

The Low Speed Electric Vehicle – China’s Unique Sustainable Automotive Technology?

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Abstract. This paper discusses the emerging market for Low-Speed Electric Vehicles (LSEVs) in China and examines the various constraints and challenges it faces. It looks at some of the problems faced by those developing LSEVs and highlights the role that institutional factors play. The paper concludes with three scenarios for how the market for LSEVs in China might develop over the coming years and speculates on the wider impact this might have.

1 Introduction

Thanks, in part, to its national strategy of building a base of industrial competitiveness founded on "*new-energy vehicles*" (a classification that includes pure electric, electric hybrid and other forms of alternative energy vehicles), China is currently a huge laboratory for the development of alternatives to vehicles powered by the internal combustion engine. Many examples of such vehicles are now being tested by China's central and regional governments. However, the high profile new-energy vehicles are not the only market for electric vehicles in China. In parallel to this, a new market segment has emerged beyond the boundaries of the mainstream automobile industry, based around Low-Speed Electric Vehicles (LSEVs), a form of vehicle that is largely indigenous to China. In our previous work, we have focused on China's capacity for technological and business model innovation (Wang and Kimble, 2010b, 2011) that has led to the growth of the industries that surround new-energy vehicles. In this chapter, we examine the potential impact of this lesser known aspect China's attempt to develop more sustainable forms of automotive technology.

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2 Low-Speed and Electric Vehicles in China

China is already a major manufacturer of low-speed light vehicles powered by internal combustion engines. Together with low-speed e-solutions for transport, such as two and three wheel e-bikes, e-scooters and e-motorcycles, these industries form the foundation for the emerging market for LSEVs. We will first examine e-mobility in China and the low-speed light vehicle industry before going on to look at LSEVs themselves.

E-Mobility in China

The e-mobility industry, which includes e-bikes, e-scooters, e-motorcycles and other forms of electric vehicle, began in China in the early 1990s. E-bikes are bicycles with a small electric motor, an average speed of 20 km/h and cost between 1000 and 2500 ¥ (\$200 and \$400). E-scooters and e-motorcycles are equipped with heavier motors, have speeds between 40-80 km/h and are priced between 2000 and 20,000 ¥ (\$310 and \$3,100).

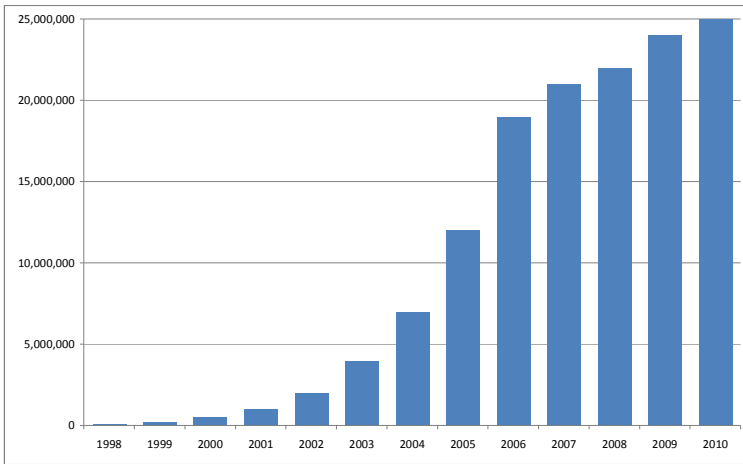


Fig. 1. Production of two wheel electric vehicles in China (Sun, 2010)

The production of 2-wheeled e-vehicles has grown to 25 million units in 2010, with more than 400 thousand units being built for export and is expected to reach 35 million units in 2015 (Figure 1). However, despite the high volume of production, the industry is still at an early stage. Currently the sector consists of around 2,700 licensed producers with the market share of the top 50 companies being around 50% (Sun, 2010), much lower than a mature industry.

For the Chinese consumer, e-bikes, e-scooters and e-motorcycles are now widely accepted. Ninety percent of the total production of e-bikes is for the domestic market. In 2009, there were 140 million users of e-bicycles, e-scooters and

e-motorcycles and 500 million users of standard bicycles. Over time, it is expected that a significant proportion of the users of bicycles will move to e-bicycles, e-scooters or e-motorcycles as income levels increase. It is also expected that some of these users, together with the 80 million motorcycle users, will switch to the low-speed electric vehicles that we describe in the following sections.

Low-Speed Vehicles in China

The low-speed light vehicle industry first emerged in China in the 1980s and found a ready market in rural areas. The Chinese authorities initially used the term "farm vehicle" and later "low-speed vehicle" to describe them; they are designed to carry both people and loads for short distances along farm roads (Wang, 2002). Three-wheel models are priced between 6,000 and 12,000 ¥ (\$1,000 to \$1,900), and four-wheel models between 15,000 and 40,000 ¥ (\$2,400 and \$6,200).

The low-speed light vehicle industry is now beginning to show signs of maturity, both in terms of its sales and structure. In 1998, there were 218 companies producing low-speed vehicles, with the four leading companies accounting for 55% of the output. By 2009, there were still 207 producers, but the four leading companies now accounted for 81% of the output. Currently the market leader, the Shifeng Group, accounts for 44.7% of the total sales. Similarly, sales reached 3.2 million units in 1999 but have now stabilized at around 2 million units / year (Figure 2).

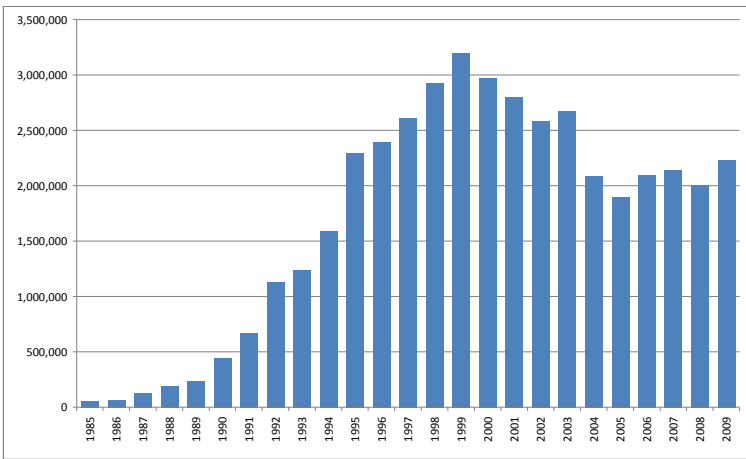


Fig. 2. Production of low-speed vehicles in China (CAIY)

Low-Speed Electric Vehicles in China

The production of low-speed electric vehicles began in 2007. The market was created by the efforts of companies from a range of different industries (Wang &

Kimble, 2010a). Some, like the Shifeng Group, produced low-speed diesel and gasoline powered light vehicles; others produced golf carts, sports vehicles or special purpose vehicles like post office vehicles or ambulances. Few however came from the traditional motor vehicle industry.

The typical LSEV is composed of an accelerator, brakes, steering wheel and a lead acid battery pack. Gearshifts, air-conditioning and safety equipment are omitted to reduce the total costs. The electric motor is connected directly to the speed controller and most models do not have a sophisticated battery management or motor control system. A typical LSEV has a top speed of between 40 and 70 km/h, the dimensions of a compact car and weighs less than 1,100 kg. Depending on the number of battery packs, it has a cruising distance of 80 km, 100 km or 150 km, and costs between 20,000 and 40,000 ¥ (\$3,100 and \$6,200).

There are two main variants. The first is based on a golf cart, which has the advantage of low cost and a simple product platform. The only change that is needed is the addition of a car body, which is often based on some popular model of small car and is handmade using glass-fibre. For the second type, the product architecture is copied from a small, traditional internal combustion engine powered car, such as the QQ from Cherry. Here the main change needed to produce a LSEV is the replacement of a traditional engine and transmission system by an electric motor assembly and battery.

In the second type of LSEV, the car body is often purchased directly and is identical to that used in small cars; however, due to costs associated with the more complex product architecture of traditional cars, this does not significantly reduce the price. Consequently, some companies are trying to redesign the chassis and suspension to benefit from the simplicity of electric vehicles. If successful, this would significantly lower the cost of this type of LSEV.

3 The Market for LSEVs in China

Before discussing the market for LSEVs, it is important to note that the Chinese economy has a dual-structure, with significant differences in income between rural and urban areas. According to the China Statistical Yearbook (2010), the per capita annual income of rural households was 5153 ¥ (\$790) in 2009, compared to 17,175 ¥ (\$2,650) for urban households, giving rural consumers an income of less than a third of those who live in urban areas (Figure 3).

The Value Proposition of LSEVs

Currently, the main market for LSEVs is in the rural areas of China. More than 70% of the population, around 900 million people, live in the rural areas. The first point to make about the value proposition of LSEVs is that, at 25,000 ¥ (\$3,900), the purchase price of a LSEV is much more affordable than a small traditionally powered car, which is priced at around 40,000 ¥ (\$6,200).

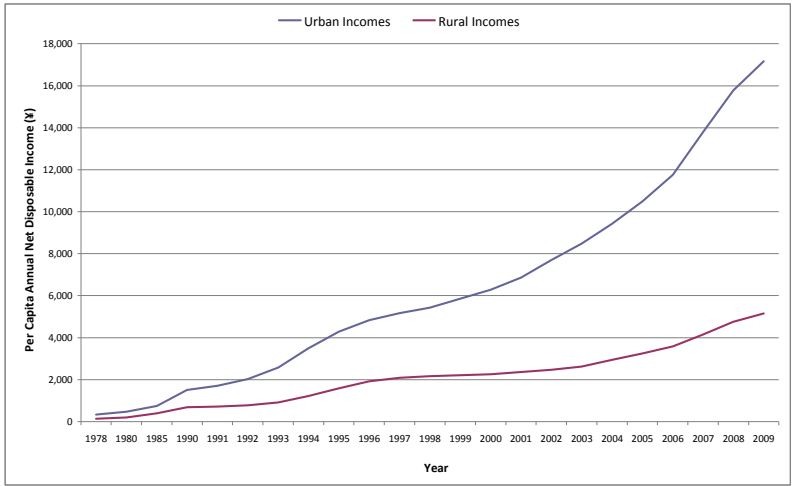


Fig. 3. The growing gap between rural and urban incomes (CSY, 2010)

However, the attraction of a LSEV lies not only in its low price, but also in its low running costs. The cost of the electricity needed to travel 100 km is around 6 ¥ (\$0.9) whereas for a small gasoline powered car the cost for the same distance would be 49 ¥ (\$7.5), or 8 times higher. In addition, the battery can be charged from an ordinary 220-volt outlet at home. In rural areas, where households have private parking spaces, this way of charging is more convenient than gasoline powered vehicles, as petrol station networks are not well developed in rural areas.

Thus, the LSEV has a clear value proposition to (low-income) consumers who live in rural areas; however, it may also offer certain advantages to a segment of the more affluent urban market. The top speed of a LSEV corresponds to the standard downtown speed limit of 60 km/h and offers urban consumers a good compromise between price and practicality. In addition, as most urban commuting distances are less than 20 km, LSEVs have the potential to meet the basic transportation needs of urban as well as rural consumers.

Chinese Institutions and LSEVs

China is what is termed a transition economy and is still in the throes of changing from a monolithic, centrally planned economy on the Soviet model to one based on international trade with the free market economies of the West (Lukas, Tan, and Hult, 2001). Such economies are characterized by complex and often conflicting institutional requirements that are seen by some as obstacles to developing competitive capabilities (Peng, 2003).

Perhaps the most obvious sense in which the decisions of various Chinese institutions might shape the future of the LSEV market in China is the simple fact that, in most of China, LSEVs cannot be used on the road. The companies that produce LSEVs are not listed in the "Announcement of Vehicle Producers and Vehicle Products", an official document published by the *Ministry of Industry and*

Telecommunication and the "Law of Road and Transportation Security", which applies to the whole of China, does not have policy or regulations to cover the use of LSEVs; consequently, LSEVs have no right to use the roads.

When there is a lack of laws or regulations that clearly define the boundaries of a new industry, provincial governments often step in to develop the industry in the interests of local economy, a situation termed "*Chinese federalism*" by Qian & Roland (1998). Thus, although modifications to national laws by local authorities are not (strictly) permitted, provincial governments in areas where LSEVs are produced have created "temporary" local policies to stimulate production of LSEVs. These include, tax rebates, funding for R&D, permission to use LSEVs on roads, and tax and road charge waivers for LSEV owners.

4 The Implications of LSEVs for Mainstream Carmakers

Because of its low price, low running costs and the ease of charging from a 220-volt home electric outlet, the LSEV offers a clear value proposition to low-income consumers living in rural areas in China. In addition, most Chinese consumers do not have a fixed notion of what a passenger car or an electric vehicle is, which may make this type of technology more acceptable outside of rural areas.

However, for most western consumers, a passenger car is thought of as a long distance cruising vehicle that has the capacity of reaching relatively high speeds. The size of fuel tank, the power of engine and a long history of use have led us to expect our cars to carry us for long distances at speeds in excess of 100 km/h. Notwithstanding this, the reality is that most people who live in urban areas are subject to the speed limits of 50 km/h or less and travel under 50 km/day. Could the LSEV offer a new value proposition to people outside of China?

Chinese LSEVs have already begun to find markets outside of China; foreign institutional buyers (e.g. governments, police departments, hospitals, post offices and airports) have bought LSEVs as a "green solution" whilst also cutting costs. Private consumers in the US, for example, have also bought LSEVs as a second or third car. The sales of LSEVs to the US have increased from 5,000 vehicles in 2008 to around 20,000 in 2010. Will LSEVs prove to be the breakthrough that some (Wang and Kimble, 2010c) have forecast? The final section of this chapter examines some possible scenarios for the future growth of the market for LSEVs.

5 Scenarios for the Development of LSEVs in China

The market in China is large enough to experiment with many different types of technology and to incorporate those technologies into many different types of product. Currently these include e-bicycles, e-scooters and e-motorcycles, low-speed light-duty vehicles powered by internal combustion engines and low-speed electric vehicles. We have seen that the future development of such vehicles in China is complex, difficult to predict and involves interactions in both the

economic and the political arena. Based on a number of factors, we see three possible scenarios for the future development of the LSEV market in China.

In the first, central government does not encourage the development of LSEVs but waits for the market to overcome existing legal and institutional barriers. If this trajectory is followed then, due to the low entry cost, we predict that the industry will remain fragmented for perhaps another 10 years after which industrial restructuring, mainly driven by competition, will reduce the number of companies. Depending on developments elsewhere, this may, or may not be to the disadvantage of the Chinese LSEV manufacturers.

The second scenario offers a more pessimistic forecast. Here the central government deliberately limits the development of LSEVs, preferring instead to favour the development of electric vehicles based on designs that try to recreate the key features of western passenger vehicles. This will hinder the development of LSEV and place Chinese manufacturers in direct competition with European and American car giants.

The final scenario sees the LSEV industry flourishing thanks to appropriate interventions by central government. In this scenario, expansion into international markets and the growing commercialization of LSEVs elsewhere acts as a boost to LSEV production in China. However, while the outlook the Chinese LSEV industry is good it will almost certainly have a negative impact in Europe, America and elsewhere.

These, of course, are only possibilities. Western consumers may come to recognize the value proposition of the LSEV for short distance urban commuting and western manufacturers may begin to develop their own LSEVs, which would pose a significant challenge to the existing producers of LSEVs in China.

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