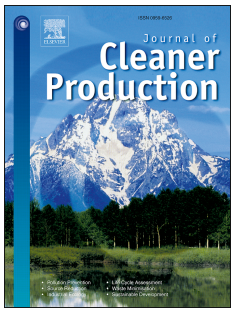
Accepted Manuscript



Carbon emissions quota allocation based equilibrium strategy toward carbon reduction and economic benefits in China's building materials industry

Siwei Zhao, Yi Shi, Jiuping Xu

PII: S0959-6526(18)30730-3

DOI: 10.1016/j.jclepro.2018.03.073

Reference: JCLP 12331

To appear in: *Journal of Cleaner Production*

Received Date: 13 September 2017

Revised Date: 7 March 2018

Accepted Date: 7 March 2018

Please cite this article as: Zhao S, Shi Y, Xu J, Carbon emissions quota allocation based equilibrium strategy toward carbon reduction and economic benefits in China's building materials industry, *Journal of Cleaner Production* (2018), doi: 10.1016/j.jclepro.2018.03.073.

Carbon Emissions Quota Allocation based Equilibrium Strategy toward Carbon Reduction and Economic Benefits in China's Building Materials Industry

Siwei Zhao[a,b], Yi Shi[a,b], Jiuping Xu[a,b,*]

[a]*Business School, Sichuan University, Chengdu 610064, P. R. China*
[b]*Uncertainty Decision-Making Laboratory, Sichuan University, Chengdu 610064, P. R. China*

Abstract

The rapid urbanization in China over the last decade has resulted in increased carbon emissions from the building materials industry. This paper seeks to reach a trade-off between economic benefits and carbon emissions in the building materials industry by integrating a carbon emissions quota allocation (CEQA) based equilibrium strategy under a carbon emissions trading (CET) mechanism that fully considers the stakeholder relationships between the regional authority and the building materials suppliers. An interactive solution approach with fuzzy random variables (FRVs) is designed to determine the trade-off between these decision makers. The methodology is then applied to a real world case to demonstrate its practicality and efficiency. Comprehensive discussions under different policy control scenarios and comparative analysis of two carbon reduction policies are conducted to assist policy makers. It was found that the proposed methodology encouraged building materials suppliers to adjust their production and carbon emissions quota purchase plans, further assisting regional authority to control the industry's emissions performance by providing a "win-win" solution for the regional authority and suppliers when making logical economic-environmental trade-off decisions.

Keywords: building materials industry; carbon emissions quota allocation; carbon reduction; economic benefits; equilibrium strategy; trade-off

1. Introduction

The Intergovernmental Panel on Climate Change Fifth Assessment Report claimed that the continual emissions of greenhouse gases is expected to cause further warming and long-lasting changes to the Earth's climate system, increasing the likelihood of severe, pervasive and irreversible impacts on humans and ecological systems (Intergovernmental on Climate Change, 2015). Faced with such serious climate change-related consequences, reducing greenhouse gas (GHG) emissions has become of major global significance. China, which is responsible for about one-quarter of the world's CO_2 emissions, has ambitious emissions reductions goals but has been unwilling to set absolute targets for fear of slowing the country's economic growth, however, China has formally submitted its climate pledge to the United Nations to boost renewable-energy sources and restrain emissions by 2030 (Qiu, 2013). The building sector, is one of the most carbon-intensive industries, contributing over one third of all global CO_2 emissions (Zhang and Wang, 2015a; Hong et al., 2015; Shi et al., 2017; Akan et al., 2017). China has been constructing many urban building projects over the last two decades (Zhang and Wang, 2015a), which has led to a dramatic increase in building industry carbon emissions (Zhang and Wang, 2015b). Therefore, to alleviate the adverse effects of increased carbon emissions, developing effective carbon emissions reduction methodologies, from both "hard-path" improvements in low-carbon technologies to reduce emissions (Wang and Su, 2014; Watson et al., 2015), and "soft-path" effective policies (Lu et al., 2016; Yang et al., 2017), is vital to the development of a low-carbon Chinese building sector.

*Corresponding author. Tel.: +86-28-85418191. Fax: +86-28-85415143.
Email address: xujiuping@scu.edu.cn. (Jiuping Xu)