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.

The effect of temperature was also examined. Temperature effects on electrical behavior were accounted for by adjusting depth of discharge with temperature through capacity. Temperature effects on battery life are described by an experimentally derived acceleration coefficient.

Finally, these latest developments in the battery model have been incorporated into SOLCEL.

Work on this project was completed in March 1982.

Recent publications

1 *Lead–Acid Battery Model: Draft Final Report*, The BDM Corporation, June 1982.