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Developments in the market for lead/acid batteries in China

Zeli Wang [1]

University of Science & Technology Beijing, PO Box 621, 30 Xue Yuan Lu, Beijing 100083, People's Republic of China

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Abstract

This paper presents a review of developments in the market for lead/acid batteries in China. The main emphasis is an operation within the industry, i.e., battery production, market development, product design and technology. Discussion is also given on the background and future prospects of trade in the battery industry.

Keywords: Lead/acid batteries; Battery industry; China

1. Background

Since the establishment of the first lead/acid battery factory in China in 1911, the industry has been developing for more than 80 years. A review of the history up to 1990 has been reported previously [1]. With the rapid development of the national economy in China, the battery industry and the battery market have both shown new trends in development since 1990. This is principally because of new government industrial policies and changes in the needs of the markets.

In order to expand the national economy, the Chinese government made a series of new policies to give priority to the development of infrastructures in the country, such as the transportation, communications, and energy-resource industries. These policies have accelerated progress in the automotive, the communication systems and the electronic industries. All these advances have provided a better background for new developments in the lead/acid battery industry.

In view of the fact that 80% of the total battery production is associated with automotive batteries, the expansion of the automotive industry will obviously create new opportunities for the battery industry. Until the end of 1993, the value of the total output of the Chinese automotive industry was more than 90 billion (RMB Yuan). This equates to 35% of the total machinery industry, or 3% of the value of the whole output of industry in China. The number of people involved in the Chinese automotive industry has now reached 1.90 million. The total number of enterprises in the industry is about 2500, of which there are 125 vehicle manufacturers, more than 600 re-equipping vehicle manufacturers, and more than 80 motorcycle manufacturers. These enterprises are able to produce more than 1.5 million vehicles and 2.0 million motorcycles each year [2].

New statistics for the Chinese automotive industry during the past four years (taken from the China Automotive Industry Yearbook) are given in Tables 1–3. These data show the main message about new developments in the Chinese battery industry. For example, the statistics show that the automotive industry has developed very rapidly in the past five years. That is, from a total vehicle population in 1990 of 5.5 million, to a level of 8.5 million at the end of 1993. In the latter, these are 2.5 million passenger cars, while the motor cycle population has now reached 8.5 million.

These large increases are due mostly to the efforts made by the government. As one part of the machinery industry in China, the automotive industry is managed, together with the China National Automotive Industry Corporation, by the Automotive Bureau in the Ministry of Machinery Industry. The organizations have paid great attention to the development of the automotive industry in China. As an important part of these efforts, the Beijing International Automotive Industry Exhibition has been held every two years since 1990. The latest event took place in June 1994 at the Beijing Exhibition Centre. More than 400 overseas companies from 23 countries, together with 700 domestic companies, attended the exhibition and displayed their new vehicle and related products.

[1] Fax: 0086-1-2017283.

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Table 1
Output of automotive industry

Year	Vehicle output × 1000						
	Total	Truck	Cross-country (Jeeps)	Coach	Car	Chassis	Motorcycles (total)
1980	222.3	135.5	28.0(20.4)		5.4	48.3	49.2
1985	443.4	236.9	25.2(20.7)	11.9	5.2	114.1	1045.1
1990	509.2	269.1	44.7(44.3)	23.2	42.4	90.6	965.8
1991	708.9	361.3	54.0(53.4)	42.8	81.1	122.9	1317.3
1992	1061.7	460.3	63.4(61.8)	84.6	162.7	199.2	1982.2
1993	> 1300.0				> 200.0		> 2000.0

Table 2
Imported vehicles

Year	Vehicle numbers × 1000			
	Total (total parts)	Trucks	Cars	Motorcycles import/export
1980	51.1	26.1	19.6	6.3
1984	88.8	28.1	21.7	107.3
1985	354.0	111.5	105.8	286.1/8.5
1986	150.1	64.6	48.3	159.4/8.7
1990	65.4(24.2)	18.4(3.0)	34.1(18.1)	11.6/43.4
1991	98.5(56.5)	18.6(4.6)	54.0(40.0)	2.3/51.3
1992	209.8(127.1)	41.5(7.2)	27.5(88.1)	7.0/72.6
1993	309.7	64.7(7.9)	69.7(111.5)	240.5/

Table 3
Vehicle population

Year	Vehicle numbers × 1000				
	(1–3) Total	(1) Truck	(2) Coach & car	(3) Special vehicle	(Total) Motorcycle
1984	2604.1	1883.6	562.8	157.7	598.9
1985	3026.3	2231.8	794.5		946.0
1986	3619.6	2465.7	966.2	187.7	1483.2
1987	4080.7	2812.1	1114.6	154.0	2477.6
1988	4645.9	3178.5	1305.8	161.6	3023.9
1989	5113.2	3463.7	1464.3	185.2	3593.3
1990	5513.6	3684.8	1621.9	206.9	4212.8
1991	5931.7 (6061.2)[a]	3866.7	1852.4	212.6	5051.5
1992	6781.5 (6917.4)[a]	4278.6	2261.6	241.3	6474.9
1993	> 8500.0		> 2500.0		> 8500.0

[a] With other vehicles.

The government has also supported strongly international cooperation programmes between the main vehicle manufacturers in China and the major western automotive companies. In the ten years up to the end of 1993, China has completed 7 truck projects, 9 car projects, 5 coach projects and 4 mining dump-truck projects. An overall plan for vehicle manufacturing in China through to the 21st centry has been constructed. The main difference between future and past automotive projects will be to elevate the performance of these vehicle manufacturers, rather than to build new companies. The Chinese government will no longer consider new vehical manufacturing programmes, but will only support the technical improvement related to existing manufacturers.

Therefore, in order to fit the needs of future markets, the 1990 national plan for the automotive industry during the next decade in China has been modified. The original plan made in 1990 for the year 2000 was:

- Vehicle population 13.66 million
- Passenger car population 3.36 million
- Annual vehicle output 2.00 million
- Annual passenger car output 0.70–0.80 million

The actual output of vehicles in 1993 was more than 1.3 million. This is more than the planned output in 1995 of 1.2 million. Therefore, at the beginning of 1993, the authorities of the Chinese automotive industry put forward a new plan for the period 1995–2005:

- Vehicle population in 1995 10.90 million
- Annual vehicle output 1995 1.50 million
- Passenger car output 1995 0.40 million
- Vehicle population in 2000 20.00 million
- Annual vehicle output 2000 2.50 million
- Passenger car output 2000 1.50 million
- Vehicle population in 2005 28.60 million
- Annual vehicle output 2005 3.00 million
- Passenger car output 2005 2.00 million

The rapid development of the automotive industry will provide good opportunities for the potential market for automotive and motorcycle batteries, while the computer and electric equipment industry, and telecommunications operations will bring increasing markets for both sealed and stationary batteries.

2. Industry scope and marketing investigation

At the beginning of the 1990s, there were more than 500 manufacturers or workshops (from national-owned

Table 4
The lead/acid battery industry in China

	1990	1991	1992	1993
Total employees	34500	35500	35500	37000
Lead consumed (ton/yr)	128000	121000	155000	166000
Output values ($\times 10^6$) (RMB Yuan)	1.71	1.72	2.20	2.57
Total profit ($\times 10^6$) (RMB Yuan)	0.15	0.15	0.17	0.17
Total sales ($\times 10^6$) (RMB Yuan)	1.33	1.44	1.74	2.20
Export (% of total kWh)	9.9	8.6	17.0	16.3

Table 5
Production of different batteries

Type of batteries	In kWh $\times 10^6$			
	1990	1991	1992	1993
Automotive	5.00	5.00	6.16	7.32
Traction	0.33	0.34	0.38	0.33
Stationary	0.24	0.22	0.27	0.30
Railway	0.13	0.11	0.10	0.10
Motorcycle	0.03	0.03	0.02	0.07
Military	0.18	0.30	0.26	0.20
Sealed		0.05	0.10 [a]	0.14 [a]
Others	0.10	0.05	0.03	0.02
Total	6.01	6.10	7.32	8.48

[a] Including the sealed batteries made by other suppliers.

large companies with more than 2000 employees, to smaller town and township enterprises) who were involved in the production of lead/acid batteries in China. Total employment was more than 50000, and total battery output reached 8 million kWh. About 80% of the whole production was made by about 100 top battery manufacturers, while 75% of the whole production came from about 60 companies out of these manufacturers. Therefore, the following statistics of the 60 top battery manufacturers in the past few years between 1990 and 1993 will be very helpful in understanding and evaluating the lead/acid battery industry in China [1,3,4]. The data are given in Tables 4 and 5.

The analysis shows that production among the top 60 battery manufacturers has increased to about 8.5 million kWh in 1993 from 6.0 million kWh in 1990. This means that the total annual production of the lead battery industry in China has been 11×10^6 kWh in 1993 after 8×10^6 kWh in 1990.

2.1. Automotive batteries

The data show that the total production of automotive batteries in China in 1993 was 80% of the total battery production of 11 million kWh. It is known that the average size of an automotive battery in China today is estimated to be 12 V, 65 Ah. This means that the number of automotive batteries made in China in 1993 was 11.2 million.

If around 10% of the batteries are exported each year according to the statistics in Table 4, then there are 10 million units of automotive batteries for the domestic market. This is more than sufficient to meet the domestic needs of the 8.5 million vehicles.

If the total vehicle population increases to 20 million in 2000, it is possible that the domestic need for automotive batteries will double. If new batteries in plastic containers become the most popular, then the average life of automotive batteries in China will be 2–3 years rather than the 1–1.5 years for the present hard-rubber types. Thus, the domestic need will be 15 million units.

Battery suppliers should also notice the strong competition in this market for the following reasons.

(i) 80% of the total batteries are automotive batteries, 75% of these automotive batteries are made by the 60 top battery manufacturers. Moreover, 80% of the total automotive batteries from the top 60 companies are made in 25 key battery manufacturers whose annual production capacity is more than 50000 units.

(ii) These key local companies usually have been equipped with advanced equipment from western suppliers. They enjoy good markets in China and are able to increase easily both the quality and quantity of their products.

Therefore, there will be a good market and strong competition for automotive batteries in the next several years in China.

2.2. Stationary batteries

With the modernization of China, the telecommunications industry is developing very fast. According to the plan made by the National Ministry of Post and Telecommunications of China, the rates of telephone usage in China will be increased to new levels during the next 10 years [5], see Table 6.

This means that the market for stationary batteries is expanding and the modern equipment in telecommunication systems is providing a new period of opportunity for advanced stationary batteries.

Between the years 1990 and 1994, the annual output of stationary batteries has increased from the 0.2–0.3

Table 6
Prospects for the telecommunications industry in China

Year	Ownership rate (%)		Telephone population (million)(total)	Telephone installation (million)(set/year)
	Rural area	City		
1995	2.5	20	48	3.55
2000	5.0	30–40	100	5.20

million, as shown in Table 5. The annual increasing rate of stationary batteries has been about 25% of the total output. In view of this golden opportunity for the telecommunications industry, the battery manufacturers in China are paying a great deal of attention to the potential market. They are prepared to produce more new stationary-battery products. Nowadays, not only the 10 traditional stationary-battery manufacturers, but also the recently developed sealed battery suppliers have joined the market for stationary batteries for the telecommunications industry.

There is no doubt that advanced stationary batteries, especially valve-regulated lead/acid (VRLA) designs with high quality, will have a good potential market in China. Due to certain policies and technical reasons, VRLA batteries have not been widely used in China telecommunications systems, though several battery manufacturers have claimed that their new products have been tested and approved.

2.3. *Valve-regulated lead/acid batteries*

VRLA batteries are made not only by the top battery manufacturers in China, but also by some recently developed companies. The new suppliers are usually more competitive because of the advanced management systems at these new companies. The VRLA batteries made by these new suppliers could cover 70% of the total domestic production. Therefore, the production of VRLA batteries in China is not dominated by the top traditional battery manufacturers. On the other hand, many such batteries are imported from overseas as part of UPS or other electrical appliances.

It can be seen, therefore, that the market for VRLA batteries is quite different from that for automotive batteries. Although the output of VRLA batteries from the top battery manufacturers shows little increase, both the production and market are still expanding. This conclusion is supported by the rapid development of computer markets. The following data show that the annual sales of personal computers have increased rapidly in China over the last 4 years [6].

(i) The total annual sales of personal computers in mainland China was 80000–120000 sets in 1990, 250000–300000 in 1992, and 400000–450000 in 1993. Sales are expected to be more than 600000 in 1994, and 1 million by 2000.

(ii) Though the total number of personal computers in China is only about 1 million, and is a small part of the total number in the present world, the market in China will be greatly expanded in the next few years as the result of private purchases.

Of course, most personal computers in offices are powered by electricity from the public supply. Nevertheless, there is a need for battery UPS systems and portable computers that run off batteries are expected to become popular. The batteries will probably be a mixture of nickel/cadmium and VRLA batteries.

3. Technical situation and future development

The following discussion covers three specific topics related to battery manufacturing, namely, equipment, lead and its alloys, and separators – rather than general aspects of technical specifications and manufacturing technology of batteries.

3.1. *Equipment*

The equipment and manufacturing technology used by the Chinese battery industry before the beginning of the 1990s was out of date. After ten years of importing equipment and technical know-how, however, battery manufacturing equipment has been considerably modernized.

By the end of 1993, more than 60 key battery manufacturers had imported different equipment from overseas suppliers. The total imported equipment had reached about 800 sets and covered more than 10% of total equipment installed in these key battery manufacturers.

At the same time, the Chinese battery-manufacturing equipment suppliers also developed their own machinery for the local battery industry. According to investigations made by the author, three suppliers are able to provide a full range of battery-manufacturing equipment at relatively competitive quality/price rates. There are also several other suppliers who could provide certain kinds of manufacturing and testing equipment.

In order to create a larger market in China, these equipment suppliers are now interested in cooperation with overseas companies to develop modern equipment for the battery industry in China.

3.2. *Lead and its alloys*

There are rich resources of natural lead in China. At the beginning of the 1990s, the main battery manufacturers were usually provided with primary lead by lead producers in the metallurgical industry. The total annual production of primary lead in China is usually more than 300000 tons. And 50% of this total product

is made by three key suppliers whose individual annual production capabilities are over 50000 tons. It is clear that China produces more than sufficient lead for its own use. No imports are necessary and there is a potential for export to world markets.

There are also small secondary lead-smelting plants in China. Due to the difficulties in dealing with pollution problems, however, no large secondary-lead suppliers or lead battery re-cycling plants were set up until the end of the 1980s. With the development of 'Pollution-free Secondary Lead Technology' in China, secondary lead plants were established after 1990. To date, the largest secondary lead supplier has been able to provide 60000 tons of lead and alloys each year, and is planning to expand and become a modern and comprehensive lead company in the next five years. It could be expected that secondary lead and scrap lead-battery recycling plants will be more and more important in the lead supply industry.

The suppliers or battery manufacturers are able to produce different lead alloys, such as the lead–calcium series, the lead–antimony series, etc. The alloys and melting techniques developed in China are able to meet the needs of advanced battery grids.

3.3. Separators

Leaf-rubber separators were the main choice for lead/acid batteries in China before the 1980s. Thereafter, Chinese separator producers imported and developed the production lines for polyvinylchloride(PVC) separators. Therefore, PVC separators were popular by 1990 and together with the rubber separators, became one of two main kinds of battery separator in China. At the same time, when the PVC type was developed, the separator producers also started to develop new kinds of separator, such as micro-glass mat, cellulose, composite and polypropylene (PP) fibre separators.

As the result of research and development after 1990, the domestic separator products in China are able to satisfy the needs of battery manufacturers. The following situation is in existence:

(i) 6 companies are involved in PVC leaf-separator production,

(ii) 3 companies are the suppliers of PP leaf and envelope separators,

(iii) 1 company has been provided with the technology of cellulose and composite separators, and is prepared to make these products,

(iv) 6 companies and 1 institute are able to mass-produce different absorptive separators,

(v) many other separator producers and separator subsidiaries of battery manufacturers can provide rubber separators.

Despite these developments, polyethylene (PE) separator material and PE envelope products have not been successfully developed and marketed in the Chinese battery industry, although PE separators are very popular in the world. In view of this fact, the main and key separator producers and battery manufacturers are very interested in developing and marketing PE separators in China, and have asked the author to convey this message to overseas producers of PE separators.

4. International cooperation and business possibilities

4.1. Business possibilities

In recent years, the Asia–Pacific region has played an important role in the development of the world economy. The economy and market in China is more and more active on the stage of international trade and related business.

During the first ten years of China opening to the outside world in the 1980s, the main way of international cooperation between the Chinese battery industry and western companies was to import advanced technology and equipment in order to modernize the industry. Therefore, by the beginning of the 1990s, the Chinese government had provided a great deal of finance to support key battery manufacturers for their import activities.

With the shift from a central economy to a marketing economy in China, the government has made a series of policies to encourage the enterprises to operate in business by themselves, and to encourage overseas investments in China. Facing the new social background, the battery manufacturers started to consider how to generate profits when importing technology and equipment. On the other hand, in view of the preferential treatment and benefits given to overseas investors, Chinese battery manufacturers are increasingly interested in developing new products and markets with foreign partners, rather than just in the purchase of the equipment. Thus, the newly developed joint-ventures in the battery industry have been both competitive and aggressive in China.

In the last year, the author has received more than 100 letters from companies in the China battery industry, and has discussed business possibilities with many people from Chinese companies or western companies. According to the wide-ranging questions asked by the author about business possibilities, it is clear that companies abroad could be sure to get much more business if they are sufficiently flexible to consider new possibilities, such as joint-ventures, licence transfer, or investing in China. Up to now, however, the most well-known battery companies in the world have not entered the market in China.

4.2. International cooperation

The rapid development of the battery industry and markets in China has brought good opportunities for international cooperation and technical exchange. The activities organized by the China Industry Association of Power Sources and the China Storage Battery Association, as well as the successful cooperation between *Batteries International* of UK and the University of Sciences & Technology Beijing of China have all made a great contribution towards furthering the understanding between the battery industry of China and the outside world.

As is well known, the magazine *Batteries International* has been successfully distributed in China since 1993. As the guest editor of *Batteries International* and the editor of the Chinese edition of the magazine, the author is very happy to report that the latter publication has introduced more than 40 western companies to a wide range of customers in the China battery industry, and many companies have built good business relationships with Chinese counterparts during the past two years. Using a database of the China battery industry built by the author and regular communication between more than 400 companies and the author, it is hoped that more and more opportunities will be provided for the technical cooperation, exchange and trade between organizations in China and abroad.

After the successful activity of the International Power Sources Symposium/Trade Show 1992 in Tianjin of China, the national organization of the China battery industry (the China Industry Association of Power Sources) has joined with the International Battery Material Association of Japan and *Batteries International* of UK to organize the second International conference and exhibition, China International Battery Fair '95 in Beijing, June 6–9, 1995.

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