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Cooperative Research and Development Agreement (CRADA) Final Report

Report Date:

July 31, 2025

In accordance with Requirements set forth in the terms of the CRADA, this document is the CRADA Final Report, including a list of Subject Inventions. It is to be forwarded to the DOE Office of Scientific and Technical Information upon completion or termination of the CRADA, as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: Lawrence Berkeley National Laboratory, Battelle (PNNL) and JMATT Construction Services, LLC

CRADA number: FP00012262

CRADA Title: Retro-Commissioning Sensor Suitcase for Energy Efficiency

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Sponsoring DOE Program Office(s):

EE-5B Building Technologies Office

LBNL Report Number: LBNL-2001693

OSTI Number:

2997166

Joint Work Statement Funding Table showing DOE funding commitment:

DOE Funding to LBNL	140,000.00
Participant Funding to LBNL	
Participant In-Kind Contribution Value	250,000.00
Total of all Contributions	390,000.00

Provide a list of publications, conference papers, or other public releases of results, developed under this CRADA:

Publicly available information of results :

- <https://www.energy.gov/sites/default/files/2023-05/bto-peer-2023-sensor-suitcase-pnnl-brambley.pdf>

Provide a detailed list of all subject inventions, to include patent applications, copyrights, and trademarks:

(Patents and patent applications are to include the title and inventor(s) names. When copyright is asserted, the Government license should be included on the cover page of the Final Report)

- *Retro-commissioning Sensor Suitcase Plus Software 2022-086 (Available for licensing)*

Executive Summary of CRADA Work:

The Retro-commissioning (RCx) Sensor Suitcase, a flexible, turn-key sensor and software system, streamlines data-driven commissioning of hard-to-reach small to medium sized commercial buildings. The collaborative project through the CRADA focused on enhancing and expanding the capabilities of the original prototype suitcase, increasing its flexibility and use cases in preparation for commercial deployment. Developments include added sensor types (e.g. CO₂), wireless mesh networking, cloud reporting, and improved usability—positioning the system for commercial deployment by utilities and service providers.

Summary of Research Results:

The Sensor Suitcase project aimed to enable cost-effective, data-driven retro-commissioning (RCx) in small commercial buildings through a self-installable toolkit consisting of portable sensors and diagnostic software. Results showed that the Sensor Suitcase could identify common operational faults leading to 5–15% energy savings opportunities, with automated reports requiring minimal user interpretation. The project adhered closely to its Statement of Work (SOW) but evolved the reporting interface and sensor logging duration based on field feedback. The development and validation of diagnostics are documented in PNNL technical reports and internal analysis summaries.

Products, Applications, and Technology Transfer

The project resulted in a deployable RCx sensor toolkit now ready for technology transfer. Key products include:

1. **Sensor Suitcase hardware:** a battery-powered, portable device suite.
2. **Software platform:** Android-based user interface and cloud-based analytics dashboard.
3. **Diagnostic methodology:** embedded RCx algorithms for HVAC and lighting.
4. **Field deployment protocol:** standard procedures for non-expert building operators.

Applications include utility-funded retro-commissioning programs¹, service-provider deployment, and integration into performance-based energy efficiency workflows. Technology

¹ <https://empoweringmichigan.com/wp-content/uploads/DTEEnergyEfficiencyAnnualReport2023.pdf>

transfer efforts include collaboration with utilities and commercialization partners. Future work may expand the system to include additional sensors (e.g., humidity, plug-load monitors) and deeper fault detection using machine learning. The project also fostered collaboration across national labs and private-sector stakeholders.