Original Research

Life Cycle Assessment of Waste-to-Energy: Energy Recovery from Wood Waste in Malaysia

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> Received: 1 June 2018 Accepted: 2 August 2018

Abstract

This paper presents life cycle assessment for a biomass-fired power plant that utilizes recycled wood waste as fuel. Life cycle analysis of the wood WtE plant was done using SimaPro software using an Ecoinvent 3.4 database and ReCiPe Midpoint impact assessment method. The main concern was given to climate change factor through the evaluation of GHG emissions of the wood WtE plant. The results showed that 31.9 g CO₂ eq of GHG emissions are emitted for every kWh of electricity generated by the wood WtE plant. The emissions value was 96.1% lower than the electricity generated by the national grid, which is 820 g CO₂ eq of GHG emissions. In conclusion, WtE emerged as a sustainable approach in disposing of solid waste while reducing GHG emissions and increasing the share of renewable energy in energy mix simultaneously. A scenario was created to show the relationship between the percentage of carbon emissions reduction that is in line with Malaysia's commitment to reduce GHG emissions by up to 45% by 2030, hence making the utilization of biomass and solid waste a reliable source of renewable energy as targeted by SEDA Malaysia.

Keywords: waste-to-energy; solid waste; life cycle assessment; biomass fired power plant; greenhouse gases

Introduction

Solid waste management is one of the most serious and controversial issues encountered by the local and regional authorities of Malaysia. Solid waste generation for the whole of Malaysia is about 33,000 tonnes per day in 2012 and 38,200 tonnes per day in 2016 [1]. Other than waste generation by household, waste generation by industrial, commercial and institution (ICI) also encompasses municipal waste, but construction and demolition waste, as well as industrial scrap, are excluded [2]. ICI waste includes food wastes, packaging, housekeeping wastes, paper, cardboard, plastics, wood, glass and metals. The generation of solid waste in

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