

## THE LEAD/ACID STORAGE BATTERY INDUSTRY IN TURKEY

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### Introduction

The purpose of this paper is to present an up-to-date statement on the lead/acid battery industry in Turkey at a general level. Industrial development in this country dates back to the early years of the Turkish Republic. During this early period, many state-owned enterprises were established. In the years immediately following World War II and after the decade 1954 - 1965, progress proceeded at a rapid pace with the introduction of new institutions and with the encouragement of private investment. This period witnessed the creation of the solid foundations of motor-vehicle production and related industries such as storage batteries. The first lead/acid battery manufacturing plant was opened in 1955 and was followed by a number of small-scale factories.

### Motor vehicle market

As a general rule, battery activities in a country are closely related to the motor vehicle market. In this respect, it should be mentioned that in Turkey, at present, there are more than twenty motor vehicle manufacturing companies (including small-scale operations) and most of these are associated with well-known international manufacturers. There are also many motorcycle manufacturing plants. The actual production figures of the motor vehicle industry have remained below capacity for many years due to economic restrictions. The number of imported vehicles is very small compared with local production (see Table 1). The number of registered vehicles has risen from nearly 0.5 million in 1970 to 3.5 million at present (including two-wheelers that number ~0.5 million). Considering the population, and excluding two-wheelers, the vehicle park is equivalent to one car per fifteen persons. This figure is expected to improve markedly in the near future.

### Other battery users

In addition to the automotive field, increasing numbers of lead/acid batteries are being consumed by other sectors as a result of the nation's

TABLE 1

Vehicle production and imports in Turkey

Year	Local production	Imported vehicles	Total
1983	120 000	4 200	124 200
1984	140 000	15 000	155 000
1985	136 000	16 000	152 000
1986	142 000	9 000	151 000
1987	175 000	5 500	181 500
1988	200 000	6 000	206 000

economic growth. Applications include: telecommunications, computers, energy-related industries, mechanical handling trucks and systems, stand-by power for emergency purposes, miners' cap lamps, mine locomotives, tractors, railways, submarines, and marine duty. Nearly all the demands for batteries have been met by local production. The only exception was in 1980 when some companies imported batteries from Europe. This has not happened since owing to the disappointing commercial results: it took a long time to sell these imported batteries in the face of the much lower prices of locally manufactured products.

### Battery market

As in other countries, the battery market in Turkey is completely dominated by the economic climate, motor vehicle population, and development and investment projects. The present vehicle park is low compared with the population of the country.

Although a rapid increase in vehicle population has taken place in the past few years, it is far from saturation level. Therefore, significant growth may be expected in the future. Extensive road construction programmes are in progress and an, at least, 8-9% yearly increase in motor vehicle population is expected in future years. This, of course, implies an equivalent rapid increase in battery demand. On the other hand, the average battery life is becoming longer and this will reduce the number of replacement batteries to some extent. Furthermore, the cost of owning a new car is increasing at a very high rate and this, too, will slow battery sales. According to field studies and laboratory life tests, the average life of locally manufactured batteries is more than 36 months. In practice, battery life is entirely dependent upon unfavourable working conditions and users not following the manufacturers' instructions. For those reasons, the guarantee given by suppliers is only 12 months for automotive batteries. By contrast, the guarantee is generally 36 months for traction and stationary batteries, but in the cases of power stations or substations it may reach as much as 60 months in specific

TABLE 2

Prediction of battery market in Turkey

Year	Automotive batteries	Industrial cells
1989	1 720 000	120 000
1990	1 824 000	125 000
1991	1 930 000	132 000
1992	2 100 000	137 800
1993	2 340 000	148 000

contracts. Studies by the authors resulted in the following predictions for battery life under real working conditions:

- cars: 30 months
- trucks and buses: 24 months
- taxis: 18 months

In general, trucks and buses use two batteries per vehicle.

Based on the above factors, a battery market forecast is given in Table 2 for a period of five years (note, motor-cycle batteries are excluded). It should be mentioned that due to the lack of accurate statistical information, the data should be taken as indicative only.

An estimate of the demand for all types of stationary and traction batteries is also given in Table 2 in terms of cell numbers. Of course, the capacities and other cell characteristics differ in the various applications.

### General profile of the battery industry

The Turkish storage battery industry is now almost 35 years old. As with other industries, the battery sector has developed under Government protectionist policies. Imports of batteries have been restricted for many years but now the market has been opened up through the implementation of reasonable tariff-protection policies. Nevertheless, battery manufacturers enjoy a protected market. In the 1960s, there were only six battery manufacturers in the country, now the number is more than 300. Most of these companies are small-scale or medium-sized units. The yearly production varies between 5000 and 15 000 batteries. Many companies operate on an assembly or rebuilding basis and obtain containers, grids, plates, oxides, separators, connectors, etc., from other manufacturers. They have semi-automatic equipment with testing facilities in their workshops. In medium-sized plants, most of the battery parts are manufactured 'in-house' while some are supplied by component suppliers. There are few large-scale battery manufacturers (6 - 7) that have facilities for manufacturing all the required parts in their plants in addition to battery assembly lines and test departments. At present, the total production capacity of the sector is about 3 500 000 batter-

TABLE 3  
Growth in lead/acid battery industry in Turkey

Year	Capacity for battery production	Battery production
1984	2 250 000	1 100 000
1985	2 500 000	1 200 000
1986	3 000 000	1 350 000
1987	3 250 000	1 400 000
1988	3 500 000	1 600 000

ies per year according to approved capacity reports. Table 3 shows the growth in total battery production from 1984 to 1988.

Small- and medium-sized enterprises represents ~50% of the labour force for the whole sector. Their market share is about 35% in recent years and is improving year by year. As a result, the Turkish battery market is extremely competitive and overbranded. Wholesale prices are low compared with international markets. Compared with European battery plants, the installed capacities of Turkish companies, even including large-scale organisations, are too low. This situation has resulted in the Turkish battery market creating its own local production of battery manufacturing machinery and equipment. Indeed, nearly all the machines required for manufacturing automotive lead/acid batteries are made locally, including quality-test facilities. Of course, such equipment is neither fully automatic nor of a high-technology standard. Nevertheless, such machinery is very attractive to small plants from the low investment point of view. For example, an oxide-production plant (mill type) with a capacity of 6 t/day can be purchased for about \$50 000 (including installations) while hand-mixing, casting and pasting machines cost between \$5000 and \$8000.

Most of the raw materials required for battery manufacture are supplied from local sources. Secondary lead production commenced many years ago and there are now five medium-sized plants in operation. In general, the latter use locally made rotary furnaces to smelt battery scrap and supply antimonial lead for grid production. Lead of 99.97% purity is imported. There are some separator manufacturing plants in the country, but they are too few to meet current demand.

Under the Government's investment policy, all industries are open to foreign participation, but no foreign investment or joint-venture project has taken place in the battery manufacturing sector. In the 1960s, only one company was interested in a licence-agreement with a foreign company. This continued for some years but is no longer valid. At present, the industry is completely self-supporting and no foreign collaboration, know-how, or licence agreements exist.

The manufacturing system is conventional and covers all battery types, *i.e.*, maintenance-free and low-maintenance batteries are manufactured in addition to standard types using ebonite or poly(propylene) containers. Through-the-wall intercell connections are used. Over 70% of the automotive batteries have poly(propylene) containers. In general, PVC separators are preferred by most manufacturers. Grids are produced by manual gravity-casting machines and the alloy contains 3 - 7 wt.% antimony. Some manufacturers have moved towards lower antimony contents. Without exception, ball-mill oxide is used for the active material.

The market has always been in an over-capacity situation and, as a result, capacity utilization is very poor. This is to be expected in an annual market of three million batteries supplied by more than 300 producers; this results in a highly competitive business. The excess capacity has been opened for export. In 1985, more than 300 000 batteries were exported and subsequently this figure rose to nearly 400 000 batteries per annum.

Stationary and traction batteries are produced by only three companies. Darak 5000, microporous PVC and other advanced types of separator are used in these types. Tubular batteries are becoming increasingly popular.

### **Manufacturing standards**

Turkish storage batteries are manufactured in accordance with the following standards suggested by the Turkish Standards Institution.

- Lead-Acid Starter Batteries Standard Reference: TS 1353
- Lead-Acid Stationary Batteries Standard Reference: TS 1352
- Lead-Acid Traction Batteries Standard Reference: TS 1354

The overall dimensions are in compliance with DIN specifications.

### **Turkey and the EEC**

Turkey formed an association agreement with the EEC in 1962; this was for twenty years and therefore terminated in 1983. In 1988, an application for full membership was lodged and is now under negotiation. This will be an important economic step for the country and is viewed with mixed feelings by the battery industry, and by other industrial sectors. It is believed, however, that the battery industry will rapidly make the necessary adjustments to meet the regulations and routines of the EEC and thereby benefit by the opportunities of this integration.

### **Conclusions**

Since 1955, the Turkish battery industry has grown in a competitive market. As a result of the rapid economic development of the country, the

demand for batteries is growing at a steady pace. The industry is entirely self-supporting, does not collaborate with any foreign company, and has no licence agreements. There is no restriction, however, on foreign investment for battery production. On the contrary, such projects are encouraged by Government. Nevertheless, exports have been at a low level. Promotional efforts to improve exports are one of the main targets of the present policy.