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Households' willingness to pay for reliable electricity services in Ghana

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ABSTRACT

Access to reliable electricity is important in increasing the living standards of households and promoting sustainable development. However, Ghanaian households have had to grapple with frequent power outages and poor quality electricity services in recent times. This study examines the factors influencing households' willingness to pay for reliable electricity services in Ghana. Using data collected from 950 households in the Cape Coast Metropolitan Area and the Tobit regression technique, it was revealed that monthly income, prior notice on power outages, business ownership, separate meter ownership, household size and education significantly affect willingness to pay for reliable electricity services. On the average, households were prepared to pay 44 percent [GH¢6.80 (US$3.42)] more, relative to the mean monthly electricity bill in the sample, to improve electricity services. It is envisaged that the findings would be used by policy makers and utility companies to make electricity generation and distribution more sustainable and efficient.

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1. Introduction

Access to electricity is important in improving the living standards of households in developing countries. It is also crucial in enabling the countries themselves to advance economically by facilitating production. Reliable electricity services allow households to meet their daily requirements of cooking, learning and entertainment [1–3]. Access to quality public services including electricity is also inextricably linked to the achievement of many of the Sustainable Development Goals [4]. A modern form of energy like electricity is a prerequisite for sustainable development and overall improvement in the quality of life. Reliable electricity supply can stimulate economic growth that will have beneficial spill over effects on households living in poverty and helps to ensure environmental sustainability by cutting down the consumption of wood based fuels such as charcoal and firewood [5]. Unfortunately, in many countries in Sub-Saharan Africa, electricity is not only limited in terms of access but its quality in terms of reliability is also questionable. This is fueled, in part, by growing demand for energy, with electricity consumption estimated to grow at the rate of 2.6 percent per annum, shortage of funds to undertake investment and diversify generation [6,7] and partly by rapid population growth and urbanization [8].

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In Ghana, electricity services are marred by low generation and frequent outages, with the mean power outage estimated to be 10 h per month [9]. Between 2006 and 2007, for instance, the country experienced electricity crisis for 13 months [10]. Similarly, between August 2012 and June 2013, the country had to resort to load-shedding as a result of the non-availability of natural gas to generate power from thermal plants [11]. Ghana's total population now stands at about 25 million but is estimated to reach 40 million by 2030 [12]. These projections have consequences for electricity demand and could worsen a potentially bad situation. As noted by Oteng-Adjei [13], electricity generation in Ghana will need to be between 18 and 25 GW in order to meet domestic demand by the year 2030. Household demand for electricity is also estimated to reach between 7000 and 13,000 GW h by 2020 [14]. Three things are at stake. First, electricity generation must be at a cheaper cost, competitively priced and from efficient and sustainable sources. The quality of supply must also be intensive, reliable and continuous. In the second instance, investment into generation must be high and must also come from a combination of sources including the private sector in order to make electricity generation and distribution more sustainable. Finally, consumers, especially domestic users, must be willing to pay extra charges in order to increase generation and improve distribution. Thus, there is the need to identify the factors underpinning willingness to pay for reliable electricity services among various categories of consumers including households at different geographical locations and socioeconomic backgrounds.

It has been reported, with varying degree of consent, in studies in other countries, that willingness to pay for electricity service reliability depends on several factors including age, sex, education, family size and composition, house ownership, household income, value orientation, political party affiliation, monthly electricity bill, and access to information on power outages [15–22]. This study employed a contingent valuation survey and Tobit regression technique that enables us to account for zero bids, to investigate the factors influencing households' willingness to pay for improved electricity services in Ghana. The rest of the paper is organized into four sections. Section 2 is devoted to review the related literature. The Section 3 discusses the methodology and the empirical model. Section 4 presents the results and discussion and the Section 5 provides the conclusions and the policy implications.

2. Literature review

A number of methodological approaches have been developed to measure people's willingness to pay to ensure the sustainability of publicly funded goods and services. The contingent valuation method (CVM) is an example of the stated preference methods whereby hypothetical markets are created for a non-marketed commodity and individuals are asked to state how much they would be willing to pay for the commodity if the market really existed. It draws upon economic theory and survey research to elicit directly from consumers the values they place upon commodities or services [23,24]. In a contingent study, the proposed improvement (or damage) in the provision of the commodity is presented in a hypothetical market and the individual is then asked to express his or her maximum (minimum) willingness to pay (or accept) to benefit (lose) from the consumption (destruction) of the commodity [25]. Contingent valuation has over seven decades of existence. Bowen [26] and Ciriacy-Wantrup [27] were the first to propose the use of specially structured public opinion surveys to value what Bowen [26] called 'social goods' and Ciriacy-Wantrup [27] referred to as 'collective, extra-market goods' that cannot easily be sold to individual consumers and the quantities available to different individuals cannot be adjusted according to their respective tastes. Both Bowen and Ciriacy-Wantrup saw that a typical feature of these goods was that, while individuals would have their own distinctive demand curves for these goods, the aggregate demand curve is obtained by adding the marginal rate of substitution (expressed in money) of the various individuals at each possible quantity of the social good.

Though Bowen [26] and Ciriacy-Wantrup [27] envisaged the CVM in the 1940s, empirical studies on the technique started to flourish fifty years later, particularly after the National Oceanic and Atmospheric Administration's blue-ribbon panel guidelines [28]. In Ghana, contingent valuation has been applied to measure willingness to pay for a wide range of goods including water [29], waste management [30,31] and biodiversity conservation [32], and it was revealed that socio-demograhphic factors, such as age, education, household size, number of dependents, gender and income, affect willingness to pay. Carlson and Martinsson [33] and Zarnikou [21] used a CVM to value electricity supply reliability and found that education, income, home ownership, family size and composition affect willingness to pay for reliable electricity. Aravena-Novielli et al. [34] elicited households' willingness to pay for reliable electricity generation in Chile. Their study revealed that consumers are willing to pay more for reliable electricity supply and also have a strong preference for energy from renewable sources than from fossil fuels. Carlsson et al. [35] suggested that income is a major determinant of willingness to pay for electricity services than other socioeconomic variables including age and education. In the USA, Goett et al. [36] found that households were willing to pay about half the price of a kilowatt-hour to reduce the number of power outages from four to two and their duration from 30 min to 30 s. Quartey [37] argued that the willingness to pay for electricity from alternative sources correlates negatively with number of dependants in a household and positively with monthly electricity bills as well as power usage.

Abdullah and Mariel [38] studied willingness to pay for improved electricity services in Kenya and reported that household size, age, employment status, bank account holding and years of residence in the study area affect willingness to pay for reductions in power outages. Edkins [39] reiterates the influence of income on WTP. Abdullah and Jeanty [40] indicated that people with higher income and those with an interest in home based businesses are willing to pay more for reliable electricity services. According to Gunatilake et al. [41] households' willingness to pay for electricity services is influenced by the ownership of a home business, perceived benefits of reliable electricity, per capita household income and the number of children of school going age in the household.

A number of authors have also studied willingness to pay for electricity from renewable sources. Du et al. [42] argued that age and awareness about environmental issues affect attitudes towards the demand and willingness to pay for electricity from renewable sources. Pepermans [43] investigated the determinants of Flemish households' willingness to pay to for electricity from renewable sources and found that households were willing to pay approximately €190 per annum. Pepermans [43] indicates that level of education, environmental awareness as well as income predict willingness to pay. Wiser [44] used a split-sample dichotomous choice approach on 1574 respondents to explore willingness to pay for renewable energy and found that willingness to pay is higher under the collective payment format than voluntary mechanism. Private provision of electricity also attracted a higher willingness to pay than the government. The study by Wiser [44] has brought two important policy issues to the fore. First, it demonstrates the suspicion of government's ability as a producer. It also proves that respondents are more likely to donate towards public services when they know for a fact that every user would contribute and that the funds would be used for the intended purpose.