Volume : 1 | Issue : 3 | December 2011 ISSN - 2249-555X

Research Paper Geography

Identifying Suitable Locations For Electrical Energy Productions Units Using Poultry Litter in Namakkal Taluk, Tamil Nadu, India Through GIS Technique

* P. Gunasekaran ** A. Ganesh

* Research Scholar, Department of Geography, Bharathidasan University, Tiruchirappalli

** Professor, Department of Geography, Bharathidasan University, Tiruchirappalli

ABSTRACT

A number of entities have proposed using poultry litter as a fuel source for electricity generation. Several studies have investigated the technical and economic feasibility of producing electricity for sale into a wholesale power grid using poultry litter as a fuel. In addition, some clustered small poultry farms may be interested in installing a centralized Anaerobic Digester facility to collect wastes within a certain distance of the poultry farms. Therefore, to promote the development of poultry litter based bio energy systems, it is essential to determine the suitable locations for such development. In this paper involved identifying suitable locations for electrical energy productions units using poultry litter in Namakkal Taluk, Tamil Nadu, India. A Geographical Information System model is developed and determined ten optimal sites for potential bio energy systems using poultry litter as the feedstock in the study area.

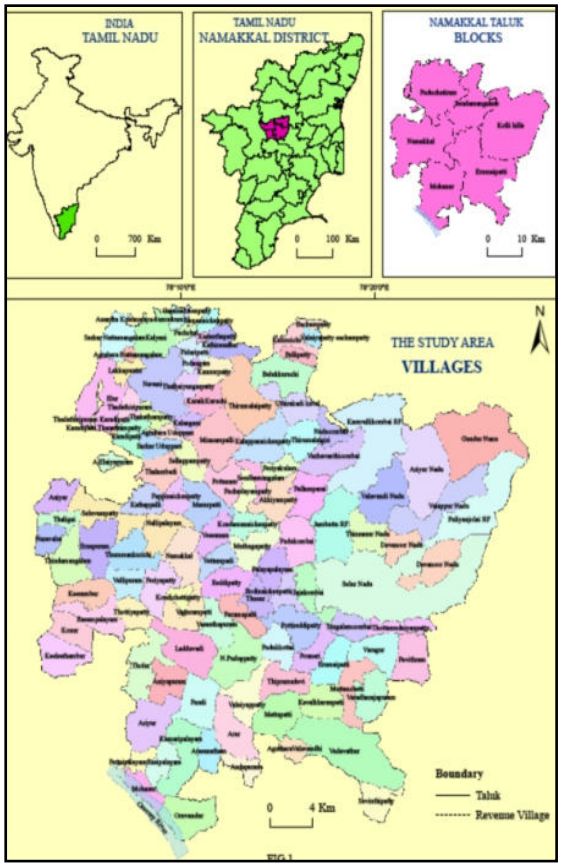
Keywords : Poultry litter, Anaerobic Digester, GIS, Optimal Sites.

Introduction

The growing consumption of energy has also resulted in the country becoming increasingly dependent on fossil fuels such as coal, oil and gas. Rising prices of oil and gas along with likely shortages in future are causing concerns about the security of energy supply, which is needed to sustain the economic growth(3). An increase in public awareness regarding the negative impact of traditional power-generating methods, especially coal and oil-fired power stations, on the environment has created a demand for developing and using environmental friendly renewable energy. El-Hadidi Y.M and A.I.Al-Turki(2007) have investigated the possibilities of utilization of poultry waste as an organic fertilizer and alternative energy source. Voivontas, D., Assimacopoulos, D., and Koukios, E.G (2001) have estimated the potential of power production from agriculture residues through Geographical Information System technique in Greek Island.. Jianguo Ma, Norman R. Scotta, Stephen D. DeGloriab and Arthur J. Lembo,(2005) proposed a GIS model for land-suitability assessment of potential energy systems featuring an Anaerobic Digesters coupled with an energy generator and variety of environmental and social constraints, as well as economic factors are integrated in the model to help determine the optimal sites for installing such systems. The Analytic Hierarchy Process method is employed to estimate the factors weights in order to establish their relative importance in site selection. The main objective of the present study is identifying suitable locations for electrical energy productions units using poultry litter in Namakkal Taluk, Tamil Nadu, India through Geographical Information System.

STUDY AREA

The study are located is between 11° N and 11° 26' N and 78° 02'E and 78° 28' E, Namakkal taluk extends over an area of 1513 sq.km.(Fig.1). Namakkal, the taluk



headquarter, is the only town in the taluk which has 117 villages grouped under six development blocks. Namakkal is known as Egg City or Poultry Town. It is also known for truck building industry. Hills are found on the northern and eastern part of the taluk. Well-known Kolli hills, the garden of Namakkal taluk, spreads over an area of 371 sq.km with peaks rising to 1300 m. Taluk has semi-arid climate, and Thirumanimutharu and Kaveri rivers pass through this taluk.(5). The maximum temperature ranges from 28^{0} to 40^{0}C and the minimum from 14^{0} to 26^{0}C. Annual normal rainfall of the taluk is 784.10 mm. Paddy is the main crop. Total population as per 2001 Census of the taluk was 550000 with density being 332 per sq.km. About 52 per cent working population is engaged in farming activities.

Methodology

In accordance with collateral data, the SOI toposheet in 1:50,000 scale used for preparing base maps. The IRS IC/PAN imagery was geo-referenced over the base map and also created the required thematic maps with the help of raster and vector based GIS software. The village-wise spatial distribution of poultry farms (2007-2008) data collected from District Poultry Development Office, Namakkal. Suitable 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. Various thematic maps are involved in buffer and overlay analysis. Location Allocation Model used for identifying suitable locations for power plants. The results were verified with the help of Global Position System.

Poultry Birds And Litter

The total number birds are 13,023,220 in Namakkal Taluk as on 2007 - 2008. The study area covers 64 villages. Poultry farms not presented in 53 villages. The quantity of poultry litter produced per day was estimated at the village level by using the average amount of litter generated per bird. The average amount of litter generated by bird was assumed as 90 grams per day. Thus the total quantity of the poultry litter generated in Namakkal Taluk is about 1172 tonnes per day.

Biogas And Green Energy Potentials

Biogas is a product of anaerobic fermentation of organic matters and consists of around 60-70 percent Methene and 30-40 percent Carbon dioxide and traces of nitrogen, sulphur and moisture. Farm wastes locally available are used for extracting biogas from poultry litter. Assuming a production of 0.1 cu.m of biogas from one kilogram of poultry liter, it is estimated that Namakkal Taluk can produce biogas of 1,17,245 cu.m per day. Assuming that one cu.m of biogas may produce two units of electricity, it is estimated that poultry litter generated in Namakkal taluk may produce about 235 megawatt of power per day.

Suitable Locations For Power Plants

Bioenergy systems using poultry litter as a feedstock suggests that they must be properly sited to avoid sensitive areas, such as streams, tanks, residential areas, transport line and forest etc.(Fig.2.). Within this model, we define these sensitive areas as "constraints" meaning they are restricted from development of poultry litter based energy

FIG.2.

systems within the area. A buffer zone is created for each of these constraints to define the minimum distances of development sites to the selected geographic feature. Different constraints correspond to different widths of buffer zones. Sites falling within streams and a buffer zone of 100m are avoided. Sites falling within tanks and a buffer zone of 300m are avoided. Sites falling within transport line and a buffer zone of 100m are avoided. Namakkal city has high density residential areas, a distance of 3000m are avoided. Villages are having medium density residential areas, a distance of 500m are avoided. A binary GIS grid is created for each constraint feature, with cells falling within a constrained area assigned "0" and cells falling outside the buffer area assigned "1". A single grid, or final constraint map, is calculated by multiplying all constraint layers together. Only the cells that have a "1" in each input layer will have a non-zero value in the final result. Location Allocation model developed and determined ten optimal sites for potential bio energy systems using poultry litter as the feedstock in Namakkal Taluk, Tamil Nadu, India.

CONCLUSION

Biogas energy is a clean, pollution free and renewable source of energy. The method of generating electricity from biogas resources is one of the most effective ways to reduce global warming emissions. Poultry litter being generated continuously in Namakkal Taluk may be profitably used, as it has a potential of generating about 235 megawatt of green energy per day. Location Allocation model developed and determined optimal sites for potential bio energy systems using poultry litter as the feedstock in the study area. Ten optimal sites were identified and buffer polygon created. The results indicated that, where the renewable energy resources are available based on distribution of poultry farms.

REFERENCES

El-Hadidi Y.M and A.I.Al-Turki (2007). 'Organic Fertilizer and Biogas Production from Poultry Wastes', Journal of Food, Agriculture & Environment, 5 (1), pp. 228-233. | Gupta K.R, Maria Anna Jankowska, Klaus Bosselmann, Prasenjit Maiti, (2008) Global Environment Problems and Policies. Delhi: Atlantic Publishers & Distributors (P) Ltd. | Jianguo Ma, Norman R. Scotta, Stephen D. DeGloriab, Arthur J. Lembo, (2005) Siting analysis of farm-based centralized anaerobic digester systems for distributed generation using GIS, Biomass and Bioenergy, 28, 591-600. | Soil Atlas, (1998) Namakkal District. Coimbatore: Soil Survey & Land Use Organization. | Voivontas, D., Assimacopoulos, D., Koukios, E.G (2001), Assessment of biomass potential for power production: a GIS based method, Biomass and Bioenergy 20, pp.101-112.