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The development of multi-objective optimization model for excess bagasse utilization: A case study for Thailand

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Abstract: In this paper, a multi-objective optimization model is proposed as a tool to assist in deciding for the proper utilization scheme of excess bagasse produced in sugarcane industry. Two major scenarios for excess bagasse utilization are considered in the optimization. The first scenario is the typical situation when excess bagasse is used for the onsite electricity production. In case of the second scenario, excess bagasse is processed for the offsite ethanol production. Then the ethanol is blended with an octane rating of 91 gasoline by a portion of 10% and 90% by volume respectively and the mixture is used as alternative fuel for gasoline vehicles in Thailand. The model proposed in this paper called "Environmental System Optimization" comprises the life cycle impact assessment of global warming potential (GWP) and the associated cost followed by the multi-objective optimization which facilitates in finding out the optimal proportion of the excess bagasse processed in each scenario. Basic mathematical expressions for indicating the GWP and cost of the entire process of excess bagasse utilization are taken into account in the model formulation and optimization. The outcome of this study is the methodology developed for decision-making concerning the excess bagasse utilization available in Thailand in view of the GWP and economic effects. A demonstration example is presented to illustrate the advantage of the methodology which may be used by the policy maker. The methodology developed is successfully performed to satisfy both environmental and economic objectives over the whole life cycle of the system. It is shown in the demonstration example that the first scenario results in positive GWP while the second scenario results in negative GWP. The combination of these two scenario results in positive or negative GWP depending on the preference of the weighting given to each objective. The results on economics of all scenarios show the satisfied outcomes. (c) 2007 Elsevier Inc. All rights reserved.

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