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Biomass Waste-To-Energy Technical Feasibility Analysis: A Case Study for Processing of Wood Waste in Malta

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Abstract : The waste management in Malta is a national challenge. Coupled with Malta's recent economic boom, which has seen massive growth in several sectors, especially the construction industry, drastic actions need to be taken. Wood waste, currently being dumped in landfills, is one type of waste which has increased astronomically. This research study aims to carry out a thorough examination on the possibility of using this waste as a biomass resource and adopting a waste-to-energy technology in order to generate electrical energy. This study is composed of three distinct yet interdependent phases, namely, data collection from the local SMEs, thermal analysis using the bomb calorimeter, and generation of energy from wood waste using a micro biomass plant. Data collection from SMEs specializing in wood works was carried out to obtain information regarding the available types of wood waste, the annual weight of imported wood, and to analyse the manner in which wood shavings are used after wood is manufactured. From this analysis, it resulted that five most common types of wood available in Malta which would suitable for generating energy are Oak (hardwood), Beech (hardwood), Red Beech (softwood), African Walnut (softwood) and Iroko (hardwood). Subsequently, based on the information collected, a thermal analysis using a 6200 Isoperibol calorimeter on the five most common types of wood was performed. This analysis was done so as to give a clear indication with regards to the burning potential, which will be valuable when testing the wood in the biomass plant. The experiments carried out in this phase provided a clear indication that the African Walnut generated the highest gross calorific value. This means that this type of wood released the highest amount of heat during the combustion in the calorimeter. This is due to the high presence of extractives and lignin, which accounts for a slightly higher gross calorific value. This is followed by Red Beech and Oak. Moreover, based on the findings of the first phase, both the African Walnut and Red Beech are highly imported in the Maltese Islands for use in various purposes. Oak, which has the third highest gross calorific value is the most imported and common wood used. From the five types of wood, three were chosen for use in the power plant on the basis of their popularity and their heating values. The PP20 biomass plant was used to burn the three types of shavings in order to compare results related to the estimated feedstock consumed by the plant, the high temperatures generated, the time taken by the plant to produce gasification temperatures, and the projected electrical power attributed to each wood type. From the experiments, it emerged that whilst all three types reached the required gasification temperature and thus, are feasible for electrical energy generation. African Walnut was deemed to be the most suitable fast-burning fuel. This is followed by Red-beech and Oak, which required a longer period of time to reach the required gasification temperatures. The results obtained provide a clear indication that wood waste can not only be treated instead of being dumped in dumped in landfill but coupled.

Keywords : biomass, isoperibol calorimeter, waste-to-energy technology, wood
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