ENERGY REQUIREMENT OF BIOMASS GASIFIER MODEL WITH SPECIAL REFERENCE TO ODANTHURAI PANCHAYAT IN COIMBATORE DISTRICT

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Abstract

Energy is the driving force primarily associated with the economic and social development of a country. Energy serves as the building block of any industry or services, which in turn propel the economy of any nation. But energy at affordable price is the prime challenge which developing countries are facing today as a result of continuous increase in primary energy cost. Biomass such as wood, crop residues, agricultural residues. Forest waste, etc., are the oldest source of heat energy for domestic purposes. The energy requirement and end use of energy at rural areas are quite different from urban environment, which are basic and essential amenities like lighting, water pumping and power for small industries dominate village energy requirements. Even now Coimbatore has rural and urban that need some form of energy other that gird electricity to light up the darkness, to improve its economy and to increase the living standards of the rural people. If Odanthurai Panchayat has to achieve its goal of becoming a leading electricity power in Coimbatore. The Odanthurai will have to find modern and renewable ways of producing energy to bridge the increasing gap between demand and supply for electricity supply. In recent years modern biomass conversion technologies have been developed which can convert biomass fuels into various energy forms. These technologies can play an important role in providing sustainable solutions for decentralized energy demand in villages and industries. The economic and environmental conditions of rural areas can be improved only by means of local empowerment and decentralized energy generation. Gasifier can play an important role in the upliftment of rural people as it serves the purpose of economic and environmental improvement. This shows that the substitution of petroleum products and CO_2 emission reduction, power generation, assessment of the social impacts and economic viability. So the successful model of Odanthurai can be replicated anywhere to fulfill the energy and other essential needs of rural people.

Key Words: Biomass Energy, Sustainable Development, Environmental improvement, Economic Viability.

1. Introduction

India being a large agrarian economy, biomass-wood, agricultural residues, animal dung, etc, is available in enormous quantities. And, hence, over 40 percent of India's total energy requirement can be met through biomass burning. However, biomass burning has been characterized with energy inefficiency and environmental hazards. Working towards a sustainable solution to the energy scarcity in rural India. "This biomass-based power generation system for rural applications could effectively make up for the absence of grid electricity supply in many remote areas. Energy is the driving force primarily associated with the economic and social development of a country. Energy serves as the building block of any industry or services, which in turn propel the economy of any nation. But energy at affordable price is the prime challenge which developing countries are facing today as a result of continuous increase in primary energy cost. Even now India has 1,54,230 unelectrified villages that need some form of energy other than gird electricity to light up the darkness, to improve its economy and to increase the living standards of the rural people. The energy requirement and end use of energy at rural areas are quite different from urban environment, which are basic and essential amenities like lighting, water pumping and power for small industries dominate village energy requirements. But the problem lies not only in the availability of cheap gird energy but also the poor financial resources of village panchayats in India. Hence rural India need different source of energy which can be decentralized for the local community. Such energy can be obtained from renewable energy sources like solar energy, wind energy, bio energy and hydro energy. Among them Gasifier is suitable for power generation because of the local availability of biomass fuel and

the requirement of semi skilled manpower for operation and maintenance. Biomass such as wood, crop residues, agricultural residues. Forest waste, etc., are the oldest source of heat energy for domestic purposes, which is currently being utilized inefficiently. In addition, there are large tracts of wastelands that can be used for growing of biomass. In recent years modern biomass conversion technologies have been developed which can convert biomass fuels into various energy forms. These technologies can play an important role in providing sustainable solutions for decentralized energy demand in villages and in industries.

2. Statement of the Problem

The energy is required for all domestic, commercial and industrial activities. Earlier the wood and coal were the prime source but cannot meet the present day requirement. The electric power has been used but there is much gap in demand and supply position as such energy crisis has erupted causing a serious problem. The home appliances like bulb, television, washing machine, heater, air-conditioner, geyser, etc. are commonly used by people as such demand has considerably increased. The power cut has affected the industrial activities to a great extent. The normal supply of electricity can only be maintained by producing more electricity by alternative methods like atomic power, hydroelectricity and use of natural gas. These sources may however be finished in due course of time therefore sources like solar energy, wind power, biomass gasifier and bio-gas plant have been suggested for additional energy requirement.

3. Need for the Study

Understanding the situation of rural energy problem in India, biomass gasifier is considered as the most suitable method for rural area in solving the energy demand. As the raw materials for this model is easily available, it is considered as an economically viable method of power generation to meet the local needs. With this background, the present study is undertaken to know the economic value of the biomass gasifier unit in Odanthurai Panchayat and also to know the reason for its success.

4. Objectives of the Study

1. To study the energy situation in India.
2. To explore the biomass availability and power generation potential in rural India.
3. To know the method of power generation using biomass gasifier.
4. To study cost and benefit of power generation using biomass gasifier in Odanthurai panchayat

5. Energy demand for Rural Areas

Biomass based technologies are a very promising option for decentralized energy generation in India, particularly in rural areas, which suffer from constant power shortages or have no access to electricity at all. Such biomass based technologies bear a great potential to trigger sustainable development in rural areas, both from a socio-economic and an environmental perspective. However, due to many different reasons such as lack of investment capital for rural development projects, biomass based technologies and biomass gasification in particular have not been able to achieve a market breakthrough comparable to other renewable energy technologies, such as wind turbines and small -scale hydro power plants. The Clean Development Mechanism (CDM) to be implemented within the Kyoto Protocol as an instrument to reduce CO2 emissions and foster sustainable development is an interesting tool to overcome the lack of investment capital and implement decentralized energy projects in rural areas in India.

A reliable biomass supply, which does not compromise local biomass resources, is of crucial importance for the impact of such as on regional sustainable development. The plantation of energy forests, as an alternative to common agricultural practices, provides enormous possibilities to improve the socio-economic as well as environmental conditions in rural areas. The costs and the managerial efforts to implement such energy plantations are, however, often underestimated. The main identified difficulty to implement energy projects in rural areas, which is also the case for the analysed power plant, is the lack of favorable load conditions and purchasing power in these rural areas.

6. Energy from Agricultural Waste

Agriculture produces biomass includes agricultural residues, crops grown for fuel, marine plants, algae, animal products and manure, food processing and forestry by products, and urban wastes. Biomass involves all kinds of plant and animal tissues, products of human and animal metabolism and organic wastes. Biomass resources are available in plenty in the agro processing centers (rice husk, baggase, molasses, coconut shell, groundnut shell, maize cobs, potato wastes and coffee wastes), farms (rice straw, cotton sticks, jute sticks), animal sheds (cow dung, poultry excreta), forests (bark, chips, shavings, saw dust), municipal wastes (city refuse, sewage) and industrial wastes (distillery effluents are spent wash, textile waste). Grasses and water based biomass such as algae, water plants, are yet other sources of biomass. Currently, biomass contributes 14 percent of the total energy supply worldwide countries, predominantly in the rural and traditional sectors of the economy. Biomass can be used, as a fuel in the biomass based power projects and the cost of production of electricity with help of biomass seem to be very low.

7. Biomass Availability and Potential Power Generation in India

Biomass resources are potentially, the world's largest and most sustainable energy source. The annual residues are a large and underexploited potential energy source and present many opportunities for better utilization. There are a number of important factors to be addressed when considering the use of residues for energy, such as animal feed, fertilizer, agent for maintaining soil organic matter, etc. Many of these residues are readily available at low cost. Agricultural residues, forest residues and livestock residues are few general varieties available in various parts of the world.

Biomass can be classified into two types, woody and non-woody. Woody biomass is derived from forests, plantations and forestry residues. Non-woody biomass comprises agricultural and agro-industrial residues, and animal, municipal and industrial wastes. Biomass energy in rural areas and in industry can be produced from biomass available from plantations, animal wastes and agricultural or agro-industrial residues such as fines, shells, stalks, straws, sticks, husk etc.

Biomass is the third largest energy resources in the world with availability of 3,000 million tones per annum, after coal and oil. It is estimated that biomass fuel currently supply around 15 per cent of the world's total energy equalent to about 25 million barrels of oil per day. In India, the recognition of biomass as a valuable energy source cannot be over emphasized on account of wide and equitable availability and utilization in rural areas in meeting 75 per cent of the energy needs. India being an agricultural country with its large resource of biomass if utilized efficiently can solve the problem of energy crisis to a large extent. India generates about 500 million tones of biomass per annum. Bio-energy accounts for 40 per cent of the total energy being presently consumed in India. The following table-1 shows the availability of biomass in India.

Table 1: State Wise Biomass Availability and Potential Power Generation in India

State	Crop Area	Crop production (kT/Yr)	Residue (kT/Yr)	Excess biomass factor	Excess biomass (kT/Yr)	Power (MW)
Punjab	8377.20	60471.95	75292.51	0.36	27093.62	3223.05
Uttar Pradesh	23632.30	163705.80	98552.91	0.24	23821.79	2855.25
Madhya Pradesh	18392.90	26454.70	41559.89	0.27	11428.66	1419.79
Tamil Nadu	15015.97	31870.81	45446.67	0.34	15354.50	1376.11
Rajasthan	15474.20	17414.18	34026.95	0.30	10363.02	1293.60

Haryana	4943.00	19008.41	27472.86	0.36	9963.02	1171.18
Maharashtra	18075.40	81890.40	37087.24	0.21	7929.82	1031.33
Gujarat	9143.50	27202.82	29807.67	0.24	7080.35	883.54
Bihar	8408.60	19722.77	27459.33	0.21	5888.00	673.55
Karnataka	8442.24	33623.44	17166.64	0.32	5497.83	650.11
Kerala	1373.20	9682.00	8474.51	0.58	4929.63	639.63
Andhra Pradesh	12034.20	35103.18	35183.82	0.15	5196.35	616.70
West Bengal	7908.60	25051..05	34174.09	0.13	4538.97	547.91
Assam	3241.50	7400.78	9929.65	0.12	1169.06	135.81
Orissa	5610.30	10947.44	10112.71	0.12	1205.75	135.77
Chhattisgarh	4527.60	4217.80	7320.98	0.15	1074.89	121.69
Uttaranchal	508.10	3841.70	2066.48	0.24	495.51	58.71
Jharkhand	585.20	905.48	1298.77	0.21	267.96	31.35
Meghalaya	205.20	525.77	646.71	0.15	99.91	11.08
Arunachal Pradesh	209.20	282.60	403.03	0.11	43.98	5.35
Total	**166,108.41**	**579,323.80**	**543,483.42**	**4.45**	**143,442.62**	**16,881.51**

Source: Indian Institute of Science, Bangalore, 2008.

This table-1 shows that biomass availability in all Indian states. Biomass availability of source like residues (agriculture waste, animal dung, forest waste, municipal waste, wood, etc), excess biomass factor, excess biomass, capacity of power generation respectively. First, In the dominate state was Utter Pradesh highly in cultivation area (23632.30), crop production (163705.80) and residues (98552.91) but otherwise excess of biomass factor, excess of biomass and capacity of power generation is next one place. Second, is at the same level of sources are available in another states like Madhya Pradesh, Punjab and Maharashtra. Thirdly, in south Indian states like Andhra Pradesh, Karnataka and Kerala comparing is better than in Tamilnadu. It is on comparing the excess of biomass factor, excess biomass and capacity of power generation in these south Indian states except in excess of biomass factor available in Kerala. Tamilnadu was have in crop area (1505.97), crop production (31870.81), residues (45446.67), excess of biomass factor (0.34), excess of biomass availability (15354.50) and capacity of power generation (1376.11). hence the table-1 showing that total biomass sources are using need for energy demand in our country rural areas. It is important role play in rural economic development, environmental protection due to sustainable development.

8. Biomass Gasifier Model with Special Reference to Odanthurai Panchayat

Odanthurai is a small village located near the foothills of Niligiris in Coimbatore district about 40 kilometers from the Coimbatore city in the state of Tamilnadu. Odanthurai village is nearer to the town called Mettupalayam in Coimbatore Ooty road. Odanthurai is one of the seventeen village panchayats attached to karamadai development block. The panchayat was established in the year 1961. the area of the panchyat is 1119 Sq Km. three sides of the village is surrounded by forest uplands and the other side by Bhavani river. The panchayat is blessed with the perennial river Bhavani and two small seasonal rivers called Kallar (River with small stones) and Chinnar (Small River). Agriculture is

the main stay of Odanthurai's economy. Most of the people are engaged in agriculture. Food crops like paddy, maize, vegetables, banana, coconut and money (commercial) crops like sugarcane, flowers, clove, turmeric, coconut, and groundnut are cultivated. The cultivable land is rich with good topsoil.

Odanthurai panchayat is not different from other panchayats in India. It has the same facilities, problems and people. The panchayat has vast population living below poverty line with little basic amenities, infrastructure and employment. Most of the people are landless labour depending agricultural related job opportunities. But all these have changed in a record time of nine years. The panchayat has transformed itself into a model panchayat by utilizing the effort of village people and responsive governance as well as the contribution from the government. In this paper we are discussing the economic and environmental benefits of gasifier which is adopted for electrification of some applications.

The panchayat has set up a 9kW biomass gasifier unit to meet water pumping, street lights and other demand in the village in a reliable manner while bringing about a reduction in their electricity bill from the utility. A Women's Self Help Group Operates the mini power plant using locally available woody biomass. As a result of the success of this community-based intervention, similar off-grid Biomass Based Mini Power Plants have already been set up in 32 panchayats in 10 districts of Tamil Nadu while they are under installation in another 56 panchayats in seven districts of the state.

9. Benefits from Biomass Gasifier Model in Odanthurai Panchayat

Economic Benefits

The village panchayat operated a water pump to pump drinking water from the river Bhavani, to the settling tanks and then from the tanks to over head water tank for public distribution. The electricity bill for street lighting is also paid by the village panchayat. These two bills pose a huge financial burden for street lighting is also paid by the village panchayat. These to bills pose a huge financial burden for the local panchayat.

The panchayat pays Rs.15, 000/- per month for electricity bill just for water pumping alone. It comes around Rs.2, 00,000/-(Two lakhs) per annum. Now the panchayat saves about Rs.5, 000/-per month (i.e. Rs. 60,000/- per annum) in electricity bill alone by operating the gasifier for water pumping. This project has also generated employment for five people in addition to the cost savings. The biomass gasifier unit is now maintained by a locally functioned Woman Self Help Group of that village.

Table 2: Cost of Electricity Board Power and Biomass Gasifier Power

(In Rs.)

S.No	Particulars	Earlier (EB supply) (Amount Rs.)	Present (Biomass Gasifier) (Amount Rs.)
1.	Fuel per unit	3.500	0.450
2.	Labour	0.446	0.664
3.	Maintenance	0.071	0.281
Total		4.017	1.395

So, savings of about 2.622 rupees per unit of electricity is achieved by using gasifier. The percentage savings is about 65%.

Environment Benefits

The sustainable use of biomass energy sources helps to manage the local environment. When wood and other biomass are properly valued by local populations as an important resource base, they are more likely to be protected. Sustainable use of biomass is also beneficial for the global climate, because it is carbon-neutral, whereas substitution by fossil fuels would add to the greenhouse effect. This is the main reason for how many industrialised countries have embarked upon policies for increasing the share of biomass in national energy consumption.

Economic Viability

Biomass Gasifier Technology can be suited very well for the rural electrification because of the following reasons:

- Easy to install, operate & maintain
- Availability of various sizes to choose
- Feasibility of operating hours as required
- With simple Technology & other back of systems
- Economic viability
- Minimum fuel consumption
- Sustainability in Power production

Other Benefits

- Energy security is provided for the particular village panchayat.
- Problems related to regular maintenance, blackouts and brownout are reduced.
- Low cost materials like agricultural residues saw mill waste, husk, stalk can be better utilized.
- For operation and maintenance of biomass gasifier local employment can be created.

10. Conclusion

The economic and environmental conditions of rural areas can be improved only by means of local empowerment and decentralized energy generation. Gasifier can play an important role in the upliftment of rural people as it serves the twin purpose of economic viability and environmental improvement. However, as noted above, this case study is estimated to generate approximately 172-246 new permanent jobs through the operation of the biomass plant and establishment of energy crops and the use of forestry products. Further, New and sustained employment in rural areas will assist in stemming the economic decline of associated village services and support industries. Most of the rural administrations have poor revenue and large energy requirements. In order to satisfy, a suitable system is needed. To fill the gap, this study proved that the Biomass Gasifier is a suitable one for rural electrification. The study shows that the unit cost of electricity from Electricity Board is Rs. 4.017 and the electricity from Biomass Gasifier is only Rs. 1.395, which is economically affordable. So, the successful model of odanthurai can be replicated anywhere to fulfill the energy and other essential needs of rural people.

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