Community Energy Storage Thermal Analysis and Management

Cooperative Research and Development Final Report

CRADA Number: CRD-11-445

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CRADA Report
NREL/TP-5400-70701
January 2018

Contract No. DE-AC36-08GO28308

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In accordance with Requirements set forth in Article XI. Reports and Abstracts A.(3), of the CRADA agreement, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: Southern California Edison Company

CRADA Number: CRD-11-445

CRADA Title: Community Energy Storage Thermal Analysis and Management

Joint Work Statement Funding Table Showing DOE Commitment:

Estimated Costs	NREL Shared Resources
Year 1	$ 30,000 .00
Year 2 or Modification #	$ 20,000.00
Modification #1	$ 20,000.00
TOTAL	$ 70,000.00

Abstract of CRADA Work:

The goal of this project is to create thermal solutions and models for community energy storage devices using both purpose-designed batteries and EV or PHEV batteries. Modeling will be employed to identify major factors of a device's lifetime and performance. Simultaneously, several devices will be characterized to determine their electrical and thermal performance under controlled conditions. After the factors are identified, a variety of thermal design approaches will be evaluated to improve the performance of energy storage devices. Upon completion of this project, recommendations for community energy storage device enclosures, thermal management systems, and/or battery sourcing will be made. NREL's interest is in both new and aged batteries.

Summary of Research Results:

The project explored battery lifetime for community energy storage systems with used and new batteries and under various battery thermal design scenarios. The project made use of Li-ion battery lifetime models originally developed for automotive applications under DOE's Vehicle Technologies Program. Those models previously highlighted that battery average lifetime temperature is the largest factor controlling battery degradation rate. Thermal designs explored for community energy storage included greenhouse (worst case), partially buried, shaded, forced

air and forced liquid cooling (best case). Designs incorporating shading and small amount of forced air circulation were deemed most cost effective. For hot climates where temperatures regularly exceed 20ºC, air and liquid cooling systems with ability to maintain battery temperature below ambient extend battery lifetime enough to justify their added expense.

Subject Inventions Listing:

None

Report Date:

20 October 2017

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DOE Program:

Hybrid and Electric Systems, Vehicle Technologies Program

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