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Energy Crisis and Household's Perception about Solar Energy Acceptance: District Hyderabad, Pakistan

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Abstract: Major cities in Pakistan are experiencing rapid growth of urban population, resulted in high energy demand and viable severe energy crisis.In this regard, easy retrieval of solar energy can play a pivotal role to cater the mounting demand of energy. Solar energy can be said as a topographical asset of Pakistan; but still,a low adoption of this environment-friendly source was observed by countrymen. Residential units are one of the major consumers of energy. Thus, public opinion can be considered as a key factor to judge the perception of renewable energy in any society. Therefore, it is obligatory to adopt the practices, which could explore the acceptance of renewable clean energy sources. Hence, the purpose of this study is to deliver empirical data about the social acceptance of clean energy, i.e. solar panels, by discovering the public opinion about solar energy. *Hyderabad, Pakistan* was selected as a case study. The *Facebook-based Questionnaire Survey* was adopted to procure data, and the sample size was determined with the help of *Taro method*. This study is imperative in a sense that it can be important for policy makers to have a precise knowledge about public perceptions towards solar energy. By investigating the public attitudes towards consumption of solar energy; it becomes easier to comprehend the future of solar energy practice in *Sindh* province, particularly in *Hyderabad, Pakistan.*

Keywords: Solar Energy, Social Acceptance, Taro Method, Facebook-based Questionnaire Survey, Descriptive Statistics.

1. INTRODUCTION

Energy is one of the fundamental needs and a prominent variable to upgrade the country's economy (Rauf, *et al.,* 2015). Huge consumption and increasing demand for energy shows that energy would be one of the major problems in the world (Khalil and Zaidi, 2014). To comply with the gigantic energy demand, developing world is also looking at renewable cleanenergy sources, in order to meet with the increasing energy needs (Holm, 2006). In spite of arich solar resource (Rauf *et al.,* 2015); Pakistan is an energy scarce country and facing severe energy crisis since last two decades (Khalil and Zaidi, 2014; Khan and Arsalan, 2016). Due to an energy shortfall in Pakistan, both rural and urban areas are confronting load shedding. Urban territories are facing 10–12 hours load shedding; while in rural domain, power is staying inaccessible for 16–18 hours daily (Khalil and Zaidi, 2014). Recently, Pakistan is looking forward to increase the use of solar energy through the installation of *Quaid-e-Azam Solar Power Park (QASP)* in the *Cholistan Desert, Punjab* (Ebrahim, 2015). Sindh government has also planned the various solar power projects, to encounter the energy requirements (Ali, 2015). In Pakistan, households consume the largest proportion of the energy, as compared to commercial, industrial, agriculture, street lights and other government consumption (Nasir, Tariq, and Arif, 2008). Hence, it is essential to identify the public perceptions about the acceptance of solar energy.This research point-outs the future challenges and public perceptions about the adoption of solar energy. Whilst, present study may augment information threshold for researchers, and offer better understandings about the public attitudes towards renewableclean energy usages.

2. MATERIAL AND METHODS

Hyderabad, the former capital city of the Sindh province, was selected for this study(Korai, Mahar, and Uqaili, 2016).On the globe, its position is between 25° 22′ 45″ North and 68° 22′ 6″ East and almost 150 km **(Fig. 1).**

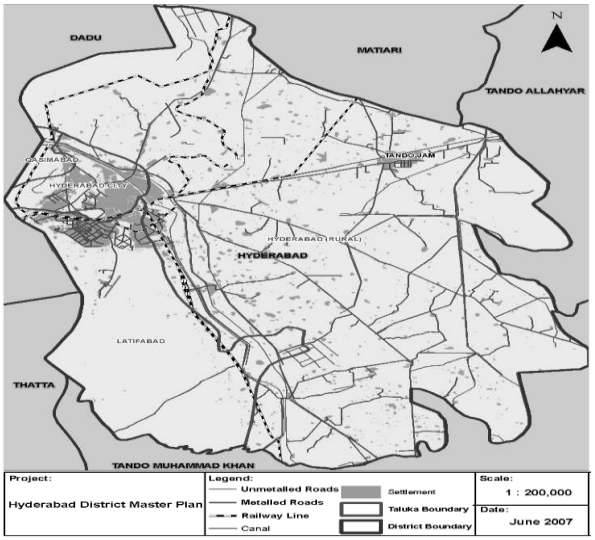


Fig. 1. Hyderabad District Map -2007 (Osmani and Company (Pvt.) Ltd.,)

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away from Karachi, which is a capital metropolitan city (Korai, Mahar, and Uqaili, 2014). The district map of Hyderabad, Sindh, Pakistan can be seen in **(Fig. 1).**

As, Hyderabad city is the second largest human settlement in Sindh; thus, energy deficiency in Hyderabad may diversely influenced the financial development. Keeping in mind the present energy demand, the provincial government of Sind found enthusiastic to adopt the option of solar power(Ali, 2015). In this view,the purpose of the research is to identify the public perceptions about the acceptance of solar energy in the context of Hyderabad city.

According to the time and economic constraints, *"Facebook-based Questionnaire Survey Technique"* was selected for data collection (Ho, 2015). By using *google forms*, questionnaire was developed and the link was shared on *Face book profiles/pages*. Respondents throughout the four Taluk as of Hyderabad city were invited to fill the questionnaires. Responses were requested from 4th September 2016 to 5thOctober 2016. The indicators, which can be utilized to quantify the public perceptions about solar energy acceptance, were arranged in questionnaire accompanied with some demographic attributes. As, the purpose of the study was to understand the public perception about solar energy acceptance and adoption. Therefore, few of the indicators were arranged in questionnaire, having Likert Scale with five points from strongly disagree to strongly agree (Joshi, *et al.,* 2015).

2.1 Sample size:

Due to lack of secondary sources about current population statistics, *"Compound Interest Formula"* was used to determine the present population of Hyderabad city (Talpur, Chandio, Baig, and Abbasi, 2016). By considering the growth rate of 0.001 (Zahid and Rajput, 2007),projected population for District Hyderabad was calculated as 204,033. In order to derive a significant sample size forthe present study, *Taro method* was implied (Haider, Amber, Ammara, Mahrukh, and Aisha, 2015). Mathematically, it can be written as follows(Oakland, 1953):

$$n = \frac{N}{1+N(e)^2} \quad (1)$$

Where

n is sample size

Nis population size

e is alevel of precision

The equation 1 was used to calculate the sample sizes, as shown in (2).

A confidence level of 95% with P = 0.05 was considered.

$$n = \frac{204033}{1 + 204033(0.05)^2}$$

$$n = 399.21 \cong 399 \quad (2)$$

The sample size was determined as 399; therefore, 399 questionnaires were filled from the study area, including selected demographic and solar energy acceptance attributes. Simple random sampling was adopted (Urpelainen, 2016; Haider *et al.*, 2015), and a *Facebook-based Questionnaire Survey*was executed for data retrieval (Ho, 2015).

2.2 Statistical analysis:

Descriptive statistical tests, i.e. frequency, percentage and mean were conducted to analyze the collected data (Urpelainen, 2016). Descriptive statistics is the strategy for outline the information in tabular, graphical, and numerical shapes(Anderson, Swweney, andWilliams, 2012).Statistical Package for Social Sciences (SPSS-22) was utilized for determining the authentic results (Haider *et al.*, 2015;Pandey, Garg, and Bharat, 2014;Turner, Yansaneh, and Jambwa, 2008).

3. RESULTS AND DISCUSSION

Mean score analysis was utilized for Likert Scale based attributes, such as importance to use solar energy for Hyderabad, willingness in paying more money for installation solar panels, awareness about solar energy, impression towards the installation of solar panels. SPSS-22 was used to find the mean scores and results can be depicted in **(Fig. 2).** Five points based Likert Scale from strongly disagree to strongly agree was employed to determine the public opinions on the solar energy acceptance.

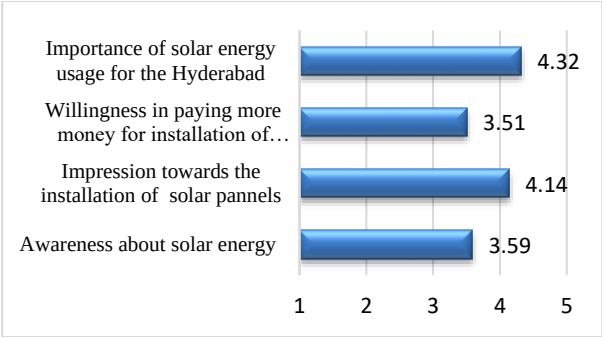


Fig.1. Likert scale based responses

(Fig.2)significantly indicates that usage of solar energy for Hyderabad is important, as it was found rated high, i.e. 4.32. Besides, public responded slightly high rate of willingness to pay for solar energy equipment, as it has amean value of 3.51. Overall impression towards the installation of solar panels wasalso achieved agreater mean value of 4.14, which clarifies the public opinions about the solar energy acceptance. In addition, awareness about solar energy was responded as 3.59, illustrating the need for awareness programs and media support, in order to upsurge the attentiveness regarding solar energy usage.

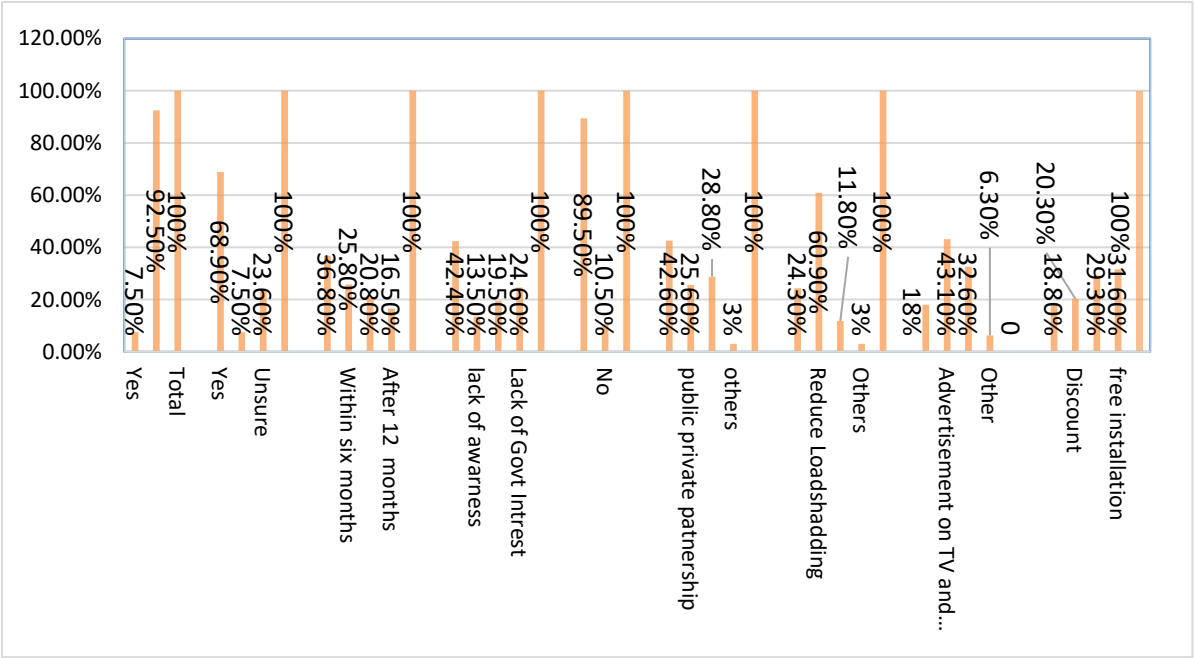


Fig.3. Public perceptions about solar energy

(Fig.3) indicates the public perception about solar energy installation. Currently, in Hyderabad, only 7.50% residents had installed a solar system in their houses, while 92.50% of the residents did not use solar energy. On asking from people about the installing of the solar panel, 68.0% people responded that solar energy is suitable for installation in their houses; whereas, 7.50% did not think that solar energy is suitable option for them. About 23.60% were unsure about the installation of solar energy. People's interest towards installation of solar energy within a month were recorded as 36.80% and 25.80% people wanted to install solar energy panels within six months. While, 20.80% people wanted to install solar energy within 12 months, and rare 16.50% people wanted to install after 12 months. According to **(Fig.3),** it can be said that most prevent factor for installation the solar panels were found as *"affordability."*Approximately, 42.40% people responded about the affordability factor. Secondly, the other preventing factor was found as *"Lack of Government Interest."* Third preventive factor was *"Absence of Trust in Solar Energy"* and forth was *"Deficiency of Awareness about Solar Energy Panels."*89.50% people responded that they would like to support government to subsidize for the solar energy; only 10.50% people were found not in favor of this action. On asking about the financial resource for installation the solar energy; 42.60% people responded to install solar energy by their own funds, 28.80% people were interested in interest-free loan, 25.60% were interested in a public-private partnership and reaming 3.0% were interested in other financialresources. Most important benefit for adoption of solar energy in people's minds were reducing load shedding; 60.0% people responded the primary benefit of the installation of solar energy was to reduce the load shedding.On the other hand, 20.30% people responded that benefit of the solar energy was to reduce the electricity bills, and only 11.80% responded that solar energy installation is beneficial in term of environment. 43.10% responded that they preferred advertisement on TV and radio for receiving information about solar energy; 32.60% preferred online information and 18.0% preferred door to door sales persons; whereas, only 6.80% preferred other methods. Most encouraging promotion for installation of solar energy was freeinstallments of solar energy. Around 31.60% people responded about free installments. The second encouraging promotion was free maintenance, which was recoded as 29.35%. Thirdly, 20.30% people responded about the discount option. Finally, 18.80% people were found in favor of the loan without interest.

4. CONCLUSION

Balanced energy demand and supply has become a dominant issue in Pakistan. Favorable climatic conditions for solar energy in Pakistan leads to put more focus on the solar energy usage.In this context, theavailable study highlights the public perceptions about solar energy by exploring the interests of people in solar energy usage, difficulties in solar energy consumption and public expectations towards the government steps regarding solar energy development. For this, data was collected through *Facebook-based*

QuestionnaireSurvey. The sample size was developed through *Taro method* for the whole *Hyderabad* district, and descriptive tests (Mean score and Frequency analysis) werecarried out through SPSS-22.

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