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Bio-ethanol in Thailand: A Life Cycle Assessment

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Abstract

Thailand has a plan to supply 3.0 million liters per day of ethanol to replace MTBE (methyl tertiary-butyl ether) in Unleaded Gasoline 95 and to substitute some Unleaded Gasoline 91 by the end of year 2011. Presently, 45 ethanol factories have received the permit from the National Ethanol Board to produce ethanol as a fuel with the total capacity up to 11.115 million liters per day. However, there still exist a number of limitations; such as raw material supply, raw materials price, yield of ethanol production, efficiency of conversion technology etc. In this research, a life cycle assessment (LCA) of bio-ethanol production through three possible routes was made. In each route, it estimated the energy consumptions and emissions during the processes; which included farming, conversion, transportation and vehicle operation stages. The feedstocks used for this study were sugarcane, cassava, and lignocellulosic materials. It was found that bio-ethanol production from sugar feedstock with 80 Bar co-generation (steam and electricity) system using bagasses as the fuel provide the best result in term of reduction in fossil fuels consumption compared to cassava feedstock for all the cases studied under this research. In addition, these scenarios provided the added benefit of CO_2 reduction due to the use of biomass for electricity and steam production. However, emission of N_2O, VOC, CO, NOx, PM10, and SOx are higher compared to conventional gasoline. For the case of bio-ethanol productions from lignocellulosic materials (herbaceous and woody), it was found that a fermentation process with electricity co-production provide the best result in terms of less fossil fuels consumption and less emission compared to other cases investigated. Even though, it showed the negative impacts by increasing VOC, CO, NOx, and PM10, compared to conventional gasoline but predict a positive result on GWP and SOx reduction.