

THE LEAD/ACID APPLIANCE BATTERY — A POPULAR POWER SOURCE REMOTE FROM THE GRID

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Introduction

While the automotive industry provides the largest market for lead/acid batteries, there are other significant markets. One of these, which is rarely recognised in its own right, is the appliance market. This market is primarily located in developing countries, especially those where mains electricity is not readily available and private income is low. The batteries are of an automotive or motorcycle type and are generally used to power television or radio sets.

The appliance market has been examined in some depth in Indonesia where it consumes a large quantity of batteries. The application is interesting because it demonstrates the versatility of lead/acid batteries and their usefulness in regions without access to cheap and reliable mains power.

Factors in the appliance market

Electricity distribution

Lack of mains power is the principal factor determining the demand for batteries in these non-automotive applications. In many developing countries, the widespread provision of mains power is not possible in the short term because of the enormous infrastructure costs involved, especially in relation to small outlying communities. For Indonesia, with a population of close to 160 million, geography plays an important role as it is impossible to supply mains power to the 6000 inhabited islands which make up the country. Most of the larger cities and approximately 12% of the country's 68 000 villages are electrified. The government has allocated as much as 10% of its development expenditure to electrification activity and plans to double the number of electrified villages by 1990.

While mains power is available in the cities and some villages, many residents are not connected. This is reflected by Indonesia's low *per capita* power consumption (in 1981, less than 100 kW h). In villages, mains power may only be supplied to the houses of village leaders and the more prosperous of the businesses. The principal barrier to the use of mains power is the connection and consumption costs which are high in relation to the

general income level. Thus, for many, the distribution of electricity in packages (*i.e.*, batteries) rather than along wires, is a more viable option.

Income

Average *per capita* income in Indonesia is estimated at US\$ 700 - 900 p.a. However, the figure for the majority of Indonesians is likely to be significantly less. In rural areas, the average *per capita* income available for expenditure on non-food items may be as low as US\$ 100. New settlers in rural transmigration areas are known to be close to subsistence levels. Thus, while mains power may be available, many people are obviously unable to afford the connection costs of several hundred US dollars and therefore opt to use battery power.

Appliances

Appliance manufacturers have recognised the marketplace reality of a lead/acid battery d.c. power source for their products in Indonesia. Radios and cassette players are manufactured with provision for a variety of power sources, *e.g.*, (a) internal d.c. power — dry cells, (b) external a.c. power — mains supply, (c) external d.c. power — lead/acid battery.

Appliances with greater power requirements (*e.g.*, television) are similarly adapted for the market with provision for either external a.c. mains or external d.c. lead/acid battery power sources. Television sets also often incorporate an integral battery voltage indicator. At least one company, the Sharp Corporation, offers a complete package consisting of a panel of solar cells, a lead/acid battery, and a colour television set.

Televisions, radios and radio/cassette players are commonly powered by lead/acid batteries. These appliances are likely to be used more often and have a longer life than their counterparts in developed countries because of the thriving used-appliance market. This market also enables consumers with low disposable incomes to obtain appliances that they could not afford when new. In remote areas, villages may have one battery-powered television set in the chief's house or central meeting place. Solar cells are often used for battery recharging.

Another lead/acid battery powered appliance increasing in popularity is the emergency fluorescent light. Many are actually sold as primary lighting systems for households not connected to the electricity grid.

Batteries

Indonesia produces a very large number of lead/acid batteries (estimated at 6.5 million units in 1983) in relation to the size of the local car and motorcycle markets. Two factors, short battery life and a large appliance battery market, account for this major discrepancy.

In 1983, the appliance market was estimated to have used 3 million lead/acid batteries (and 600 million dry cells). Television sets and home lighting required 1.4 million automotive batteries, while radio/cassette and home lighting accounted for the remaining 1.6 million motorcycle batteries.

There is a huge variation in battery quality in Indonesia with the medium-to-large manufacturers producing batteries of an international standard and selling primarily to the automotive industry. The small and cottage industry manufacturers often use reclaimed negative plates and separators, and even lead obtained from rudimentary smelting operations, which sell both 'soft lead' and 'antimonial lead' of uncertain grade. These batteries are often of poor quality and are generally sold into the appliance market where their low price is an important selling criterion. The market appears to be very brand conscious, but not particularly discerning, and there is considerable pirating of major brand names.

Despite these problems, the market still thrives and many people choose to use lead/acid batteries instead of primary cells for radios and cassette players. Indeed, some motorcycle batteries are specifically modified for this usage by the addition of as many as three extra terminals so that a variety of voltages can be accessed. These batteries are specifically labelled 'Special for Tape Recorder - All Transistor Radio' and often carry pirated brand names of popular radio/cassette players.

Battery recharging

Recharging of appliance batteries is generally performed by small specialist shops in market areas. These shops obtain their power from the electricity mains or from small diesel or petrol generator sets. The charging operation is often conducted in the most rudimentary fashion with many batteries (up to 20) of widely differing capacities connected in series. Television batteries are sometimes recharged by use in motor vehicles, while solar cells are employed in some remote areas.

Entertainment

The growth in appliance usage has been stimulated by the availability of all-night radio programs (both local and overseas), the use of satellites to transmit television programs to outlying areas, and the ready availability of inexpensive (often pirated) music cassettes.

Enterprising economy

The enterprising nature of the Indonesian economy has helped the development of the appliance market in that it has assisted the availability of new and used batteries and appliances, as well as the provision of charging facilities. The situation has been further helped by the introduction of modified batteries and the adaptation of appliances to accept external d.c. power.

Other applications

While appliances constitute the major part of the market, the synergy of an adaptable product, market need and enterprise, results in many other

uses of batteries not normally considered by battery companies. These applications include batteries for the lights of food gatherers and batteries used by fishermen in shallow water to stun fish by electrical discharge.

Conclusions

Television and radio have long been regarded as necessities in developed countries, and this is becoming the trend elsewhere. Despite low incomes and poor access to reticulated electricity, most people in developing countries place a high priority on the use of these goods and are turning to batteries to solve their power-supply requirements. Because of its advantages over primary cells, the lead/acid battery is being increasingly used to fill this need. The market for appliance batteries has the potential to grow significantly if given some encouragement.