



Research in Power Electronics and Energy Conversion - do we need a joint European initiative?

Adequate and dependable supply of electrical energy is a necessity for industry, mobility and the comforts of life. This is today achieved with alternating current, transmitted and distributed by densely meshed energy grids that span entire continents; for reasons of physics, there is no alternative to sinusoidal a.c.

To be universally applicable, voltages and currents with different and variable waveforms are usually needed, for adjustable speed drives ranging from computer disc size to 100 MW compressor scale, steel making furnaces or for electrolytic and welding equipment; similarly at the supply side for covering long distances with d.c.-links, sea crossings by cable or for connecting grids with different frequencies. Controlling the load flow in meshed a.c. grids by electronic line-side equipment is another field. With renewable energy sources or fuel cells, where d.c. or fluctuating frequency a.c. is initially generated, electronic converters are indispensable; finally, there are the innumerable power supply schemes in communication and computer equipment. All these diverse interfaces are designed with semiconductor devices. Because of their speed of response and for safe operation and matching to the needs of the load, power electronic actuators require broad-band signal processing and control, today implemented with microelectronics and optical links. This involves semiconductors at the lowest and highest power levels, representing a growing segment of modern electrical engineering.

While early contributions to semiconductor technology originated in Europe, the work leading to high power switching devices has been concentrated in USA and Japan; this applies also to signal processing and microelectronics. Still, power electronics has reached a remarkable industrial level in Europe, where experience with mercury-arc converters (widely used in Europe in view of its potential for energy conservation, but largely bypassed in USA because of low energy costs) could be carried over to the new era. During the 70's and 80's important contributions to converter-fed and microelectronics-controlled a.c. drives emerged in Europe, resulting from research activities in industry and university laboratories with experimental interests. Today, about 40% of the world market in power electronic and energy conversion equipment is produced by European-based companies.

Contrasting this glorious past, things look quite different in many industrial countries today. Caused by a dramatic decrease of interest in technical subjects in the era of globalization and the dominance of information-related sciences, few students are now willing to engage in subjects even remotely connected with energy; the number of university laboratories is being reduced and investments are redirected towards other channels that are more in the public favour. As a result the university-based applied research in the field of energy systems is drying up, promising positions in industrial development remain vacant and there is a danger that Europe loses the competitive edge in the international market, becoming second rate in yet another important technical area.

Maybe there is a need for a

European Research Initiative on Power Electronics and Energy Conversion

for bundling the scattered potential through a joint action of universities and industry with the aim of benefitting the competitive position of European industry, even having an impact on European integration. It could be helpful to look across the Atlantic, where two years ago a "Center of Power Electronics Systems (CPES)" was founded in Blacksburg, Va, USA by five universities with the support of about 100 industrial partners. The joint research projects at CPES are centered around the topic "Integrated Power Electronic Modules and Systems", ranging from "Advanced materials" through "System integration and design tools", "Power electronic controls" to "Power integrated circuits". Surely, a direct transfer of the CPES idea would be difficult in view of the many countries involved and the diversity of research organizations in Europe, but it might be worthwhile thinking about it.

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