

SOLAR ENERGY ACCESS IN RURAL OFF-GRIDD AREAS OF BANGLADESH: DETERMINANTS AND IMPACTS

Sakib Bin Amin, North South University, +8801758871668, sakib.amin@northsouth.edu
Mainul Islam Chowdhury, North South University, +8801710161871, mainul.chowdhury@northsouth.edu
S.M. Asif Ehsan, North South University, +8801796398919, syed.ehsan@northsouth.edu
S.M. Zahid Iqbal, North South University, +8801799114433, zahid.iqbal@northsouth.edu

Overview

In this paper we aim to identify the important socio-economic, geographic, and demographic factors at the individual, household, and community level, that affect the access and adoption of solar home system (SHS) in rural Bangladesh. Our study has two major parts of analysis. In the first part, we identify different factors that determine the SHS adoption of households. For this part of the research, households' several individual-level and socio-economic factors' information such as their income, education, age, access to other sources of electricity, access to credit, number of household members, neighbors' access to SHS, way of obtaining SHS, reasons for not getting SHS, and information on many other important factors were collected through a questionnaire survey. For the second part of our study, we explore various economic and social impacts of SHS adoption on households in rural Bangladesh. Among others, some important socio-economic aspects in this part of our analysis include education and health, economic opportunities, and the living standard of impoverished rural households.

Methods

To attain the research objectives, in this paper, we have incorporated both quantitative and qualitative techniques. For the quantitative part, utilizing a primary questionnaire-survey dataset, we have applied the random utility model for discrete choice decision-making, based on the Probit Binary Response regression method. Besides the empirical analysis, the qualitative part of the paper helped us obtain an in-depth picture of SHS's current scenario in rural areas by finding out the nature and causes of SHS adoption, socio-economic impacts of SHS, and SHS's future development in Bangladesh.

Our questionnaire survey for this study included 500 households (one respondent from each household). To see if the SHS barriers vary across different geographical regions of Bangladesh, our study areas include coastal off-grid villages, *char* (small island) and *haor* (wetland) areas, and impoverished northwestern regions of the country. The survey area includes villages where the SHS program has been implemented by POs and comparable non-project regions that do not have access to SHS. The respondents were randomly selected from both with-SHS and without-SHS groups of households, upon consultation with the *Union Parishad* (local government) offices. The households with and without SHS might have unobserved attributes that can contribute to their being in the specific group, which can give rise to classic endogeneity issues and might lead to biased estimation results. However, our study's random selection of households ensures that the unobservable factors or characteristics of households with and without-SHS are not correlated with the covariates included in our estimation process. In other words, the random selection followed in this paper makes the two groups of households (with and without SHS) as comparable as possible, which can significantly reduce the selection bias. Our primary survey respondents are divided along the line of gender, income groups, and ethnicity in the selected regions.

The qualitative part of this paper utilizes a number of qualitative data collection tools such as key informant interviews (KIIs), Focus Group Discussions (FGDs), and case studies conducted alongside the primary questionnaire survey to gather further insights into the factors influencing SHS adoption decisions and impacts of SHS in rural Bangladesh. A total of four Key Informant Interviews (KIIs) and four Focus Group Discussions (FGDs) have been conducted as part of the study. In addition, eight real-life case-studies have been collected to better understand the barriers and motivations as well as the impacts of SHS on households and communities. The KIIs were carried out among households from different socio-economic strata, providers of SHS, officials from NGOs who are involved in the distribution and maintenance of SHS, and other stakeholders. Each FGD ensured the participation of 20 to 25 individuals, with a considerable number of women in each group. Besides, an enabling environment was created to ensure marginalized and impoverished citizens' participation in the FGDs. By combining qualitative and quantitative methods, we obtained an in-depth picture of SHS's current scenario in rural Bangladesh. These also helped us highlight the existing barriers to SHS adoption and SHS's future development in Bangladesh. Moreover, the eight case studies collected from the field have helped us further understand the experiences of SHS users in installing SHS, effects on their households, and reasons for not obtaining SHS for the non-users.

Results

Our results suggest that the households from the *char*-areas and coastal areas are more likely (by 29 percent and 10 percent respectively) to obtain SHS compared to other areas. Also, access to SHS credit increases the adoption likelihood by 35.5 percent, and it is statistically significant. Other factors significantly affecting the household's decision to adopt SHS in Bangladesh include household habitat, household size, primary occupation, education level, and asset value. Finding that financial constraint is one of the most important factors hindering the household level SHS adoption, we also investigate determinants and barriers of obtaining credit-access for purchasing and installing SHS. Access to SHS-credit was found to depend on the household's primary occupation, NGO activity, and income groups. Households informed about the SHS by NGOs are, on average, 40.3 percent more likely to get credit-access for purchasing SHS than households informed by their neighbors or relatives. Being from *char* and coastal areas increases the likelihood of receiving SHS credit by 18.4 percent and 19.7 percent, respectively. Additionally, if the household head's primary occupation is agriculture, the household is 26 percent more likely to receive the SHS credit compared to other households. However, years of schooling, and being from low-income groups negatively affect the possibility of obtaining SHS-credit. Interestingly, we find that the total asset and land ownership value do not play any important and statistically significant role in getting SHS loans.

Conclusions

This study finds households' habitat location (from *char* or coastal area), their primary occupation (agriculture or non-agriculture), having livestock asset, total asset ownership, household size, having school-going children in the household, and the type of habitat (*kacha* or *paka*) play statistically significant and positive roles in the SHS-adoption decision of households. On the other hand, total land ownership and way of being informed about the SHS (from NGO vs from neighbors-relatives), are significantly and negatively related to household SHS adoption decision. Having access to credit is a significant determinant of adopting SHS because of the high upfront cost of the SHS installation. Hence, we explore factors that can improve or deter households from obtaining loans for purchasing SHS.

The majority of the households, both from the with-SHS and without-SHS groups, agree that access to SHS has improved or would improve their standard of living. Most households surveyed in our study agree that having SHS at home improves the education and health facilities. The majority of the households in our study also do believe that access to SHS has improved local infrastructure and has created more business opportunities.