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Procrastination on production of energy using renewable sources retard settlement of congenial society: Evidence of Bangladesh

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Abstract

A better flow of resources to total package of energy production can ensure sustainable development of a nation. Bangladesh is a country which cannot yet make available all resources of energy required for sustainable development. Production of energy from renewable sources are not yet been accounted nationally. Sustainable Development Goals (Goal–7) demands creation of energy through resources like: water, air, sunlight and joint effect of another environmental resources. The task of production of energy through renewable sources has already been started but in a discrete manner.

As a result, energy from conventional resources are used heavily for completing the production cycles in Bangladesh. The sources of energy at persisting process are mentioned as: natural gas (54.67%), fossil fuel (21.72%), coal (6.97%) wind, solar etc. (0.085%) and hydro (0.12%) and bio-fuels (15.90%). It can be pointed that the sources of energy through renewable resources is observing very negligible picture even after nine years of adopting UN convention and ratification for SDG (Goal 7).

The absent of energy through renewable sources and burning of coal, fossil fuels, and natural gas for energy warming the atmosphere and affecting human health and environment. Considering this, the study attempts to find relationship of per capita generation of electricity with economic growth and other energy resources. Besides this, the study attempts to know how the changes of resources quantity influence the per capita generation of energy. Moreover, the research required to find out the turning point of the individual series contributing to the amount final product.

The values of the parameters and the analysis are shown significant results, which support that the atmosphere getting more heat, polluting the environment and affecting the human health. As a result, more strong steps are to be taken to get rid of many unacceptable issues which is degrading atmospheric environment, human health and retarding the development of congenial process of living.

On this situation, the study suggests that the generation of electricity observing renewal process should be started in full swing reducing the persisting long traditional process. This may lead to achieving targeted indicators for sustainable development goals (SDG 7) and help creating a pleasant and congenial society.

Keywords: Renewable energy; Congenial society; Quantitative analysis; Industrial pollution; Deforestation; Sustainable development; Performance analysis

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1. Introduction

On increasing of population sizes and their necessities enforce fast requirements of output from various sectors. The pollutions are produced on use of different types of energy producing resources. The sources are on brick kilns, deforestation, plying of cars, fumes from factories as well as dust accumulation from various sources. Moreover, the environment also polluted through thermal pollution, air pollution, solid waste pollution and noise pollution. All those are produced through dumping industrial pollution in the natural water, soil erosion, deforestation, decrease in dissolved oxygen level, and disruption of amphibian habitats.

The adopted MDG fails to get complete achievement due to lack of transparent performance assessment system, limited efforts to harness the potential of the private sector and weak regulations about the implementation. The task on UN implementation of MDG is expired in 2015. On termination of the task of MDG implementation the UN adopted sustainable development goals (SDG) including 17 different goals with 169 targets. The creation of clean energy is one amongst the 17 goals.

The study attempted to know the progress on clean energy creation programs of Bangladesh. The study collected data on persisting production ingredients of energy and placing those amounts for final products and how much that supports the Sustainable Development Goals. The study collected data from the government sources also using AI process and analysis of data are carried out using statistical techniques. The results are showing that even after nine years of adopting convention and ratification the country could not even produced significant amount of energy through renewable sources. Thus, the observed shortage of amount of renewable energy disrupting the settlement of congenial society.

2. Literature Review

Ahmed HU and Rahman M (2005) pointed that the increasing trend in the fertilizer used in agriculture sector, unplanned disposal of municipal solid wastes and deforestation practices are the likely indicators for the degradation of environmental position which demands for developing efficient management of environmental variables. The research also pointed that required amount of forest area can maintain soil fertility level, conversion process of carbon di-oxide to oxygen and ensure balance in the ecosystem.

Ahmed HU (2009) mentioned that higher cultivatable land required higher quantity of chemical fertilizer to be applied to maintain sustainability of the producers as well as the country. This practice develops environmental degradation across the country. The research also pointed that lowering the cultivable land from production process resulted higher expense for import which cuts down expenses from potentates plans required for building sustainable development. As a result, government and non-government organizations needed to be finding out appropriate PPP for ensuring sustainable development.

I. Arsel et al. (2024) mentioned that solar radiation on a region is one of the main parameters in deciding how conversion devices designed to utilize solar energy. Investment on solar energy is highly essential to predict the annual average solar radiation on the region.

Objectives

The study will attempt to check following postulations:

- Computation of bi-variate relationships amongst GDP, per capita electricity generation, consumption of natural gas, consumption of HSD, SKO, and LDO, coal, and consumption of liquid furnace oil.
- Computation of descriptive statistics, turning points of the data and to explain behavior of the series following empirical rule $\bar{x} \pm 3$ standard deviations of the mean. The rule states that if in any process 68% of data falls within one standard deviation and 95% observation falls within two standard deviations and 99.7% within three standard deviation, then the data treated to follow a normal movement practice. To judge the quality of data the co-efficient of variation, were also estimated for knowing behavior of ingredient series and final products.
- Development of a multivariate regression model for the per capita generation of electricity with the ingredients used in the persisting practices, and finally the
- Recommendations and suggestions are placed after performing the analysis.

3. Methodology

3.1. Data

Data on GDP, per capita electricity consumption, consumption of natural gas, and consumption of HSD, SKO, and LDO for the period 2005-2021 collected from the publication of Bangladesh Bureau of Statistics. Moreover, sources of supply of electricity and their share of production were collected from the publication of SREDA (Sustainable and Renewal Energy Development Authority). It may be a question how felicitous services for the society can be ensured. To answer this question the discussions are required on what are the resources of generation of electricity and how far it is suitable for human health. The answer will be given by all corners about the resources are: natural oil and gas, coal, nuclear fission, biomass, petroleum, geothermal and solar thermal heat. In the second stage of clarification the electricity produced through renewable sources is good for human health. Because, the energy produced in renewable sources such as: solar, wind power, solar power, bioenergy (organic matter burned as a fuel), and hydroelectric including tidal energy, which is self-replenishing and have very low carbon foot print. A society can enjoy better living standard if the consumption of energy ensured produced through the renewable sources where carbon foot is almost absent.

3.2. Research Design

The design of the study has been prepared to answer the question, if the sources of products playing responsible role in the persisting process of generating electricity. The research will attempt to find the relationships amongst the variables like: GDP, use of liquid furnace oil, natural gas, HDO, LDO, SKO and coal. In this regard, a regression model will be developed to verify if the position of generation of electricity series is influenced by all the series used as ingredients for producing power. Moreover, to check the behavior of selected series are moving forward following approximately normal behavior or in discrete manner. Besides this, the study delineates the demerits for not adopting renewable process in the production of required amount of electricity and how does it affect human settlement.

4. Results and Discussion

Table 1 Bi-variate correlation coefficient between selected variables

Correlations		[1]GDP	[2]lifucons	[3]natgasconsu	[4]HSD	[5]percapgene	[6]usecoal
[1]GDP	Pearson Correlation	1	-0.097	-0.521*	0.282	-0.434	-0.297
	Sig. (2-tailed)		0.712	0.032	0.274	0.082	0.247
	N	17	17	17	17	17	17
[2]lifucons	Pearson Correlation	-.097	1	0.673**	0.702**	0.758**	0.485*
	Sig. (2-tailed)	.712		0.003	0.002	0.000	0.048
	N	17	17	17	17	17	17
[3]natgasconsu	Pearson Correlation	-.521*	0.673**	1	0.284	0.950**	0.694**
	Sig. (2-tailed)	.032	0.003		0.268	0.000	0.002
	N	17	17	17	17	17	17
[4]HSD	Pearson Correlation	.282	0.702**	0.284	1	0.361	0.349
	Sig. (2-tailed)	.274	0.002	0.268		0.155	0.170
	N	17	17	17	17	17	17
[5]percapgene	Pearson Correlation	-.434	0.758**	0.950**	0.361	1	0.708**
	Sig. (2-tailed)	0.082	0.000	0.000	0.155		0.001
	N	17	17	17	17	17	17
[6]usecoal	Pearson Correlation	-0.297	0.485*	0.694**	0.349	0.708**	1

Sig. (2-tailed)	0.247	0.048	0.002	0.170	0.001	
N	17	17	17	17	17	17

*. Correlation is significant at the 0.05 level (2-tailed); **. Correlation is significant at the 0.01 level (2-tailed). NB: 1 GDP, 2 Consumption of liquid furnace oil, 3Consumption of natural gas, 4 HSD (High Speed Diesel), LDO (Low Density Oil), SKO (Super Kerosene Oil), 5 per capita generation of electricity, 6 Consumption of coal.

Table 1 is representing the Bi-variate correlation coefficient between output and electricity consumption, natural gas consumption and consumption of HSD, SKO & LDO, and use of coal, and per capita generation of energy. The analysis is showing a negative and insignificant relationship of GDP and per capita generation of electricity. This means that the production level of electricity is not being able to support the growth of output at current situation. On the other hand, consumption of natural gas and per capita generation of electricity is highly correlated meaning that the natural gas supporting the production of electricity. The analysis is also showing that the consumption of liquid furnace oil generation of energy series correlated significantly and positively. This means that even after nine years of closing the activities on MDG programs the country cannot even go forward for producing energy using renewable sources at significant level. As a result, it may be pointed that the present energy generation process moving forward creating excess pollution. This practice changes climate heats up, change rainfall patters, increase evaporation, and rise sea levels. Again, this situation affects the availability of safe drinking water and threats of frequent severe drought.

Table 2 Estimated values of the parameters of the model

Model	Estimated value	Standard Error	T-value	Sig
Constant	-100.735	48.615	-2.072	0.063
Liquid furnace Oil	0.185	0.090	2.043	0.066
Natural gas	0.002	0.000	5.241	0.000
HSD Oil	-0.038	0.066	-0.570	0.580
Loss of forest	-0.066	0.069	-0.963	0.356
Coal	35.844	70.475	0.509	0.621

$R^2 = 0.939$; Adjusted $R^2 = 0.912$; DW = 1.709; $F_{(5,11)} = 33.992(0.000)$; MSE = 977.635 Source: Estimated using available data sources.

Table 2 is showing the estimated values of the parameters of the model regressing all the series of resources on per capita generation of electricity. The estimated values of the model selecting parameters are found very significant. This means that the selected model fitted the data very significantly. The constant and the parameters on uses of liquid furnace oil and natural gas are found significant. Moreover, all the series representing the ingredients group for producing electricity jointly and significantly influence the per capita energy generation series. The value of the MSE (Mean Sum Square Error) is found very high representing the data points are dispersed widely around the central moment (Mean).

An empirical rule states that if 99.7% of data of a series found within$\bar{x} \pm 3$ standard deviations the process follows a behavior of normal distribution. Under this rule 68% of data falls within $\bar{x} \pm 1$ standard deviation, 95% data falls with within $\bar{x} \pm 2$ standard deviations. On the other hand, the descriptive measure ranges of a series tell us how far the largest value in the data set from the smallest value. The range has significant role in describing the variability as long as there are no outliers. An outlier is an extreme high or low value that stands alone from the other values.

Table 3 representing the results on turning point analysis of the series on: consumption of natural gas (mm cft), furnace oil(liter), amount of generated electricity(gwh), consumption of HD, LDO, SKO (liter), loss of forest area(hector), per capita consumption of electricity(kwh), and per capita generation of electricity (kwh). It is mentioned that performing turning point analysis explanation about the behavior of data is carried out. The analysis has been showing that all the selected series have significant number of outlier and also have high percentage of co-efficient of variation. Moreover, the estimated values of skewness and kurtosis are showing very abnormal values which exhibit that the series are not perfectly symmetric, and signifies that the series are less homogeneous, less consistent, and less uniform. This implies that the use of ingredients for producing electricity and the presentation of final products are moving forward in discrete manner, which causes an imbalance in the availability of the final products. The reasons may be the deficiencies of knowledge in use of new technologies which are really more efficient but absent in the process for producing and distributing power in the market.

Table 3 Turning point analysis on power generation sources of the period 2006-20021

Power Supply Sources	Mean	Std. Deviation	Skewness	Kurtosis	Observation in the range $\bar{x} \pm 1\sigma$	Coefficient of variation
Natural Gas Consumption (MMCFT)	186872.19	42190.85	0.903	-0.337	76.47%	22.57%
Furnace Oil (Liter)	287.72	172.38	0.231	-0.928	35.24%	59.91%
Total Generation of Electricity (GWH)	43272.58	19222.88	0.616	-0.933	59.00%	42.42%
Consumption of HDO, LDO, SAO(Liter)	192.94	186.01	2.343	6.672	94.12%	96.40%
Loss of Forest area (Hector)	362.0	131.50	0.894	0.826	88.24%	36.32%
Per capita Consumption of Electricity (KWH)	236.31	96.26	0.553	-1.010	70.59%	40.73%
Per capita Generation of Electricity(kwh)	275.28	105.15	0.583	-1.010	58.82%	38.00%

Source: Estimated using available data sources.

Table 4 Resources for supply of electricity and share

Sl.No.	Fuel/Resources	Installed Capacity	Share (%)
1.	Coal	6604 MW	21.39
2.	Gas	12194MW	39.50
3.	HFO	6442MW	20.8
4.	HSD	290MW	0.94
5.	Imported	1160MW	3.76
6.	Renewal	1381.4MW	4.47
7.	Captive	2800MW	9.07
Total		30871MW	100

Source: SREDA (Sustainable and Renewal Energy Development Authority), 2023.

Table 4 is representing resources used for electricity and the participation in percentage. The data is showing that coal, gas, and fossil fuel still are playing major roles in ensuring the amount of required supply. Only 4.47% out of total capacity are being found available through renewable sources in the year 2023. Besides this, the country has imported energy from the Adani Power Company of India spending about 1 billion US dollar.

5. Conclusion

- The data on percentage change of generation on electricity over the preceding years for the period 2018-2019, 2019-2020, and 2020-2021 are estimated at 17.29%, -1.20%, and 8.27% respectively. The individual values of these three periods are supposed to be distributed closely around 8.24MW, which is seen nonexistent and thus it is clear that the generation activities moving forward in discrete manner.
- High concentration of Ozone level that is found in the stratosphere around 15-30 KM above the earth surface. It covers the entire planet and protects life on earth by absorbing harmful ultraviolet radiation-B(UV-B) from the sunlight. The use of air conditioner, refrigerators, and aerosol and burning of fossil fuels, coals, and natural gas generating more heat in the atmosphere. Warming also linked to the destruction of tropical forest area and hampers the production of agricultural sector with expectation of draught. This also creating risk for human life causing fatal diseases like: skin cancer, leprosy, and arsenic (per lac) which was estimated at 2.77 in 2011 but the same information is observed at 4.89 in 2014. The high rate of percentage induces for incremental

expenses on treatment and ultimately reduces the opportunity of investment capacity of households and output level.

- Global warming is linked with renewable energy has the capacity to reduce greenhouse gas emission by up to 20%. This energy generation process is capable to generate domestic employment up to 55000 full-time jobs across the economy.

- Bangladesh Power sector master plan (2016) pointed that the country has the potentiality to generate combined 3.6GW energy through renewable sources. But the targeted figure has not yet been touched even after 2023.

- The mean, and standard deviation, on total generation capacity of energy (in MW) and maximum generation (in MW) are estimated for the period 2016-2021. The estimated values of mean are found at 17708.44 and 1972.00 and standard deviations at 3662.17 and 1731.38 respectively. The values of co-efficient of variation is estimated at 21% and 14% respectively. The estimated picture on the two indicators giving bleak signal which may be due to wrong recording or failure to achieve the target.

- Investment on renewal energy draws capital to local area and can boost up the economy. It supports to establish new factories and business institutions. These opportunities support production of solar panels, wind turbines, hydroelectricity and biomass for producing renewable energy and improve local manufacturing capacities.

Recommendations

- Data timeliness and accuracy is very important in achieving the targeted goal. The analysis is showing very bleak picture for generating energy through renewable process. This may be the reason the wrong recording process, lack of timeliness and variation on following appropriate process of production. The concerned authority may be advised to be remain transparent with the assessment of performance. This will build trust, accountability and level of collaboration for the success of the sector. The transparencies again establish relationships amongst the stake holder of the business such as: employees, employers, customers, and investors for ensuring more success.

- The higher rates on the incidence of diseases such as: skin cancer, leprosy, arsenic, and problems at eye sight, and respiratory tract are pushing inhabitants on excess expenses on health management which reduces people's investment and productivity levels and making uncongenial environment in the society. Considering, this situation, the study like to put advices to the concerned authority to activate production process of energy using sunlight, wind mill and other processes. Otherwise, sustainability through implementing SDG 7 would not be achieved in the targeted time frame

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed

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