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Reduction potential of CO_2 emissions in China's transport industry

Boqiang Lin [a,b,*], Chunping Xie [c]

[a] School of Energy Research, Collaborative Innovation Center for Energy Economics and Energy Policy, Xiamen University, Xiamen, Fujian, 361005, PR China
[b] Newhuadu Business School, Minjiang University, Fuzhou 350108, China
[c] School of Energy Research, Xiamen University, Xiamen 361005, China

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ABSTRACT

Energy saving and carbon dioxide emission reduction in China is drawing increasing attention worldwide. China is currently in the stage of industrialization and urbanization, which is characterized by rapid growth of energy consumption. China's transport industry is highly energy-consuming and highly polluting. In 2010, oil consumption in China's transport industry was 38.2% of the country's total oil demand, and accordingly had given rise to increasing amounts of carbon dioxide emissions. This paper explores the main factors affecting carbon dioxide emissions using the Kaya identity. Co-integration method is developed to examine the long-run relationship between carbon dioxide emissions and affecting factors of GDP, urbanization rate, energy intensity and carbon intensity in the transport industry. Both carbon dioxide emission and reduction potential are estimated under different emission-reduction scenarios. Monte Carlo simulation is further used for risk analysis. Results show that under BAU (Business As Usual) scenario, carbon dioxide emission in China's transport industry will reach 1024.24 million tons (Mt) in 2020; while its reduction potential will be 304.59 Mt and 422.99 Mt under moderate emission-reduction scenario and advanced emission-reduction scenario, respectively. Considering this huge potential, policy suggestions are provided to reduce the level of CO_2 emissions in China's transport industry.

Contents

* Corresponding author at: New Huadu Business School, Minjiang University, Fuzhou 350108, China. Tel.: +86 5922186076; fax: +86 5922186075.
E-mail addresses: bqlin@xmu.edu.cn, bqlin2004@vip.sina.com (B. Lin).

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1. Introduction

1.1. Climate change and the transport industry

Climate change and global warming have attracted increasing attentions worldwide, and has become a serious challenge for many countries. Among various environment challenges, carbon dioxide emission is particularly of great concerned. In 2010, China's carbon dioxide emissions were estimated to be 8332.5 Mt (Million ton), accounting for 25.1% of the world's total emissions [23]. Therefore, world carbon emission mitigation requires commitments from China to control and reduce its emissions from all sources, especially fossil energy. Otherwise, world carbon dioxide emissions are expected to increase at an even higher rate due to China's progress of industrialization and urbanization. Therefore, understanding and analyzing carbon emission factors in China's key industries are of vital importance [32].

The transport industry is an important sector, and is key to national economic and social development. Modern transportation has evolved into an important economic activity for human civilization [31]. The transportation sector is one of the major components of globalization and makes a vital contribution to the economy as well as, plays a crucial role in daily activities around the world [36]. However, given that, the global energy consumption of the transport sectors, is about one third of the total energy consumption of the world at present, energy saving and emission reduction in the transport sector, is of great importance [56]. The transport sector has been identified as one of the major contributors to the depletion of fossil fuels, the degradation of the environment and deterioration of human health [3]. A recent study regarding the influence of anthropogenic activities towards climate change had also proven that the transportation sector would be the highest potential contributor to atmospheric warming in the near decades [31]. At present, fossil fuels take nearly 80% of the primary energy consumed in the world, of which up to 58% alone are consumed by the transport sector [46]. Globally, the transportation sector is the second largest energy consuming sector after the industrial sector and accounts for 30% of the world's total delivered energy [8].

1.2. China's transport industry

China's transport sectors are mainly divided into four parts, which are, road, railway, waterway and civil aviation. In general, China's road transport occupies an important position for middle-short distance transport, and the railway plays a crucial role for long-distance transport [56]. The road transport and railway undertake most of the passenger transport; while the waterway transport and civil aviation only undertake a small amount of traffic volume, but play significant roles in China's international transport. From Fig. 1, it is noticed that road transport has replaced railway and became the dominant passenger transport since 1990. Though the proportion of civil aviation in passenger transport is limited, it has grown rapidly, especially in recent years. For the waterway transport in China, it has the least share in passenger transport but the largest share in freight transport.

As is shown in Fig. 2, energy consumption in China's transport industry is increasing rapidly yearly, particularly in road transport sector due to the considerable increment of vehicles. As the demand for private vehicles is still huge in China, it is expected that the energy consumption in road transport sector will keep growing [33].

It is notable that China's current transport industry is of high energy-consuming and heavy-polluting. As a matter of fact, CO_2

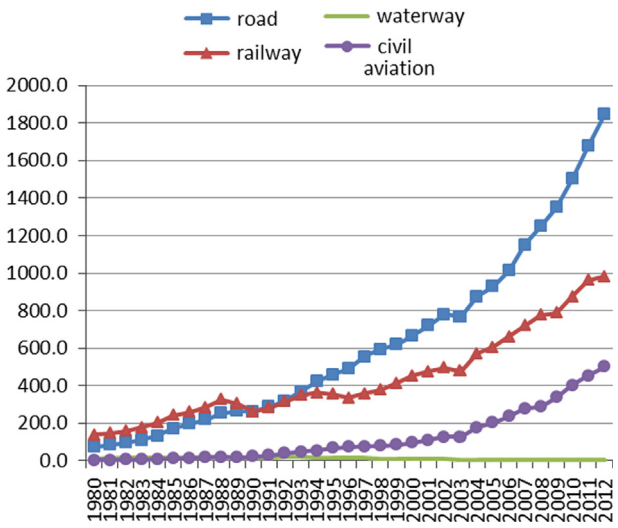

Fig. 1. Turnover volume of passenger transport in China's over 1980–2012 (unit: billion person km).

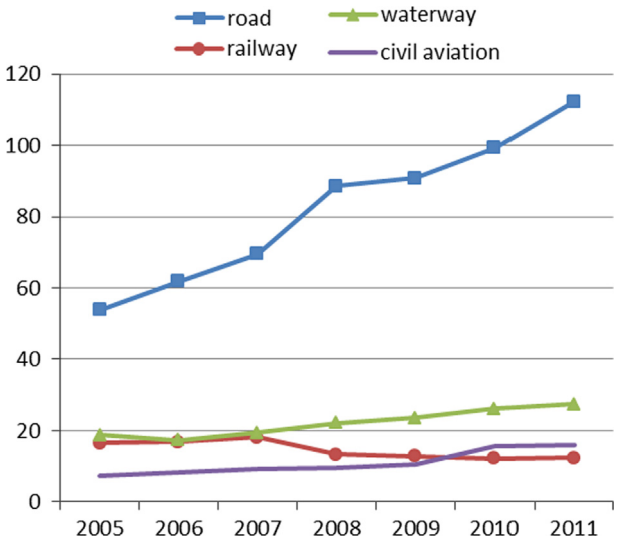

Fig. 2. Energy consumption in China's transport industry over 2005–2011 (unit: MTOE).