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A scenario analysis of Beijing's private traffic patterns

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Abstract

Sustainable development is a basic state policy of China. Changing the unsustainable production and consumption patterns plays an important role in implementing this policy. In this paper, taking private traffic pattern of Beijing as an example, we compare the life-cycle environmental impacts of different scenarios. Assumptions which concern the role of both consumers and producers are taken in scenarios' development. Scenario results show that combing sustainable consumption and production patterns is essential for future. This paper gives some policy implications about the role of government in promoting sustainable private traffic patterns in Beijing.

Keywords: Sustainable production; Sustainable consumption; Private traffic pattern; Life-cycle assessment (LCA)

1. Introduction

In the past, producers were regarded as the core of sustainable development. After Rio Conference in 1992, consumers were promoted to the same level of importance. In 2002, at the summit in Johannesburg, research on consumers was much more emphasized [1]. As an important part of product's life cycle, consumers have an important influence on the whole product chain. The integration of sustainable production and consumption is the prerequisite of sustainable development [2,3].

Sustainable development is a basic state policy of China. Changing the unsustainable production and consumption patterns plays an important role in implementing this policy. Social responses to environmental problems have focused largely on the production side of economic activities: innovative technologies for material mining, energy supplying and manufacturing. Facts show that environmental gains achieved by such producer-orientated policies are offset by trends on the consumer side – population growth, higher standard of living and people's desires to consume products and services [4–6]. As a country like China with a large population and scarce resources, more attention should be put on consumers if sustainable development is to be realized.

Motorization of private traffic is a clear trend in China, especially in big cities. On the one hand, motorization promotes life quality, brings mobility and comfort, and provides more choices for people's employment and residence; on the other, it also leads to environmental problems, an especially serious pressure with decreasing air quality. In this paper, taking Beijing as an example, we first introduce the motorization of private traffic in Beijing and its social and economic backgrounds. Then we compare the life-cycle environmental impacts of low-motorization, middle-motorization and high-motorization development scenarios in 2020 with the base year 2000. Assumptions which concern the consumers' choices and technology advancement are taken in scenarios development. This paper emphasizes the important effect of the integration of production and consumption. At last, this paper gave some suggestions on the role of government to promote sustainable private traffic in Beijing.

2. Motorization of private traffic in Beijing and its environmental impacts

2.1. Motorization and the changes of private traffic mode in Beijing

Beijing is currently experiencing one of the highest annual motorization growth rates in the world [7,8]. Private ownership

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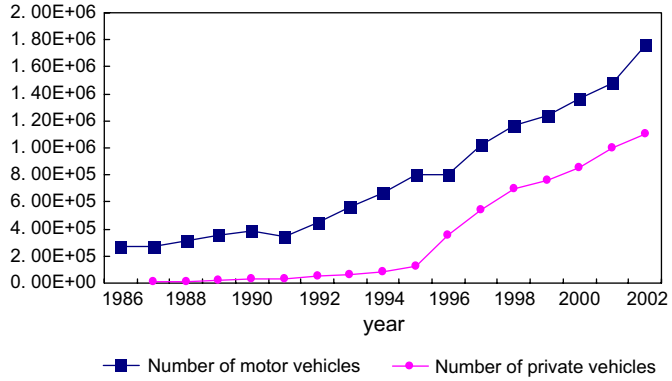

Fig. 1. Number of motor vehicles and private vehicles in Beijing.

of automobiles was strictly restricted by the state; the majority of passenger vehicles were traditionally owned by government and state-owned enterprises. Along with the adoption of an open-door policy and the shift to a more market-oriented economies, the government has begun relaxing restrictions on private vehicle ownership; as a result, the number of privately owned vehicles has grown substantially in a relatively short period of time [9]. Fig. 1 shows that at the end of 2000, the total vehicle stock in Beijing was about 1.36 million; more than five times that of what is was in 1986 and with an annual growth rate of 13% [10]. The rapidly increasing trend of private cars came after mid-1990s. Private purchase of automobiles increased at an annual rate of 44% between 1986 and 2000. Private vehicle population in Beijing between 1986 and 2000 has grown to about 120 times. In 2003, there are 0.8 million private cars in Beijing, a motorization rate of 11 vehicles per 1000 population [11]. Private purchase of automobiles accounts for more than 90% of new fleet in Beijing automobile market in 2003.

China has long been known for its widespread use of bicycles in urban transport. This situation has changed to a considerable degree with the increasing use of automobiles for work and leisure activities. Two surveys, in 1986 and 2000, on private traffic mode have been carried out in Beijing by the government. These results, shown in Fig. 2 [12], reflect the motorization trends of private traffic mode. Bicycle took up 58% of passenger traffic demand in 1986. This proportion declined to 38% in 2000; the share of public buses as a whole declined from 32% in 1986 to 27% in 2000, while the total number of passenger buses is estimated to have increased from 6000 to 15,000 during this period [10]; and the share of private cars in total passenger traffic volume increased from 5% in 1986 to 23% in 2000. It is assumed that the share of private motorized travel demand will increase in the future due to the government's policy of encouraging private car.

2.2. Environmental impacts of motorization in Beijing

The rapidly increasing vehicle fleet, combined with low emission standards, poor road infrastructures, outdated technologies and unmatched monitoring systems, makes Beijing as one of the most polluted city in the world. It is reported that under actual operation conditions, the average emission rate of carbon monoxide (CO) and hydrocarbons (HC) of cars in Beijing is four to five times higher than those of similar cars in U.S. Compared with developed countries, the emission rate of newly produced cars in Beijing is 10 times higher [13]. This is particularly true for CO, HC, nitrogen oxides (NO_x) and a variety of potentially harmful emissions. Table 1 shows the increasing contribution of vehicle emission to total air emissions in 1995, 1998 [14] and 2000 [9] in Beijing. From 1995 to 2000, the percentage of total vehicle emission CO increased from 76.8 to 84 and NO_x increased from 21.7 to 73. Motor vehicles' emissions now constitute the main source of air pollution in Beijing. The growing vehicle population is one of the most urgent problems facing 2008 Beijing Olympics.

3. Driving forces of private traffic motorization in Beijing

Motorization of individual traffic patterns is influenced by income, urban structure, policy and habits, etc. The individual's right to unlimited, motorized, personal mobility has emerged as an important measure of progress in modern democratic societies [15]. In China, private cars are regarded as an important symbol of promotion of living condition and social status. Therefore private purchase of cars is encouraged by policy and is a target of many families. As to Beijing, its sprawling also spurs family cars buying and changing in employment patterns.

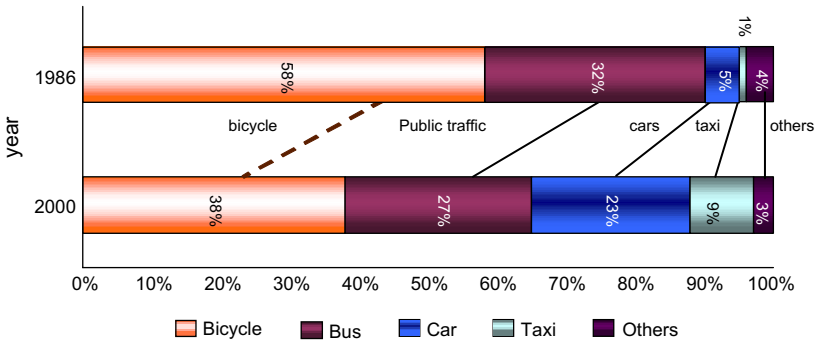

Fig. 2. Private traffic mode of Beijing between 1986 and 2000.