Bangladesh J. Environ. Sci., Vol. 47, 21-26, 2024 @ BAED ISSN 1561-9206

IMPACT OF BIOGAS PRODUCTION ON LIVING STANDARD IN RURAL AREA OF BANGLADESH

A. K. M. R. Islam[1]*
Graduate Training Institute, Bangladesh Agricultural University, Mymensingh-2202
*Author's email: akmri2003@yahoo.com

ABSTRACT

This study investigates the impact of biogas production on living standards and the relationship between farmer activities and livelihood status in rural Bangladesh, highlighting the need for fundamental requirements.Twenty two villages from three districts were selected for this study. One hundred and eighty farmers were interviewed during July to September 2021; whereas ninety five farmers were biogas plant owner and rest of them have capacity to install biogas plant. The result shows that the increase modern technology use has highest mean score (0.85) and 34.74 % of the beneficiaries from biogas plant have above 500000 taka income level compared to 34.11 % of non beneficiaries in the same level. There was no mentionable difference among the respondent's categories through annual income. Most of the respondents (above 70%) used modern techniques such as aluminum/plastic made sieve, glass plates, tray fryer, grinding machine, flux, hot pot plastic bucket, plastic pot, bicycle, wood khat with mattress, iron machine, tube well water, packaging materials, upgraded cloth and toilet with water cistern. No significant differences were shown through beneficiaries and non-beneficiaries except wood khat with mattress. The majority of the beneficiaries has medium (36.84%) to upper (53.68%) level livelihood status while the respondents with non beneficiaries has medium (36.47%) to upper (52.90%) level livelihood status, which means impact of biogas production is low. The livelihood status is highly correlated with improved environmental safety significantly ($p \leq 0.1\%$). The time saving and patronizing child more, increased fish cultivation and increased production of composed fertilizer were not correlated significantly with livelihood status at $p \leq 5\%$ level of probability.

Key words: Biogas, living status, rural area, poverty, income and modern technique.

Introduction

Bangladesh has huge potentials for utilizing renewable energy sources such as solar, biomass, wind, and mini-hydropower (Mondal *et al*., 2010). Out of the various renewable sources solar and biomass has huge potential in Bangladesh (Islam *et al*., 2006).The first biogas plant in Bangladesh was established in 1972 at Bangladesh Agricultural University, Mymensingh Campus. Lately, Bangladesh has 55,000 biogas plants all over the country (Huda *et al*., 2014). Traditionally, Governmental and Non-Governmental organizations provide technical and financial support to install biogas plant in Bangladesh (Islam *et al*., 2008). In future six lakh household biogas plants could be established by our own available resources materials; that will improve our living status. Moreover, a vast number (approximately 40 percent) of our rural people are landless and 15.6 percent of our landless are ultra poor (per day per person caloric intake is 1600 kcal) (BBS, 2000). There is a prominent shortage of protein, vegetables and fruits thus nutritional improvement is of prime concern for livelihood improvement (Haque, 2002). Biogas has a potential to increase vegetable through composed waste using biogas slurry, increase socio-economic opportunities at local level and help in improving peoples livelihood (Ishara, 2004). The information about the livelihood status of biogas plant owners in our country is unknown due to lack of research. Therefore the present study was designed to determine the impact of biogas production on living standard and identifying the relationship of their living standard to farming activities in rural areas.

Materials and Methods

The survey was conducted by the researchers themselves during July to September 2021 at 22 villages of three districts named Pabna, Tangail and Mymensingh to attain the objectives of the present paper. Dairy

and poultry farmers with biogas plant owner and the farmers who have capability to install biogas plant were considered during this study. One hundred and eighty farmers were interviewed; whereas ninety five farmers were biogas plant owner and rest of them have no biogas plant. The researchers visited the farm and collected the data directly talking with the farmer. The questionnaire for this study was developed mainly with dichotomous type questions. The respondents were measured about their living status by getting their opinions on different techniques as 'yes' corresponding to 1 means used the technique and 'no' corresponding to o means not used. Therefore score range could be 0 to 30 for different technique questions, where o indicating low status and 30 indicating high status. The respondents were classified in to three categories with their living standard as low level (score below 11), medium level (score 11 to 20) and upper level (score above 20) of status. The data was analyzed by using SPSS-22. General descriptive statistics, frequency and percentage frequency were used to present the data. Proportion test was used to compare the farmer's categories with respect of their modern technique used. The $\chi 2$ test was used to compare the respondent categories with respect of their livelihood status and income. The relationship between livelihoods status to biogas plant related farming activities were measured by correlation test. All the tests were calculated with respect of 5% level of probability.

Results and Discussion

Farmer's activities related to biogas production for living status improvement: Table 1 shows that 34.74 % of the beneficiaries from biogas plant have above 500000 taka income level compared to 34.11 % of non beneficiaries in the same level. The least income level is less than 50,000 taka for 2.11 % beneficiaries from biogas plant compared to 3.53% non beneficiaries at the same level. There were significance differences among the income level's categories in both types of respondents at 0.1 % level of probability, but no mentionable differences were found among beneficiaries from biogas and non-beneficiaries.

Table 1. Income level of beneficiaries and non beneficiaries from biogas plant

Incomes (Annual)	Beneficiaries (n = 95)		Non-beneficiaries (n = 85)		Pearson Chi-square Asymp. Sig. (2-sided)
	Livelihood status category	Percentage (%)	Livelihood status category	Percentage (%)	Income level Categories
less than 50,000	2	2.11	3	3.53	
50000-150000	9	9.47	11	12.94	
150001-250000	23	24.21	20	23.53	***
250001-350000	19	20.00	16	18.82	
350001-500000	9	9.47	6	7.06	
above 500000	33	34.74	29	34.11	

Frequency distribution of respondents for using modern technique: The respondents percentage used modern diurnal household techniques are presented in Table 2. All the respondents used aluminum/plastic made sieve, glass plates, plastic bucket and plastic pot/small box. Among the respondents at least 20% used iron-made frying pot followed by use of floor rug (22.11% for beneficiaries and 20 % for non-beneficiaries). No significance difference was found among the beneficiaries and non beneficiaries of the respondents. Table 3 shows the respondents percentages for using transportation, recession and furniture techniques. All respondent with beneficiaries and non-beneficiaries used wood khat with mattress except 5.89% non beneficiaries. Almost 84.21% percent beneficiaries used bicycle compared to 81.2% non beneficiaries used the same technique. Among the respondents at least 7.4% and 7.1% beneficiaries and non beneficiaries used vehicles. A significant difference was found through the respondents categories only in use of wood khat with mattress. The respondent's percentages used health, environment and social techniques were presented in Table 4. Hundred percent respondents used tube well water. Most of the respondents (92.63%, 94.74% and 93.68% beneficiaries respectively) used iron machine for cloth ironing, packaging materials/bagging and toilet with water cistern compared to 90.60% non beneficiaries used the

same techniques. Among the respondents at least 1.05% beneficiaries used washing machine. No significant difference was found among the respondents categories.

Table 2. Distribution of respondent by using modern diurnal household techniques

Techniques	Beneficiaries (n = 95)		Non-beneficiaries (n = 85)		PT*
	Frequency	%	Frequency	%	RT**
1. Use of aluminium/plastic made sieve	95	100	85	100	-- (NS)
2. Use of glass plates	95	100	85	100	-- (NS)
3. Use of tray fryer	73	76.80	62	72.90	0.603 (NS)
4. Use of milling or grinding machine	69	72.63	60	70.60	0.301 (NS)
5. Use of flux	87	91.58	76	89.40	0.499 (NS)
6. Use of hot pot	89	93.68	77	90.60	0.770 (NS)
7. Use of plastic bucket	95	100	85	100	-- (NS)
8. Use of plastic pot/small box	95	100	85	100	-- (NS)
9. Use of aluminium made pressure cooker	48	50.53	44	51.76	-0.164 (NS)
10. Use of iron-made frying pot	19	20	17	20	-- (NS)
11. Use of floor rug	21	22.11	17	20	0.346 (NS)

Table 3. Distribution of respondent by using transportation, recession and furniture

Techniques	Beneficiaries (n = 95)		Non-beneficiaries (n = 85)		PT*
	Frequency	%	Frequency	%	RT**
1. Use of plastic tool/Rack	69	72.63	57	67.10	0.808 (NS)
2. Use of vehicles	7	7.40	6	7.10	0.077(NS)
3. Use of Bicycle	80	84.21	69	81.20	0.534(NS)
4. Use of Dining Table	62	65.26	53	62.40	0.3988(NS)
5. Use of Motorcycle	56	58.95	45	52.90	0.816(NS)
6. Use of Ceiling/Table/Standing fan	57	60	54	63.53	-0.486(NS)
7. Use of Cooking stove	22	23.16	20	23.53	-0.059(NS)
8. Use of Television	60	63.15	58	68.24	-0.717(NS)
9. Use of radio cassette player	45	47.40	39	45.88	0.204(NS)
10. Use of wood khat with mattress	95	100	80	94.11	2.399(S)
11. Use of refrigerator	50	52.63	43	50.58	0.274(NS)

Table 4. Distribution of respondent by using health, environment and social activities

Techniques	Beneficiaries (n = 95)		Non-beneficiaries (n = 85)		PT*
	Frequency	%	Frequency	%	RT**
1. Use of iron machine for cloth ironing	88	92.63	77	90.60	0.492(NS)
2. Use of tube well water	95	100	85	100	--(NS)
3. Use of washing machine	1	1.05	0	0	0.947(NS)
4. Use of packaging material/Bagging	90	94.74	77	90.60	1.072(NS)
5. Use of upgraded cloth	79	83.16	68	80	0.547(NS)
6. Use of toilet with water cistern	89	93.68	77	90.60	0.770(NS)
7. Leader of any society or organization	52	54.74	45	52.90	0.247(NS)
8. Membership of cooperative society	53	55.79	45	52.90	0.389(NS)

* PT = Proportion test (Z-value) (Asymp. Sig. (2-sided)
** RT = Respondents Categories

Livelihood status of the respondents: On the basis of the score obtained, livelihood status was classified into three categories a slow, medium and upper level status and presented in Table 5. The majority of the beneficiaries have medium (36.84%) to upper (53.68%) level livelihood status while the respondents with

non-beneficiaries have medium (36.47%) to upper (52.90%) level livelihood status. There were significant ($p<0.001$) differences among the livelihood status's categories in both types of respondents. No mentionable differences were found among the respondent's type means biogas production impact is low.

Table 5. Distribution of respondents by level of livelihood status with respondent categories

Incomes (Annual)	Score range	Beneficiaries (n = 95)		Non-beneficiaries (n = 85)		PT*
		Frequency	Percentage	Frequency	Percentage	LSC**
Low level status	0-10	9	9.47	9	10.58	
Medium level status	11-20	35	36.84	31	36.47	***
Upper level status	21-30	51	53.68	45	52.90	

Score: Yes = 1, No = 0 and score range per respondents are 0 to 30.
* PT = Proportion test (Z-value) (Asymp. Sig. (2-sided)
**LSC = ivelihood status category

Relationship between livelihood status to farmer's activities: The relations of livelihood status to biogas production related farmer's activities were presented in Table 6. The livelihood status was highly correlated with improved environmental safety significantly. There was no significant correlation of livelihood status to time saving and patronizing child more, increased fish cultivation and increased production of composed fertilizer at $p \leq 5\%$ level of probability.

Table 6. Correlation with livelihood status to Biogas plant related farmer's activities (N=180)

Items	Correlation coefficient	r^2	Significance (P)
1. Income generating and saving	0.413^{*}	0.171	0.040
2. Time saving and patronizing child more	0.133	0.018	0.113
3. Increased fish cultivation	0.139	0.019	0.111
4. Increased crop cultivation	0.407^{*}	0.166	0.041
5. Improved environmental safety	0.904^{***}	0.817	0.000
6. Increased modern technology use	0.837^{**}	0.701	0.002
7. Increased cooking and lighting facilities	0.777^{**}	0.604	0.003
8. Decreased deforestation	0.292^{*}	0.085	0.048
9. Increased production of composed fertilizer	0.140	0.020	0.110
10. It make family life comfortable	0.519^{*}	0.269	0.039

Livelihood could be improved by enhancing capabilities, assets and activities essential for living. Energy is the key consideration to improve living life. Due to absence of available energy; renewable energy as biogas could fill up this gap to develop living status. Increased modern technology use (0.85) has highest mean score followed by increasing cooking and lighting facilities (0.82) and improved environmental safety (0.81). From all mean score it is clear that their contribution on living standard is not optimum due to lack of needed innovations and livestock farming inputs to improve livelihood status. To save the environment at the vicinity of poultry and dairy farm biogas plant could be provided. The income level among the respondents categories were found discrepancy and no mentionable difference was shown through beneficiaries and non-beneficiaries (Table 1). That is availability of credit loan and government subsidies are required to purchase livestock farming and renewable energy inputs which are utilized to increase income. Recently donors such as UNDP and the World Bank have started to emphasize a "sustainable livelihood" approach for alleviating poverty as a global phenomenon (UNDP, 2000; World Bank, 1998). Table 2 shows the use of modern techniques by the respondents. Among thirty modern techniques, above 80% respondents used aluminum made sieve, glass plates, flux, hot pot, plastic bucket, plastic pot, bicycle , wood khat with mattress, iron machine, tube well water, packaging materials and toilet with water cistern. Rest of them less than 40% respondents used iron-made frying pot, floor rug, vehicle, cooking stoves and washing machine. There was no significant difference in beneficiaries and non beneficiaries for using modern techniques. Table 5 shows that 47% respondents have medium to low level

livelihood status. These indicate that the impact of biogas production on livelihood status is low due to lack of experience on biogas plant operation, installing duration and unavailable training received. The alternative energy technologies (such as biogas plants, micro-hydro plants, solar photovolatic systems and improved cooking stoves) which are friendly to the environment have a potential to increase socio-economic opportunities at the local level and help in improving people's livelihood (Ishara, 2004). The farmer with biogas plant owner have good knowledge on biogas plant operation and maintenance than the farmer without biogas plant and all type of farmer have very positive attitude towards biogas plant (Islam, 2014). In fact maximum farmers are low awareness about biogas plant (Islam, 2013) and 11% farmers with biogas plant owner have received training on operation and maintenance (IDCOL, 2011). Now it is essential to support the respondents on livestock farming and biogas plant activities for developing society and improving living status in rural areas. As for example the effect in particular renewable energy technology on human capital was evident in the enhanced quality of life of rural households and a greater sense of connectivity to wider society. Switching from kerosene to electric lamps has reduced indoor pollution, improved the quality of light and reduced the risk of house fires (Saura, 2002). Improved environmental safety is positive and more significantly correlated with livelihood status. There is no significant correlation of livelihood status to time saving and patronizing child more, increased fish cultivation and increased production of composed fertilizer at $p \leq 5\%$ level of probability. These happened because biogas plant related such activities were not spread out and the respondents were less awareness about them (Islam, 2013).

Conclusion

Renewable energy, such as biogas, can help address the energy shortage and improve living standards by filling the gap in available energy sources. The study explores the influence of biogas production on living standards and the relationship between farmer activities and livelihood status in rural Bangladesh. This study revealed that 9.5% beneficiaries from biogas plant have low livelihood status while the respondents with non-beneficiaries have 10.63% Low level livelihood status, which means the visible impact of biogas production is low. The livelihood status is correlated significantly with improved environmental safety, modern technology use, cooking and lighting facilities. The time saving and patronizing child more, increased fish cultivation and increased production of composed fertilizer were not correlated significantly with livelihood status at $p \leq 5\%$ level of probability. Therefore, visible improvement of living status of biogas plant owner could be improved by awareness building, increasing innovation and farming inputs through government and other institutional support.

References

BBS, 2000. Householod income and expenditure survey. Bangladesh Bureau of Statistics. Ministry of Planning. People's Republic of Bangladesh.

Haque, M., Moniruzzaman,I. K. and Samsuzzaman, S. 2002. Livelihood improvement of the poor participants of a rural skill training and income generation project in northern Bangladesh. Bangladesh Journal of Extension Education, 14 (1&2): 53-61.

Huda, A. S. N., Mekhilef, S. and Ahsan, A. 2014. Biomass energy in Bangladesh: Current status and prospects. Renewable and Sustainable Energy Reviews, (30): 504-517.

IDCOL (Infrastructure Development Company Limited). 2011. Annual biogas users survey report-2010,dated 29 November 2011, P-75. National Domestic Biogas and Manure Programme, Netherlands Development Organization, Bangladesh.

Ishara, M. 2004. Implementation of alternative energy technologies in Nepal: Towards the achievement of sustainable livelihoods. Energy for Sustainable Development, 8(2): 9.

Islam, A. K. M. R. and Hossein, M. S., 2013. Dairy farmer's awareness on biogas plant in Mymensinghdistrict, Bangladesh. Bangladesh Journal of Environmental Science, 25: 57-62.

Islam, A. K. M., Islam, M. and Rahman, T. 2006.Effective renewable energy activities in Bangladesh. Renewable Energy, 31(5): 677-688.

Islam, A. K.M.R. and Hossein, M. S. 2014. Livestock farmers' knowledge, perceptions, and attitudes toward biogas plant in Bangladesh. International Journal of Renewable Energy Research, 4(1): 77-82.

Islam, M. R., Islam, M. R. and Beg, M. R. A. 2008. Renewable energy resources and technologies practice in Bangladesh. Sustainable Energy Review, 12: 299–343.

Mondal, M. A. H., Linda, M. Kamp and Nevelina, I. Pachova. 2010. Drivers, barriers, and strategies for implementation of renewable energy technologies in rural areas in Bangladesh-An innovation system analysis. Energy Policy, 38(8): 4626-4634.

Saura, G., 2002. President of Cuba Solar, Villa Clara. Personal Communication.

UNDP (United Nations Development Programme), 2000. Sustainable energy strategies: Materials for decision makers, UNDP energy and atmosphere program, United Nations DevelopmentProgramme, New York.

World Bank, 1998. Meeting the challenge for rural energy and development, World Bank, Washington DC, pp. 1-14.