



Green energy potentials for reducing green house gas emissions in atmosphere using GIS

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ABSTRACT

The increase in use of non-renewable fossil fuels may have increased the amount of carbon dioxide and other Green House Gases in the atmosphere to produce climate change and other environmental problems both on local and global scales. The Intergovernmental Panel on Climate Change predicts that there will be a temperature rise of about 1.4 to 5.8°C during 2100. Almost all the countries are now seriously thinking on controlling the fossil fuel use so as to arrest global warming. Biogas energy produced from poultry litter is one of the fastest growing clean energy source technologies across the world. Mapping of power potential from poultry litter in Namakkal block is the focus of the present study. The study employs Geographical Information System to map the biogas energy resources of Namakkal block and analyze the variability considering spatial aspects. Taking these into account, the present status of the alternative energy potential is assessed and maps have been prepared. The Poultry litter quantity has been estimated and used for evaluation of the alternative energy potential. The study shows that, the great green energy potential (83,457 KW/day) available in Namakkal block. This technology ensures reducing Green House Gas emissions, sustainable development, energy security and employment generation in the study area.

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Introduction

If the temperature rise is not controlled, our future generation is going to witness many more climate change connected tragedies like water scarcity, migration of people due to seawater inundation in the costal areas, reduction in food grain production, recession in the economic growth of the countries. World opinion has been growing in favour of looking for alternatives to fossil fuels that would ensure eco-friendly and sustainable development on the one hand and energy security on the other (2). Renewable energy sources will play an important role in the sustainable development in the future. Biomass based energy systems can be built on a wide variety of feedstock's and use many different conversion technologies to produce solid, liquid or gaseous fuels. These fuels can then be used to provide heat, electricity or to power vehicles. Voivontas et.al.(7) have estimated the potential of power production from agriculture residues through Geographical Information System technique in Greek Island. Ramachandra (4) used a Geographical Information System to map and analyze biogas as fuel one such alternative, which can be obtained by anaerobic digestion of animal residues and domestic and farm wastes abundantly available in Karnataka State. Biogas can be used in automobiles after its purification. Removing CO₂, H₂S and water vapour through Scrubbing Technique and compressing it into cylinders makes it easily usable for transport applications such as three-wheelers, cars, pick up vans and etc. (6). The present work was to study the estimation of alternative energy potential from poultry droppings. This research embraces, formulating a strategy for a sound environmental management of poultry wastes, and a viable and profitable proposal for generating green energy.

Study Area

The present study area is Namakkal Block in Namakkal District of Tamil Nadu, India, which is abundantly available for

poultry litter [Fig.1]. This block is located between 11° 09' 00" and 11° 15' 00" N latitudes and 78° 02' 30" and 78° 12' 30" E longitudes, covering an area of 21,544 hectares (1). The study area includes 23 villages and one municipality (Namakkal). The general geographical information of the block is rocky and undulatory area. The southern part of the block is upland area and maximum elevation is 344 m above mean sea level. Geological formation of the area is comprised of igneous, sedimentary and metamorphic rocks (1). The Thirumanimuttar is non-perennial River, flowing from north west to western part of the block.



The number of streams and tanks constitute the drainage of the block. The major ten soil series of the taluk can be grouped under two broad categories, i.e. red soil and black soil (5). Regarding cropping pattern Cholam is the first in net sown area (3). Population density of the block is about 356 persons per sq.km as per 2001 population census. Either directly or indirectly 52 percent of the people engaged with agricultural activities. Total area cultivated under all crops is only 48 percent of the land.

Data and Methods

The village wise spatial distribution of poultry birds (2007-2008) data collected from District Poultry Development Office, Namakkal. In accordance with collateral data, the SOI toposheet

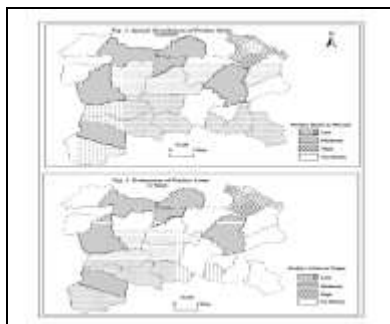
in 1:50,000 scale and maps from various organizations have been used for preparing various thematic maps. Simple statistical techniques are used to calculate the percentage of spatial distribution of poultry birds, estimation of poultry litter, estimation of biogas potential and mapping of green energy potential from poultry waste. Constructions of thematic maps have been done with aid of ARC/GIS 9.1 software.

Results and Discussions

GIS is used for identifying and quantifying the renewable energy potential. The findings of the present investigation have been classified into four headings namely,

Spatial Distribution of Poultry Birds

The study area included 23 villages. The spatial distribution of poultry birds are 46, 36,500 presented in Namakkal Block were analyzed using a GIS and constitutes the basis for the estimation and presentation of the available alternative energy potential [Fig.2]. The study shows that, highest range of poultry birds presented in Marurpatty village in 24 percent due to good environment and infrastructural facilities. The moderate amount of poultry birds distributed in five villages ranges between 6 to 11 percent.



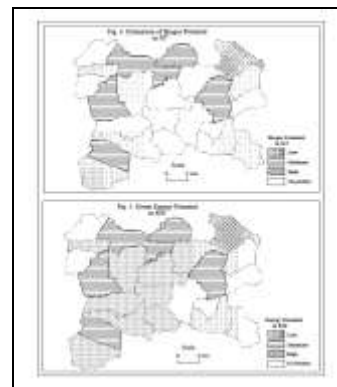
The low level of poultry birds presented in twelve villages in less than six percent. Remaining five villages the poultry farms are not presented.

Estimation of Poultry Litter

Physical quantities of poultry litter produced per day were estimated at the village level by multiplying the average amount of litter generated per bird. The average amount of litter generated by a bird was assumed 90 grams per day. Therefore the total quantity of the poultry litter generated in Namakkal block is about 417 tons per day. The highest amount of poultry litter were generated per day was estimated at Marurpatty village which are 98 tons per day [Fig.3]. The moderate amount of poultry litter was generated by five village's ranges between 23 to 47 tons per day. Twelve villages are produced less than 22 tons of poultry litter per day.

Estimation of Biogas Potential

Biogas is a useful fuel. It can be burned directly or used to fuel an engine to generate green electricity. Biogas is a mixture of CH₄ (65%) and CO₂ (35%) and small amounts of hydrogen sulphide (H₂S), water vapour and other gasses produced from poultry litter. Assuming a production of 0.1 cu.m of biogas from one kilogram of poultry litter. The total amount of biogas potential estimated at Namakkal block in 41,729 m³ per day [Fig.4.]. The Marurpatty village has the highest amount of biogas potential in 9,837 m³ per day. . In five villages biogas production is between 2197 to 4694 m³ per day. In twelve villages, it may be less than 2,196 m³ per day. The theoretical potential is presented as a thematic map of the total amount of biogas available in each village.



Mapping of Green Energy Potential

Biogas energy potential assessment is based on compilation and computation of poultry litter supply for the green energy generation. The estimation of biogas potential was implemented in Geographical Information System to obtain maps showing village wise variation of green energy potential [Fig.5]. Assuming that one cubic meter of biogas may produce two units of green electricity, it is estimated that poultry litter generated in Namakkal block may produce about 83,457 kilowatt of green energy per day. The highest amount of green energy potential per day was estimated at Marurpatty village which are 19,674 kw per day. Five villages are estimated 4,393 to 9,387 kilowatt per day. Twelve villages produce low level of green energy potential in less than 4,392 kilowatt per day.

Conclusion

The atmospheric carbon dioxide concentrations are calculated to be rising at 2 parts per million a year, the burning of fossil fuels and forests the global level exceeds 385 parts per million. The safer level is viewed by NASA scientists as no more than 350 parts per million. Almost all the countries are now seriously thinking on controlling the fossil fuel use so as to arrest global warming. Namakkal block possesses great biogas energy potential and opportunities are open. The Poultry litter quantity has been estimated and used for evaluation of the green energy potential. The study shows that, the great green energy potential (83,457 KW per day) available in Namakkal block. This technology ensures reducing Green House Gas emissions, sustainable development, energy security and employment generation in the study area.

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