NANO SOLAR GRID (NSG) FOR RURAL MARKET POWER CRISIS

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ABSTRACT: The Indian Rural Marketing is a very complex and unique thing to be forecast. It has been observed that in rural market several companies have entered and proved themselves with proper understanding of the market an innovative marketing idea. An alternative source of off-grid electric power, solar home systems (SHS) stand out above all other options e.g., wind, hydro, geo-thermal, tidal systems because of their wide-scale potential at latitudes less than 45 north or south of the Equator where daily solar irradiance is more constant throughout the year and where the bulk of the Third World's population live. A questionnaire-based survey study was carried out in a rural area of Bangladesh to ascertain the impacts of SHSs on the lives of the rural population. The installation of an SHS was found to improve the comfort and living standard of rural dwellers. Easier access to TV, radio, cell phone, and the Internet helped the rural population become part of a more global culture. More attractive down-payment and instalment package options will allow poor target groups to adopt this system. The standard of SHS components and after-sales service should be improved to ensure sustainably and popularity among the mass population for at least 10 years at minimal cost to the consumer. Our findings can also help policymakers adopt more SHS-friendly policies to further the interests of inhabitants of rural areas that are not connected to the grid.

KEYWORDS: solar home systems; rural households; impacts; livelihoods

I. INTRODUCTION

In 1878, Thomas Edison demonstrated an incandescent light bulb, imagining that electricity will be so cheap that only the rich will burn candles. Yet, Edison's dream has not materialized for the 1.06 billion people who do not have access to electricity. In 2011, the Sustainable Energy for All initiative was launched by the United Nations to overcome this situation. Finally, in November 2015, universal access to modern energy services, including access to electricity, became the seventh Sustainable Development Goal (SDG 7).

Energy, and therefore access to energy, is crucial for achieving almost all SDGs. The vast majority of the global population, without access to electricity, live in rural communities, mostly in sub-Saharan Africa and Southeast Asia. These households rely on kerosene lamps, candles, and increasingly on battery-run flashlights for lighting. Access to electricity can be achieved by extending the national grid, developing independent community-level grids, or providing individual household solutions. For rural off-grid areas, decentralized energy systems based on renewable energies are crucial to achieving SDG 7. On a household level, so-called solar home systems (SHS) are a viable option for electrification. An SHS consists of a PV panel, a charge controller, wiring, and a battery. Depending on the system capacity, it provides enough electricity to run several LED lamps, a TV, mobile phone chargers, and one or two fans (see Supplementary S1).

Although there is no universal definition of "nano grid", this term is most often used to refer isolated very small grids (power output typically ranging in from few hundred watts to few kilo watts). It has

very different meanings in different contexts. Service is typically alternating current (AC), and customers can use lights, fans, and mobile, radio etc. Sometimes it is a synonym of micro-grid. In other cases, particularly in developing countries, nano-grid refers to systems of very small scale and typically reaches fewer than 150 household customers.

In commercial contexts of developing countries like Bangladesh, every minute is important for a shop owner/businessman in a rural market/bazaar. As a result of national electricity crisis government and private power producers are mainly focused to power urban areas and industries. There is no doubt about their electricity requirements but rural businessman needs are always underestimated. It is even more important for a person who is self-employed. We can easily determine the price of electricity but it is very difficult to determine the loss as a result of no electricity/load shedding. It does not only hamper commercial activity but also resist us from passing quality leisure time which indirectly affects our economic activity. It also creates loss for different types of service related works like education, communication and comfort. Our target is to keep all direct and indirect loss at a minimum level.

II. PRESENT SCENARIO IN RURAL MARKETING

As we know Indian economy comprising of both urban sector as well as rural sector. And concept of rural marketing in Indian economy has always played an influential role in the lives of people. In India, leaving out a few metropolitan cities, all the districts and industrial townships are connected with rural markets. The rural market in India is not a separate entity in itself and it is highly influenced by the sociological and behavioural factors operating in the country.

The Indian rural markets with its vast size and demand base offer great 102 opportunities to marketers. About 68.84% of the consumers live in rural areas and more than half of the national income is generated from rural areas. Of the 121 crore Indians, 83.3 crore live in rural areas while 37.7 crore stay in urban areas, Our nation is distributed approximately in 6,30,000 villages which can be sorted in different parameters such as literary levels, accessibility, income level, penetration, distance from nearest town etc. It is only natural that rural India occupies an important position in the marketing strategies both in the narrower and broader spectrum.

III. RURAL MARKETING STRATEGIES

The market strategies aimed at an urban or industrial consumer significantly differs from the rural market strategies and the dynamics of the rural market make it varied from other markets. This, along with many other related issues, have been subject matter of powerful discussions and debate in countries like India and China and focus of even international symposia organized in these countries. Rural markets and rural marketing involve a number of strategies which includes following:

- Bundling of inputs
- Client & location specific promotion
- Unique selling proposition
- Joint or cooperative promotion
- Management of demand
- Developmental marketing
- Business ethics
- Partnership for sustainability

• Extension services

IV. GENERAL COUNTRY PROFILE

Bangladesh is moving towards achieving the tag of Developing country with an annual GDP almost 6 % over the last past decade. Recently population thriving dramatically nearly 158 million and annual growth rate of 1.39 % over the past decade. The majority of them are living in the rural areas, and only 32% of households have access to electricity, but the availability of electricity about 22%. Bangladesh is one of the largest in population at 9th position in the world with 158 million people at the end of 2014, where total 52% people have partially electricity access, while only 10-15% of rural have the access to electricity demand mainly meets the light, ceiling fan, refrigeration, irrigation, productive uses loads.

In Bangladesh, the electricity demand of all sectors including agriculture, commercial service, industry, and domestic services. The domestic households and industry sectors are consuming of electrical power about 43% and 44% respectively in total of about 87%. The GDP growth rates significantly depend on the production of a country, as Bangladesh is an agricultural and small size industrial production based country, and production always depends on electricity, the GDP growth and electricity generation growth. It is estimated that 1% increase in per capita energy consumption causes an increase in per capita GDP by 0.23%.

A typical SHS in Bangladesh costs around 500 taka per watt peak. For example if anyone wants to buy a 40Wp SHS, have to pay more than 20,000 and for an 80/85Wp SHS it is around 40,000. Instalment is available but interest rate is high for most common SHS programs. But the main benefit, anybody can be owner of his/her own power system/power generator. On the other hand mini grid requires high installation cost which is impossible for a low or middle income earner. Also it requires high technical knowledge and enough space to install. If any problem occurs in medium or large grid, it is very unlikely to solve it by the users/local technicians. So, our job is the find a solution that includes the benefits of SHS and mini solar grid and that excludes the limitations of both.

As power users we have targeted peri urban and rural market shop owners considering that they face frequent load shedding and loose customer. They have to pay more if any generator support exists. That also creates fume, smoke and sound pollution. They have ability and willingness to pay if quality light is provided because it creates direct positive effect in their livelihood. Rural market businessman typically don’t need fan which require lots of power. Household users need fan badly, especially for children and senior citizens. In a small and congested shop, small amount of light is enough and keeping a kerosene lamp or candle is often dangerous. Geographical benefits include more users availability in short distance, hence less transmission line needed. That makes monitoring and maintenance becomes easy too. It also makes revenue collection becomes easier and users can’t use more than the permitted load.

There have also few problems that include variable load demand in different time and season. Fulfilment of one demand creates new demand like mobile charging, more lights in one shop, radio etc. These variable demands need dynamic power solution in future.

Our proposed nano grid system design includes different technical and financial parameters. Their short description and possible solution is given below.

TABLE 1
FIELD PROBLEMS IN NSG

Problem type	Field scenario	Steps taken for solution
Financial	Possible clients not interested to pay more than they pay for generator or kerosene or candle. This is typically 8-10 taka/day.	Bill rate is decided 7 taka/per day. Solar light is available from sunset to midnight even grid power is available somewhere, sometimes.
	Local power businessman wants to earn more using solar power than the present earning using generator/IPS backup.	System material cost is kept below 100,000 BDT (equivalent to 1250 USD). That ensures to cross breakeven point with minimum period.
	Some feel comfortable to pay daily and some wants to pay monthly basis.	Both options are available (daily in Faridpur, monthly in Nilphamari) as per local community need.
	Sometimes solar light may be unavailable due to natural disaster or technical fault.	Users don't have to pay is case of unavailable light.
	In SHS per unit cost is high due to minimum battery price. In mini grid per unit cost is high due to protection system, heavy transmission and distribution system.	In nano grid per unit cost is as low as 250 taka/Wp including 3 days of autonomy.
Technical	Mini grids are technically difficult and design faults occur that prevents maximum system efficiency.	Technically, nano grids are simple multiplication of a typical SHS.
	All components are not locally available.	Components are locally available.
	In SHS, if system is not fully utilized users hardly can do anything.	In nano grid, power producer can increase/decrease consumer/load to ensure maximum use.
	In SHS sometimes lights are on when where is no activity in the room.	High efficiency SMD LED lights are fully used in economic activity.

An economic or commercial decision typically affects stakeholders, paying for what, or sets the price that some entity may be allowed to charge.

V. OPERATION PRINCIPLE OF AN SHS

Solar panels are made up of many individual solar energy collectors called solar or photovoltaic (PV) cells that convert sunlight energy directly into electricity due to the photovoltaic effect. Solar cells are usually wafer-based crystalline silicon cells or thin-film cells on cadmium telluride or silicon substrate. The cells are very thin (about 1/100th of an inch), usually 3 to 4 square inches (around 20 to 25 cm2), and have a standard lifetime of 20–30 years. An SHS includes a solar panel, one or more batteries, a charge regulator or controller, an inverter to convert direct current (DC) to alternating current (AC) for grid-compatible AC appliances, cables, and switches for safety. An SHS usually operates at a rated voltage of 12 V direct current (DC) to provide power for low power DC appliances such as lights, radios, and small TVs for about three to five hours a day. The PV module is usually placed on the rooftop of a house at an angle to collect maximum sunlight. The battery of the SHS should typically have a storage capacity of 3 days in the event of cloudy days.

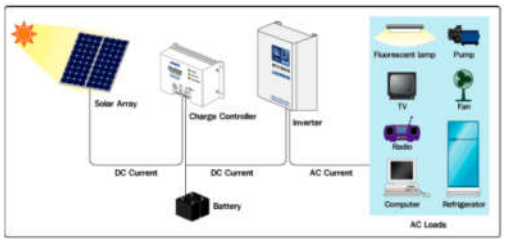

Fig 1. Typical solar home system

Technical regulations: The technical design is finalized considering the following issues.

• System generates power at 12V DC and runs at 230V AC.

• System autonomy is 3 days.

• Total load may vary from 200W to 300W.
• If charge controller, battery or panel is damaged system can run at a lower efficiency.
• Have to use locally available components.
• Maximum efficiency of system components should be used. Financial regulations: The financial/commercial design is finalized considering the following issues.
• Total material cost is limited to 100000 taka excluding procurement, transportation and installation.
• Daily revenue from energy selling is 7 taka.
• Revenue collection is possible for 10 months/year considering rainy season and natural disaster.
• System price can be reduced by considering lower autonomy.

Process regulations: System installation and maintenance procedure have to keep as simple as possible so that local un-expert/semi expert peoples can learn quickly.
• System capacity can be increased easily by adding parallel components.
• System can be divided easily by adding minimum components.
• System can be transferred easily.

VI. CONCLUSION

SHS can satisfy basic energy needs (i.e., lighting), especially in off-grid rural areas in Bangladesh. SHS has profound and far-reaching economic, socio-cultural, and demographic impacts on life and living of the rural people in Bangladesh. Most of the respondents are found satisfied with their SHS. Poverty reducing impacts could also be achieved by promoting larger-capacity SHS that can be used for income generating activities. Most of the users did not have the necessary technical knowledge to maintain their SHS or obtain optimal benefits. Basic training (e.g., fixing minor technical problems, cleaning the panel) of users and good support service would ensure the continued functionality of an SHS. Because an SHS is an interlocked system (i.e., if any one of the devices components is damaged, the system does not work), after-sales service is very important. If after-sales service is poor, this could have an adverse effect on growth of the SHS market. Skilled technicians are another significant obstacle for after-sales services. Due to the presence of numerous manufacturers (local and foreign), standard component testing is highly recommended. Maintenance of a standard quality will increase the lifespan of SHSs and also make SHSs more feasible for use in the future.

VII.REFERENCES

1. Laufer, D.; Schäfer, M. The implementation of Solar Home Systems as a poverty reduction strategy—A case study in Sri Lanka. Energy Sustain. Dev. **2011**, 15, 330–336.
2. World Bank. Access to Electricity (% of Population).
3. Mondal, M.A.H. Economic viability of solar home systems: Case study of Bangladesh. Renew. Energy **2010**, 35, 1125–1129.
4. Government of Bangladesh. Bangladesh's Power Sector at a Glance (May 2015).
5. Burt, E.; Peter, O.; Susan, B. Scientific Evidence of Health Effects from Coal Use in Energy Generation; University of

Illinois at Chicago: Chicago, IL, USA, 2013
6. Kharecha, P.; Hansen, J. Coal and Gas Are Far More Harmful than Nuclear Power.
7. Samad, H.A.; Khandker, S.R.; Asaduzzaman,M.; Yunus,M. The Benefits of Solar Home Systems: An Analysis from Bangladesh; Policy ResearchWorking Paper; No. 6724;World Bank: Washington, DC, USA, 2013.
8. National Renewable Energy Laboratory. U.S. Renewable Energy Technical Potentials: A GIS-Based Analysis; National Renewable Energy Laboratory: Golden, CO, USA, 2012.

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