A. Gonin/CEA

Thin-film lithium battery fabrication facility on the premises of the joint CEA–HEF laboratory, at CEA/Grenoble. Such microbatteries are used, in particular, for smart-card security features.

III. STORAGE OF ELECTRICITY AND INTERMITTENT ENERGIES

Storage generally, and more specifically electricity storage, has always been the weak point for energy. It is in this respect that technological breakthroughs may have the most decisive outcomes. The issue arises crucially for mobile, "on the go" applications.

In the area of portable devices, the world has gone for a logic of growing consumption, where the source must have the ability to deliver maximum energy and power, for minimum mass and volume. Aggregate value of the world portable storage battery market thus rose by a factor 6 between 1996 and 2000, while the lithium-ion pathway supplanted the nickel–cadmium (NiCd) pathway, or even nickel–metal hydride (NiMH) technology.

The market for power batteries in the transportation sector, whether it be urban transportation, railways or aviation, is still dominated by NiCd technology. For all-electric and hybrid vehicles, NiCd and NiMH will certainly be supplanted in the medium term by lithium.

CEA has taken up both of these pathways, with development of lithium minibatteries featuring polymer electrodes. The organization's research effort has enabled development of low-cost, high-performance electrode materials. Work is further proceeding on novel battery electrolytes – polymer–gels and molten salts.

Its expertise makes it possible, in particular, to look to development of high-power batteries for small electric vehicles. Finally, the organization is developing production of microbatteries, using techniques previously mastered in microelectronics.

At the same time, storage of intermittent energies, frequently involving as it does electricity storage, is a key point for the rise of renewable energies. A requisite when source and user are in remote, off-grid locations, storage is no less of a requirement when the source is connected to the grid. The point here is to preclude the grid experiencing imbalances, even as, impelled by market liberalization, connections of this type stand to become increasingly prevalent.

The issue is being addressed, at the European level, by a review, coordinated by CEA. Comparison of the various storage technologies, according to utilization, covered a number of criteria, from environmental impact to energy efficiency, through cost. Having reached varying stages of maturity, these technologies may or may not offer, as the case may be, depending on applications, margins for optimization in terms of cost, reliability, and efficiency.