that the mean willingness to pay for the improved electricity supply services from the open- ended question survey is 1.32 ETB, while it has a value of 1.24 ETB from the closed-ended dichotomous choice questions per KW, putting the households' willingness to pay within the range between 1.24 and 1.32 ETB per KW of electricity for the proposed improved electric power services in the town.

4.3. Households Total Willingness to Pay and Total Revenue

The total population of the town's administration was 132,361 constituting 49,023 households which are approximately the same as dividing the total population by the average family size of 2.7 which is obtained from the surveyed results (Debre Markos Town Electric Power Supply Office, 2021)

Table 3:- Aggregate WTP and Aggregate Revenue (in birr) from Improved Electric Services

Class interval for WTP (in birr) per Kwh	Mid (Class mark) for WTP	Sample Distribution of Households		Total number of Households	Total WTP (in birr)	Sampled Households willing to pay at least that amount (cumulative)		Total Households willing to pay at least that amount (cumulative)	Total Revenue (in birr)
(1)	(2)	(3) no.	(4) %	(5)	(6)	(7) no.	(8) %	(9)	(10)
0.0-0.50	0.25	43	10.64	5,218	1,304.5	404	100	49,023	12,255.75
0.51-1.00	0.755	97	24.01	11,770	8,886.35	361	89.36	43,805	33,072.775
1.10-1.50	1.3	162	40.10	19,658	25,555.4	264	65.35	32,035	41,645.5
1.60-2.00	1.8	51	12.62	6,189	11,140.2	102	25.25	12,377	22,278.6
2.10-2.00	2.05	34	8.42	4,126	8,458.3	51	12.63	6,188	12,885.4
2.60 -3.00	2.8	17	4.21	2,062	5,773.6	17	4.21	2,062	5,773.6
Total		404	100	49,023	61,118.35				

Source: Own survey, 2022

The total number of households in each boundary, which is computed by multiplying total number of households in the town by proportion of households falling in each interval, is shown by column 5.

Furthermore, the total willingness to pay in ETB per KW of electric power is calculated by multiplying the total number of households willing to pay that amount by the mid WTP amount is indicated in column 6. In this column 6, the total sum of willingness to pay values give the grand WTP which shows that 49,023 households are expected to pay 61,118.35 ETB, if each household uses only one KW per day. But from the descriptive analysis of the surveyed data, it is clearly noted that the mean electric power consumption per household per day is 6.15 KW and therefore the total amount that 49,023 households are willing to pay is estimated to be 375,877.8525 ETB per day. This implies that, if the electric power development scheme in implemented, a household is willing to pay 7.67 ETB per day or approximately 230 ETB per month. This result is in between the mean WTP amount of birr 228.78 from the closed-ended dichotomous format and 243.54 ETB per month per household in the open ended follow up survey. Columns 7 and 8 show the number and percentage of sample households that are willing to pay at least the amount given in each interval given in column 1 and the total number of households that are willing to pay at least this amount in each boundaries is indicated in column 9. Column 10 indicates that the total revenue that the town's utility management will collect from the sale of electric power to the residents if the improvement scheme is developed. It is obtained by multiplying the total number of households who are willing to pay at least the amount in each interval by the mid WTP amount that respondents are willing to pay on the average. It is clearly indicated that total revenue initially increases as households payment for electric power usage per KW increases and reaches its maximum of 41,645.5 ETB when the price of electricity per KW is 1.3 ETB per household and then after it decreases and attains its minimum of ETB 5,773.6 per KW. Therefore ,it is possible to conclude that the maximum revenue can be collected from the improved electric supply system at the average price of ETB 1.3 per KW per household and the maximum revenue is ETB 256,119.825 per day as the average household consumption of electric power is 6.15 KW per day.

Therefore the result of this contingent valuation method study shows that the mean WTP amount per KW of electricity is between 1.24 and 1.32 ETB from closed-ended and open-ended responses respectively, which is much higher than the current electric bill tariff rate of ETB 0.0044 per KW for the consumption range of 0-50 KW. This result is consistent with Kateregga (2009) who conducted a study by using the CVM to elicit outage costs of electric energy consumers in three Ugandan suburbs by interviewing a sample of 200 households.

Therefore the town's utility management can implement the proposed electric power supply improvement scheme, this is so because, in addition to solving the electric power supply problem of the town, it can increase the tariff substantially from this improved power supply services and this will also increase total revenue from the sale of improved electric power as well as households' welfare with more hydroelectric power source and decreasing the average power outage time of electricity services.

5. Conclusions

Unreliable and frequent electric power interruption, which is mostly provided by the public utility managers, is the common characteristics of most developing countries including Ethiopia. According to the information obtained from Debre Markos town electricity utility management office, the town is one of the areas which face unreliable, frequent and serious outage, inadequate supply of electric power. By applying the double bounded elicitation format with follow up open-ended question, the study used the Contingent Valuation Method (CVM). The study used both secondary and primary data for the year 2021/22. Both non-probability

and probability sampling were used to select the study area and the sampled households from the town respectively. This study used well-designed questionnaire as best instrument for collection of the primary data from these sample households. The study used cross-sectional data collected from only 404 usable randomly selected sampled households from Debre Markos town and the CV surveyed responses were analyzed through descriptive analysis.

It is clearly showed that, from the total of 404 usable responses, 312 (77.23%) of households which accounts more than half used electricity confirmed that hydroelectric power source is the main source of electricity for their households. 346 (85.6%) of the total 404 respondents said that there is more electricity interruption (outage) time per day and power outage is the most serious problem in their households. 320 (79.21%) of the surveyed household said that the existing electricity power quantity in KW is low, and from their common experience they got electricity power supply with an average of 7.71 hours within 24 hours, which shows the electricity power shortage is a serious problem in the town. The study result also revealed that, 321 (79.46%) of the total surveyed respondents were not satisfied with the existing electricity supply in the town due to the factors that include, frequent electric power interruption, unreliability of the existing electric power supply, power shortage, and higher bill payment. The study also revealed that 175 (43.32%). of the total surveyed respondents said that government should be responsible organ to provide and administer the electric power supply in the town

393 (97.28%) of the total 404 usable responses had positive amounts as they were willing to pay for improved electric supply services per KW with a mean WTP of 1.24 ETB per KW within the closed-ended dichotomous format and 1.32 ETB per KW from the open-ended responses, which is much higher than the current electric bill tariff of the town which is 0.0044 ETB for the electricity consumption brackets of 0-50 KW.

The total of 49,023 households in the study area had the total WTP of 61,118.35 ETB per day or ETB 1,833,550.5 per month for one KW of improved electric supply services, which shows that if the electric power development scheme in implemented, a household is willing to pay 1.24 ETB. But the mean electric power consumption per household per day is 6.15 KW and therefore the total amount of that 49,023 households are willing to pay is estimated to be 375,877.8525 per day or 11,276,335.58 ETB per month. This implies that, if the electric power development scheme in implemented, a household is willing to pay 7.67 ETB per day or approximately 230 ETB per month for an approximate daily electric power consumption of 6.15 KW. This result is in between the mean WTP amount of birr 228.78 from the closed-ended dichotomous format and 243.54 ETB per month per household in the open ended follow up survey. Furthermore the maximum amount of revenue collected from these 49,023 households per KW of electricity is 41,645.5 ETB when the electric power is sold with an average electric bill price of 1.3 birr. These results showed that, if the proposed electric power development scheme will be implemented by the town's utility managers, in addition to solving the severe electric power interruption and its unreliable nature of the town, the electric power service office can collect more revenue from the sale of improved electric power supply by charging higher price than the current tariff.

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