battery requirements analysis; (3) survey current secondary battery state-of-art; (4) identify significant differences between battery requirements and existing technology; (5) support the necessary research and development required to rectify these differences; (6) develop the resulting technology so that cost effective photovoltaic systems incorporating battery energy storage are viable.

(1) A generalized Sandia Computer Code, SOLSTOR, has been used to simulate various residential system studies to determine the optimum array, battery storage and auxiliaries under various assumptions. Work is directed towards bounding the scope of initial study areas by comparing the economics of a PV residential system to a utility fed residential system.

(2) The "reasonableness" of the simulation studies has been checked by using input assumptions of two recent DOE funded studies. The results were compatible.

(3) Studies to date have indicated that various factors such as tax rates, tax credits, and escalation rates of alternative energy affect the timing of the economic viability. Other factors such as component cost and performance affect the sizing. Important parameters that affect the system viability are the sell back ratio and time-of-day rate schedule of the utility. Increasing the sell back decreases the storage feasibility; while increasing the time-of-day ratio increases the feasibility.

(4) A linear programming effort is in the debugging stages. An exact solution of the system configuration will be possible, and the best operating strategy to use to minimize the overall energy costs will be determined.

(5) Preliminary designs for a battery test laboratory have been completed. Portions of the data acquisition system have been ordered.

(6) A full state-of-art lead–acid battery has been sized for system studies at the Photovoltaic System Definition Project Facility. This facility will be used in a cooperative manner to test arrays, balance of system components, and batteries.

(7) Contact has been established with NASA/Lewis, MIT/LL and MERADCOM regarding PV application experiments that can serve as inputs to load profiling and battery technology requirements.

HANDBOOK FOR BATTERY ENERGY STORAGE IN PHOTOVOLTAIC POWER SYSTEMS

Bechtel National, Inc., San Francisco, CA 94119 (U.S.A.)

The objective of this contract is to provide a concise source of information on batteries, both existing and developmental, that can be used by designers of photovoltaic systems. The emphasis is to be on that information required successfully to interface the battery with the power system. The

handbook is aimed at individuals involved with evaluation, design and development of photovoltaic systems, who may not be fully cognizant of battery system design, performance and costing.

The handbook consists of five sections:

(1) Introduction, which covers battery terminology, basic concepts and characteristics.

(2) General Design Considerations, which covers system configuration, duty cycle, capacity, current–voltage characteristics, charging and other conditions impacting the design, fielding and operation of a general battery system.

(3) Commercially Available Batteries, which covers specific characteristics of three existing battery systems: lead–acid, nickel–cadmium, and silver–zinc.

(4) Near Term Batteries, which covers the projected characteristics of improved lead–acid, nickel–iron and nickel–zinc.

(5) Advanced Batteries, which covers the more speculative projected characteristics of the ambient and high temperature battery systems. Included are advanced lead–acid, zinc–chlorine, redox, sodium–sulfur, lithium–metal sulfide, and others.

The handbook has been completed in the rough draft version and is currently under review by battery manufacturers, developers and users. Their comments are to be incorporated into a final draft version that should be ready for review in mid August, 1979.

An extension of the contract duration has been requested that will cover the additional time required to complete the program.