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Development of Design Practices for PV/Battery Remote Area Power Supplies (RAPS)

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Why RAPS Standards/ Design Practices?

Objective

- Support development and facilitate coordination of standards and recommended practices for RAPS, concentrating on the storage system
  - IEEE Standards Coordinating Committee 21 (SCC21) – Energy Storage Working Group

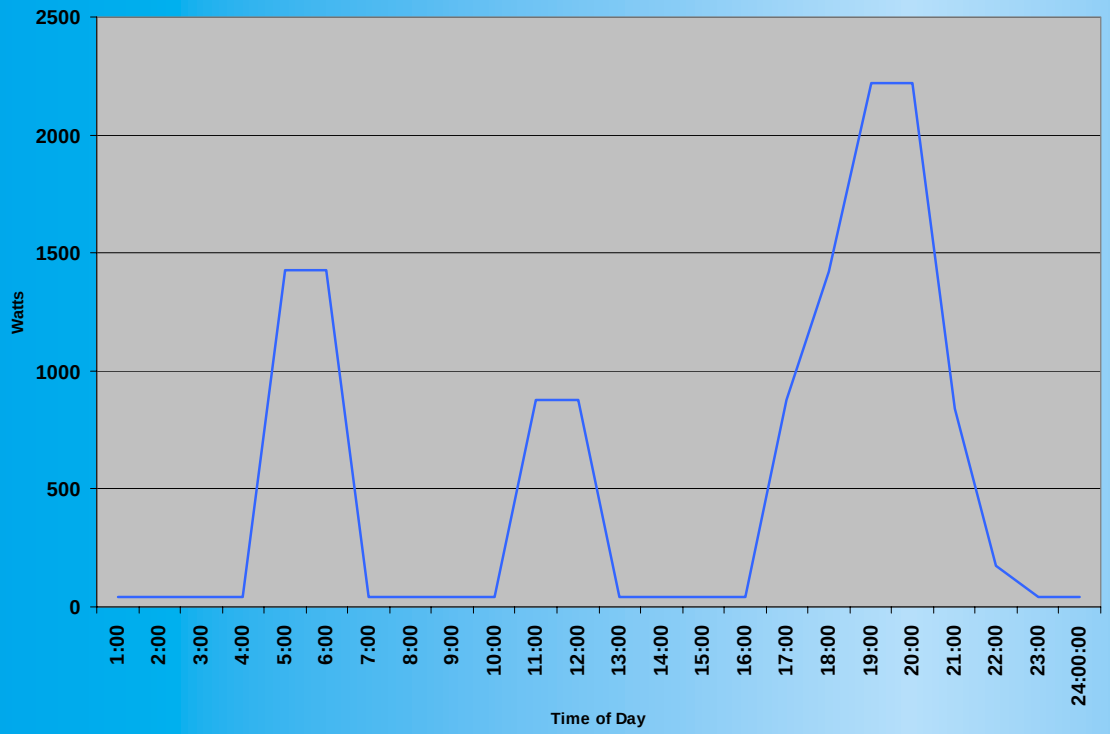
Purpose

- Enable renewable generation options in remote areas
- Address the lack of standards and recommended practices for storage components

Past RAPS Efforts (since 1997)

- Work with standards committees and groups
  - SCC21 Energy Storage Working Group
  - Monitoring of other standards groups: System Performance Working Group, IEEE/PES Stationary Battery Committee, and other international groups
  - * **Found that working with/supporting SCC21 provides the best venue for accomplishing goals**
- Loads and resources research
  - Constructed database of more than 70 RAPS sites
  - Identified load profiles of several home and village RAPS sites
  - Identified “typical” village profiles
  - Analyzed data (looking for trends)
  - * **Information is being used in hybrid design practices document**

Typical Village Load Profile



- Profile similar in shape to single home profiles
  - ~ 60 Homes
  - ~ 300 People
  - Street Lights
  - Community Center
  - Health Center
  - Water Pump

Current Tasks

- **Actively support and participate in the Energy Storage Working Group of IEEE's SCC21**
  - Providing technical and secretarial support
  - Providing input to working documents
  - Distributing meeting information
  - Keeping track of completion of action items and send reminders to members

  Facilitate communication among working group members
  - Created (and currently maintaining) password-protected web site for the group on Energetics' server for "day-to-day" business
  - In the process of working with NREL on "official" web site
- **Update Loads and Resources Paper (originally completed in 2000)**
  - Adding information on a cold-weather RAPS installation in Alaska ("Loads")
  - Using NASA global weather database to obtain new insolation profiles ("Resources")
  - Adding sites to RAPS database in appendix

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Energy Storage Working Group Activities

- **Published five Recommended Practices or Guides** involving the sizing, installation, and maintenance of lead-acid and nickel/cadmium batteries in PV applications
- Most recent publication was **IEEE 1361™ "Guide for Selection, Charging, Test and Evaluation of Lead-Acid Batteries Used in Stand-Alone Photovoltaic (PV) Systems"** Lead Author: Tom Hund, Sandia National Laboratories
  - Will help PV system designers select and evaluate batteries, design PV systems, and test the selected battery.
  - Includes information on lead-acid battery technology, battery charging characteristics, environmental characteristics, PV operating conditions, and a test procedure for charge parameters and battery performance

-Excerpt from May 1, 2003 IEEE press release

Energy Storage Working Group Activities (cont.)

- Developing two Guides for the use of lead-acid batteries
  - PAR 1561 – **Draft Guide for Sizing Stand-Alone Energy Systems** (Draft 7) (Lead Author: Carl Parker, ILZRO)
  - PAR 1562 – **Draft Guide for Array and Battery Sizing in Stand-Alone Photovoltaic (PV) Systems** (Draft 1) (Lead Author: Rob Rallo, Kyocera Solar)
- Have begun work on the revision of two Recommended Practice documents:
  - Std. 1013-2000 - **Recommended Practice for Sizing Lead-Acid Batteries for Photovoltaic (PV) Systems**
  - Std. 937-2000- **Recommended Practice for Installation and Maintenance of Lead–Acid Batteries for Photovoltaic (PV) Systems**

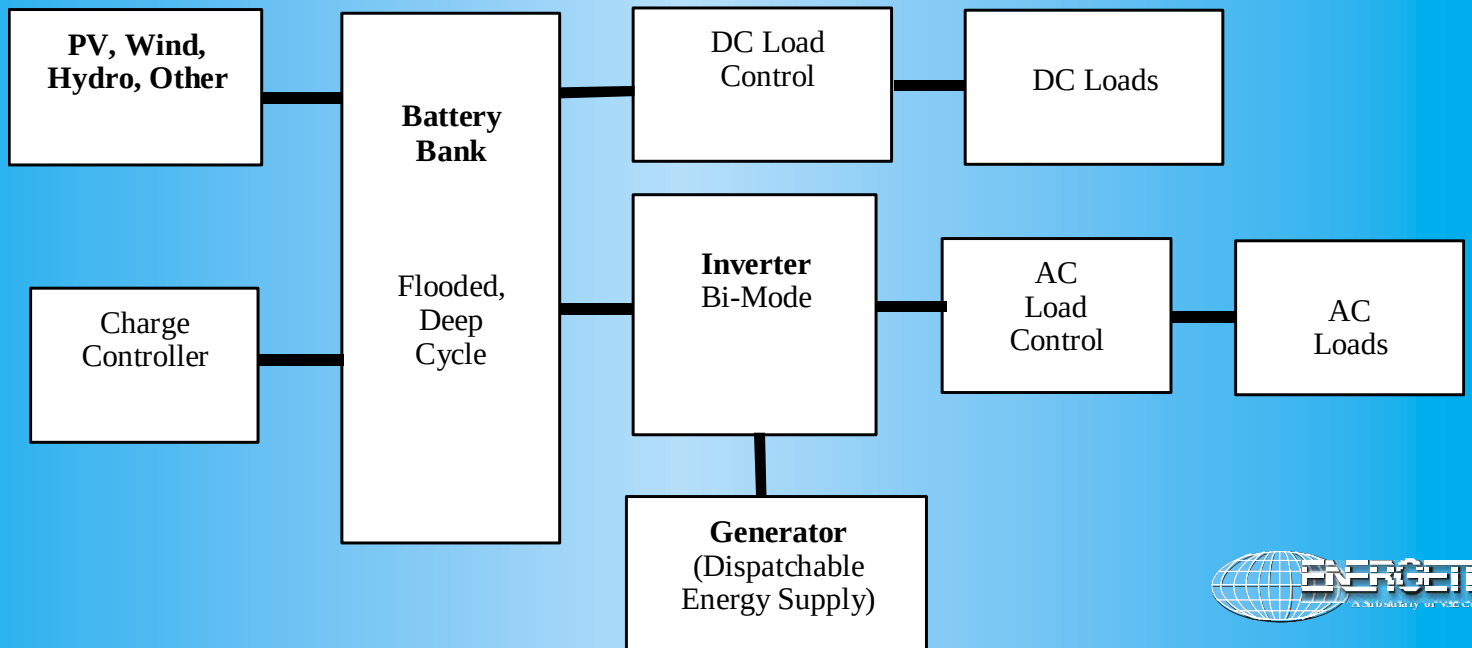
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Developing PAR 1561

Lead author: Carl Parker, ILZRO

Status: Seventh working draft

Objective: To provide information to optimize the performance and life of lead-acid batteries in remote hybrid power systems by providing guidance as to how such systems should be managed.



Technical Topics Addressed in PAR 1561

Safety and environmental issues: safety procedures, electrolyte and electrical hazards

Battery installation, design, and procedures: location, electrical connections, acceptance testing

Battery management and operations: water loss, sizing, charging/discharging, equalization, control parameters

System Operations: set points, monitoring, load shedding

Maintenance: preventive and corrective action

Troubleshooting: capacity loss, water consumption, voltage drops, excess voltage fluctuation

Developing PAR 1562

Lead Author:

Rob Rallo,

Kyocera Solar

Status: Draft 1

Objective: Provide procedures to size the PV array and battery to improve the performance, cost-effectiveness and lifetimes of stand-alone PV systems



Technical Topics Addressed in PAR 1562

Safety: arc hazard, hydrogen venting, secondary containment

Battery selection and use: battery characteristics, PV system parameters

Testing: parameter selection, PV battery test procedure, test equipment and data acquisition, initial battery charge, procedure for initial capacity test, procedure for PV battery cycle test, procedure for final capacity tests

Upcoming Work: Std. 937-2000

- Applying for a new PAR to modify Std. 937-2000, “Recommended Practice for Installation and Maintenance of Lead – Acid Batteries for Photovoltaic (PV) Systems”
  - No field test is currently required in the document
  - Group is considering: *Do we want to add testing criteria? Do we want to keep the maintenance schedules?*

Upcoming Work: Std. 1013-2000

- Currently applying for a new PAR to modify Std. 1013-2000 “Draft Recommended Practice for Sizing Lead-Acid Batteries for Photovoltaic (PV) Systems”
  - P1562 (Draft 1) is an overall sizing document
  - Group is deciding: *1) Keep Std. 1013-2000 and reference it in P1562 or 2) Incorporate Std. 1013-2000 into P1562.*
  - Either way, need to have Std. 1013 reaffirmed because P1562 won’t be ready for a few more years.

Energy Storage Working Group Meetings

- Recent meetings:
  - October 2001 – Las Vegas, Nev.
  - September 2002 – Research Triangle Park, N.C.
  - February 2003 – Tempe, Ariz.
  - June 2003 – Denver, Co.
- Next meeting:
  - February 2004 – Cocoa, Fla.

Energy Storage Working Group Website

Goal

- Increase communication among energy storage working group members
- Share information about the group's activities

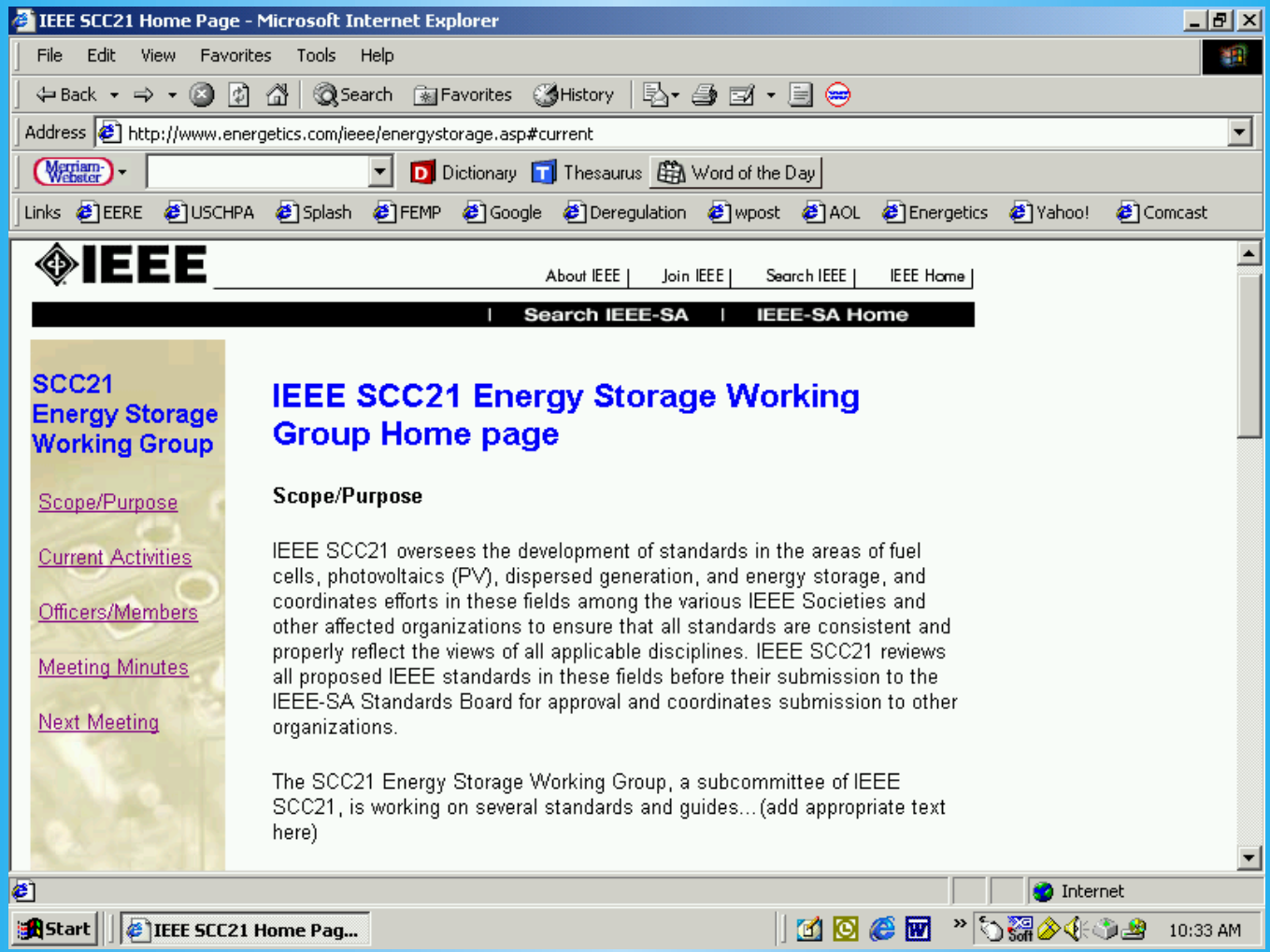
Content

- Updated versions of working documents
- Information about upcoming meetings
- Meeting minutes (most recent and archived)
- Member lists

Future Options

- Comments/suggestions area for each document
- Links to recent energy storage-related reports and books that would be of interest to the group

Energy Storage Working Group Website



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Future Plans

- Continue support of SCC21
  - PAR 1561
  - PAR 1562
  - New documents:
    - Std. 937
    - Std. 1013
- Continue updating Loads and Resources paper
  - Consider database including RAPS sites
- Keep maintaining web site