Zinc Battery R&D at Sandia

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NAATBatt Workshop on Zinc Battery Technology

November 16, 2018

Sandia Grid Energy Storage R&D

- Advancing battery chemistries through technology development and commercialization
- Optimization at the interface between power electronics and electrochemistry.
- Power electronics including high voltage devices , high voltage passives and magnetics and new power converter topologies
- Energy storage safety – cell and module level safety test and analysis. Engineered safety of large systems. Predictive models for ES safety
- Development of analytics and controls for integration of utility class storage systems
- Energy storage project development to support DOE's demonstration projects and outreach to the industry

Zn-MnO_2 Core Research Program

Sandia National Laboratories

Dr. Timothy Lambert

Zinc Anodes, electrolyte additives and separators

Dr. Jonathon Duay
David Arnot
Dr. Matthew Lim
Kristin Maus

CUNY The City University of New York Energy Institute

Prof. Sanjoy Banerjee

Stable zinc anodes for high-energy-density rechargeable aqueous batteries & Manufacturable low-cost MnO_2 Birnessite cathode

Prof. Robert Messinger
Dr. Gautum Yadav
Michael D'Ambrose
Jinchao Huang
Dr. Damon Turney
Michael Nyce
Snehal Kohlekar
Brendan Hawkins

NM STATE UNIVERSITY

Prof. Igor Vasiliev

DFT modeling of the electrochemical behavior of MnO_2

Birendra A. Magar

Northeastern University, Boston, Massachusetts

Prof. Joshua Gallaway

Understanding phase change processes of energy storage materials

Matthew Kim

Related Materials Research

Stony Brook University

Prof. Esther Takeuchi

Synthesis of low cost cathode materials, MnO_x and similar systems

Sandia National Laboratories

Dr. Erik Spoerke

New composite membranes to address a range of problems in Zn, Na battery systems

URBAN ELECTRIC POWER

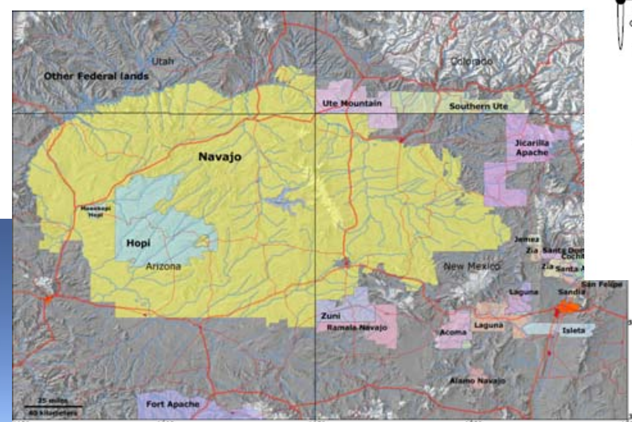
Advance manufacturing R&D to reach doubling cell capacity from 200Ah to 400Ah (~0.5kWh/cell) while simultaneously reducing the BOM from the current $21 per 200Ah cell to $15 per 400Ah cell.

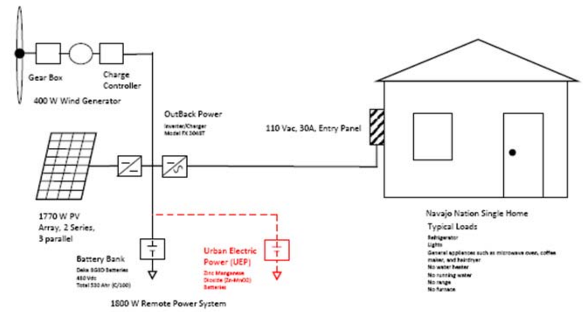
Residential/Community Storage for Remote Communities

Many Native American communities in the west are too remote and dispersed for utilities to be able to justify building power lines. Many locations are often located in harsh environments with high or cold temperatures. Sandia is field testing UEP's Zn-MnO_2 batteries to see how they perform in these environments.

Navajo Nation Demonstration Project

Current Systems: 1800W PV, 400W Wind Turbine, 530 Ah Lead-acid Batteries





Microgrids in AK and other remote areas…

Do they work well with off-the-shelf inverters?

Reprogramming in retrofits can cause operational problems

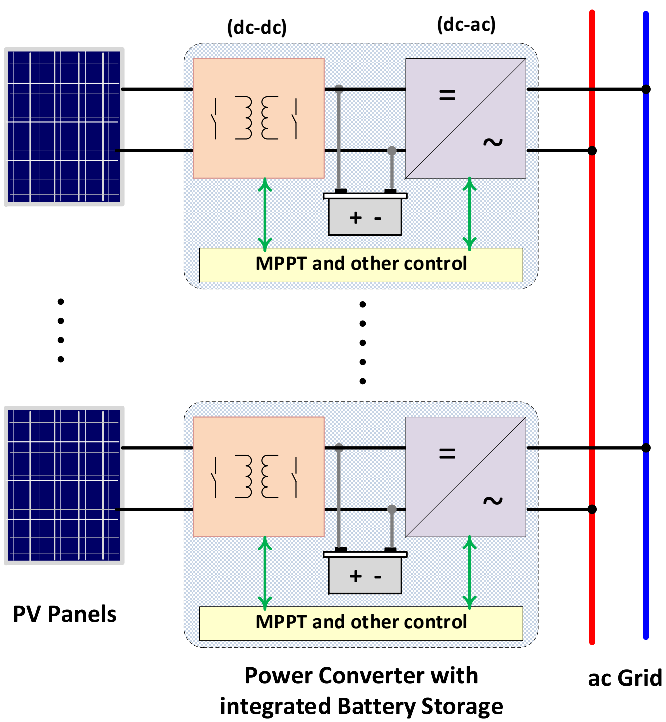
Do they require maintenance?

Residences on the Navajo Nation are scattered over 27,000 sq. mile area

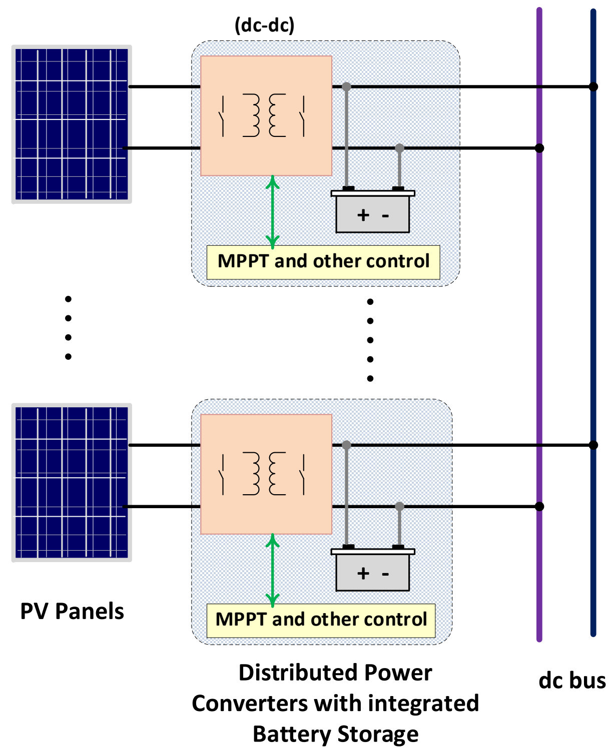
Are Zn-MnO_2 batteries robust?

Temperatures can range from -20 to 110 F

Distributed Storage to Enable Firm PV Modules



Distributed micro-inverters at panel level with integrated Battery Storage



Distributed isolated dc-dc converters at panel level with integrated Battery Storage

Distributed dc-dc converters with integrated battery energy storage at the panel level make the intermittent PV generation a controllable energy resource. Distributed control overcomes inefficiencies of current microinverter topologies

Acknowledgements

This work was supported by

US DOE Office of Electricity Delivery

Energy Storage Systems Program

U.S. DEPARTMENT OF ENERGY