Electric Bikes are China's Real Electric Vehicle Story

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Along with its booming market for petroleum-fueled autos, China is also a global leader in promoting greater use of electric and alternative fuel vehicles. Automakers are responding to the government's ambitious objective to have 1 million electric cars on Chinese roads by 2015, with BYD now selling its E6 electric sedan to individual buyers (*Bloomberg*).

Yet the real Chinese electric vehicle story is the strong sales of electric bicycles and scooters, with more than 25 million likely to be sold in 2011. An estimated 120-to-140 million of these marvelous little machines currently whiz silently down bike lanes and roads throughout China. To put this number in perspective, Chinese drivers now own roughly 72 million passenger cars, according to *People's Daily*.

Exhibit 1: An electric bike in China shows off its substantial carrying capacity

Source: China Digital Times

Regulatory risks to the growth in e-bike sales are rising as municipalities become increasingly concerned with climbing accident rates and death tolls as fast and silent e-bikes are mixed in with slower traditional bicycles. For instance, Shenyang and Foshan have restricted or banned e-bike use in certain zones of the city, Wuhan and Zhuhai have banned them outright in city limits, and Changsha has restricted the issuance of new licenses for e-bike riders. In addition, the central government issued rules in 2009 capping e-bike speeds at 20 km per hr (12mph) and restricted the weight to no more than 40 kg (88lb) (*Bloomberg*).

However, we believe the fleet will still grow and that two-wheelers will remain China's premier electric vehicle for at least the next 5 years. Administrative restrictions will likely trim e-bike sales growth rates below their potential maximum level, but most Chinese municipalities lack the resources or desire to devote major attention to going after e-bike riders. Indeed, arbitrarily curtailing the use of such a popular mode of transportation on a large scale could spark major

public backlash, which is the last thing Beijing wants as it grapples with inflation and other challenges.

The continuing growth in e-bike sales does not mean Chinese will stop buying cars, but the growing number of e-bikes and how they interact with personal cars and investment in expanded public transit systems has significant implications for how vehicle use patterns will evolve in China in coming years. In turn, these dynamics potentially hold major implications for China's gasoline and crude oil demand moving forward.

Why Urban Chinese like E-bikes

1) **They are highly affordable.**

Chinese car buyers can currently purchase BYD's entry-level F3 sedan for around US$10,000, according to data from *China Autoweb*. BYD's new E6 electric sedan costs closer to US$60,000 before subsidies, according to *Bloomberg*. In contrast, an e-scooter from Hangzhou Hangpai Electric Vehicle Co. can be had for US$700, or about 7% the price of the basic gasoline car and 1.1% the price of the unsubsidized electric car (1.7% the price of the E6 with all subsidies). Electric bicycles are even cheaper. For instance, Damei Strong Bicycle's GT-S Top Class E-bicycle costs as little as US$335, or about 3% the price of the BYD F3 sedan.

2) They are cheap to operate.

E-bikes and scooters cost much less to operate than cars do. A Chinese driver who drives 300 days per year and covers an average of 12.5 miles per day (20km) with an average fuel efficiency of 25 miles per gallon at today's average Chinese retail gasoline price of around US$4 per gallon will pay US$4.16 per day to operate his car. Our estimate accounts for the cost of fuel burned, as well as maintenance, parking, and incidental costs car owners are likely to face over the course of each year they own their vehicle.

Paying around US$4 per day to commute to work and run errands might sound good to drivers in Europe, Japan, or the U.S., where operating a car is much more expensive, but it does not look so good to China's emerging urban middle class, members of whom we estimate can operate an e-bike for roughly 21¢ per day (1/20 the cost of owning and driving a car). Even for the higher tiers of the middle class in urban areas who might own a car, this large cost disparity can make e-bikes highly attractive as second or third vehicles for regular around town use.

3) E-bikes are much more convenient than cars in urban areas.

Anyone who has sat for a half-hour or more amidst the exhaust fumes and irritation of a traffic jam in Beijing, Shanghai, or other Chinese cities and watched e-bikes silently shoot by in the designated bike lanes can appreciate the machines' ability to smoothly and quickly work through congested urban areas. With respect to electric vehicles, electric cars will save gasoline,

but will contribute to road congestion and spend just as much wasted time sitting in traffic jams as their petroleum-fueled cousins.

Certain Chinese cities have begun restricting or even banning e-bike use in some areas because their speed and silence create hazards to pedestrians and other bicyclists, but the two-wheelers continue to have a major advantage over cars in terms of accessibility in crowded urban zones and do so without the noise and smoky exhaust of gasoline-powered scooters and motorbikes.

Convenience of parking and charging

E-bike expert Dr. Christopher Cherry calculates cars typically require 28 square meters of parking space, while an e-bike or e-scooter only needs 2 square meters. Many urban areas in China are short on parking space (please see our detailed research on the subject). While more parking lots are being built, shortages are likely to persist for years as people living in areas built with few parking options continue to purchase vehicles.

Also, unlike electric cars, which typically require specialized docking stations to charge, the e-bikes can be plugged into the wall outlet in an apartment. Plugging into an unmodified wall outlet is considerably cheaper than setting up dedicated charging stations like those required by electric cars (at a cost of US$2,000 plus tax and licensing fees for the Nissan Leaf's at-home charging station). Also, prospective electric vehicle buyers in China face the fundamental problem that most existing Chinese housing complexes do not include integrated parking facilities and even fewer Chinese have access to the personal garages or nearby private parking space upon which the American model of at-home electric vehicle charging is predicated.

Implications of e-bikes for China's oil consumption

In terms of oil demand displacement potential, if the average car user drives 12.5 mi (20km) per day in a BYD F3 class sedan (25 mpg fuel economy), using 1.9 liters of gasoline, the average car would use roughly 4.1 bbl of fuel per year, after accounting for fuel wastage idling in traffic jams (equivalent to 15% of distance driven).

Thus, the more than 10 million e-bikes likely to be added to China's fleet in 2011 could likely effectively replace more than 20 million barrels of gasoline per year (we discount the actual arithmetic number of 40 million barrels to account for the fact that many households, especially in urban areas, may own and use both cars and e-bikes and that people may also use public transport or their personal cars during inclement weather, for example).

Based on Sinopec's 2010 ratio of 1 barrel of gasoline produced for every 5 barrels of crude oil processed, this could translate to more than 100 million barrels per year, or 274,000 bpd of oil supplies. This is equal to roughly 3% of China's total daily oil demand and is nearly 25% larger

than the average of 220,000 bpd of oil that China is likely to import from Kazakhstan in 2011 (*Reuters*).

E-bikes lead demand and environmental risks

E-bikes bring substantial oil conservation benefits, but pose environmental costs in other ways. First, they increase electricity demand in a country where 80% of power comes from coal-fired plants. Second—and more pressing—their batteries use as much lead as a car in many cases. The average e-bike uses 10.3kg of lead per unit, while larger and more powerful e-scooters use 14.7kg of lead per unit on average, according to the Asian Development Bank. As such, China's anticipated production of 33 million e-bikes in 2011 will require 340,000 tonnes of lead, or 8.3% of China's total forecast lead demand for 2011.

Furthermore, because e-bike batteries are charged and discharged more often than car batteries, they must typically be replaced much more frequently (every 1-2 years on average). The high replacement rate is a matter of concern because although Chinese battery recycling rates have risen rapidly and now likely exceed 85%, PRC-based battery recyclers in many cases still use outdated technology and practices and have much higher lead emission rates than comparable facilities in Europe or the U.S.

To put e-bike lead emissions into perspective, consider that a 2009 Asian Development Bank study estimated that an average Chinese e-bike accounts for 520 mg of lead emissions per km of use over its lifetime. In contrast, a U.S. car burning leaded gasoline in the 1970s at a 30 mpg fuel economy emitted only 33 mg of lead per km of use, an amount that nonetheless was deemed unacceptable and helped drive the phase-out of leaded fuels in the U.S.

Here it bears noting that a car burning leaded fuel actually emits lead while driving, whereas the e-bikes do not emit lead while operating, but rather help drive high lead emissions that are concentrated in areas near mines and smelters. Heavy metal pollution in industrial zones across China from Guangdong and Hunan in the South to Huludao in the Northeast garners increasing political attention and smelter shutdowns have resulted.

Likely modes of reducing e-bike lead emissions include closing smaller smelter that use dated technology and promoting the use of batteries that use lithium. Crackdowns on the most polluting smelters will likely continue, while lithium battery use will grow only slowly since lithium batteries are still not cost-competitive with the traditional lead-acid units.

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