Sustainance of Biomass Sector: Enhancing its Efficiency by Reducing Fuel Losses

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Abstract— Being an agrarian country, the potential for power generation from biomass sources abounds in India. However, despite tremendous potential and opportunity, the biomass based power generation in the country has not attained what it should have in all these years. The sector has witnessed significant number of biomass power projects getting closed over the last few years. The authors underline the need for strategic and scientific approach to bring down losses and increase efficiency of projects for attaining viability.

Key words: Biomass, Fuel Losses

I. INTRODUCTION

Today, amid climate change concerns and fast depleting fossil fuel reserves, there has been global emphasis on harnessing alternative sources of energy. Governments across the world are increasingly focusing towards harnessing the potential of solar, wind, biomass, tidal, geothermal and hydro power resources as a step towards creating a sustainable and energy secure world. The Government of India has also embarked upon ambitious renewable energy path, with a target of installing 175 Giga Watt (GW) capacity by 2022. Currently, a lot of emphasis is being given to solar and wind energy development, however, one can’t ignore the fact that biomass based power production has been one of the major components of renewable growth in India over the years. Biomass has been one of the main sources of energy in India, especially in the rural areas, since long. Currently, when there is a lot of talk about energy security and sustainable development, reliance on renewable sources of energy is the best alternative.

A. Biomass & Rural Development

In the Indian context, where a significant amount of population in rural population is still devoid of reliable power, biomass based power generation could be the cost-effective and reliable solution. From a development point of view, biomass power generation has a positive impact on rural economy. With a biomass availability of about 120 – 150 million metric tonnes per annum, covering agricultural and forestry residues, there is immense potential in India to bolster rural economies. Among all the segments of renewable energy, biomass is the only one that requires fuel for power generation. In spite of this, the benefits of power generation from biomass are much more and unparalleled to other renewable energy technologies. The biomass based power projects not only help in addressing power woes of rural areas, but they also lead to creation of new job opportunities in and around the village localities where the projects are set up. It has been emphasized by several experts that biomass power helps in empowering rural population and hence there it requires more encouragement for providing energy access and in addressing larger goals of sustainable development.

B. Challenges & Complexities

Despite the immense potential for economic and sustainable growth, it has been observed that investment in biomass based power projects have stalled over the recent years in India. Several projects have been shut down due to various reasons leading to poor financial performances.

A decade ago, biomass based power plants were at boom because of the high incentive from the CDM, conducive government policies, low cost of biomass feedstock, and absence of competing industries. However, during the last few years, the sector has borne the brunt of exponential increase in the price of the biomass fuel. At the same time, the tariff for the biomass power projects did not get revised in the same proportion, making holes in the pockets of the project owners.

The biomass based power plants are seen as challenging projects, as there is a lot of dependence on fuel from agricultural yields. The entire fuel chain is very complex, which begins right from the stage of harvesting of the crop. The process involves collection of the biomass feedstock after harvesting; stacking, baling, etc. after which the fuel is transported to the storage centres of the power plants.

The issues like crop growing pattern, fuel properties, awareness among the farmers, and the challenges involved in segregation, acquisition and transportation of fuel from the agricultural fields to the power plants do not help the cause of the power plant owners. The unpredictable nature of biomass fuel with respect to cost imbalances, market competitiveness and storage complications have added to the distress of the owners. The storage process again involves a number of activities for ensuring that the fuel when fed to the boiler is in good condition, retaining its maximum calorific value.

The entire process involves complex planning and great knowledge to capture the true value. The situation, therefore, calls for looking at ways for making biomass power projects sustainable and viable in the long-term. The emergence of competing industries has led to increase in demand of biomass fuel. This has ultimately resulted in increase of price of the fuel. Due to continuous escalation of price of biomass fuel and the constant export tariff, the power plants have been facing financial crisis. This situation is more severe in those biomass power plants that rely on biomass feedstock that is available once or maximum twice in a year, depending upon the crop cycle as per the climate. The industry has, therefore, been demanding of strict policy and regulatory measures so that the biomass projects remain viable with time and contribute in inclusive growth of the country.
II. METHODOLOGY

A. Re-Storing Efficiency

The need, therefore, arises to adopt such measures which may lead to increasing viability of the biomass projects within the available scenario. One such factor identified in the entire cycle of the biomass fuel chain is the adoption of ways to minimize degradation and loss of the biomass fuel for efficient output. Storing biomass for meeting the requirements of the power plant throughout the year requires huge infrastructure and land. In the recent times, a number of project owners have undertaken fuel assessment studies to estimate the unaccounted losses in the entire system which could be rectified and efficiency could be increased. The purpose of such studies is to:

1) Establish the variables that govern the overall cycle efficiency;
2) Assess the overall impact on the fuel by climate conditions;
3) Identify other hidden non-conventional factors that govern the entire economics.

The complex issue of assessment of fuel loss can be understood by breaking the entire process into simple investigable steps. This could be illustrated from the observation of some of the fuel loss assessment studies carried out by DESL.

Study matrix of fuel assessment of a biomass power plant is shown in the figure 1 below to capture losses:

III. RESULT & DISCUSSION

The fuel assessment study carried out at a biomass power plant in India by DESL answers a number of questions pertaining to the impact that the study has had. The study was carried out for two years, which resulted in highlighting several factors that lead to degradation and loss of biomass fuel right from transportation till final combustion in the boiler.

Results were validated by reconciliation with the boiler performance. Intensive sampling & quality protocols were drafted to cater to the accuracy of the study. It was observed that the impact of the rainfall, soil where the fuel is stored and wind play major roles in fuel loss. There was loss on account of calibration, gain in moisture due to rainfall, wind age loss, etc. All these impact the overall efficiency of the boiler & thus the consumption of the fuel. Degradation loss of fuels is common in green fuels, and therefore they need to be consumed at the earliest and not stored for longer periods.

![Fig. 1: Study Matrix of Biomass Fuel Assessment](image)

Fig. 1: Study Matrix of Biomass Fuel Assessment

Below graphs shows the loss distribution for the study and the impact of the moisture and loss in the efficiency in the boiler leading to reduction in final energy output.

Loss at the point of procurement of biomass fuel was about 12.6 %, followed by average degradation loss of 6%, followed by average Wind age loss at about is 2% and 1.4% on account of transportation. Out of all losses procurement loss is very high which has to be rectified in future perspective.

![Fig. 2: Statistical Pie & Bar Chart for the Moisture Content](image)

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IV. CONCLUSIONS

As the prices of biomass fuels keep increasing every season and there is regulated electricity cost, it becomes pertinent to adopt economic measures for operating power plants. In the year-2001, biomass prices were Rs. 20-30 per quintal, which got hiked up to Rs. 200-230 per quintal in 2015. Estimated cost will be in the range if Rs. 300–400 per quintal by 2020. Implementation of fuel management is also one of the crucial steps for preventing fuel loss. Wind loss is higher in a few areas with higher velocity, and this cannot be controlled unless studied. The same cannot be totally eliminated, but can be reduced. However, gain in moisture due to rainfall can be controlled by covering the fuel with tarpoline or plastic covers that do not allow water to seep in. Other losses can be reduced by improvement in collection efficiency and proper monitoring at the procurement points.

Minimizing fuel loss in the entire cycle chain is one way of enhancing efficiency of the biomass based power plants, thereby increasing profitability. It is very important
that the biomass power plants control the fuel losses and optimize the portions, leading to a win-win situation.

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