

A Preliminary Study of challenges of Housing Energy Consumers

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Abstract—Implementation of maximum demand charge is a possible solution to better reflect the cost of generating and delivering electricity. However, this implementation leads to additional charge in the electricity bill and would effect on the electricity affordability among the residential customers. As a preliminary study on the issue related to electricity affordability and willingness to pay for maximum demand charge, this paper uses survey data collected from 411 residential electricity customers in Malaysia and descriptive analysis. Findings from this study indicates most of the respondents do not face electricity unaffordability problem and seem to be willing to pay for the maximum demand charge.

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I. INTRODUCTION

TAMILNADU EB currently is aiming to achieve economic viability-reflective of market price [1]. One of the possible ways to achieve this is by having the cost of servicing electricity being shared by all electricity users. In Malaysia, Tenaga Nasional Berhad (TNB) charges peak demand using Maximum Demand (MD) charge. The MD charge is essential to finance as high as 30 percent of the total electricity costs [2]. However, only commercial and industrial customers are paying the MD charge. The small customers at low voltage level are only paying energy charge as their peak load requirement is still low [3]. To the best of the authors' knowledge, there is no academic study done in Malaysia on issue related to electricity affordability and willingness to pay (WTP) for MD charge. Using questionnaires from survey on 411 respondents, both issues are investigated using descriptive analysis.

II. RELATED WORK

A. Overview of Malaysian Electricity Supply Industry (MESI) and Maximum Demand (MD) charge As part of the initiates by the Ministry of Energy, Green Technology and Water, MESI Reform was introduced to ensure the nation's electricity supply industry could power the country rapid economic growth. The reformation is useful to ensure long-term electricity system security, supply quality as well as manageable and sustainable tariffs for the benefits of the country. One of the potential solution to achieve these goals which is in the interest of this paper is adding MD charge in the residential electricity bills. MD can be defined as the highest level of electricity demand being recorded by TNB system during a 30-minute interval in a month. The charge is based on the recorded MD in kW multiplied by the respective MD rate. MD charge helps utilities recover the

cost of providing the capacity to meet the peak demand, which is more expensive than meeting the average demand [4]. Therefore, it is important for TNB to have enough generation, transmission and distribution capacity to meet the peak demand whenever required by customers [5]. Failure to provide sufficient capacity leads to energy brownouts or worse yet, blackout. B. Willing to Pay (WTP) on MD charge WTP is a highest price a consumer is willing to buy for one unit of [8].

These studies claimed socio-economic characteristics, such as age, education, household size, number of dependents, gender and income are important factors influencing WTP measure. In a study by Carlsson & Martinsson (2007), they suggested income is a major determinant of WTP for electricity services other than age and education [9]. While, Goett et al (2000) find households are WTP about half the price of a kilowatt-hour to reduce the number of power outages from four to two and its duration from 30 minutes to 30 seconds [10]. f products or services. Baidoo et al (2013) applied WTP measure for a wide range of goods including water, Padi et al (2015) used WTP measure on waste management and Vondolio (2009) used it on biodiversity conservation [6][7].

The households' electricity affordability is an important issue that need to be considered if the MD charge is being imposed on them. This is because MD charge will be an additional charge in their electricity bill that leads to higher electricity bill. But, it can also be an incentive for residential customers to be more energy efficient by consuming less electricity or be more supportive towards renewable energy practice such as installation of solar panel. In a study by Panayides (2013), affordability is being measured as a percentage of income spends on electricity [14]. Hence,

unaffordability is when a household spends more than 10 percent of their income on the electricity bill. Individuals with difficulty in paying electricity bill will be less likely to pay for the MD charge. Alternatively, there are other three measurement of electricity affordability such as the percentage of income goes into electricity bill, the percentage of income goes into essentials and basic need electricity [14].

In another study by Ranasinghe (2011), he measured electricity affordability using more direct questions such as the respondents' difficulty to pay the electricity bill, are they are to the monthly electricity bill on time and whether they had taken steps to reduce electricity bill such as using alternative energy for cooking, using energy saving bulbs and self-control electricity consumption [15]. DeCicco et al. (2013) find residents who are in the bottom property value tercile will face electricity affordability problem if their home energy bills are doubled from its current value and residents in the top and middle property value terciles will only face electricity affordability problem if their home energy bills are tripled from its current value [16].

III. RESEARCH METHODOLOGY

In collecting the information for the purpose of this research, a survey approach is used since it is able to deal more directly with the respondent's attitude in terms of their feeling, thoughts, and perception [17]. The survey approach also gives more accurate response to evaluate information on respondent's attitude since it is able to draw generalized conclusions from the target population [18]. In the first stage, the survey is conducted based on pilot test whereby the questionnaire is distributed to 154 respondents randomly selected in Peninsular Malaysia.

The purpose of the pilot test is to examine respondents' views on the questionnaires and to ensure the questionnaire is clearly defined with no ambiguity prior to the actual survey. As the result from the pilot test, six questions were removed. Then, the survey proceeds with actual survey whereby the final questionnaires are distributed to 465 respondents randomly selected in Peninsular Malaysia. The survey questionnaires used to collect information on respondents' electricity affordability related to their WTP for MD charge is presented in Table 1. The WTP questionnaires are answered based on five point likert scale varying from 'Definitely not willing to pay' to 'definitely willing to pay' and electricity affordability questionnaires are answered based on nominal and interval scales. This study uses descriptive analysis to investigate the household's socio-economic characteristics and their electricity affordability related to their WTP for MD charge.

The descriptive analysis is useful to make some general observations about the data collected in socio-economic characteristics such as number of male and females, marital status, the age range, the level of education, occupation, the range of household income, household size and residential

location of the respondents. The same approach also is useful to explore and summaries the respondents' electricity affordability such as affordability to pay electricity bill, steps taken to reduce electricity bill, kind of energy cooking used, energy saving bulb usage, money spent for other sources of energy, home status, percentage of monthly income represent electricity bills, average monthly expenditure and percentage of MD charge from total monthly expenditure that respondent afford to pay.

IV. RESULT AND DISCUSSION

A.Socio-Economic Characteristics and Descriptive Statistics There are 465 respondents collected from the final survey with majority of them aged 20 years and above. Although the respondents are randomly selected, they are limited to those who has knowledge on electricity bill and indirectly involved in paying the electricity bills. Once the data set are being filtered and all records with missing data are removed, the final dataset is equal to 411 respondents. The result of the descriptive statistics on the respondents' socio-economic characteristics are presented in Table 2.

A majority of the respondents are female (60%) and married (74%). The sample shows quite an evenly age distribution with 30 percent of the respondent are between 20 and 30 years old, 35 percent falls between 31 and 40 years old and 35 percent falls above 40 years old. Nearly 71 percent of the respondents holds a degree and 54 percent of them working in the education sector. However, majority of the respondents (46%) earning less than RM5,000 per month. Mostly, the respondents lives in a house occupied by 4 to 6 peoples (61%) and situated in rural area (68%)

V. CONCLUSION

From the survey data collected for this study, electricity unaffordability seem not to be a serious issues to most of the respondents. These could potentially contribute to the positive feedback on WTP on MD charge with high percentage on 'willing to pay' response. This could give an indication that the public are willing share the cost of servicing electricity. Hence, MESI objective to achieve economic viability-reflective of market price will soon be achieved.

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