Resource Potential of Sawdust and its Spatial Distribution in the Kandy District

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Preliminary Study to Assess the Resource Potential of Sawdust and its spatial distribution within the Kandy District.

Introduction and Objective of the study:

Kandy District is quite famous for its home gardens which in fact use traditional agro-forestry methods for the provision of its basic requirements such as food, fodder, timber, medicine etc. Therefore substantial amounts of trees are grown in home gardens and private holdings and harvested in a sustainable manner providing continuous supply of raw material to operate a large number of saw mills. Information from international experience indicates that the total waste volume in saw mills would vary between 47 and 52 percent of the incoming log volume. The current disposal method adopted by saw mill owners is to dump the wastes in a pile and which are left to smoulder and burn on a continuous basis polluting the air, soil and water around the vicinity of the mills. IDEA being an environment friendly organisation concerned about this situation decided to carry out a preliminary study to assess the overall availability of saw mill waste in the Kandy District. The objective was to find the feasibility of utilising the waste for whatever productive purpose, which could result in reducing or eliminating the present harmful impacts. IDEA however, is aware that the most promising sector, which could utilise the saw mill waste is the energy sector. This information possibly could be used to support investment decisions for wood-energy systems and to assess the potential and capacity of such systems based on the availability and dispersion of the waste material. . Follow-up activities by any party could further investigate, in detail, investment opportunities and the economic feasibility. The current energy situation in the country greatly enhances the economic viability of waste-wood energy system investments and provides a more complete solution to the waste disposal problems of the sawmills. There is a range of technological options currently adopted in several countries, namely gasification, conventional and modern combustion systems and densification. Power generation using wood waste is a proven and established technology in many developed countries and substantial amount of experience is available for reference. The long history of wood waste using energy industry has created a wide variety of power system designs from conventional, low capital -low efficiency designs to modern, high capital- high efficiency designs from which an appropriate technological design could be adopted to suit the Sri Lankan energy and economic context.

Methodology of Obtaining Information.

Divisional Secretaries(D.S.) in the Kandy District were consulted to obtain the list of sawmills registered in their respective divisions. The list of mills is given in annex 1. From this list, 10 mills were identified to physically measure the waste output. The relevant list is given in Annex 2. Further investigation is required to find out the exact number of mills in operation. Although licence has been granted. there may be a few mills, which are not in operation. The mills were provided with sacks to collect their waste from the bins and the daily output were measured in each of the ten mills for three days. Information was obtained from 20 more mills using a questionnaire with regard to their daily outputs of sawn timber.

The average quantity of sawdust produced /unit volume of sawn timber was calculated from the measurements obtained and this average was used to calculate the daily sawdust production in relation to the volume of sawn timber at the mills which were not subjected to physical measurements.

An attempt was also made to estimate the delivery cost of sawdust. This involves finding the actual cost and time involved in collecting the sawdust, filling and tying the sacks and hauling the sacks up to the point of transport keeping everything ready to load the lorry. The cost and time taken to load the sacks transport to a hypothetical power station site 15km away and unloading and emptying the sacks to a storage facility was also assessed.

Results.

Information obtained from the ten mills reveals that the daily sawn timber production from each mill is within the range of 150 - 250 cuft. Each cuft of sawn timber produce six kg of sawdust on the average (Range: 5.53 – 7.27 kg). The average daily production of sawdust is 1216 kg (Range: 950 kg – 1425 kg). From the information received through the questionnaire from the 20 mills, the range of daily production is also seen to be 150 – 250 cuft of sawn timber. Average sawdust output/cuft sawn timber is approximately 6 kg.

All mills are run at least 20 days a month. Since Katugastota area in the Harispattuwa D.S.Division has the largest concentration of saw mills and it would be the most suitable site for a power station as the sawdust could be delivered at least cost. Alternatively, since Yatinuwara too has a large concentration of saw mills, a location in Yatinuwara may be considered as a optional site.

The following table gives the availability of sawdust calculated at the average value of 1216 kg/mill and the delivery cost categorised according to the distance to sawmills from Katugastota, which is the load centre.

D.S.Division	No:of sawmills	Distance from Katugastota	Potential Availability of sawdust kg	Delivered cost/ton
Poojapitiya Harispattuwa Pathadumbara Akurana	4 18 8 4	0 – 9 km	41344 kg	Rs 655.00
Kundasale Thumpane Poojapitiya Udunuwara Medadumbara Harispattuwa Patha Hewaheta Yatinuwara	9 19 14 12 5 3 2 25	9 – 18 km	108224 kg	Rs 814.00
Kundasale Pathadumbara Udunuwara Gampola Pasbage Korale Minipe Thumpane	4 2 2 7 2 5 4	Above 18 km	31616 kg	Rs 1130.00
Total	149		181184 kg	

In addition to the availability of saw dust in the Kandy District, within 18 km from Katugastota, nearly 10000 kg can be collected from 10 sawmills in the Matale DS.Division (This is not included in the chart). Delivered Cost includes the cost of Collection, Loading, Transport and Unloading. Since mill owners do not place a cost for the sawdust other than the labour cost of collection, the delivered cost is virtually the cost of raw material delivered at site.

Basis of calculation:

Lorry hire: Rs 3000/day
15Cts/kg to be paid to the mill owner to cover cost of collection, filling and tying the sacks and piling the sacks for loading (Rs150/ton). Two labourers/day: Rs 800.
Cost of sacks: Rs 30/ton (Sacks to be replaced every 2 weeks)

Site within 9km: Lorry can make 4 trips carrying 2 tons/trip. Total of 8 tons/day.
Cost/ton: Rs 655.
Estimated availability of sawdust: approx. 41tons

Site within 9- 18km. Lorry can make 3 trips carrying 2tons/trip Total of 6 tons/day.
Cost/ton Approx. Rs 814.
Availability of sawdust: 108 tons (additionally about 10 tons available in Matale town not included)

Site within 18- 40km Lorry can make two trips. Total of 4 tons/day
Cost/ton: Rs1130.
Availability of sawdust: 31tons.

Average weight of a sack full of sawdust is 17kg.)
Average transport cost/ton : Rs 828.

Observations.

The majority of trees coming into sawmills are from home gardens and private plantations. The most common trees are the Ginisapu(Michelia Champaca), Pulun(Bombax Ceiba), Lunumidella(Melia Dubia), Havari Nuga(Alstonia) and Tuna(Cedrella Serreta) and to a lesser extent, Mahogany(Swetenia Macropylla), Jak(Arto Carpus hetrophyllus), Teak(Tectona Grandis). In the absence of proper data with regard to plantation and land ownership patterns it is difficult to make a projection of log supplies in the future. Therefore there can be a certain amount of uncertainty with regard to the long term availability of raw material supplies to the mills.

However according to the mill owners, in the past there had been an uninterrupted supply of logs. They are quite optimistic and confident that the same trend will continue in the future as the practice of growing trees for commercial purposes are well established and is a regular income generation activity in the Kandy District. Therefore adequate availability of sawmill waste in the future is likely to remain the same as at present.

The majority of the residuals produced by a typical sawmill operation are either green sawdust or solid pieces of slabs and edgings. Logs typically are not de-barked prior to sawing, and most of the bark is therefore disposed of with the slabs and edgings. Since, most of the waste volume is green, the average moisture content may be around 45%, wet basis.

Sawdust from the bins are collected regularly through out the day and dumped in a pile and burnt in the open or fed into the incinerator at the periphery of the mill. The daily sawdust production is burnt on the same day and in some cases transported to a distant place if the Pradeshiya Sabha does not permit the burning at the mill. If the mill is bordering a stream often the sawdust is dumped into the stream. Therefore, in case that sawdust is utilised for power generation action has to be taken for daily collection from each mill. Leaving it for another day takes additional space and is considered to be burden on the mill owner.

Current disposal practices are causing significant air and water pollution problems. Often the open smouldering of sawdust in pile causes the continuous presence of smoke at ground level and associated emission of particulate is a serious health threat to the residence living in the neighbourhood.

Water run-off from exposed piles of unburned and partially burned wood waste is contaminating nearby streams and the surroundings. Ground water contamination may also result from leaching of tannic acids resulting from biological degradation of sawmill wastes.

Utilisation of these residuals for energy production will reduce or eliminate, depending on the degree of utilisation, the need for open burning and the piles of unburned waste. If only this benefit is considered, installation of wood-waste-to-energy systems will significantly reduce the environmental degradation caused by current practices.

In addition, burning of the residuals in a controlled manner will produce significantly fewer air contaminants than are generated by open burning. It is also observed that small quantities of sawmill wastes are removed by villagers living around for domestic purposes and domestic industries such as for mushroom growing, poultry. However the quantities are comparatively small and insignificant in relation the total availability.

Few mill owners expressed their interest to explore the possibilities of using the waste to generate power to meet their internal energy requirements and to feed the excess power to the grid. However a suitable cost effective technology has not been offered to them yet. Therefore competitive use of sawdust is unlikely in the near future.

From the information gathered it could be estimated that a total of 181 tons of sawdust is available daily from 149 mills in the Kandy District assuming all the mills are in operation. Of this, 41 tons could be made available at a delivery cost of Rs 655/ton, 108 tons at Rs 814/ton and 31 tons at Rs 1130/ton. On a theoretical basis assuming 2 kg of sawdust could generate 1 kWh of electricity, 181 tons of sawdust could generate about 90000 kWh/day. Considering all three categories the average transport cost/ton is Rs 828.00 which gives a fuel cost of Rs 1.66/kWh. This indeed is a competitive cost compared to all other sources of energy, which warrants the attention of prospective investors for serious consideration. Assuming a more realistic scenario where it can be assumed that only 75% of the mills are in operation, and mills are operating only 20 days a month, the total monthly availability of sawdust would be approximately 2715 tons. At 80% capacity factor the sawdust available could conveniently power a 2 MW power station (based on 2 kg/1kWh).

However a matter for serious concern would be to find out a suitable strategy to commit and bind the mill owners to provide the sawdust continuously for a time horizon of at least 15 years.

The other matter of concern is the combustion emissions of the technology adopted. Combustion or incineration technologies are not in general considered to be clean technologies. In terms of environmental considerations, air emissions, water consumption for cooling and solid waste management are the major sources of concern related to the use of biomass fuels for power generation. The public has to be made aware and convinced of the precautionary methods adopted to mitigate the harmful particulate and other air pollutants emitted to the atmosphere and ash disposal methods. The common air pollutants related to biomass combustion are Sulphur Dioxides (SO_2), Carbon Monoxide (CO), Oxides of Nitrogen (NO_X) and Volatile Organic Compounds (VOC).

There should essentially be a guarantee that national air quality and other environmental standards are maintained and adhered to. However it must be recognised that combustion under controlled conditions would be less polluting than the present method of open burning adopted by the mill owners.

Recommendations and Conclusions:

This study establishes that sawdust production from sawmills in the Kandy District is adequate to establish a 2MW power generation system and the likely fuel cost is favourable compared to other energy sources.

Further study and analysis are required to establish commercial viability taking into consideration the capital and operational costs based on international experience.

Study to evaluate the environmental impacts of power generation using sawdust is essential in comparison with the present practices adopted by the mill owners.

Public protest for establishment of a biomass using power generation facility is likely considering the trend of similar protests presently experienced in Sri Lanka and the known pollution potential of biomass combustion.

With a view to secure continuous supply of sawdust, inviting mill owners to participate in the capital investment may be prudent.

The results of this study may be presented to prospective investors for favourable consideration.

ANNEXES:

1. **List of saw mills in the Kandy District**
2. **List of mills where measurements were carried out**
3. **Map indicating the sawdust availability by D.S.Divisions**

Annex 2

List of sawmills where measurements were done.

Name of Mill	Vol: of sawn timber in cuft	Sawdust in kg	Kg of sawdust/ Cuft of sawn timber
1 Navaratna Sawmill, Ambatenne	580	3820	6.6
2 Central Sawmill, Ambatenne.	519	3608	6.95
3 Premaratna Sawmill, Pilimatalawa	585	3550	6.03
4 Katugastota Sawmill, Katugastota	620	3750	6.04
5 Jayasingha Sawmill, Pilimatalawa	744	4200	5.65
6 Ariyawansa Sawmill, Alawatugoda	485	2850	5.87
7 Mudunkotuwa Sawmill, Menikhinna	548	3100	5.65
8 Ranawana Sawmill, Alawatugoda*	392	2850	7.27
9 Ariyadasa Sawmill, Wattegama*	470	2600	5.53
10 Ahmed Sawmill, Alawatugoda	595	3430	5.76
***Total for 2 days. Others, Total for 3days**			
Daily Average	198	1216	6.14