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The 27th Global Excellence Seminar

Let there be light: Innovative solutions for energy access in India

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Presenter

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Moderator

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Abstract

This presentation is based on Dr. Yoon's work to study how electrification via renewable energy sources – solar energy – can lead to commercial success and thereby adoption of renewable energy in rural areas with little or no access to reliable energy. In this study, Dr. Yoon's research focused on the demand-side of rural energy markets by finding out any potential barriers that prevent the rural people from adopting renewable energy and understanding what type of technology the rural people may prefer. Specifically, Dr. Yoon attempts to study the barriers to solar technology adoption through 1) the understanding of the rural consumers' willingness to pay for the solar lanterns, as well as the 2) investigating the patterns of demand for solar home systems.

Pertaining to the study for willingness to pay for solar lanterns, Dr. Yoon focused on rural consumers' willingness to pay (for solar lanterns) by introducing two scenarios - a given trial period and a trial period with postponed payment for the solar lanterns. Meanwhile, with regards to studying the patterns of demand for solar home systems, a survey was conducted.

Dr. Yoon found that the rural consumers' willingness to pay will increase when they were offered delayed payment for the solar lanterns. However, rural consumers have a lower willingness to pay for solar lanterns in contrast with solar home systems. This is because consumers preferred saving up to purchase the higher capacity solar home system instead of the lower capacity solar lanterns. Dr. Yoon also found that households with a relatively high expenditure level, higher education level, and younger age of the household head tend to be more willing to pay for the solar home system. Unfortunately, in general, although the rural consumers perceive a high value for the solar home system, household budgetary constraints limited their willingness to pay. Lastly, Dr. Yoon's work identified a complementary relationship between possessing experiences with using grid electricity and the willingness to pay for solar energy.

The adoption of renewable energy products

The ability to improve reliable energy access and promoting renewable energy usage remains one of the most pressing challenges for sustainable development. That being said, Dr. Yoon maintained that research must be done to ascertain the determinants of commercial success in rural energy markets of developing countries, particularly from the angle of consumerism of people living in rural areas with little electricity access. Viewed this way, Dr. Yoon's research focused on shedding light on the demand-side of rural energy markets by finding out any potential barriers that prevent the rural people from adopting renewable energy and understanding what type of technology the rural people may prefer.

Existing literature has examined the question of why consumers tended to not adopt solar products despite the presence of advocacy campaigns and benefits offered. Foster and Rosenzweig (1995) attributed this phenomenon to the existence of the problem of technology adoption and information barriers (lack of awareness). In short, consumers are concerned about receiving low-quality or defective products, which their concerns are further exacerbated by the fact that they may not necessarily possess adequate information to identify, purchase, or seek after-purchase assistance for their product. Acknowledging this, Dr. Yoon attempts to study the barriers to solar technology adoptions through 1) the understanding of the rural consumers' willingness to pay for the solar lanterns, as well as the 2) investigating patterns of demand for solar home systems.

The case of Uttar Pradesh (India)

In this regard, a study was conducted in Uttar Pradesh, the second poorest province in India, where there are 31 million homes without electricity and 43.2% of its rural household are still dependent on kerosene for energy. For the first research objective, Dr. Yoon attempted to find out the rural consumers' willingness to pay (for solar lanterns) by introducing two

scenarios - a given trial period (one week of usage with no payment required) and a trial period with postponed payment for the solar lanterns. The purpose behind this is to determine if the provision of such options would result in a statistically significant impact on rural households' willingness to pay for solar lanterns. As such, 3 treatment groups – control, trial (period), delay (payment) – was established to categorize 1008 randomly selected poor households, and the Becker-DeGroot-Marshak method was utilized to elicit the consumers' individual actual willingness to pay.

Additionally, based on the findings from this aforementioned setup, Dr. Yoon scaled up the findings by experimenting on solar home systems to establish the patterns of demands for it. A survey was conducted on a total of 76 villages. Questions were asked pertaining to the interviewees' socio-economic characteristics, knowledge of solar technology, views about politics, and solar technology. In addition, questions were asked to check the interviewees' awareness and knowledge of the solar home system to identify and correct any peer effects and perception gaps that may be present. Finally, the interviewees' willingness to pay for the solar home system were enquired.

The determinants of willingness to pay in Uttar Pradesh

For the case of solar lanterns, Dr. Yoon found that there is a significant difference in the bid price between delayed payment and the control group. This suggests that if people were offered delayed payment, their willingness to pay will rise. However, there appears to be no statistical impact for the case when consumers were given a trial period in their willingness to pay. With regards to the effects of the trial period and postponed payment on willingness to pay, the direction of the relationship was found to be positive but statistically insignificant. Furthermore, out of 1008 households, only 110 purchased solar lanterns. Dr. Yoon concluded

that in general, this evidence shows for solar lanterns, people tend to have a lower willingness to pay for solar lanterns.

With regards to the solar home system, Dr. Yoon found that there is an overall high awareness of the system, with 64% of the respondents knowing the system, 89% of them having seen it before, and 75% of them knowing someone that uses the system. Based on the findings, households with a relatively high expenditure level, higher education level, and younger age of the household head tend to be more willing to pay for the solar home system. Furthermore, Dr. Yoon found that the interviewees' price the system at an average of 7526 rupees (~US\$120), However, when asked how much they are willing to pay for the system, the interviewees are only willing to pay around 4209 rupees (~US\$67). This suggests that interviewees perceive a high value for the solar home system, but household budgetary constraints limited their willingness to pay. According to the results, Dr. Yoon found high income, high education, high kerosene expenditure, and prior experiences with the usage of grid electricity will increase one's willingness to pay.

In conclusion, Dr. Yoon found that the demand for solar lanterns was lower than average as consumers were found to prefer saving up to purchase the higher capacity solar home system. Dr. Yoon suggests that as rural consumers could take up 24 months or 36 months of loans to pay for the solar products, once they develop confidence in the company and its product, they are willing to purchase a higher capacity home system. Additionally, Dr. Yoon found a positive effect of rural electrification on solar home system. A complementary relationship between possessing experiences with using grid electricity and the willingness to pay for solar energy was found. Dr. Yoon suggests that users with prior experiences of using grid electricity may have experienced its unreliability, and thus were more willing to use/ pay for solar energy.

Finally, the findings from this research provided the basis for additional future research to be conducted. Similar to the present study of solar lanterns, consumers' willingness to pay for solar pico-grid can also be conducted. Additionally, it can also prompt the study of a dynamic pricing scheme to see if people respond to different prices in low resource settings.

Discussion

Dr. Song Jiyeoun asked about the general implication on the Indian energy industry and what lessons could be transferrable from the case of India. Dr. Yoon responded that this research was presented to the Indian government. The government then identified remote areas of India for social enterprises to work on. Following this, the government would provide incentives to enterprises with funding from multinational enterprises and foundations. In this sense, the research was scaled up to the level of a national policy scheme. With regards to the latter question, Dr. Yoon responded as a result of this research, she is now working with the Asian Development bank on trying to understand the demand for solar energy of rural households living in small island developing states. Dr. Song then asked about the status/ stage of the project in India. Dr. Yoon replied that currently in India, a national policy was implemented ensuring social entrepreneurs to provide electricity in rural areas. Additionally, as there are more stakeholders interested in such development projects in India, funding is available. However, the same cannot be said for the other developing countries. Dr. Song then enquired on the continuity and effectiveness of renewable energy in developing countries as Dr. Song pointed out that although the world is generally moving towards the trajectory of adopting renewable energy, various scholars have disputed and have remained skeptical on the utility and effectiveness of the renewable energy. Dr. Yoon responded that the price of solar energy is comparable to that of coal and gas due to advancements in technology. Dr. Yoon added that China is currently leading in the solar energy market. However, there is often an

issue of efficiency as electricity tends to be used more at night than during the day. Thus, Dr. Yoon recognizes that a more advanced energy storage system must be developed, which she added that South Korea excels in. Dr. Yoon also added that effectiveness has to also consider the long-term outlook and thus the solar product should be longer-lasting and not prone to malfunction.

Dr. Lincoln William asked if Dr. Yoon has considered splitting samples based on demographics characteristics to look at energy homogeneity. Dr. Yoon acknowledged that this method cannot be done in the Indian case but she is now trying to utilize this in her current research on island groups.

Dr. Kim Booyuel enquired about the magnitude of the rural consumers' willingness to pay in contrast to their monthly income. Dr. Yoon responded that given the consumers are willing to spend their monthly wage, the valuation of their willingness to pay is high. Dr. Yoon continued that people in those settings have little understanding of interests and loans, and so she is grateful for social enterprises that help the rural consumers with practical monetary calculations and provision of financial information as it is critical in their decision making for solar products.

Dr. Park Tae Gyun mentioned a Korean case study of a 1970s nationwide effort to provide electricity access. In the case study, Dr. Park mentioned a possibility that the accessibility of electronics resulted in the country deciding to have electricity, and not the other way round. Dr. Park also highlighted the possibility of backlash from the introduction of new technology as the people might be used to the status quo. Dr. Yoon acknowledged Dr. Park's points and mentioned that such points were taken into consideration in her new project. Dr. Yoon recognizes the difficulty in trying to convince people to adopt new technology, citing examples of peoples' persistence in using biomass to cook in contrast to a stove. As such, she

emphasizes that more focus groups and more studies in analyzing the friction in changing to new technology must be conducted.

An offline participant asked if there was a successful model which Dr. Yoon referred to in her research. Dr. Yoon responded that Bangladesh was a country she looked at. Dr. Yoon mentioned that she had conducted prior research based on the provision of better-quality water in Bangladesh. She also added that Bangladesh is a success story as it possesses financial institutions like Grameen Bank that provides microfinancing loans to the poor at affordable pricing. However, the case of Bangladesh is hard to replicate.

Dr. Ki Youn enquired about the main factors in the decision-making process of international organizations and aid agencies in deciding which energy source to provide. Dr. Yoon responded that the World Bank and the United Nations developed a ‘Sustainable Energy for All’ initiative. Under this initiative, any organization that desires to contribute can simply reach out to the initiative and specify the organizations’ expectations. Dr. Yoon provided the example of the Gates Foundation, in their provision of assistance, stipulated a requirement of females in their project to ensure consideration of gender issues. Dr. Yoon concluded that as criteria differ across donors, the specifics can differ but generally there is a pinpoint source to render assistance.

Rapporteur

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