

ESTIMATION OF ENRICHED BIOGAS POTENTIALS FOR VEHICULAR USE IN PUDUCHATIRAM BLOCK, TAMIL NADU, INDIA

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ABSTRACT

Energy is one of the most important commodities in modern life, but burning fossil fuels is our main source of energy, releases carbon dioxide, causing global warming. Due to rising cost of petroleum products and environmental concerns it has become imperative to make use of local resources as an alternate to petroleum fuels. Therefore, it is a world wide trend to explore and make use of biogas as an alternate fuel in vehicles generating from poultry litter. The present study reveals that enriched biogas potentials generating from poultry litter in Puduchatiram block for production of Bio-CNG to substitute compressed natural gas using in automobile and transport applications. Biogas can be used in automobiles after its purification. Removing CO₂, H₂S and water vapour and compressing it into cylinders makes it easily usable for transport applications such as three-wheelers, cars, pick up vans and etc. Taking these into account, the present status of the enriched biogas potential is assessed. The study shows that, the great enriched biogas potential (20,355 M³/day) and compressed biogas potential (14,533 Kg/day) available in Puduchatiram block. This technology ensures reducing GHG emissions, sustainable development, energy security and employment generation in the study area.

Key words: Poultry litter, Enriched Biogas, Clean energy, Automobiles, Global Warming. GHG, Sustainable Development.

I. INTRODUCTION

Energy security has an important bearing on achieving national economic development goals and improving the quality of life of the people. Burning oil, gas and coal which provides four fifths of the energy used each year emits carbon dioxide, the main cause of global warming. The biofuels industry in India is poised to make important contributions to meet India's energy needs by supplying clean, environment-friendly fuel. This renewable energy is already used for electricity production, but the best upgrading solution of this clean energy should be the injection into the natural gas grid or the production of vehicle fuel (3). Kapdi et al (2,5) have explained, biogas is produced by anaerobic digestion of biological wastes such as cattle dung, vegetable wastes, sheep and poultry droppings, municipal solid waste, industrial waste water, land fill, etc. generated huge quantities of compressed methane, a gas with an immense potential and an alternative source of vehicle fuel. Virendra K. Vijay et.al (9) have explained the natural gas has 75 to 98% methane with small percentages of ethane, butane, propane while biogas has about 60% methane and 40% carbon dioxide. It is possible to improve the quality

of biogas by removal of CO₂, H₂S and enriching its methane content up to the natural gas level. After methane enrichment and compression it can be used as vehicle fuel just like CNG. It has lower emission than natural gas and diesel. Biogas traffic use results in very low emissions of SO₂, NO_x, particles and noise. Ramirez Saenz et.al (6) have evaluated a biofiltration system for removing hydrogen sulfide and volatile fatty acids contained in a gaseous stream from an anaerobic digester. The elimination of these compounds allowed the potential use of biogas in automobiles. Chandra Shekhar Sahu (7), said that biofuels is important for the country from the viewpoint that it enhances rural development, provides employment and income generation opportunities to the farmers, and finally helps India achieve its energy security. The main objective of the present study is to make village-wise estimation of enriched biogas potential from poultry litter in Puduchatiram Block, Namakkal District, Tamil Nadu, India.

II. STUDY AREA

The study area is located between 11°16' N and 11°26' N latitude and 78°4' E and 78°15' E longitude,

covering an area of 194 sq.km. The study area includes 31 villages (Fig.1.). The general geographical information of the block is rocky and undulatory area. Nainar malai is a cultural and historical important place located in eastern part of the block with the elevation is 743 m above mean sea level. The block is well known for egg production and sends the eggs to all over the country. Sago factories are located in and around this Block. Sago and starch production in this area are exported to other countries (1). Geological formation of the area is comprised of igneous, sedimentary and metamorphic rocks. The major ten soil series of the block can be grouped under two broad categories, i.e. red soil and black soil (8). Taluk has semi-arid climate and the number of streams and tanks constitute the drainage of the block. Regarding cropping pattern Cholan is the main crop (1). Total population as per 2001 Census of the block was 72,700 with density being 366 per sq.km.

III. DATA AND METHODS

The village wise spatial distribution of poultry farms (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. IRS IC/PAN satellite data used land use / land cover classification. Block map with village boundaries were digitized to generate base layers using ARC/GIS 9.1. Simple statistical techniques are used to calculate the percentage of spatial distribution of poultry birds, poultry litter and enriched biogas potential. The theoretical potential is presented as a thematic map of the total amount of enriched biogas energy available in each village.

IV. POULTRY BIRDS AND DROPPINGS

The spatial distribution poultry birds are 37, 69,420 presented in Puduchitiram block (Fig.2.). The study area included 31 villages. The study shows that four villages namely Elur, Kalyani, Navani and Thanathampatty, is having high level of concentration of poultry birds in more than 10 percent. Five villages are having moderate level of distribution of poultry birds in 5 to 10 percent. In twelve villages have low level of concentration of poultry birds in less than 5 percent. The poultry farms not presented in 10 villages.

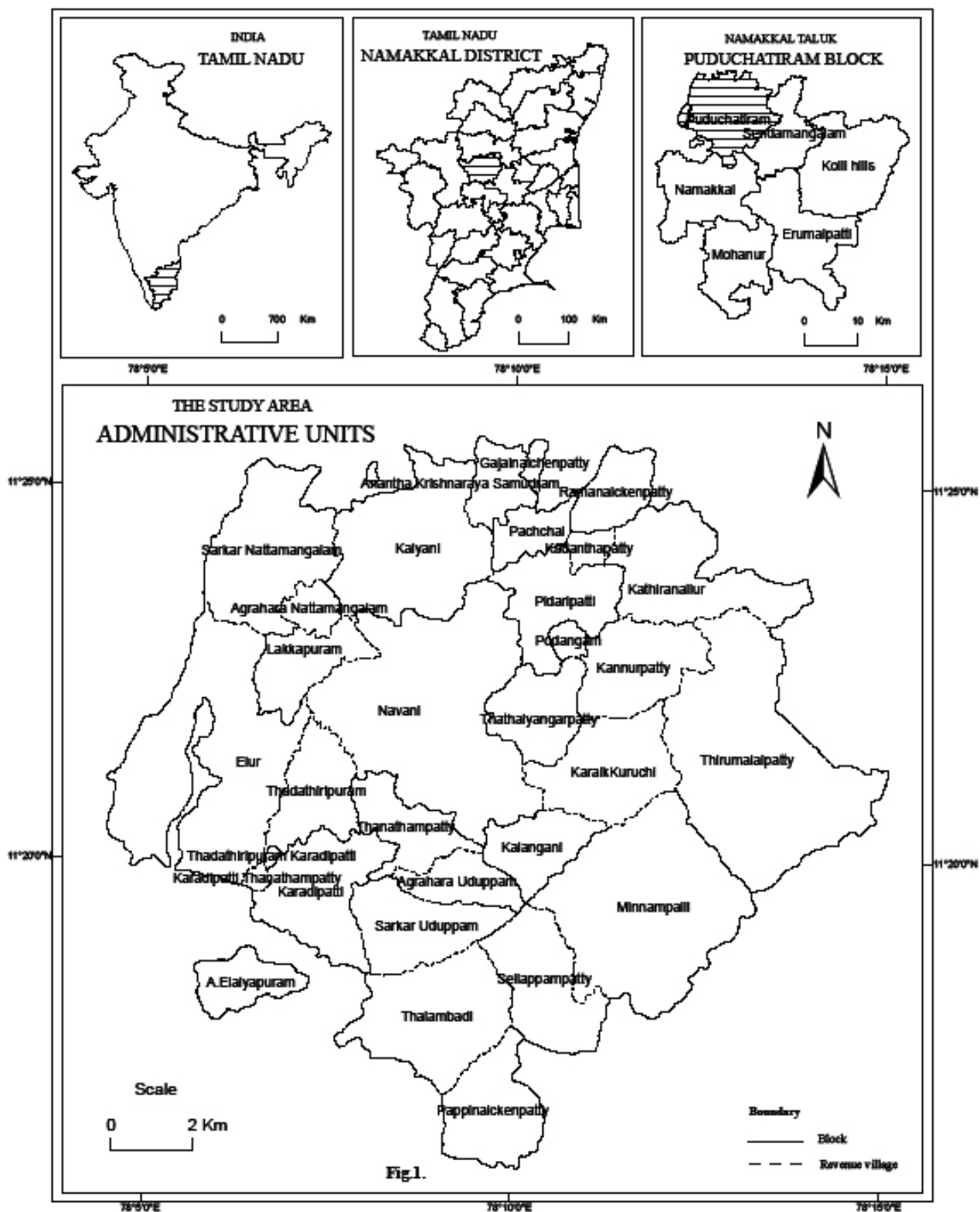
The total quantity of poultry droppings produced per day [Fig.3] was estimated at the village level by

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 droppings generated in Puduchitiram block is about 339 tonnes per day. Elur, Kalyani, Navani and Thanathampatty, villages respectively generated high level in 49 tonnes, 46 tonnes, 40 tonnes and 36 tonnes per day. Five villages are generated moderate level droppings in 19 to 30 tonnes per day. Twelve villages are produced less than 19 tonnes of droppings per day.

V. POTENTIAL OF ENRICHED AND COMPRESSED BIOGAS

Biogas is a product of anaerobic fermentation of organic matters and consists of around 60 to 70 percent Methane, 30 to 40 percent Carbon dioxide and traces of nitrogen, sulphur and moisture. The input material for the biogas materials for biogas digesters are the wastes that are found locally such as poultry droppings. The residues are introduced into a closed digester, where without the presence of free oxygen. Assuming a production of 0.1 cu.m of biogas from one kilogram of poultry droppings. It is estimated enriched biogas potential that Puduchitiram block can produce 20,355 cu.m per day (Fig.4). In four villages are having high level of potential in more than 1815cu.m per day. The moderate level of enriched biogas distribution in five villages between 636 to 1814 cu.m per day. In twelve villages are estimated less than 635 cu.m per day.

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. The present status of the compressed biogas potential is assessed and maps have been prepared. Assuming that one cu.m of enriched biogas may produce 0.714 kg of compressed biogas, it is estimated that poultry droppings generated in Puduchitiram block may produce about 14,533 kg biogas per day. In four villages estimated high level in more than 1296 kg per day (Fig.5) and five villages estimated between 454 to 1295 kg per day. Twelve villages produce less than 453 kg of compressed biogas per day. This technology ensures reducing Green House Gas emissions, sustainable development, energy security and employment generation in the study area.



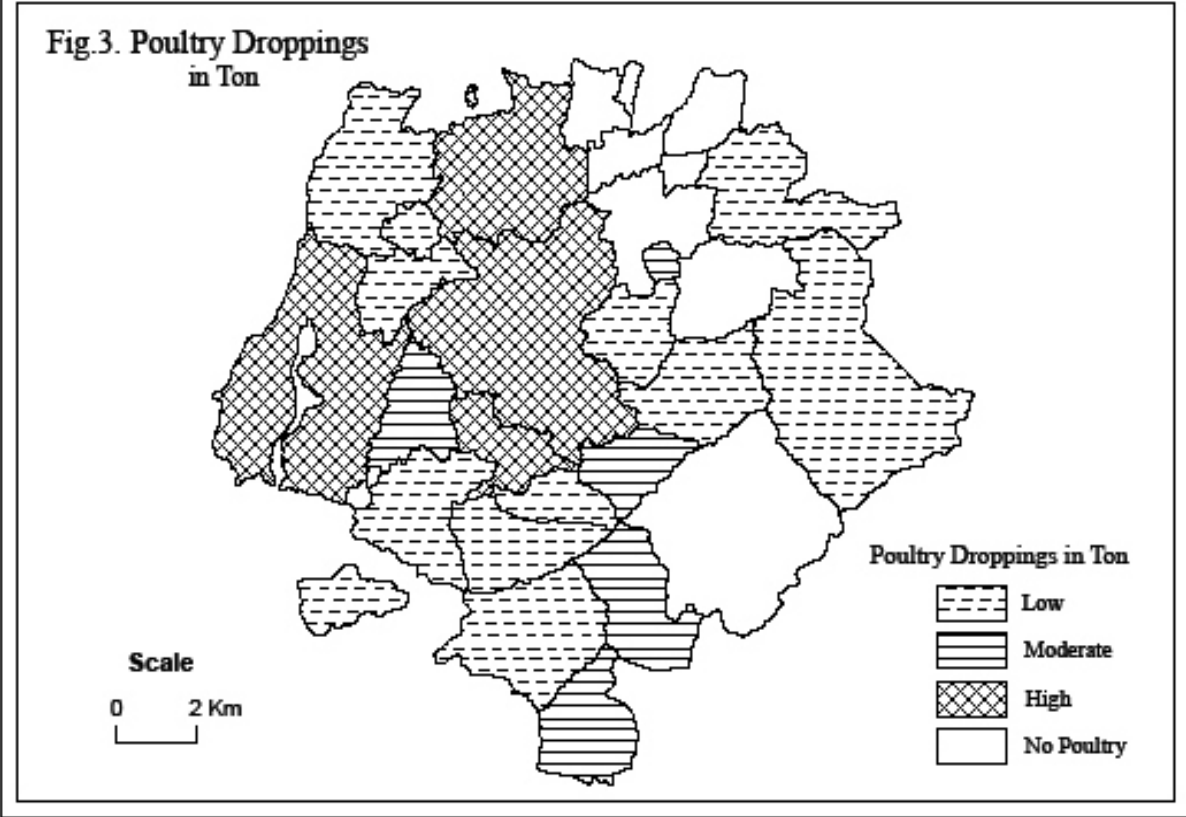
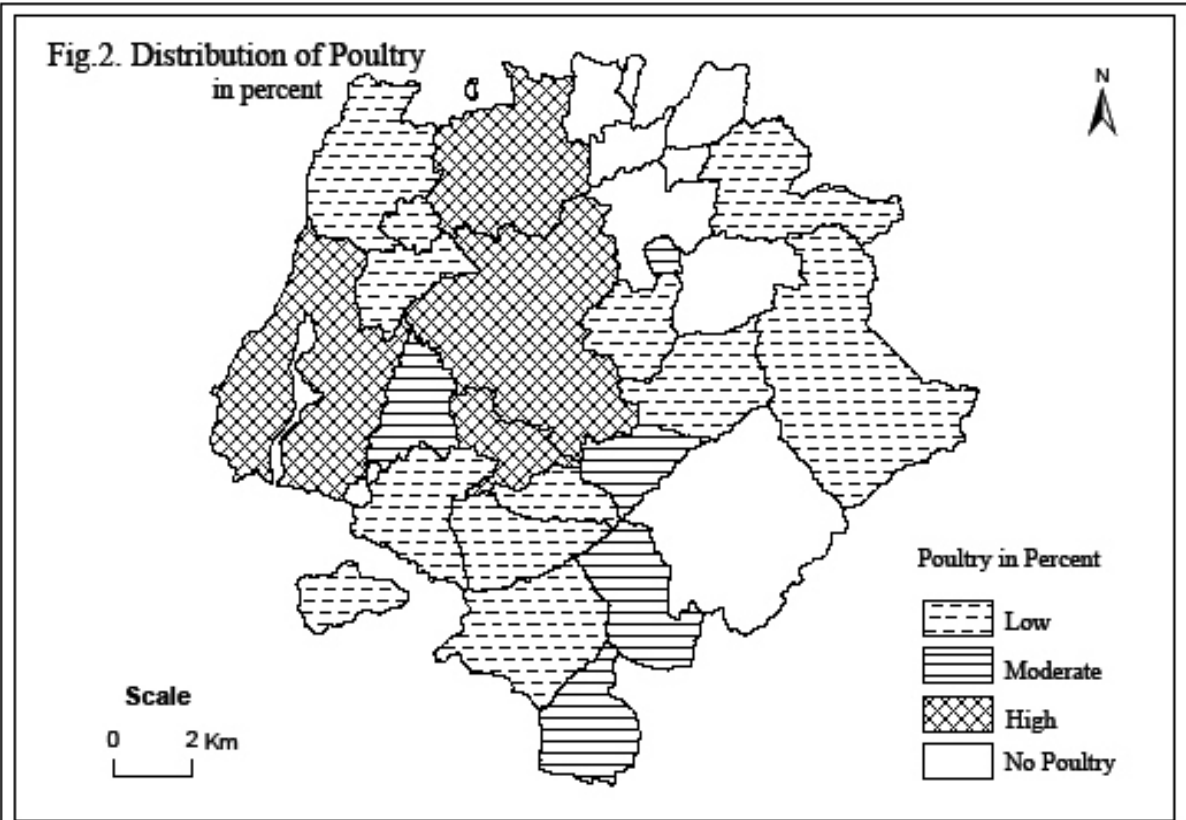
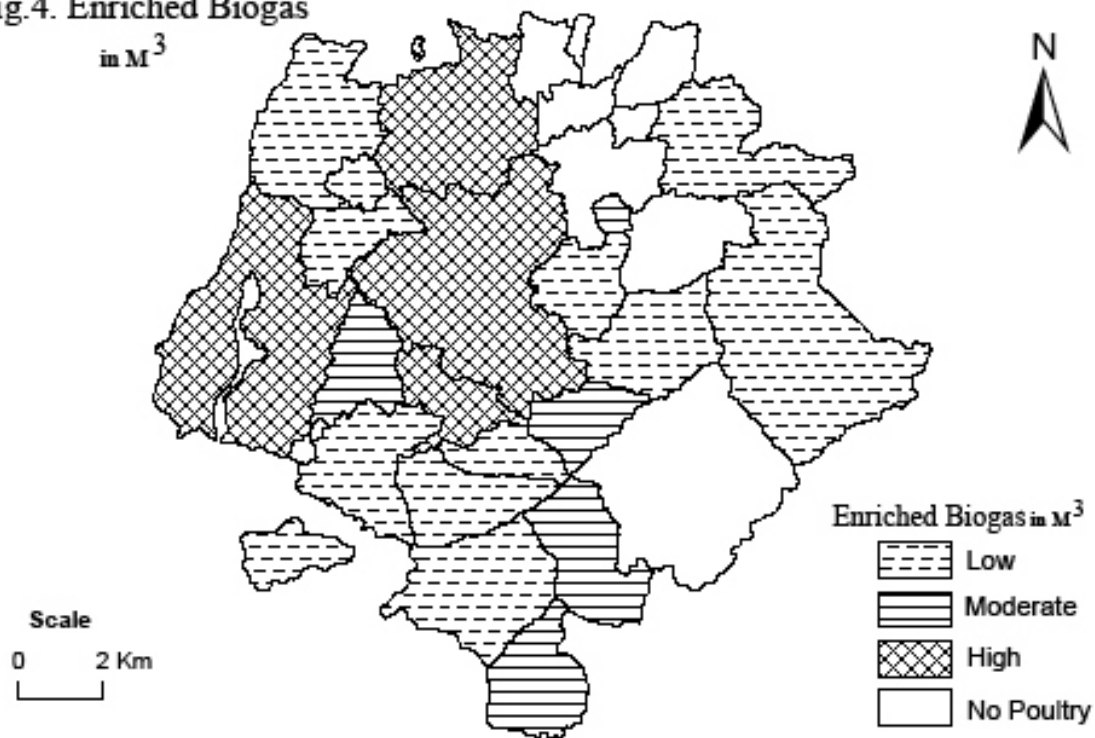
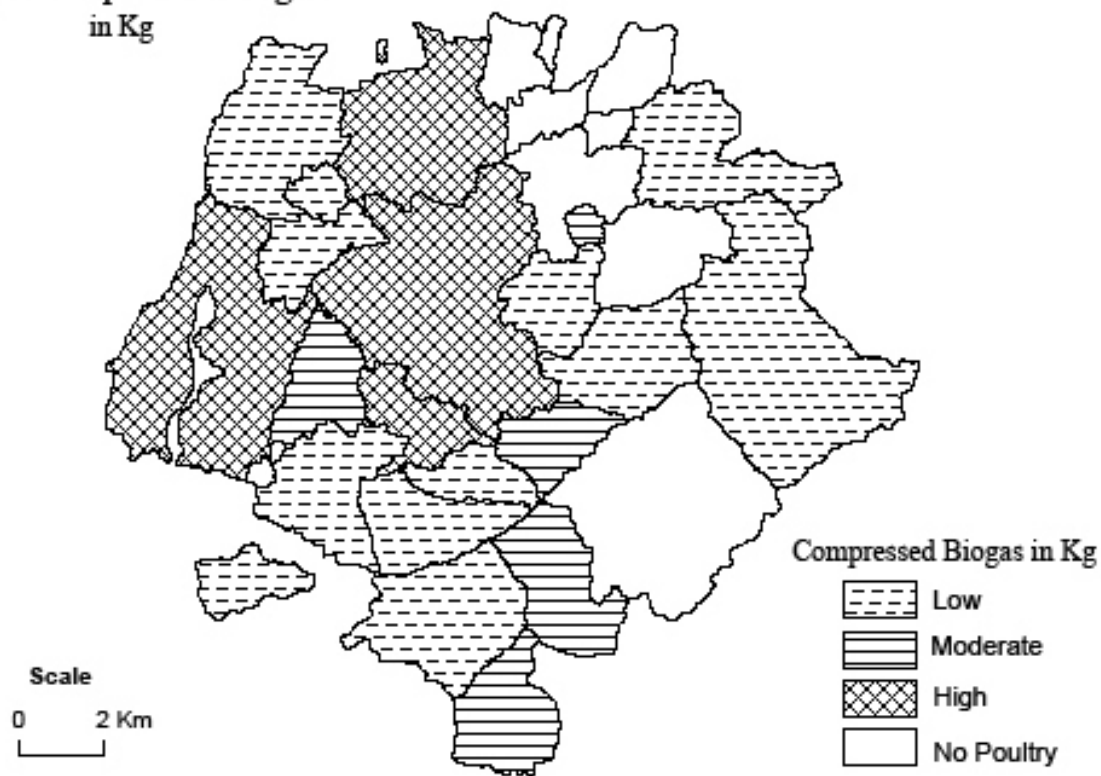


Fig.4. Enriched Biogas**in M³****Fig.5. Compressed Biogas****in Kg**

VI. CONCLUSION

Our generation absolutely must overcome the world's dependency on fossil fuels. If we are to halt climate change we will need to reduce emissions of carbon dioxide by 90 per cent by 2050 worldwide (2). There is large potential of enriched biogas 20,355M³/day and compressed biogas potential 14,533 Kg/day available in Puduchatiram block to make it an alternate fuel for vehicle. Potential of biogas is not fully utilized and commercialized. Biogas produced in large size biogas plants should be enriched before bottling for storage and mobile purpose, as enriched biogas has more calorific value and better fuel quality. Overall, the study revealed that biogas enrichment and compression system is a profitable venture for rural areas due to availability of large quantity of poultry litter. The system is recommended to establish rural entrepreneurship for the effective utilization of local resources for production of biogas energy in decentralized manner and sustainable rural development.

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