Radius Wise Analysis Of Biomass For Power Generation In Punjab State

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Abstract

There is no doubt that man has been dependent on Nature's bounty of forest wealth and fossil fuels to cater to his energy needs. With day by day time increasing, especially in the current century, he has become more and more dependent on electricity for running the wheels of his civilization. Most of the electricity till now has been generated from fossil fuels in huge power plants run by coal and oil or by nuclear fuels. However, the continuously increasing use of fossil fuels has dangerously depleted their available natural resources. Green house gas effect in the environment also increases the cost of fossil fuels due to depletion of ozone layer. Punjab being an agriculture state has no coal and oil reserves so it depends on the other states for the supply of fossil fuels. In this paper radiuswise analysis of biomass has been done. For analysis purpose Banur village, Distt. Patiala of Punjab state has been selected as a centre point. This analysis includes the generation, consumption and surlpus of biomass.
Keywords- Biomass Generation, Consumption, Surplus,Transportation Cost

1. Introduction

Biomass has always been an important energy source for the country considering the benefits it offers. It is renewable, widely available, carbon-neutral and has the potential to provide significant employment in the rural areas. Biomass is also capable of providing firm energy. About 32% of the total primary energy use in the country is still derived from biomass and more than 70% of the country's population depends upon it for its energy needs. Biomass power & cogeneration programme is implemented with the main objective of promoting technologies for optimum use of country's biomass resources for grid power generation. Biomass materials used for power generation include bagasse, rice husk, straw, cotton stalk, coconut shells, soya husk, de-oiled cakes, coffee waste, jute wastes, groundnut shells, saw dust etc[1]. Different estimates are given for biomass potential and their optimum utilization. Bhattacharya [2] estimates a gross potential of about 33 EJ (of which 7 EJ from the process based residues for the south East Asian region, including China) for 1994. If only the process-based residues were to be used, they would contribute about 25% to the total primary energy production of these countries. Cleland and Purvis [3] analyzed an independent power plant using wood waste. Cudiff [4] used LP for designing biomass delivery system. The model minimized the delivery cost by scheduling shipments from the various on-farm storage locations. Husain [5] formulated a model for minimizing landowner's costs for a power plant. In addition to traditional production and harvesting costs, they also included landowner's opportunity costs and actual transport costs. Amur and Bhattacharya [6] estimated biomass energy consumption of 65.07 million tons in Pakistan. Similar studies in Sri Lanka, Philippine,indicated biomass energy consumption of 3.6 and 32.45, million tons of oil equivalents respectively. Gemtos [7] conducted a study regarding the collection of cotton stalks and using them for energy production. The energy consumed for operation has been also calculated and compared with the energy of biomass collected and gave a positive balance. Qingyu [8] studied biomass energy consumption in China. They found that shares of agricultural residues, fuel wood and animal waste in total biomass energy consumption were 57.7%, 39.2% and 3.2% respectively. Singh Sahdev [9] developed a linear programming model for maximize biomass energy production through optimum selection of crop areas in a village Islamnagar of district Bhopal (India) Kadam [10] developed a model for predicting the delivery rates of straw. According to this study the net delivered cost was observed US$ 20 ton-1(dry).The amount of rice straw available as a feedstock ranges from 1.0 to 1.4 million-ton year-1. Singh Surendra [11] conducted a study to optimize the energy inputs for the cotton crop in Punjab. Various mathematical functional relations were fitted between the yield and total energy input was proved that the average yield of cotton could be increased by 6-8% with an additional energy input of 1-3% through tillage, irrigation and spraying operations. Juginer M [12] developed a methodology to set up fuel supply strategies for large-scale biomass conversion units. The methodology focused on how to determine gross technical energy potential, net availability, cost of collection and pre treatment of the residues. Flynn [13] determined the optimum plant size determined by using three biomass fuels in Western Canada. Three biomass fuels were agricultural residues, whole boreal forest and forest harvest residues.

2. Study area

The coverage of study area for biomass assessment study is taken as 65% of Patiala district, 100% of Fatehgarh Sahib district, 60% of Rupnagar district within the radius of 50 K.M. 35% of Patiala district, 40% of Rupnagar district, 80% of Sangrur district, 40% of Nawanshehar, 60% of Ludhiana district within the radius of 50-100 K.M. from cogeneration plant site at Banur village.

3. Biomass generation

The biomass in the study area can be generated as;

a) Crop residues:

Block-wise crop residue generation = Block-wise crop production * crop residue ratio

and the crop residue ratio is obtained from survey data

b) Biomass from Industries: All the industries in the districts generating and consuming biomass have been surveyed and the primary data obtained are taken into account.

c) Biomass generation from other than forest land: There are scattered patches of tree species and bushes available in the villages. The villagers fulfil their domestic fuel requirement by branch cuttings /fallen branches of various trees growing in the study area.

Table 3.1 Total Biomass Generation in the study area

a) Within 50-100 K.M. radius

S. No.	Biomass	Generation in MT/yr.
1	Crop residue	2288915
2	Paddy husk	246022
3	Saw chips	15180
4	Saw dust	7590
5	Baggasse	222816
	Total(a)	2780523

b) Within 50-100 K.M. radius

S. No.	Biomass	Generation in MT/yr.
1	Crop residue	4875487
2	Paddy husk	612297
3	Saw chips	45875
4	Saw dust	18350
5	Baggasse	226545
	Total(b)	5778554

4. Biomass consumption

The biomass in the study area is consumed as domestic fuel & fodder.

a) Crop residues used as domestic fuel &burning/disposed off : The crop residues cotton stick, maize cob, mustard stick & husk are used as domestic fuel.

b) crop residues used as fodder.

Table 4.1 Total Biomass Consumption in the study area

a) within 50 K.M. Radius

S.No.	Biomass	Consumption in MT/yr.
1	Crop residue	2288915
2	Paddy husk	157291
3	Saw chips	15180
4	Saw dust	7590
5	Baggasse	222816
	Total(a)	2691792

b) within 50-100 K.M. Radius

S No.	Biomass	Consumption in MT/yr.
1	Crop residue	4875486
2	Paddy husk	457168
3	Saw chips	45875
4	Saw dust	18350
5	Baggasse	226545
	Total(b)	5623424

5. Biomass (Paddy Husk) surplus availability for power generation

a) within 50 K.M. Radius

Surplus = (Generation) – (Consumption) *100 /Consumption

= (246022-157291)*100 /157291

=88731 *100 /157291= 56.14 %

S. No.	Biomass from	Generation in MT/yr	Consumption in MT/yr	Surplus in MT/yr	Actual surplus in MT/yr
a)	Agro-industries				
1	Paddy husk	246022	157291	88731	87844
	Total (a)	246022	157291	88731	87844

b) within 50 K.M. -100 K.M. Radius

S. No.	Biom-ass from	Generation in MT/yr	Consumption in MT/yr	Surplus in MT/yr	Actual surplus in MT/yr
a)	Agro-industries				
1	Paddy husk	612297	457168	155129	153578
	Total (b)	612297	457168	155129	153578

Surplus = (Generation) – (Consumption) *100 /Consumption

= (612297-457168)*100 / 457168

=155129 *100 /457168

=33.93 %

c) within 0 -100 K.M. Radius

Sl. No.	Biomass from	Generation in MT/yr	Consumption in MT/yr	Surplus in MT/yr	Actual surplus in MT/yr
a)	Agro-industries				
1	Paddy husk	858319	614459	243860	241421
	Total (c)	858319	614459	243860	241421

Surplus = (Generation) – (Consumption) *100 /Consumption

= (858319-614459)*100 / 614459

=243860 *100 /614459

= 39.69 %

6. Transport cost analysis

The transport cost of biomass for various districts of Punjab w.r.t Banur (central point)

*Cost (Rs./ ton) = (.1273 * lead distance (km) + 8.26) * 56

Table 4.14 Transport cost of biomass in Rs./ton for various districts. in Punjab

District name	Transport cost (Rs./ton)
Patiala	819
Fatehgarh sahib	733
Rupnagar	819
Sangrur	1170
Nawanshehar	1033
Ludhiana	1161
Total	5735

Conclusion

The major crops of the study area are wheat, paddy, maize, sugarcane & mustard. The 8.25 MW co-generation plant at Banur village, tehsil-Rajpura, distt-Patiala using only paddy husk as the fuel for the generation of power. It can be concluded from the above tables that, there is a major quantity of biomass surplus in the form of paddy husk (rice husk). The theoretical paddy husk generation in (0-50) KM radius is estimated to be, 246022 MTs & the total consumption of paddy husk is 157291 MTs. Therefore the surplus paddy husk is 88731 MTs. The theoretical paddy husk generation in (50-100) KM radius is estimated to be, 612297 MTs & the total consumption of paddy husk is 457168 MTs. Therefore the surplus paddy husk is 155129 MTs. The surplus paddy husk available in the entire region (0-100) KM radius is 39.69%. Therefore there is high potential of the paddy husk in the Punjab state.

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