

PRIMARY LITHIUM BATTERIES IN EUROPE — AN INDUSTRIAL AND COMMERCIAL FACT

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Many events have recently occurred on the lithium battery scene and are still occurring today. The lithium battery industry is very active and progressively shaping up: companies have built new production facilities (Fig. 1), newcomers are joining the competition, and licencing agreements and acquisitions have been announced (Fig. 2). New products, with increasingly improved performances, are launched on the market place which continually unveils new applications.

Under these circumstances, one must agree that to evaluate the lithium battery market today and to forecast its growth is a necessary but very perilous task.

In 1983, the lithium battery market* could be evaluated according to Table 1.

In the U.S., military OEM and procurement, pacemaker manufacturers, and more recently industrial electronic manufacturers, have been the driving forces in developing the market. In Japan, the consumer electronic industry, such as watches, hand calculators, and toys, was the first user of lithium batteries, which explains the rapid build-up of production facilities to meet the volume requirement and the relatively low dollar figure for the market.

In Europe, the situation is less clear and it is more difficult to define the driving forces which have shaped the market as it is today and which might be different from one country to another.

In 1983, three countries, United Kingdom, Federal Republic of Germany, and France, accounted for more than 50% of the European market and the F.R.G. itself for almost 25%. In addition to these three countries, Scandinavia is a very active and promising market which may attract more and more attention.

Memory back up is the leading application, with almost 30% of the market. This application has developed primarily around the telephone industry in France, the U.K. and the F.R.G., and it is now spreading over various types of equipment such as: T.V. sets, Hifi tuners, video tape recorders, and calculators.

*Excluding Research and Development funding and reserve and prismatic cells.

HELLESENS		Li-SOCl ₂ PRISMATIC AND CYLINDRICAL CELLS
RENATA		Li-MnO ₂ BUTTON CELL
SAFT		Li-MnO ₂ BUTTON CELL Li-CuO CYLINDRICAL CELL Li-SOCl ₂ CYLINDRICAL CELL
SILBERKRAFT		Li-SO ₂ CYLINDRICAL CELL
SONNENSCHN		Li-SOCl ₂ CYLINDRICAL CELL
TADIRAN		Li-SOCl ₂ CYLINDRICAL CELL
VENTURE TECHNOLOGY		Li-MnO ₂ BUTTON AND CELLS Li-FeS ₂ CYLINDRICAL

Fig. 1. European production facilities.

DONOR	ACCEPTOR	CHEMISTRY
SANYO	GENERAL ELECTRIC DURACELL RENATA	Li-MnO ₂
SAFT	FUJI	Li-MnO ₂
MATSUCHITA	ELECTRIC STORAGE BATTERY EABLE PITCHER	Li-CF _x
POWER CONVERSION INC	SILBERKRAFT CROMPTON PARKINSON	Li-SO ₂
CATALYST RESEARCH CORP.	WILSON GREATBATCH METRONIC	Li-I ₂

Fig. 2. Licensing agreement for technology transfer (non exhaustive).

TABLE 1

	Millions \$	%
U.S.	100	66
Japan + Far East	25	17
Europe	25	17
Total	150	100

This market segment is expected to grow in the next five years at a rate of 20% per year, and the solid cathode system, *e.g.*, lithium-manganese dioxide, should become the dominant chemistry in progressively replacing the lithium-liquid cathode system, mainly LiSOCl_2 , which today accounts for half of the volume of sales.

The lithium battery for pacemakers still represents, in 1983, 20% of the European market, and it is expected to grow at a moderate 5% per year.

APPLICATION	1983		1988		● expected growth rate ● product trend
	M\$	%	M\$	%	
Memory back up	7.5	30	19	30	20% Solid cathode such as Li-MnO_2 will dominate
Medical implantable	5.0	20	6.5	10	5% Li-I_2 for pacemaker. Solid cathode or Li-SOCl_2 for new application such as pumps
Military	4.0	16	15	23	30% Emergence of spiral wound Li-SOCl_2
Other non consumer - heatcounter - oil logging - paging device - ...	8.0	24	10.5	16	15%
Consumer	2.5	10	14	21	41% Li-MnO_2 or Li-CF_x button and cylindrical
TOTAL	25	100	65	100	20%

Fig. 3. European market 1983 - 1988 by application.

The leading chemistry is the lithium-iodine system, but the development of new medical implantable devices, *e.g.*, drug pumps, will certainly favor the introduction of new more powerful systems, *e.g.*, LiSOCl_2 .

Military applications occupy only the third place in 1983, with 15% of the market. Military procurements are very low as compared with, for instance, the U.S., and are concentrated in Northern Europe. Military OEM are developing many new applications powered by lithium batteries, *e.g.*, sonobuoys, night vision equipment, proximity fuses, radiocommunication, mines, etc. This market segment might present the highest growth rate in the near future; 30% is a commonly accepted figure. Low temperature and power requirements should enhance the emergence of spiral wound LiSOCl_2 cells.

Besides these three main applications, the remaining 35% of the market is highly diversified and covered by applications such as heatcounters, oil data logging, paging devices, and anti thief tags. Figure 3 summarizes the European market according to applications and trends.

The future of lithium batteries, as foreseen today, is largely dependent on the development of two main applications — memory preservation and

military equipment — and on the success of related industries in world competition. However, a 20% per year compound growth is expected which will attract more and more competitors (Fig. 4).

	Li-MnO ₂	Li-CF _x	Li-SO ₂	Li-SOCl ₂	Li-I ₂	Li-CuO	Li-FeS ₂
ALTUS				■	■		
CATALYST RESEARCH					■		
CROMPTON PARKINSON			■				
DURACELL				■			
HELLESENS				■			
MATSUCHITA		■					
POWER CONVERSION INC			■				
RENATA	■						
SAFT	■			■		■	
SANYO	■						
SILBERKRAFT			■				
SONNENSCHNEIN				■			
TADIRAN				■			
UNION CARBIDE CORP.							
VENTURE TECHNOLOGY	■						■
WILSON GREATBATCH					■		

Fig. 4. 1984 European market. Who is selling what?