BARRIERS OF IMPLEMENTING HOUSEHOLD LEVEL SOLAR PHOTOVOLTAIC SYSTEMS IN KURUNEGALA DISTRICT OF SRI LANKA: A SOCIAL PERCEPTION ANALYSIS

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INTRODUCTION

Goal seven of the sustainable development goals set by the United Nations emphasizes the importance of affordable access to renewable clean energy all over the world (UNDESA, 2021). The evolution of solar photovoltaic (PV) techniques were developed in Sri Lanka in the 1970s. Since then, solar PV technology has attracted the private sector with great success. Since most companies targeted the urban areas, few non-governmental entities had established solar PV at the community level to supply electricity to the areas the Ceylon Electricity Board does not cover. Solar PV development in Sri Lanka has appreciated and grabbed donors' attention, such as the Asian Development Bank and World Bank (Gunaratne, 1994). The economic developments, which are planned and ongoing, have increased the drastic demand for electricity in Sri Lanka. The rising electricity demand will increase the emission of greenhouse gases unless the strategy for non-renewable energy is formulated and implemented (Silva, 2020). The government of Sri Lanka has given a target to be a carbon-neutral country by 2050 as per international obligations. Building rooftop solar PV technology plays a considerable role in supplying electricity to customers. The installation of solar PV on the roof area of the building can reduce land usage to a certain extent, particularly in Sri Lanka's urban areas. Further, solar PV electricity generation can curtail the negative environmental impact. Kurunegala is a district in Sri Lanka which has twelve hours of solar radiation in a day throughout the year, as shown in Figure 1 (Weather Spark, 2022)

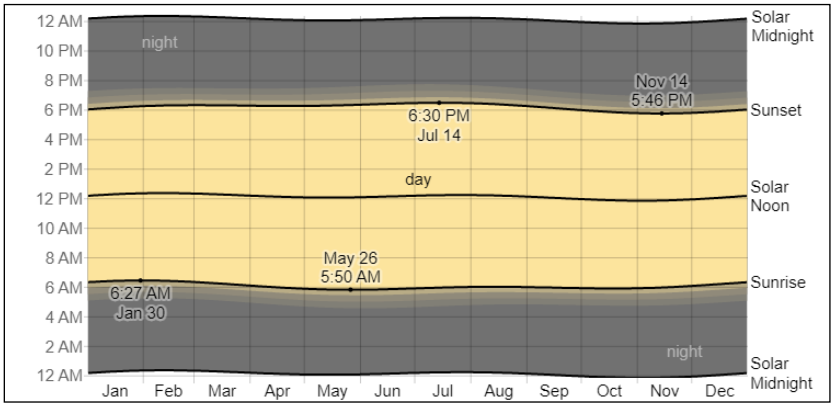

Figure 1 Annual Solar availability in Kurunegala (Weather Spark, 2022)

However, there are many barriers to implementing solar PV systems, especially rooftop solar PV in Sri Lanka, identified by scholars through previous studies. The improper allocation of institutional responsibility in screening and approving solar PV projects makes the approval process difficult since many stakeholders are involved in the approval process (JICA, 2018). The technical know-how about solar PV and the lack of awareness of the economic, environmental, and social benefits are critical issues in Sri Lanka. The financial barrier is one of the main barriers to implementing the household rooftop solar PV.

As per previous studies, there is no clear evidence to conclude the impact of values or attitudes on the behavioural decision of solar PV implementation. However, some scholars and psychologists are confident in changing behaviour and attitude regarding energy usage (Dwyer et al., 1993). Hence the present study highlights the requirement to understand the factors hindering household investors in implementing rooftop solar PV systems at the household level. As such, the study's objective is to identify the barriers to implementing solar PV systems in residential buildings to generate electricity from the perspective of homeowners in the Kurunegala district in Sri Lanka.

METHODOLOGY

The study involved obtaining a response to the questionnaire from 104 individuals across the Kurunegala district in Sri Lanka about their perceptions and the barriers to implementing household solar energy systems in their houses. The responses were collected from the individual members and not from the household since different opinions and ideas can be obtained within the same family regarding the barriers to implementing solar PV systems. The data collection was done in May and June 2021 through online (Googlr form) and face-to-face methods. The respondents were reached through the Divisional Secretariat offices in Kurunegala district. The online respondents represented approximately 70% of the sample. The sampling method concentrated on maximising geographic diversity to enable the participants to form rural and urban individuals. The questions were based on economic and environmental values, technical know-how, and social behaviour. The questionnaire consists of two sections: background information and ten critical factors for implementing solar PV systems with a 5-point Likert scale choice.

RESULTS AND DISCUSSION

The number of respondents for this study is 104, out of which 64 are males (62%), and 40 are females (38%). The age range of respondents is 20 to 65 years. The majority represents (38%) of the age group of 35 to 45 years old. Nearly 89% of the respondents are between the 25-55 age group. Household size is categorized into four groups; 62% of respondents fall under 4-6 household size, 28% under 1-3, 9% under 7-10, and 1% under ten or more household size. Most respondents (53%) serve either in government or private service. Concerning the educational background of the respondents, 53% of respondents have completed tertiary education, 30% have completed a university degree, 11% have completed secondary education, and 6% have completed primary education,

Most of the respondents (88%) live in the Kurunegala district, while 81% of respondents live in houses. Most respondents (88%) know that electricity can be produced using a solar PV

system, whereas 73% consider solar energy as one of the best solutions to curtail the energy crisis in Sri Lanka, as shown in Figure 2.

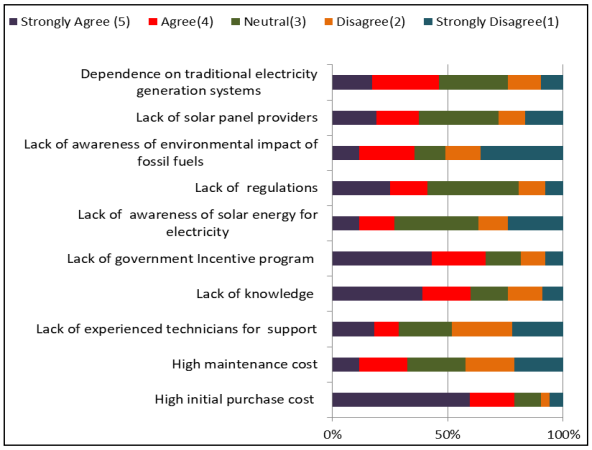

Figure 2 Respondents' perceptions of barriers in implementing solar PV system

As per the responses, a high number of respondents showed a perception of solid agreement on the factors. Figure 3 presents the questionnaire that identifies various barriers to implementing rooftop household-level solar PV energy generation. 62 out of 104 strongly agreed that higher implementation cost is the barrier to the household-level solar PV energy system

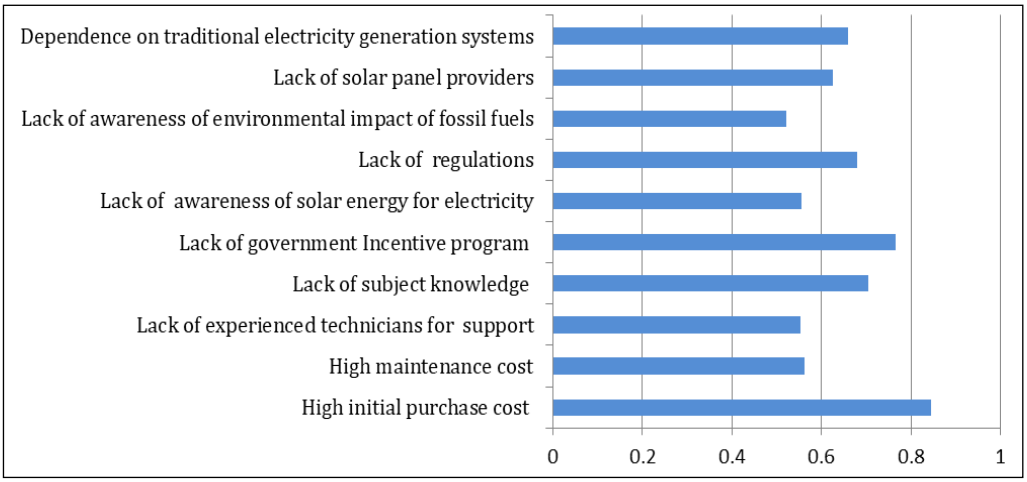

Figure 3 Relative Important Index of barriers in implementing solar PV system

Relative Important Index (RII), which is necessary to rank the main selection criteria, was identified through literature synthesis and a questionnaire survey. The collected data through a questionnaire survey were ranked using RII as this technique was used by researchers to rank factors in their research in previous studies. Hence RII was calculated to rank the main factors as barriers to implementing rooftop household-level solar PV energy generation systems in this study, as shown in Figure 3. As such, the factor “higher implementing cost” is identified as the most influencing barrier, followed by a lack of government incentive programs and subject knowledge to implement rooftop household-level solar PV energy generation in Kurunegala district of Sri Lanka.

$$RII = \frac{\varepsilon W}{A * N} \ldots (1)$$

Where;

RII	=	Relative Important Index
W	=	Weighting given to each factor by the respondents
A	=	Highest weight
N	=	Total number of respondents

CONCLUSIONS AND IMPLICATIONS

The research on social perception towards implementing household-level solar PV energy generation systems in Kurunegala district of Sri Lanka was carried out, responses were examined, and results were analyzed. One hundred four population samples contributed and responded to the questionnaire with distributed age groups, higher levels of the working class, and considerably high educational levels. Most respondents have heard about the solar PV system and understand that solar PV electricity is one of the best solutions to the electricity crisis. The results show that higher implementation cost is the most influencing barrier, followed by a lack of government incentive programs and subject knowledge to implement rooftop household-level solar PV energy generation in Kurunegala district of Sri Lanka.

***Keywords**:* Barriers, renewable energy, social perception, solar photovoltaic

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