Reference - CAR Energy Storage Labs - Overview

> Updated on 2025-08-21 by @KemingHe

Facilities & Infrastructure

The CAR Energy Storage Labs encompass 1,000 sq ft across three specialized rooms, featuring state-of-the-art battery testing capabilities developed over 20 years of research excellence. **Facility opened in 2019** to accommodate increasing electric vehicle research demand.

Core Testing Facilities

- **Main Battery Lab**: State-of-the-art battery cyclers, environmental chambers, liquid chillers for low voltage to 48V systems
- **Battery Pack Fabrication Lab**: Spot welders and high voltage tools for safe battery pack operations
- **High Voltage Lab**: Testing capabilities up to 900V for automotive battery packs
- **Hardware-in-the-Loop Lab**: Battery management systems (BMS) integration and control strategy testing

Research Capabilities

- **Material Development**: Synthesis and characterization, pouch cell fabrication in moistureless glove boxes
- **Testing & Benchmarking**: Cell, module, and pack performance from coin-cell to automotive size packs
- **Modeling & Simulation**: Electrical, thermal, and degradation modeling with automated testing protocols
- **Control Systems**: Rapid prototyping and verification of battery, electrical, and thermal control algorithms
- **Temperature Testing**: Performance assessment across different temperatures and testing protocols

Research Focus Areas

Energy Storage Materials & Cells

- Advanced lithium-ion battery materials (cathode, anode, electrolyte) for improved energy density, safety, cost reduction
- Silicon-based anodes and solid-state electrolyte development
- Electrochemical impedance spectroscopy and systematic characterization

Control & Diagnostics

- Battery management systems (BMS) with diagnostics and failure prediction (SOC, SOH)
- Fault-tolerant functionalities with self-diagnosis and self-reconfiguration capabilities
- Fast-charging optimization and abuse tolerance enhancement

System Integration & Applications

- Hybrid and electric powertrain energy optimization and management
- Electric aircraft energy storage systems (NASA ULI $10M project)
- EV charging and grid interaction systems
- Second-life battery applications and aging characterization

Industry Partnerships

Strategic collaborations with leading automotive and energy organizations:

- **Automotive**: Honda, Ford, Toyota, Fiat Chrysler Automobiles, Stellantis, General Motors

- **Energy**: American Electric Power, U.S. Department of Energy, LG Energy Solution
- **Aerospace**: NASA ($10M ULI project for electric aircraft), Venturi
- **International**: US-China Clean Energy Research Center (CERC-Truck)

Key Research Enterprise Metrics

- **Research Growth**: $8M+ annual research projects (expanded from $1M to $14M+ under current leadership)
- **Faculty & Staff**: 40+ visiting scholars, 45 staff members, 42 CAR-affiliated faculty, 100 graduate students
- **Student Impact**: 56 undergraduate students across 7 motorsports teams including Formula Buckeyes, EcoCAR, Buckeye Bullet

> Retrieved from and fully fact-checked against https://car.osu.edu/car-energy-storage-labs on 2025-08-21