- Proposed WEBS operational scenarios.

Initial data collection activities at Molokai Electric Company have been completed.

Further data collection and a preliminary dynamic study will be scheduled when MOECO's new generators and load control equipment have been fully tested.

CUSTOMER VERSUS UTILITY LOCATION, OWNERSHIP, AND CONTROL OF ELECTRICAL STORAGE

Research Triangle Institute, P.O. Box 12194, Research Triangle Park, NC 27709 (U.S.A.)

The customer-side-of-the-meter project concerns three questions:

- For grid-connected photovoltaic or wind energy systems, on which side of the meter should the battery storage be located ?
- If located on the customer's premises, who should own the battery storage, the utility or the customer ?
- If located on the customer's premises, who should control the operation of the battery, the utility or the customer ?

The preferred outcome of the study was defined as a methodology that would allow varied situations to be examined in a quantitative fashion using input parameters describing the application situations.

The methodology developed by Research Triangle Institute to address the questions of location, ownership, and control of electric storage batteries is embodied in two coupled linear programming models that allow the computation of breakeven battery life cycle costs to answer the location question and, in a simple life cycle cost formulation, to answer the ownership question. Under the modeling approach taken, the question of control of the customer battery is moot because the control perspective is that of overall system optimization including customer and utility.

Although the examples considered with the models are not diverse enough to generalize on the answers to the questions of location, ownership, and control, the evidence is clearly in the direction that location in the utility is preferred, that ownership by the utility is preferred over residential customers but not necessarily over commercial customers, and control should be exercised to minimize total system cost without regard to who exercises control.

Work on this contract was completed March 1982.

Recent publications

1 R. A. Whisnant, *Location, Ownership, and Control of Electric Storage Batteries in Utility-Connected Photovoltaic or Wind Systems*, Research Triangle Institute, July 1982.

LEAD–ACID BATTERY MODEL DEVELOPMENT/PROGRAMMING SUPPORT

The BDM Corporation, 1801 Randolph Road NE, Albuquerque, NM 87106 (U.S.A.)

Project objectives are to

- Continue development of the current lead–acid battery model and incorporate the model into the Sandia National Laboratory computer code SOLCEL;
- Provide programming support directed at presenting graphic analysis of the SOLSTOR computer code simulations; and
- Provide programming support for improvements in the SOLSTOR code.

The development of a model to describe lead–acid battery electrical behavior in photovoltaic (PV) applications was based on an extension of work done by Mobil–Tyco. The application of the Mobil–Tyco results and methodology to other battery charge and discharge data was investigated. Good correlation with discharge profiles was obtained. Correlation with charging profiles was good only in the range of about 40 to 70 percent state of charge with poor correlation elsewhere.

Additional PV battery data were obtained. Efforts to validate the Mobil–Tyco model using these data were less successful. The variation of internal resistance solely as a function of states of charge appeared inadequate. Analysis showed that there was a significant dependence of internal resistance on discharge rate especially at states of charge below about 40 percent.

An alternative method of expressing I-V relations using 'Apparent Resistance' (RA) was introduced by BDM. RA was defined as the ratio of terminal voltage to terminal current for charge and discharge operation.

Battery life as affected by cycling was examined. Specific information was not available from manufacturers. These data were obtained elsewhere allowing refinement of the initial model, which used a life decrement associated with an incremental discharge/charge scenario.