ENERGY AUDIT OF TIMBER LOG PROCESSING IN SOUTHWESTERN NIGERIA

BY

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Certification

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Dedication

This work is dedicated to Chief Abraham Olabosoye Oke, my late father.

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Abstract

Timber log processing is an energy intensive process which involves converting log into lumber of different sizes and shapes using different and varied methods. The energy supply problems facing Nigeria have adversely affected many log processing industry in the country leading to self-generation of energy. There have been various energy audits in some industries but with little or no attention on the log processing industry in Nigeria. Thus, this study investigated the pattern of energy use, type of existing energy sources, estimation of specific energy and energy efficiency of log processing in selected sawmills in Southwest Nigeria.

Twenty four sawmills were selected across five States; Oyo (four), Osun (five), Ogun (eight), Ondo (five) and Lagos (two). Measuring instruments namely: wattmeter; stop watch; measuring tape and digital tachometer were used to measure the current, voltage and power factor; time of operation; sizes of timber log and the speed of electric motor during operation respectively in each of the sawmill. Standard energy equations were used to determine the quantity of energy consumption and specific energy of log processing. Energy equations presented by the US Department of Energy (2014) were used to determine energy saving consideration in the operation of sawmills.

Two main sources of energy were used in log processing: diesel or petrol electric power generator and the national grid; in an average percentage usage of 70:30 respectively. The average working hours is eight hours per day and six days per week. The specific energy ($kWhm^{-3}$) and average processing costs per unit volume (₦m^{-3}) for the seven wood species processed in the selected states were *Afara (Terminalia Superba)* - 1.56 and 32.37; *Iroko (Milicia excelsa)* - 4.48 and 92.96; Mahogany *(Khaya Ivorensis)* - 1.47 and 30.51; *Opepe (Naulea Diderrichii)* - 1.77 and 36.73; *Omo (Cordia Millenii)* - 0.75 and 15.57; *Obeche (Triplochyton Scleroxylon)* - 0.58 and 12.04; *Igba (Parkia biglobosa)* - 1.10 and 20.96. During normal operation, the average motor efficiency is 83.3%, the percentage of full load is 30.9% (the theoretical percentage of full load is 75%), the voltage is 201.9Volts and power consumption is 6.53kW. The electric motors in use in the sawmill facilities were oversized resulting in under-loading and huge loss of energy. The appropriate horsepower (hp) rating that should have been installed in sawmills to ensure energy management was estimated to be 10 hp. The use of appropriate electric motor would result in energy saving of about 22.44kWh and a monetary savings of about ₦484.92 per hour per electric motor.
Energy could be managed from the demand side of log processing while efficiency of energy use in log processing could be achieved with proper selection of electric motor. Energy saving of about 56MW and monetary savings of about ₦1, 210, 360.32 could be made annually on each electric motor.

Keywords: Energy Audit, Sawmill Facilities, Timber log processing.

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