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A Geographical Study of Economics and Revenue of Biogas Plants in Kolhapur District (MS), India

Krishna B. Patre*

Abstract :- The socio-economic background or the profile of the biogas plant holders can give an idea about the social and economic strata of the society who are using biogas. It is also necessary to review the social and economic background of the biogas plant holder in order to assess the relationship between biogas plants and rural development. For example rural families having animals, agriculture land, required area for biogas plant, financial ability, climatic suitability and desire to build the biogas plants leads into increasing numbers of biogas plants and vice versa.

Keywords :- Economics of Biogas, Revenue, Biogas Plants, time and space.

Introduction :- A very first aim of the present geographical investigation is to find out the spatial distribution of biogas plants and the geographical variables responsible for the heterogeneous distributions. It has also attempted to study the operational efficiency of the biogas, economics of biogas and its role in the rural development through grass root level facts. The present chapter is based on field work carried out by the researcher in the 2018. The facts and figures are collected as per the sample designed explained in the chapter first and attempts are made to make more precise and scientific study. The total 648 respondents or biogas plants were comprehensively observed, analyzed and evaluated in the light of objectives taken into consideration. For the sake of systematic and effective presentation, the whole chapter has broadly classified into six sections as per the objectives. The first section deals with the introduction and overall outline of the chapter. The second section highlighted socio-economic background of the biogas plant holders, in which social and economic indicators are separately analyzed. The section third has focused on the Spatial pattern of biogas plants in Kolhapur district. It has started with the nature, types and present status of biogas plants in study region and ends with the spatial distribution and operational efficiency of biogas. The section fourth has comprehensively presented the economics of biogas, in which cost, revenue and profitability of biogas evaluated. The section fifth is concerned to the role of biogas in rural development and sixth section presented summary of the present chapter. Let us see one by one.

Objective :- To Study Economics and Revenue Biogas Plants in Kolhapur District.

Study Area :- Kolhapur district is situated in the southern part of Maharashtra state. It lies between 15°43' and 17°17' North latitude and 73°40' and 74°42' East longitude (Map 2.1). It is surrounded by Belgum district of Karnataka state to the east and south, Sangli district to the north and Ratanagiri and Sindhudurg district to the west. The Sahyadri ranges to the west and Warana River to the north form the natural boundaries. The last and most important subcomponents in the spatial distribution of biogas is the spatiotemporal variations in the biogas. In fact, in geographical point of view, Spatiotemporal variation can be classified into four sub groups according to the nature and extent of variation over a period of time and space (21) (PDF) Spatial Temporal Variation of Biogas in Kolhapur District.

Economics Of Biogas Plants :- The economics of biogas plants includes analysis of cost, analysis of returns (revenue) and profitability from the plants. The cost, revenue and profitability of biogas has also studied as per the Geo-climatic zone. The all calculations are made based on the average figures of concern item. The standard cost, revenue and profitability concepts and techniques are used in order to get precise idea about the economic viability of the biogas plants.

Cost Analysis :- The total cost has been broadly classified into two categories namely fixed cost and operational or variable cost. The fixed cost is the initial cost occurred on the installation of plant.

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A) Fixed Cost :- Table 4.19 indicates the fixed cost on the biogas plant as well as operation cost as per the Geo-climatic zone. The fixed cost includes the expenses on the bricks, sand, cement, labour, steel, stone, rocks, pipe, gas stove burner, door, roof material, interest on investment, depreciation and other costs. On an average the fixed cost of biogas installation in western zone, middle zone eastern zone and whole study region is recorded to Rs. 25908, Rs. 24937, Rs. 24200 and Rs. 25015 respectively. It means that on an average there is no much more differences in the fixed cost of biogas across the region. However, comparatively fixed cost is slightly more in case of western Geo-climatic zone.

B) Operational Cost :- The operational cost is also called as variable cost. It has included the expenses such as Per day cost of dung, Maintenance (feeding the dung, dung feed to the plant, painting, repairs and replacement), Cleaning of Biogas Compost, Transportation of Biogas Compost, Other Miscellaneous Expenses etc.

Table 3.19

Cost Estimation of Biogas Plants in Study Region

Cost	Particulars	Western Zone (Amt. in Rs.)	Middle Zone (Amt. in Rs.)	Eastern Zone (Amt. in Rs.)	Total (Amt. in Rs.)
A) Fixed Cost	Bricks	2140	1771	1860	1924
	Sand	680	451	540	557
	Cement	3000	3616	3600	3405
	Labour	5200	4812	4500	4837
	Steel	1430	1071	1160	1220
	Stone	1768	1361	1450	1526
	Rocks	1880	1661	1750	1764
	Pipe	2250	1978	2000	2076
	Gas Stove /Burner	2000	2250	1800	2017
	Door Material / roof	2160	2347	2100	2202
	Other	360	579	400	446
	Interest on Investment	2400	2400	2400	2400
	Depreciation	640	640	640	640
	Total Fixed Cost	25908	24937	24200	25015
	B) Operation Cost /Variable Cost	Per day cost of dung	60	60	60
Maintenance (feeding the dung, dung feed to the plant, painting, repairs and replacement).		2140	1260	1471	1624
Cleaning of Biogas Compost		2400	2860	2150	2470
Transportation of Biogas Compost		2500	1800	1950	2083
Other Miscellaneous Expenses		300	300	300	300
Total Operational Cost		7400	6280	5931	6537
Total Cost =A+B	33308	31217	30131	31552	

Source : Compiled by the Author Based on Field Work 2018

These expenses are occurs when biogas is in operation. Data shown in the table 4.19 reveals the fact that Rs. 7400, Rs.6280, Rs. 5931 and Rs. 6537 is the operational cost observed in western zone, middle zone, eastern zone and Kolhapur district as whole respectively. It means that though there is no much more differences in the operational cost of biogas plants across the Geo-climatic zones, the operational cost of biogas is comparatively more in case of western region.

C) Total Cost :- The sum of operational cost and fixed cost is known as total cost. It has evidence from the table 4.19 that the average total cost of biogas plant's is Rs.33308 in western zone and it is Rs. 32217 in case of middle zone. The total average biogas plant cost of eastern zone and Kolhapur district as whole is observed to Rs. 30131 and Rs. 31552 respectively. It implies that average biogas plant expenses are significantly less in eastern region and it has followed by middle region. On the contrary, the total biogas plant expenses are significantly more in western region. However, there is no much more variations or disparities in the total cost of biogas plants across the Geo-climatic zone.

Revenue Analysis :- The economic benefits derived from the biogas are included in the total revenue generation from biogas. It is quite difficult to exact calculation of the revenue due non accounting of the plant holders. Researcher has obtained data based on the responses given by the respondents and made self calculations based on market rates. For example energy saving due to biogas has calculated based on the market rates of the LPG. In fact, households are given approximately information which is finalized by the researcher based on market rates and self judgment.

The revenue derives from the biogas plant has grouped into three categories i.e value of energy, value of compost and other values.

Table 3.20

Revenue Generation from Biogas Plants

Revenue	Particulars	Western Zone (Amt. in Rs.)	Middle Zone (Amt. in Rs.)	Eastern Zone (Amt. in Rs.)	Total (Amt. in Rs.)
Value of Energy	Annual Energy Cost Saving = Per Day Energy Cost Saving as per Market Price (Energy Cost of Alternative Fuels)*365 days	23725	25915	32485	27375
	Lightening Cost Saving	350	240	120	236
	Saving of Other Agriculture Residual	850	651	780	760
	Market Price of Compost per Trailer	4500	5200	7200	5633
Value of Compost	Increased Income from Agriculture due to Biogas Compost	3600	4150	3860	3870
	Monetary value of Saving per day Time for the Collection of Agriculture Residual as a Cooking Fuel	2700	2700	2700	2700
Total Revenue		35725	38856	40210	38263

Source: Compiled by the Author Based on Field Work 2018

A) Value Of Energy :- Table 4.20 indicates the Geo-climatic zone wise revenue generation from the biogas plants in study region. It is evidence from the data that Rs. 23725, Rs. 25915, Rs. 32485 and Rs. 27375 is obtained from western zone, middle zone, eastern zone and whole study region respectively from the biogas plants through the annual energy cost saving. It means that eastern zone has receiving more revenue from the annual energy cost saving. Likewise, Rs. 350, Rs. 340, Rs. 120 and Rs. 236 is obtained from western zone, middle zone, eastern zone and whole study region respectively through biogas plants from the saving of lightening cost. The Rs. 850, Rs. 651, Rs. 780 and Rs. 760 were saved in western zone, middle zone, eastern zone and whole study region respectively through biogas plants from the saving of

other agriculture residual).

B) Value Of Compost :- The second major source of revenue from the biogas is the compost generated through biogas. It is seen from the data that on an average Rs. 4500 in western zone, Rs. 5200 in middle zone, Rs. 7200 in eastern zone and Rs. 5633 in whole study region is revenue generated through biogas in the form of compost. It is interesting to note that Rs. 3600 in western zone, Rs. 4150 in middle zone, Rs. 3860 in eastern zone and Rs. 3870 in whole study region is the revenue generated through the agriculture income.

C) Other Values :- Monetary value of saving per day time for the collection of agriculture residual as a cooking fuel is found to Rs. 2700 in all the Geo-climatic zone. In fact, it is kept constant by assuming 90 days during the summer and 30 Rs. per day.

In short Rs. 35725 in western zone, Rs. 38856 in middle zone, Rs. 40210 in eastern zone and Rs. 38263 in whole study region per year is the revenue generated through biogas plants in the study region. It means that comparatively more revenue is being generated through biogas plants in eastern zone.

Summary :- The present chapter has humbly attempted to cover three major objectives of the entire research task. These major objectives were To study spatial pattern of biogas plants in Kolhapur district; to assess the economics of biogas plants.; and to examine the relationship between biogas plants and rural development. By considering these three main objectives chapter has attempted to make more impartial and precise study. It has comprehensively presented social background, economic background and agriculture profile of the sample biogas plant holders. In depth analysis of spatial pattern, economics of biogas and its role in rural development has carried out by applying standard tools and techniques. At bottom line it can be stated that biogas are mainly concentrated in eastern region and it has pure spatiotemporal variation in all the Geo-climatic zones. The economic benefits and economic viability of biogas plant is observed in all the Geo-climatic zones but it has comparatively more in case of eastern zone and less in case of western zone. The low profitability of biogas in western zone and more profitability of biogas in eastern zone have occurred due to the variations in the physical factors. The contribution of biogas plants in the rural development is notable in all the Geo-climatic zones of the district, though the role of biogas in agriculture development is insignificant. The environmental significance of biogas is also appreciable and it has proven as a good source of green energy to the rural area.

4.4.3 Profitability Analysis :- In order to assess the profitability of the biogas plants across the geo-climatic zones, researcher has performed following financial analysis.

Net Income :- The net income from the biogas plants has calculated by subtracting total cost from total revenue.

Net Income = Total Revenue - Total Cost

Gross Profit :- It has obtained by subtracting purchases plus direct expenses from the sales. Thus it has calculated by using below formula.

$$\text{Gross Profit} = \text{Sales} - (\text{Purchases} + \text{Direct Expenses})$$

Net Profit :- The net profit has computed by subtracting total operating cost, interest and depreciation from the gross profit. Thus it has calculated by using below formula.

$$\text{Gross Profit} - (\text{Total Operating Expenses} + \text{Interest} + \text{Depreciation})$$

Operating Profit:- It has computed by subtracting operating expenses from the total revenue. Thus it has calculated by using below formula.

$$\text{Operating Profit} = \text{Total Revenue} - \text{Operational Cost}$$

Benefit Cost Ratio :- It is a ratio of all present expected benefits to the all present value of associated cost. Thus it has calculated by using below formula.

$$\text{Benefit Cost Ratio} = \text{Present Value of All Expected Benefits} / \text{Present Value of All Associated Cost}$$

Net Present Value (NPV) :- It is obtained from deducting today's value of invested cash from the today's value of the expected cash flows

$$\text{Net Present Value (NPV)} = \text{Today's Value of the Expected Cash}$$

Flows – Today's Value of Invested Cash

Net Income from Biogas :- It is observed from the table 4.2 and figure 4.7 that on an average Rs. 2417, Rs. 7639, Rs.10079 and Rs. 6711 the net income from the biogas plants is recorded in western zone, middle zone, eastern zone and in whole district respectively. It means that net income from biogas plants is significantly more in eastern zone and it is very less in western zone.

Gross Profit from Biogas :- On an average Rs. 25625, Rs. 29876, Rs.38514 and Rs. 31337 the gross profit from the biogas plants is recorded in western zone, middle zone, eastern zone and in whole district respectively. It means that gross profit from biogas plants is significantly more in eastern zone and it is less in western zone.

Net Profit from Biogas :- On an average Rs. 22585, Rs. 26836, Rs.35474 and Rs. 28297 the net profit from the biogas plants is found in western zone, middle zone, eastern zone and in whole district correspondingly. It means that net profit from biogas plants is significantly more in eastern zone and it is less in western zone.

Operating Profit from Biogas :- On an average Rs. 28325, Rs. 32576, Rs.34279 and Rs. 31726 the operating profit from the biogas plants is found in western zone, middle zone, eastern zone and in whole district respectively. It means that operating profit from biogas plants is significantly more in eastern zone and it is less in western zone.

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