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HOW CAN WE LEARN FROM OUR MISTAKES DURING COVID-19? CIRCULAR ECONOMY IN INDIA THROUGH BIOGAS ECONOMICS

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Недавняя пандемия по-прежнему учит нас тому, что наши идеи и то, как мы воплощаем эти идеи в повседневную жизнь, влияют на природные ресурсы и экономическое благополучие нашей планеты Земля. Изменение климата, экологические катастрофы и недавний кризис пандемии COVID-19 преподали нам уроки быстрых инноваций и изменения образа нашей жизни. Именно такая комбинация создает проблемы с климатом, истощает энергию, меняет ландшафты, уменьшает запасы ископаемого топлива, и, фактически, меняет саму экономическую географию наших стран. С другой стороны, наблюдается возврат к естественной экосистеме, чтобы избежать излишнего загрязнения окружающей среды и создания рисков, которые еще больше вредят экологической симметрии нашей земли. Циркулярная экономика – это благо, и в этой научной работе рассматриваются основы циркулярной экономики на примере полезности производства биогаза и его разумного использования в сельских местностях Индии. Эта статья носит исследовательский характер и основана на проведенных экспериментах в сельских поселениях, где биогаз используется в качестве ресурса и заменителя ископаемого топлива. Статья устраняет пробелы в измерении полезности в экономике биогаза, используя принципы циркулярной экономики для нашей повседневной жизни на благо страны.

Ключевые слова: *циркулярная экономика, биогаз, экономика здравоохранения, COVID-19, поведенческая экономика, устойчивость.*

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The recent pandemic is still teaching us pertinent thoughts about how we think and reciprocate our thoughts into our daily lives which affect the natural resources and economic well being of our planet earth. Climate change, environmental calamities and the more recent crisis of COVID-19 pandemic has taught us lessons of fast innovation and changing the way we live our life. On that very conjunction lies the ills of climate energy depletion and fast changing landscapes of fossil fuel degradation which is in fact changing the very economic geography of our nations. On the contrary there lies the return to natural ecosystem to avoid unnecessary indulgences in pollution and hazard creation which further harm the ecological symmetry of our earth. Circular economy is a boon and this research paper wisely builds upon the fundamentals of circular economy through wise utility of biogas production and its usage in rural villages in India. This paper is exploratory and based on filed experiments in rural villages where biogas is being implemented as a resource and substitute to fossil fuel. This paper bridges the gaps in utility measurement in biogas economics linking circular economy principles to our daily lives for national benefit.

Keywords: *Circular economy, Biogas, Health economics, COVID-19, Behavioral economics, Sustainability.*

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Aim of the Research: This research work focuses on filed experiments conducted in rural villages in India learning from the grassroots levels through judgmental interview techniques and creating empirical evidence supporting the adaptation and changing landscapes towards circular economy and green economics which are so crucial to a poor country like India where lies vast inequality, poverty and hunger amidst a fast depleting energy bank across various sectors. According to IMF, India will be a trillion dollar economy which in turn requires energy to sustain its dream. India cannot rely on fossil fuels anymore. This study is explorative with case studies from villages which shows the economic indicators of biogas economics.

1. Introduction: The widely polarized global community with its reckless desires has taught us hard-hitting lessons during this pandemic that technological advancement is necessary but not at the cost of preserving human existence and natural ecosystem and balance [1]. Where on one part the global community is fast on the verge of depletion of natural resources it is necessary to take the path of frugal innovation and create fast moving open innovation practices which are so crucial to keep the natural ecosystem going. The Paris Accord of Climate change has already given us sharp warning symbols that if we do not move away from our present reckless behavioral tendencies we may be endangered in our natural resource economics by 2050 [2]. This has made researchers think differently and create sustainable path to create newer virgin avenues which can help sustain our future generations with energy and fuels. Every global economy needs energy! This is the criteria very few national economists can ignore and pursue their policies at national levels [3]. Moreover in such scenario the depletion of fossil fuels makes it mandatory not only for developed nations but even poorer countries to think differently but innovate and create resilient products [4]. Circular economy principles are fast changing the landscape of energy consumption and how people react to energy depletion and innovate [5]. Various countries like Sweden, Netherlands, and Finland have started innovating and realizing the importance of circular economy by utilizing the natural resources to the maximum and shifting energy to the required mapping zones for better utility based consumption practices [6]. You may call it differently in way of green economics or circular economy, but the underlying foundation caters to the same linear growth model with the same demand related curves for sustainability issues [7]. The pandemic has brought the national policymakers to think holistically towards changing the growth model in villages in India where the maximum migration, unemployment and rising death tolls during COVID has pushed the local authorities to a helpless situation [8]. Adding to it the menace of energy deficit the government is facing with shortage of fuel resources which it can divert to agricultural utility during high harvesting time. Such policy measures have brought sharp decline in demand and have shown gross inflation with rising energy demands across various verticals in economy of India [9]. There are also behavioral impulses to technological shifts and opening up the innovation Pandora of circular economy [10]. Latest World Bank reports have shown behavioral economics play vital role in creating decision making in circular adaptation in emerging countries which are so crucial in financial modeling and inventory generation [11]. Thaler (2005) has propounded nudges to be pertinent factor in decision making which can be duly applied to regions with absolute poverty where buying decisions are not always rational [12]. Prahlad (2017) notes that social innovation leads to inclusive growth models in countries like India which can generate employment as well as lateral income sources [13]. World bank reports from 2018 suggests a rising inequality among developing countries like India and a need to involve multidisciplinary studies in growth model analysis and social choice theories related to ethical business operations [14]. In such scenario, intrapreneurial growth among social sector in India is very important for national growth and development [15]. Recent research study by Aditi (2018) suggested a social intrapreneur paradox in circular economy flow of income in backward regions of West Bengal [16]. Camacho (2019) suggests another revolution in the form of green entrepreneurs which are basically financially included into the bottom of the pyramid structure to create a stable platform where poverty trap can be excluded [17]. OECD studies have taken behavioral functionalities with the MDG which speaks not only about poverty but also linked to SDG with concerns over energy efficiency and climate changes [18]. The Climate change conference in Paris fought for better utility of alternative sources of energy which can help sustain global economy till 2050 [19].According to recent study conducted by the national economic units of India, behavioral philosophies of economics plays pivotal role in decision making in creation of funded and self funded biogas units in rural districts [20]. The rational decision making process requires extensive grassroots funding and incubation process to generate national level shift in policy making.

2. Materials and Methods: The research is based on exploratory case analysis of circular economy best practices in a model village according to Government of India scheme for climate change proposal and World Bank assisted livelihood program utilizing renewable energy and usage of waste products into the natural ecosystem. Here we chose the tribal community because the crisis of pandemic was better reflected in this population which tried to balance livelihood with alternative source of energy consumption. The gini coefficient is very grim in these regions because of educational dearth and policy measures which are not so suitable for livelihood balance. This study brings forth the challenges in circular economy adaptation opportunities and barriers in these poverty striken areas with in-depth analysis and bottom of the pyramid model a recommendation with inclusive growth [21].

Case Study Sunderban district, West Bengal, India

Rational for study:

1. Economy of Sunderban has a per capita income less than 4 dollars.
2. Energy is widely utilized as a structural prerogative to Biogas implementation projects.
3. Part of Government of India initiative in circular economy best practices.
4. Historical significance of mangrove dense tourist destination.
5. Major COVID-19 infected region with wide containment zones.
6. Tribal infested region in West Bengal.

Table 1 – Author generated Biogas economic structure

Potential of various organic wastes

Material	Biogas(m^3/kg)	Methane (%)
Cattle dung	0.04	60
Green leaves	0.1	65
Food waste	0.16	62
Dry leaves	0.118	59

Above figure creates a stable paradigm over utility based economic allocation towards biogas utilization in rural regions due to greater impetus on agricultural renewal system and lower inventory costs.

Table 2 – Author Generated Estimation

Potential of marketing trends in Biogas finished product

Sunderban region	Product amount	Profit (%)
Northern region	4KTon	34
Western region	8KTon	23
Eastern region	5KTon	45
South region	10KTon	78

The above figure shows clearly a rising trend in agricultural marketing practices in all regions of Sunderban district and how tribal community is balancing their lives over marketing activities with respect to biogas production. A higher trend is seen in southern region with active participation of local panchayats which are the local rural governing councils having funding activities. The above figures are reflective with negligible effects of the pandemic. The increasing trends have been substantiated by 5% economic push supported by the national planning authority with circular best practices and how well wastages can be recycled.

Table 3 – Biogas inflicted employment status

Globally	Total jobs (330,000)
China	155000
India	84000
Germany	42000
Europe (excl Germany)	29000
other	17000
Bangladesh	14000
United States	6000

Table 4 – Biogas Economic analysis in Sunderban district

No.	Indicators values	Period (Year)		
		2019	2020	2021
1	Evaluation amount for processed slaughterhouse units waste processed	9281.00	15,283.00	143,435.00
2	Count of neutralized bodies units* (Mton)	448.00	674.00	537.00
3	Electricity obtained values(MWh)	3689.00	8952.00	4456.00
4	Thermal energy Quantify obtained (MWh)	1808.00	4891.00	3874.00
5	Maximum electricity unit capacity of BI (MWh)	16,280.00	17,280.00	13,280.00
6	Degree of usages	26.08%	47.18%	32.36%
7	Green enrgy certificates obtained (number)	8987.00	15,652.00	22,396.00
8	Electricity bought units (MWh)	12,023.00	9624.00	12,205.00
9	% for electricity from own production for total consumption	24.02%	45.86%	33.75%
10	TOTAL INCOME, =valuation	699,022.00	1,246,587.00	812,461.00
11	Evaluation of the electricity produced (rupees)	226,860.00	610,355.00	452,340.00
12	Evaluation of the thermal energy produced (rupees)	88,128.00	252,948.00	112,049.00
13	Evaluation for the certificates obtained (rupees)	254,954.00	456,345.00	292,974.00
14	From neutralizing inter bodies (rupees)	20,080.00	15,939.00	29,098.00
15	Evaluation Total Expenditure in which values	495,940.00	582,899.00	799,547.00
16	Material Expenses rates (Substances in utility) (rupees)	80,506.00	152,982.00	321,245.00
17	Evaluation for Maintenance engines (rupees)	60,291.00	208,713.00	84,270.00
18	Utilities values(predominantly gas unit) (rupees)	75,727.00	91,782.00	118,157.00
19	Direct salary values (rupees)	70,857.00	77,026.00	82,991.00
20	Parameters Own induced consumption green in certificates (rupees)	55,755.00	68,452.00	30,148.00
21	Other miscellaneous operating expenses (rupees)	143,804.00	85,944.00	130,734.00
22	Evaluation RESULT for OPERATING (rupees)	203,081.00	663,688.00	33,914.00
23	AMORTIZATION NET evaluation rates VALUE (rupees)	322,143.00	322,143.00	322,143.00
24	Net Result (without allocation of administration and cost of processed)	-119,062.00	-341,545.00	-288,229.00
25	Wastages units (rupees)	436,912.00	716,848.00	659,817.00
26	NET RESULT (Approx rates) Rupees	307,851.00	2,058,393.00	321,588.00

The above table illustrates economic indicators for biogas production in consecutive years inflicted by the pandemic with greater thrust on energy bank indices.

To further the cause of research the employment capacity of various nations irrespective of GDP is being calculated which is strikingly important to create deductive study towards biogas utility in India.

Table 5 – Techno-Financial analysis: Biogas economics Sunderban district, India

Parameters	**Values**
Production scale values	
BG0011 cells production (mtonne/year)	145
BG0011 EPS production (mtonne/year)	138
Total algae- biomass production indices (mtonne/year)	**283**
Capital cost (including fixed, installed and working capital)	
Pond values (million rupees)	318
Land values(million rupees)	25.6
Pumps evaluation (million in rupees)	5.85
Total capital intensive valuation (million in rupees)	322.45
Annual capital charges (million rupees/year)	**32.22**
Operating cost indices	
Chemicals utility (P fertilizer: Ca (H2PO4)2 H2O) (million rupees/year)	2.3
Other operating cost (including utilities, maintenance and repairs, labor etc.) (million $/year)	3.26
Total operating cost (million rupees/year)	**2.56**
BG0012 algae biomass production values(rupees/tone)	143

The above figure clearly illustrates the economics of biogas production functionalities in the rural households in Sunderban districts with the operating cost merely reaching 2% mark which is indicator of best practices in energy consumption.

3. Analysis: The field experiment conducted were primarily based onj theoretical foundations of developmental choices and rational behavioral analysis of poverty program in India with respect to available databases in COVID-19 infected community transmissions in tribal villages. Such results showed a proportionate increase in human demands towards resource allocation to cheaper circular economy practices supported by various national level program and state local collaborative works in green energy transition. Such transition in tribal livelihood is quite surprising with respect to human hunger and absolute poverty with the result of total collapse of system during the pandemic. Mass migration was a result which also resulted in reverse resource utility factors in economic dynamics. The Gobar dhan Yojna of the Government of India towards utility of Gobar,a type of excreta which can be an important ingredient in biogas production principle. Various models were generated thereby for creating revenue generation in biogas plants in Sunderban region which capitalized on manure and wastages. There lies ample research evidence towards increasing proportionality to energy consumption with poverty line reflections. Therefore it is imperative from this study top understand and evaluate importance of utility in green energy transition due to waste resource allocation in agricultural related factors.

4. Deduction: For a dredging economy during crisis like COVID-19 it is imperative for future energy leaders to conceptualize economy based on green energies and utilizing natural resources rather than throwing away the waste. There only the concept of making circular economy going circular lies where the less affected raw materials as well as the garbage is utilized randomly and creates a lifecycle for minim sing cost and economic output of energy allocation (22). Such best practices can only create balances in natural resource mobilization program of the government with minimal resource optimization and creating a catalyst for growth and development (23). Though there lies various limitations in policy implications with biogas primarily concerned with literacy rates and traditional best practices in emerging countries but the dichotomy of the green economics still hits hard at national level planning and budgetary allocation without global awareness program (24). Reaching out to the masses with energy bank utility assets and energy mathematical dialects inn itself is a paradox with the rise of the digital revolution and moving away from the baby boom period with resource depletion. Prahalad et al. has reiterated that poverty can be capitalized by inclusive growth models and social innovation with the adaptability of the BOP models into rural empowerment program (25). Greater focus lies on skill development and national level program like MNREGA of Government of India sustaining rural livelihood with innovation led plethora generation.

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