

## TECHNOLOGY DEVELOPMENT AND THE JOURNAL OF POWER SOURCES

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As a contribution to this invited series, three points are offered:

### 1. Scholarship can always be better

A spectroscopist I once knew maintained that the literature was so full of misinformation that its reading was a waste of time. He concluded: "I'll do my own experiments", and used no references in his publications. By contrast, a knowledgeable battery man I once knew spent a lifetime diligently studying, selecting, culling from what others published, to the point that he himself never published, nor was he even a useful consultant, always responding: "I'll have to look into that question more deeply."

In between these two absurdities there are those who *DO* study the literature, *DO* experimental research and theoretical analysis, *DO* publish accurate accounts of their work — free of misleading statements — and *DO NOT* repeat. The modern tendency to make references to *ONLY* the most recent literature can be misleading, if not unjust.

Today we see "Pb(IV)" appearing in papers on the lead-acid system. It is at least interesting that in 1907 G. N. Lewis thought enough of Dolezalek's account of his preparation of  $\text{Pb}(\text{SO}_4)_2$  to write a substantial abstract about the work (*Chem. Abstr.* 1:1659). Much more recently, with the emergence of HED non-aqueous cells based on organic electrolytes, one seldom sees reference to Solomon's publication (*Proc. Phys. Soc. London Sect. A*, 1962) on  $\text{CH}_3\text{CN}$  based cells. One could be forgiven for omitting an earlier disclosure of his colleague, Dalin, to an ECS meeting in 1960.

Good scholarship demands that early work be referred when credit for advance (or blame for misleading) has to be recognized; today's authors must take especial care to avoid misleading our progeny. Perhaps, in good part because the First Editor has been highly knowledgeable about batteries and their competitive power-sources, and has used his extensive knowledge of literature and of the modern players to see that good refereeing has been done, the first ten years have produced papers with sound information based upon good scholarship, particularly with respect to clarity and reference to

prior art. When the Journal loses that remarkable memory for prior art, it will have lost a resource which will be hard to replace, but which must be somehow replaced if the Journal is to maintain and even improve its quality.

## 2. Fads in research

Hard, sceptical analysis of the pros and cons of undertaking (or terminating) a program of research are expected of scientists and engineers. There are three essential factors to a decision to initiate or terminate: technological, economic, legal. Peer-review or management-review methods are often weak on at least one of these — one suspects worldwide. Some of us work at the technology-push end, some at the demand-pull end. In either case, the important technological, economic, and legal questions can be formulated as follows:

*Technological:* What would/could this new innovation do which cannot be achieved by devices which already exist? What would be its likely advantages and disadvantages? Hard thermodynamic and kinetic questions follow. A defensive or a bandwagon approach to decision is insulting.

*Economic:* Who needs this better performance? Who wants it? How much will some customer wish to, and be able to, pay for it? How much investment in human resources, materials, and money would be needed to produce this technological advance? What will it cost initially to demonstrate feasibility and to carry out the various engineering stages which would precede production?

*Legal:* What government(s) — local, national, other — will encourage, condone, or discourage its development and use? What prior art already exists in the form of patents or other intellectual property which could promote or suppress the effort being considered?

Answers to these questions will vary because diverse needs and value-systems arise from geopolitical factors about every  $10^4$  km<sup>2</sup> over the face of the earth. A *PLUS* in one location may well be a *MINUS* elsewhere. For example, within the five geopolitical regions of my own country, an analysis of the potential of hydrogen systems shows that there is little potential in four, but a modest need for their installation and growth in the fifth, along the St. Lawrence Seaway Corridor. Appropriate investments of human and material resources are being made.

This Journal might be able to promote more rational analyses in aid of decisions on investment. Would more systems analysis, in which the *SOURCES* and *USES* of the energy, as well as the *CONTROLS* for heat and mass transfer in response to variable electrical demand, not be appropriate for publication? There are other publications dedicated to control theory and practice, but none in which the principles are adapted and applied to power-source environment.

This Journal already provides a medium for intercommunication of regional interests as well as for technico-economic-legal information which

can help prevent wasteful misuse of research and development resources by thoughtless commitment. This theme could be developed.

### 3. No recent fundamental discoveries warrant redirection of the journal

There seemed to be two questions in the Editor's invitation to contribute to this Series: (a) What new or emerging technological areas deserve watching and participation, and from whence are they likely to come? (b) What modifications in the aims, format, and methodology should the Editorial Staff of this Journal initiate now, in anticipation of needed change?

On the first question, no particular insights come to mind, and certainly no revelations have been received by me from Above. However, there are many techniques for trying to keep aware of incipient change. One is as follows.

Each member of the Editorial Board has available — in addition to specialized resources — libraries and document centers, conferences and other sources of information outside his own specialty. One occasionally should spend some hours just browsing — shopping around in these external resources. The process usually does turn up surprises. Sometimes it is an idea, sometimes the report of a study on a seemingly irrelevant (“poorly titled”) topic, sometimes a new material. One asks: “I wonder how we could use that in our business?”. Curiosity is the key, enough curiosity to promote the search, pose the question, and propose an answer. Personally, at the moment of writing, I am studying the soliton concept — the solitary solutions to certain non-linear equations which may have relevance and offer guidance to the design or application of future electrical power sources.

Recognition of “other ways” is sometimes called insight. An insatiable curiosity about power sources prompted one enthusiast I know to *STUDY* and *WORK ON*: bioenergetics; thermoelectric and thermionic devices; windmills; hydrogen systems; MHD; Otto-cycle, Brayton and Stirling engines; solar cells; laser power translation; as well as batteries and fuel cells. The curiosity was focussed by two questions: *WHAT* will it do, and *FOR HOW LONG? WHAT* will it *NOT DO*, and *WHY NOT?* In other words, what are the strengths and the limitations, the pros and cons?

Now some of these power-source systems fall well outside the present purview of JPS. The present focus is on batteries; rotating machinery is excluded. Whether or not the usefulness and the circulation of the JPS to the worldwide workers in the power-source field would be increased by broadening its scope is a question perhaps worth considering. At the moment, I would rather we enter the second decade with the dedication to emphasize scholarship in this Journal and to promote more critical analysis of R & D selection through publication of the power-source systems-analyses. Broadening its scope, I would defer.