Challenges in absorbing the Biogas technology in rural and urban India: A review

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Abstract
Biogas in upcoming years emerged as most promising renewable technology to convert agricultural, animal, industrial and municipal biodegradable waste into energy. Biogas development can be integrated with strategies to improve sanitation as well as reduce indoor air pollution and greenhouse gases. Currently, the total biogas production in India is about 5% of total t. This is quite low compared to its potential, which is estimated to be in the range of 29–48 billion m3/year. Hence, this study aims to identify both technical and non-technological barriers responsible for biogas adoption in India. Biogas adopting is affected by various waste, renewable energy, and socio-eco policies of urban and rural India. Therefore, causes must be individually studied for rural and urban biogas systems existing in India using comprehensive Method of analysis. The results show that type and importance of challenges varies accordingly due to the difference in technology maturity, feedstock availability and quality, supply chain, awareness level and policy support.
Keyword: *Juggernaut, Bio Mass, Sustainability, Feedstock.*

1. Introduction

Biogas is formed by anaerobic oxidation of biodegradable waste, Bio gas is mixture of methane gas (65%) and carbon dioxide (15%) and other gases. Despite of providing sustainable energy biogas contributes in reducing negative impact associated with organic wastes such as groundwater and soil contamination emission of local air pollutants like dioxins and furans as well as methane, a potent green house gas [3]. Table No.1 shows how effectively can biogas is in comparison to other resources. Even though environmental, health and social co-benefits from biogas production are commonly recognized, there are several barriers in transferring the biogas technologies that need to overcome. Several support schemes such as the National Biogas and Manure Management Program (NBMMP), off –grid biogas power generation program, waste to energy program have been implemented by the government of India(GOI)for biogas development in India [4][5].Biogas implementation in developed and developing economies. Based on the review, it was found that barriers varies in different regions depending on the inclination of market maturity and availability of natural resources like biomass, land, and water. Barriers such as low ambient temperature and water unavailability in arid regions are area

specific problems. Previous research studies have identified various barriers to biogas. Adoptions in different countries, for instance, UK [1], Europe [12], Sweden [16], China [6] and Thailand [13], some from a stakeholder perspective [1], some from a system perspective [16] and some from a multi-level perspective [15].

Table 1.1 m^3 biogas equivalent to-

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S.NO	***Weight age of Substance***	***Substance***
1	*0.60 lit*	*Kerosene*
2	*3.50 kg*	*Firewood*
3	*12.50 kg*	*Cow Dung*
4	*1.50 kg*	*Charcoal*
5	*0.43 kg*	*LPG*
6	*4.70 kWh*	*Electricity*

2. Barriers in adopting biogas technology in Rural India

After study and expert review various barriers are divided into several categories which affect the adoption of biogas technology

2.1. Financial and economic barriers

High initial capital fund is one of the major barriers to biogas technologies for rural applications [2]. The costs such as construction, labor & equipment cost of installing a biogas plant are relatively high for rural households.

2.2. Market barrier

Biogas faces great competition with other fuel alternatives available in the market. Several factors like the assurance of fuel supply, ease of purchasing power and household income have an impact on household fuel choices [11]. In rural India, biogas has to compete with the cheaper alternatives available like traditional solid biomass, firewood, and cow dung, which are generally available for cooking applications [14]. The calamities associated with the use of traditional biomass i.e. time consumed in firewood collection, indoor air pollution, loss of forest resources, are not taken into calculation by these households.

2.3. Social and cultural barriers

There are several social-cultural barriers uphold the uptake of biogas technology in rural areas. First, people and plant owners are unwilling and hesitate to the use of night soil/human excreta in biogas plant due to the attached social stigma. Second, women are primarily responsible for cooking in rural households and primarily exposed to the indoor air pollution caused by burning solid fuels. The level of women in the rural society is very low and they have very limited decision making power which acts as a critical factor to make use of clean fuels.

2.4. Regulatory and institutional barriers

A line organization approach is adopted in the NBMMP program initiated by the central government. The program is inefficiently targeted as ownership of 2–3 cattle is one of the criteria to gain the capital subsidies provided under the program to install a biogas plant. Since the majority of households in rural areas does not have 2–3cattle, it is very difficult for them to get a capital subsidy which act as obstacle in the adoption of biogas technologies. Therefore, low-income households' depend on locally available biomass resources for cooking and household purpose. Multiple agencies are involved in the implementation of the national biogas development program. Lack of coordination and competition between them for the incentives has been identified as one of the reasons for the poor performance and low absorbing of the biogas technology in rural areas [11].

2.5. Technical and infrastructural barriers

India has rich biodiversity as well as wide range of physic. Limited supply of water and raw materials are two crucial factors plays very important role in the effective functioning of biogas plant. Under-feeding of inputs or feeding in wrong ratios deteriorate the performance of biogas plant or formation of manure, making installed plant completely dysfunctional. These failures create a wrong perception about the biogas technologies that discourage the potential users .In dry areas ,Western(Arid region) parts Rajasthan generally faces the problem scarcity of water which compelled women to spend several hours to fetch and transport the water needed for cooking and drinking as well as sanitation purposes. Thus, a large amount of water needed for proper functioning of biogas plants is one of the reasons for the low uptake of biogas technologies in dry and arid-prone area[8].The biogas production during the winter season is not sufficient for cooking which juggernaut the users to switch to other fuels. In addition to these challenges, the- absence of skilled human resource to repair technical faults occurring during biogas operation acts as another challenge that deterring the impingement of biogas technologies in rural areas [7].Lack of awareness about the technology, its associated benefits as well as incentives provided by the government has also been identified as one of the reasons for low usage of biogas as their primary fuel for cooking [14].

3. Barriers to biogas technologies in urban areas

3.1. Financial and economic barriers

Financial barriers like high initial as well as running cost, unavailability of long term financing options, high interest rate and high-risk perception by financial institutions are identified as the most important barriers to biogas impingement in urban areas. The high expenditure cost and low output act as entry barriers for small private players/developers.

3.2. Market barriers

Urban areas are well equipped with modern transmission lines of electricity which available at low-priced from coal and natural resources which creates a gesture of competitiveness for the biogas technologies in electricity field.

3.3. Technical and infrastructural barriers

The distribution of organic and non-organic waste is not done in urban households resulting in the low-quality organic feedstock Due to improper segregation, dust and unwanted material are also exist to differ the degrees in the feedstock. In this case, sorting of wastes needs to be done before digestion at the plant which create extra capital cost burden thus preference of biogas technology is limited. Failure to supply the committed quantity and quality of waste to plant by Municipal Corporation was recognized as one of the reasons for the closure of waste to energy plants [2]. Thus Inferior quality substrates affect the plant productivity and ultimately result in lower electricity generation.

4. Conclusion

The socio-economic characteristics like household size & income, agro-climatic conditions should also be considered while developing policies for biogas adoption in urban and rural. Biogas system installation cost barrier can also be reduced by providing low-cost credits like interest-free loans or subsidized loans or cheap technology like low-cost polythene biogas plants that are used of private players in the biogas sector in rural areas. This would help in developing the local markets for feedstock's and technologies. The competition between the private players would also help to bring down the biogas technology prices .Besides financial and technical support, several programs must be created to spread the awareness about the short-term and long-term health effects of indoor air pollution generated by biomass (wood, cow dung) fuels .Policy makers of India should have learnt from developed countries like Germany & Sweden to promote the use of biogas technologies in the urban areas. For instance, the government ban on disposal of municipal solid wastes to landfills has changed the waste management scenario in Germany and augmented the demand of biogas plants for managing organic wastes [9].Biogas technologies face competition from other renewable electricity generation technologies like solar & wind. Market risks faced by the biogas electricity generators can be minimized by providing either price based (preferential tariffs) or quantity based (minimum purchase quota) support from the government in the initial development phase. To reduce the producers' losses in the initial stages of operations, the biogas based plants could be exempt from scheduling and tax imposed on income of urban households.

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