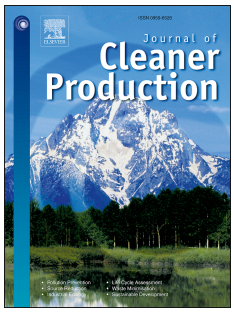
Accepted Manuscript



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Şebnem Yilmaz Balaman, Hasan Selim

PII: S0959-6526(16)30661-8

DOI: 10.1016/j.jclepro.2016.06.001

Reference: JCLP 7364

To appear in: *Journal of Cleaner Production*

Received Date: 27 January 2016

Revised Date: 30 May 2016

Accepted Date: 1 June 2016

Please cite this article as: Yilmaz Balaman E, Selim H, Sustainable design of renewable energy supply chains integrated with district heating systems: A fuzzy optimization approach, *Journal of Cleaner Production* (2016), doi: 10.1016/j.jclepro.2016.06.001.

Sustainable design of renewable energy supply chains integrated with district heating systems: a fuzzy optimization approach

Şebnem YILMAZ BALAMAN[a]*, Hasan SELİM[a]

[a]*Department of Industrial Engineering, Dokuz Eylul University, Tinaztepe Yerleskesi, Buca, 35160 Izmir, Turkey*

Abstract

This study aims to develop a comprehensive decision model for sustainable design of biomass based renewable energy supply chains and district heating systems (DHS) with thermal energy storages. The model integrates the strategic decisions such as location and capacity selection for energy plants and storages with tactical decisions related to biomass production, supply and transportation planning, inventory management and energy production. The main aim is to find the optimum configuration of the supply chain and DHS to meet the heat demand of a particular locality. The model combines cost and service level objectives and accounts for biomass supply, material flow, capacity, demand and technical constraints. The problem is formulated as a fuzzy Mixed Integer Linear Programming (MILP) model that comprises for multiple biomass types and system uncertainties. To explore the viability of the proposed model, computational experiments are performed on a real-world case. Sensitivity analyses are conducted to examine the impacts of cost and capacity limit of thermal energy storage, as well as heat demand, on the objective functions and thermal storage capacity. The results reveal that the proposed model can effectively be used in practice to assist the decision makers in planning energy production systems in a sustainable and effective manner.

Keywords: *Biomass based energy production, renewable energy supply chains, multiobjective mixed integer linear programming, fuzzy decision making.*

*Corresponding author. Tel.: +90 232 3017623; fax: +90 232 3017608.

E-mail address: s.yilmaz@deu.edu.tr (Şebnem Yılmaz Balaman)

1. Introduction

Biomass based energy production systems are important renewable and sustainable energy foundations. In order to perform the major activities in a biomass based energy supply chain such as biomass cultivation, collection, storage and transportation, biomass to energy