CHAPTER 9

Introduction: Urban Transport and Climate Change

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Urban Transport and CO₂

Reducing CO₂ emissions is a growing challenge for the transport sector. Transportation produces roughly 23 percent of the global CO₂ emissions from fuel combustion. More alarmingly, transportation is the fastest growing consumer of fossil fuels and the fastest growing source of CO₂ emissions. With rapid urbanization in developing countries, energy consumption and CO₂ emissions by urban transport are increasing rapidly.

These growing emissions also pose an enormous challenge to urban transport in China. As a recent World Bank study of 17 sample cities in China indicates, urban transport energy use and greenhouse gas (GHG) emissions have recently grown between 4 and 6 percent a year in major cities such as Beijing, Shanghai, Guangzhou, and Xian (Darido, Torres-Montoya, and Mehndiratta 2009). In Beijing, CO₂ emissions from urban transport reached 1.4 tonnes per person in 2006. The numbers could be considerably higher in 2011. A national estimate suggests that in 2006 GHG emissions from urban transport in China were 290 million tonnes, or 700 kilograms per capita, and 26 percent of the total GHG emissions from all transportation in the country and about 15 percent of the CO₂ emissions per capita in China in the same year.¹
Opportunities for Low-Carbon Urban Transport

Despite the trend toward increasing emissions, opportunities exist for low-carbon urban transport development in China. Figure 9.1 provides a schematic of the drivers of emissions from urban transport and indicates entry points for urban transport policy interventions to save energy and reduce CO₂ emissions.

The six entry points in figure 9.1 all relate to the fact that, in essence, GHG from transport are emitted from the fuel used on motorized trips. The figure shows that increases in the level of economic activity in a city usually result in an increase in the total number of trips; that is, the aggregate level of transport activity. These trips are distributed across the range of available modes (referred to as the modal split), depending on the competitiveness of the alternatives for any given trip maker. Every motorized trip emits GHG emissions and the amount of emission depends largely on the amount and GHG intensity of the fuel used, or the efficiency of the vehicle fleet and the energy intensity of the fuel used. Finally, driver behavior impacts the fuel use; after certain threshold speeds, fuel consumption becomes significantly higher. While this complex and distributed nature in which GHG emissions are generated makes transport a particularly hard sector in which to dramatically reduce emissions, there are several strategy options for a city looking to reduce the carbon foot-

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Figure 9.1  Entry Points for Energy Saving and CO₂ Reduction

<table>
<thead>
<tr>
<th>Economic activity</th>
<th>Transport activity</th>
<th>Modal split</th>
<th>Vehicle fleet</th>
<th>Energy intensity of fuel use</th>
<th>Behavior</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic structure and spatial distribution of economic activities</td>
<td>Volume Total tonne-km Total passenger-km Location</td>
<td>Modal shares in freight and passenger transport</td>
<td>Size Type</td>
<td>Type of fuel Fuel economy</td>
<td>Load factor Speed</td>
</tr>
</tbody>
</table>

Source: Authors.

Note: MJ = megajoules; TKM = tonne-kilometer; PKM = passenger-kilometer.
print of its urban transport sector, all of which are very relevant to Chinese cities today:

- **Changing the distribution of activities in space**: For any given level of economic activity, if a city can influence the distribution of activities in space (for example, by changing land-use patterns, densities, and urban design) it can have an impact on the total level of transport activity. Better land-use planning and compact city development can lead to fewer or shorter motorized trips and a larger share for public transport of motorized trips. Chapter 4 laid out the issues, structural challenges, and a way forward to address this challenge.

- **Supporting low-carbon transport modes**: A city can also influence the way transport activity is realized in terms of choice of modes. Chapters 10 and 11 will discuss improving the quality of relatively “low emission” modes such as walking, cycling, and various forms of public transport. Such steps can help a city attract trip takers to these modes and lower their carbon emissions per trip.

- **Affecting vehicle use**: Finally, a city can take a range of measures that directly influence what vehicles are being used and how much private transport is being used. Chapter 12 will describe two approaches to reduce emissions from motorized vehicles. One is the adoption of technological measures that reduce the carbon emissions of motorized vehicles per unit of travel. The other is the adoption of demand management measures that would reduce the amount of automotive travel. This includes both non-pricing controls on vehicle ownership and use (for example, restrictions on parking or days the car can be used), and pricing controls such as fuel taxes, higher parking fees, and congestion pricing.

Experience internationally and in China suggests that there is no easy solution to reduce GHG emissions from transport. A comprehensive approach is required that simultaneously seeks to (i) reduce the demand for total motorized transport activity through appropriately designed urban places; (ii) promote the use of “low-emission” transport modes such as walking, cycling, and public transport; and (iii) use the most efficient fuel-vehicle technology system possible for all trips. Box 9.1 presents the case of Singapore, illustrating the benefits of a comprehensive approach in this respect. While cities will need to find the right mix of strategies to suit their particular circumstances, the following general approaches apply:
As cities grow in population and expand their spatial footprint, perhaps their most important priority is to ensure that their spatial footprint is compatible with strong, competitive public transport.

As incomes increase, creating viable alternatives to the use of cars for those who have a choice will be absolutely critical in almost all of China’s cities to keep them livable and functioning efficiently. For the larger cities, actively managing automobile use will increasingly be a necessary option to consider and develop.

Technology will need to complement these two fundamental strategies—and in that role can provide significant GHG reductions and other related environmental benefits.

Box 9.1

**Singapore: A Role Model for Urban Planning and Transport**

Singapore is a model of the most transformative urban development in the world. The city-state has made a remarkable transition from a city afflicted by poverty to a wealthy, bustling metropolis—all in less than 40 years. Adherence to strong planning practices and transport policies has made Singapore an attractive place to live and work, as well as a desirable location for foreign investment.

With only about 650 square kilometers of land area and nearly 5 million inhabitants, Singapore is characterized by a high population density and efficient transport systems. This success is achieved through a multifaceted transport and land-use strategy consisting of three key components:

- **Integration of town and transport planning**: Industrial, residential, and social infrastructure is placed within walking distance of bus stops and mass rapid transit (MRT) stations. Road networks are designed to make bus service accessible from residential areas, and pedestrian walkways are covered to provide protection from rain and extreme weather. A mixed-use planning strategy puts work and home closer together, moderating the demand on transport systems. These strategies serve to minimize the levels of motorized transport activity associated with any given level of economic activity.

- **Improvements in public transport**: The far-reaching, multimodal public transit network consists of four major systems: MRT, light rapid transit (LRT), buses, and taxis. The transit systems have integrated operating institutions, service net-

(continued next page)
works, and fare schemes. The stations are situated in or near commercial and office developments and are designed to facilitate efficient transfers between modes. Public transit is regulated to maintain its reliability, affordability, and efficiency. These strategies serve to make public transport attractive even to relatively high-income users.

- **Management of vehicle ownership and usage**: Ownership of personal vehicles is limited by a government-controlled quota (Vehicle Quota Scheme) and a tax on new vehicle registrations (Additional Registration Scheme). Usage of personal vehicles is deterred by a congestion charge for vehicles entering a designated restricted zone during certain hours (Electronic Road Pricing). The city is also careful to limit total road length to what it considers “optimal levels” and ensures that all road construction and maintenance is supported directly by revenues from road users.

The planning and policy measures to deter driving and encourage public transit have reduced congestion and pollution, which is a major draw for international business and investment (Willoughby 2001). Over time, Singapore’s planning strategies have contributed to an increase in GDP per capita to a level higher than some already developed countries, all while maintaining a low level of energy consumption in the road sector (see figure B9.1.1). Singapore has set a precedent for sustainable policy development, ensuring that low-carbon land use and sound transport planning practices are part of its future.

**Figure B9.1.1 Singapore and Europe: Ground Transport Energy Consumption**

Sources: Lam and Toan 2006; Willoughby 2001; World Bank Development Indicators Databank.

Note: ktoe = kilotonne of oil equivalent.
Notes


Bibliography


