CONSUMERS’ PERCEIVED ECONOMICAL EVALUATION OF POWER QUALITY

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ABSTRACT

This article presents the methodology to evaluate the quality of power supply by home consumers and its results. The study was based on a survey made in Brazil in 2008, on home consumers’ payment willingness in areas where the power supply showed low quality.

BACKGROUND

The determination of the ideal power quality levels for the distribution of electric energy is a very controversial issue. If on the one hand customers want to pay the least possible for the best quality to be offered, on the other hand, the utilities aim at achieving the greatest possible rate to provide the same level of quality offered. Even when the required quality levels are set by a regulatory agency, the exact investment required to meet these levels rests unclear and the question remains whether consumers are willing to bear this cost.

The quality of the power energy supplied is a critical issue for the segment of power distribution. In natural monopolies, such as electrical services consumers do not enjoy the freedom of choosing their suppliers thus quality assessments and costs are defined by a regulatory agency. Fitting the regulation of fees and quality patterns involve variables and decisions such as investment volume and operational costs needed to improve the quality of the services provided and consumers disposition to pay more for the services of power supply and the penalties imposed on the utilities if they do not meet the quality levels set by the regulation. In case the regulatory agency asks for high quality levels but does not allow the fee which corresponds to the investments and costs involved, the regulatory agency is putting the utilities at a disadvantage and jeopardizing the sustainability of the services. On the other hand, if the regulatory agency allows the fees to reflect high quality level disregarding consumers payment willingness he will be imposing unnecessary expenses on society and if the penalties do not cover the consumers costs due to poor quality, there will be no incentives to improve the quality.

To ensure the efficiency of power supply provision is one of the challenges in the regulation schemes involving regulatory mechanisms, utilities, consumers and society. Trying to answer that question, AES Eletropaulo, the largest Brazilian power utility, sponsored a research to develop a methodology for determining the value of consumers' willingness to pay for a greater or lesser level of the quality offered using the Contingent Valuation Method. This survey of consumers’ willingness to pay for the improvement of power supply quality is part of the project to develop methodologies to evaluate the impacts of service quality considering consumers perspective in order to grant subsidies to the technical planning investments and develop new products and services better fit to consumers’ needs. The project included Eletropaulo as well as Universidade de São Paulo and Fundação Instituto de Pesquisas Econômicas. This paper presents the main results of the research, realized on August of 2008.

SURVEY DESIGN

The objectives for the survey were to perceive the impacts generated by service quality assessment by the consumers residing in the regions with critical performance and estimate the willingness to pay for quality improvement and/or to receive a compensation for reducing or maintaining the quality level. In order to identify these areas, it became necessary to verify in which areas service quality levels were below the standards demanded by the Regulator and also the satisfaction indicators of customers in such areas, showing their dissatisfaction with the services provided.

Service quality refers to the availability and reliability on the power supply and it is measured through continuity indexes SAIDI and SAIFI which consist in a legal method for quality controlling the supply. The highest indexes are made public by the Brazilian Electricity Regulatory Agency – ANEEL – which calculates the overall aim of the different utilities in the country grouping the ones with similar characteristics. In AES Eletropaulo’s case, the aims established are fulfilled and in many cases the performance was better than the regulated ones. However, there are regions inside concession with lower quality provision compared to the total average, showing SAIDI and SAIFI indexes 100% higher.

Through the survey of home customers’ satisfaction in 2007 and the indexes of reliance, developed by Abradee - The Utilities Association - with the Instituto Vox Populi it was possible to establish the relation between dissatisfaction and
CONTINGENT VALUATION METHOD

The Willingness to Pay Survey is based on the contingent valuation method. The method consists in the measuring technique of sampling surveys to extract the individual preferences for property and/or services thus calculating the Maximum Disposition to Pay for the improvement of a public service, or the Minimum Disposition to Receive for a decrease in the quality or level of offer for property or service. This estimate defined by Hick’s equivalent and compensatory variations, can be interpreted as the property value for a representative individual.

The Contingent Valuation Method is one of the most spread approaches to obtain the payment disposition for goods for which there is no market. In general terms, The Contingent Valuation Method consists in presenting to the individual, preferably in face to face interviews a hypothetical market for the good in question. Thus, the Willingness to Pay is revealed though a conveniently asked question. In this way, the estimated value is contingent to the hypothetical market presented, thus its denomination.

To lead Willingness to Pay Survey through the Contingent Valuation Method involve circumstances different from conventional surveys which have to be taken into account. The character of the survey and the elaboration of the instrument to collect data are critical issues for the survey. There is no standard approach for designing the survey of contingent valuation. There are however a series of elements well defined to undertake the survey which we can consider as a methodological route to guarantee the reliance and the validity of the results.

Assembling the scenario to be shown to the interviewed person is the key aspect in the notion of the survey; the interviewed subject has to know what he is paying for or not, the form of payment and the consequences of his choice. Those are the minimum requirements to enable a rational choice in the context of usefulness of the consumers’ theory.

An important issue that distinguishes the survey is how to obtain from the interviewed person his Willingness to Pay. There are several ways of asking this, the two main ones being an open ended question, whereas the person expresses the value he wishes and the question is: “What is your limit willingness to pay for a good or service?” This focus has been criticized by the specialists for being extremely vague leading people to express attitudes towards the good instead of evaluating the good or project at stake. Another method is the Referendum format, involving a choice by the interviewed person and the question is “Are you willing to pay $ X for the program being evaluated?” YES or NO answer.

The referendum method is better for evaluating public goods and is based on a political market model where people express their choices through polling, approving or disapproving alternatives, for being used to the mechanism of choosing, since they make political choices and pay for the provision of public goods through fees, public fees and taxes, producing a more realistic scenario for the survey of Contingent Valuation.

To apply the method a combination of exploratory qualitative techniques is used, such as focus groups, deep exploratory interviews which help the quantitative survey. The Contingent Valuation Survey can be considered as a type of pluralistic survey since it combines qualitative and quantitative methods to obtain advantages from both. Prior to applying the field survey tests and pilot-surveys are undertaken to evaluate in real conditions the survey’s and the questionnaire’s performance as well as the interviewing process also for the training of the researchers.

To help formulating the survey two focus groups were chosen with representative elements of the surveyed universe – residential clients in critical areas with different income – a low-income group, between 3 to 5 minimum salaries and another with higher income, between 15 to 20 minimum salaries. Prior to the fields survey, a pilot survey was undertaken with 50 interviews. One minimum salary is about US$ 220.00 .

RESEARCH

The questionnaire is the essential tool of the research, because it is trough its understanding that the interviewed persons can evaluate the proposed good or service on a hypothetical market circumstance and the scenario exposed in the survey.

The questionnaire was based on open and closed questions, comprehending 3 blocks of questions. The first block refers to perception and evaluation of the power supply quality, involving knowledge of Eletropaulo, service perception of AES Eletropaulo, services’ price evaluation of the power supply and the evaluation of its quality.
To evaluate the quality of the power supply different aspects were analysed such as frequency or when did the interruption occur; the attributes of the quality supplied, such as up to 3 minutes, more than 3 minute interruption and voltage variation. Damages and losses due to power shortages were also analysed as well as the services provided in such situations. This first part of the survey allowed for the analysis of the degree of satisfaction and helped evaluating the quality provided in power supply. The second block presents the scenario and the questions about the Willingness to Pay for and Willingness to Receive and the third block presents data and information for the interviewed persons characteristics (income, age, inhabitancy conditions).

Scenario
The survey aimed at evaluating the quality of the services provided and it was observed at the qualitative phase of the survey that the consumers’ dissatisfaction was more associated with the aspects of the service provided by the concessionary than with the quality of the power supplied. Furthermore, it became clear that residential customers are more aware of concrete issues such as billing errors, surges, power interruptions, showing difficulty to evaluate and quantify the quality of the power supply. In order to present an executable and plausible scenario the interviewed persons were informed about the current situation of the power supply services in the critical areas, and the future situation if investments were made in the network in order to improve the quality of the services. To illustrate this, the SAIDIs and SAIFIs graphics were presented in figure 1. This way, the interviewees noted the variation on the quality level of the services. After the presentation of the panorama, the WTP e WTA questions have been made. Although the usual recommendation in literature is to always formulate the questions in the willing to pay format, the reactions and answers of the interviewees from the focus groups performed in the process of construction of the questionnaire, indicated an ambiguity in relation to the panorama of the disposal to receive by the groups. One of the groups revealed themselves as sympathetic to the disposal to pay and another to receive. For this reason, both questions were added to the final questionnaire. Adopting the referendum model, the interviewed was confronted with a WTP question, asking if the customer would pay for an investment in the energy network to improve its quality to the indices of the energy company best regions. After that, a WTA question was made, asking about the acceptance of a discount in exchange of keeping the quality as it was. The clients could answer NO to any of the questions, even denying to pay the investment and to do not receive any discount. The WTP and WTA values asked were defined during the qualitative phase, where six values were determined (R$ 1, 2, 3, 5, 7 and 10) as possibilities of increase or discount on the monthly energy bill. The WTP values have been distributed randomly among the interviewed and the WTA values were function of the WTP. Follow-up questions were added, asking for the reasons of the answers. The figure 2 presents the questions scheme.

RESULTS
WTP and WTA
Taking into account all values, the WTP results show that 24.6% of the sample is willing to pay for the execution of proposed investments while 75.4% is not. As expected, the percentage of the interviewee in favor of the investment diminishes as the value of the contribution rises. 41.43% are willing to pay the minimum monthly value, 1.00 Brazilian Real, during two years for the execution of the investments and only 14.29% of the interviewee are willing to pay the maximum monthly value, 10.00 Brazilian Real for the same purpose. Among those who would not accept pay by the investment 73.2 % accepted the discount, even if the value is less than proposed for the investment. The main reason for not willing to pay is related to the increase in electric energy bill. Among those who accepted the WTP and opted by the discount, only 20 % did it due to satisfaction with the quality of supplying. Among those who did not accept the WTP but preferred the discount, only 4 % were satisfied with quality of the service.

WTP estimation
The most important point to be highlighted from the obtained results is the significant portion of the interviewee does not accept the minimum offered payment. Such result probably reflects that a portion of the population is not willing to reduce its consume of other goods to “pay” something to the improvement of the supply. From a practical point of view this high proportion of rejection to the minimum value takes to a technical problem. Any model which do not introduce explicitly a high concentration of null responses will produce low reliable results. More traditional models, for example, based on symmetric distributions probably will produce negative estimations for WTP. A possible solution to this problem is the use of an estimation method called Turnbull. This method is different from the censored logit model for being totally non-parametric. As result, any attempt of obtaining conditional results implies to divide the sample in groups according to the desired variable.
Since the proportion of answers “yes” to the question of willingness to pay is always decreasing as the offered value rises, the application of this method becomes quite simple. For a random discrete variable it is known the average is given by:

\[
E(WTP) = \sum_i \Pi_i \times X_i
\]

Where \(\Pi_i\) is the probability associated to each one of the offered values \(X_i\).

The WTP is a continuous variable, but as indicator is discrete and the equation (1) can be used to build an approximation of the minimum value for the average of WTP. Thus, this value corresponds to the minimum possible value associated to this probability. By using this rationale for all values, the lower limit of minimum average WTP can be approximated by:

Min. Average WTP = (0.414 x 1) + (0.289 x 2) + (0.244 x 3) + (0.233 x 5) + (0.167 x 7) + (0.143 x 10) = 5.49

Another alternative is to exploit the fact that interviewees have been presented also to a stimulated response for their willingness to receive a discount for the quality stay as it is. This rationale can be repeated for all offered values in order to calculate the sample proportions associated to each one of the intervals.

The minimum value found to WTP, which represents the lower limit for willingness to pay, was 5.49 Brazilian Real, on average, every month, by customer, during 2 years. On the other hand the lower limit for the WTA was 7.90 Brazilian Real.

The results of this survey show that it is possible develop methodologies that take into account the consumers WTP for quality as a way for obtaining economical incentives for planning the investments and resources allocation for attainment of the true society demands.

There are surveys on course that intend to quantify the necessary investments to improve the service quality. Thus, the comparison between quality of supplying and necessary investments for quality can be done by the utility.

**REFERENCES**


