Recent publications

1 PSE&G, Draft functional description of the BEST Facility Test Data Processor, presented at the *Meeting of the EPRI Testing Methodology Group, Argonne, Illinois, September 19 - 21, 1978.*
2 PSE&G, Guidelines for BEST Facility Battery Testing Programs: A working paper, presented at the *Meeting of the EPRI Testing Methodology Group, Argonne, Illinois, September 19 - 21, 1978.*
3 P. A. Lewis and A. Pivec, The BEST Facility — accelerating the development of utility load leveling batteries, *28th Power Sources Symp., Atlantic City, New Jersey, June 12 - 15, 1978.*
4 R. V. Snow, The design of the battery energy storage test facility, *IEEE Power Engineering Soc., Summer Meeting, Los Angeles, California, July 16, 1978.*
5 E. A. Hyman and A. Pivec, The Battery Energy Storage Test Facility: test programs and data processing — an update, *14th Intersoc. Energy Conversion Engineering Conf., Boston, MA, August 5 - 10, 1979.*

TECHNICAL AND ECONOMIC ASSESSMENTS OF ELECTROCHEMICAL ENERGY STORAGE SYSTEMS

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The objective of this program plan is to provide a comprehensive methodology for systematically implementing the analytical, technical, and economic assessments of electrochemical energy storage systems.

The application of this methodology will result in objective and realistic technical and economic assessments of advanced battery systems which can aid in the acceleration of advanced battery systems for commercial load leveling applications.

Four major tasks are required to implement the needed technical and economic assessments. These tasks are:

1. Overall Technical Assessments
2. System Stability Impact Assessments
3. Overall Economic Assessments
4. Battery Cost Methodology.

Each of these tasks and accomplishments to date are briefly described.

(1) Overall technical assessments

In order to perform an overall technical assessment, each of the four battery systems listed below will be examined:

— zinc–chlorine
— sodium–sulfur
— lithium–sulfur
— advanced lead–acid.

Each system will be examined as to its balance-of-plant requirements to satisfy major environmental, safety, and permit issues. Major input for this assessment will be drawn from contacts with battery developers, the literature, and selected small scale testing. When available, results from previous tests or actual accidents will be used.

Work to date has consisted of developing a functional description of a battery system to identify required balance-of-plant systems, and to prepare a preliminary listing of major environmental, safety and permit issues for zinc–chlorine battery systems.

Work in progress is the completion of the description and estimation of the balance-of-plant requirements for the zinc–chlorine battery.

The objective for 1980 is to complete the engineering description and initial cost estimate for the zinc–chlorine, sodium–sulfur and lithium–metal sulfide battery systems.

(2) System stability impact assessments

This task is to examine the dynamic interaction of dispersed storage devices and the impact on power system stability, and to develop valid mathematical models for storage and associated d.c./a.c. conversion equipment, to perform simulation studies to verify the ability of dispersed devices to operate as planned and to determine control requirements. Also to evaluate the impact of applying alternative control schemes ranging from independent local control to centralized dispatching.

An extensive literature search on batteries, fuel cells, HVDC systems, and converter and control systems has been completed in an effort to use as much applicable existing data as possible.

A definition of modeling requirements has been compiled from a detailed study of the basic electrochemistry phenomena occurring in battery storage systems, and existing available transient stability programs have been reviewed for possible application.

The services of an electrochemical consultant will be utilized to aid in the development of battery and converter models.

Work in progress is to define and develop final models for battery and conversion equipment, and also to program and debug computerized models with limited testing. Special programs to investigate unusual stability problems such as harmonics will also be developed.

(3) Overall economic assessments

Economic assessments will be conducted to identify the impact of battery systems on generation planning and generating system dispatch for an optimally (excluding energy storage) expanded reference utility system.

A simplified analysis of the impact of battery systems on two extreme expansions of the reference utility system will be provided.

(i) All base load unit expansion,

(ii) soft technology expansion.

Battery system data will be utilized from the latest available DOE information sources.

A representative utility system has been selected for analysis in the 1985 - 2004 period. Basic data and assumptions were mutually agreed upon by PSE&G and DOE concerning capital costs, fuel prices, unit characteristics, etc. An assessment of the potential impact of batteries in a system in which only base load units (nuclear and coal units) can be used for future capacity was completed, and a similar assessment of an all soft technology utility expansion was begun.

In 1980 it is planned to:

complete the soft technology expansion assessment;

assess the potential impact of batteries on a utility system in which all types of conventional generating units (base load, peaking, and intermediate) are allowed for future capacity needs;

identify capital costs or equivalent ($/kW) savings attributable to the following advanced battery parameters for the reference system:

(a) Storage system life and salvage value;

(b) battery availability;

(c) T&D savings resulting from dispersed siting;

(d) energy storage conversion parameters;

(e) impact on generator minimum loading.

(4) Battery cost methodology

It is planned to determine the critical cost components for each type of battery plant, and establish a standard method for estimating total installed costs, utilizing the battery cost techniques developed by A. D. Little under contract to EPRI, and the balance-of-plant costs developed in the Overall Technical Assessments. Furthermore, sensitivities for changes in items such as cost of money, labor, and major raw materials used in battery fabrication will be determined, all in relation to the ongoing development of the relevant battery technologies.

The contract package with A. D. Little has been prepared and is being reviewed by DOE, and in 1980 it is expected that A. D. Little will begin close coordination with the Overall Technical Assessments task in preparation for the major work commitment in FY 1981.