

CalNEXT Knowledge Sharing Webinar

Commercial HVAC

June 16, 2026



Energy Solutions, AESC, TRC, UC Davis, VEIC

Program paid for by ratepayers

Agenda

| | |
|--|----------------|
| Introduction and CalNEXT Events Update | 2:00 |
| Occupant-Centric Micro-Zone Control for Commercial Buildings | 2:04 |
| ASHRAE Guideline 36 Open-Source Supervisory Control Technology Development and Demonstration | 2:13 |
| Automated Guideline 36 Validation | 2:22 |
| Energy Efficiency Building Electrification Project Success Tools | 2:31 |
| Heat Pump Rooftop Unit Demonstration | 2:40 |
| Commercial Building Duct Sealing Energy Savings and Cost Analysis | 2:49 |
| Wrap-up: Additional Q&A if needed | 2:57 – 3:15 |

Presenters



Greg Barker

Engineering Fellow
CalNEXT 2026 Outreach Team



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Presentations include (as applicable):

- 1. Project Summary**
- 2. Study Objectives**
- 3. Stakeholders**
- 4. Demonstration Sites**
- 5. Summary of Savings**
- 6. Summary of Findings**
- 7. Conclusions and Next Steps**

These and all completed projects have a public final report on [calnext.com/approved-projects/!](https://calnext.com/approved-projects/)

Upcoming CalNEXT Events

INNOVATION NEXUS

August 26, 2026
8:30 a.m. - 5:00 p.m.



*Big ideas for
California's
energy future*

Energy Education Center
Irwindale, California

Registration is open at
calnext.com/events/innovation-nexus/

CaINEXT Will Be Attending



ETCC ET Summit

October 20 - 21

Davis, California

www.etcc-ca.com/summits/2026



ACEEE Summer Study in Buildings

August 2 - 7

Asilomar, California

- Multiple accepted CaINEXT papers
- Informal Session planned

Upcoming CalNEXT Knowledge Sharing Webinars

| Tentative Theme | Month |
|---|-----------|
| Industrial Technologies | September |
| HVAC Refrigerants & Cost-Optimized HVAC | October |
| Clean Space and Water Heating | November |
| Grocery and Foodservice | November |
| Water Heating | December |
| Multifamily | January |
| Agricultural | February |

Questions Are Encouraged!

Ask your questions of the presenters via the Teams Q&A panel during the webinar!

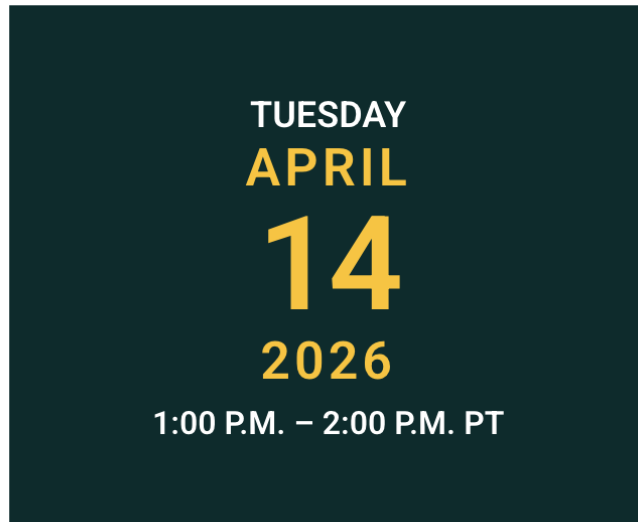
Presenters will monitor the Q&A as possible after their presentation.

The hosts will engage any remaining questions as time allows up until 3:15 pm PT

The CalNEXT Team will be using a poll in the 2nd half of the meeting to help bring you the most relevant ET information!

Previous CalNEXT Knowledge Sharing Webinars Available Online

Visit calnext.com/events/



WEBINAR

Knowledge Sharing Webinar

Residential Energy Technologies

Our first Knowledge Sharing Webinar, which focused on residential energy technologies, was held on Tuesday, April 14, 2026. We showcased several completed CalNEXT projects and shared their results and supporting research.

- 🎥 [Missed the event? Watch the recording.](#)
- 📄 [View the presentation slides.](#)

More CalNEXT Website Updates Coming Soon

CalNEXT
ENERGIZING CALIFORNIA'S FUTURE

Home How to Participate ▾ About ▾ Events ▾ Resources ▾ **Approved Projects** Keep in Touch

Approved Projects

Projects that have been reviewed by the CalNEXT program team using our [review criteria](#) and accepted by the program administrator are listed here. Statuses will be updated at least monthly and final reports will be linked when available. Listed completion dates are estimates and will be updated if needed.

Projects are filterable by technology area (based on the [TPMs](#)) and [Project Type](#). They are also sortable by any column and searchable by any keyword.

To view all past and current California statewide emerging technology projects and reports, please visit the [Emerging Technologies Program Portal](#) or the [Emerging Technologies Coordinating Council](#) websites.

Technology Area ▾ Project Type ▾ Search: **Search**

| Project Name | Project Number | Technology Area | Project Type | Status | Completion Date |
|---|----------------|-----------------------|--------------|--------|-----------------|
| ▶ Lab Test of a Commercially Available Multi-Function Heat Pump | ET26SWE0028 | Whole Buildings, HVAC | TSR | Active | 2027/06 |
| ▶ Package CHPWH with PCM Storage | ET26SWE0026 | Water Heating | TSR | Active | 2027/08 |
| ▶ Measure Development HVAC Pump Motors | ET26SWE0024 | Process Loads | TSR | Active | 2027/04 |

CaINEXT Partner Team

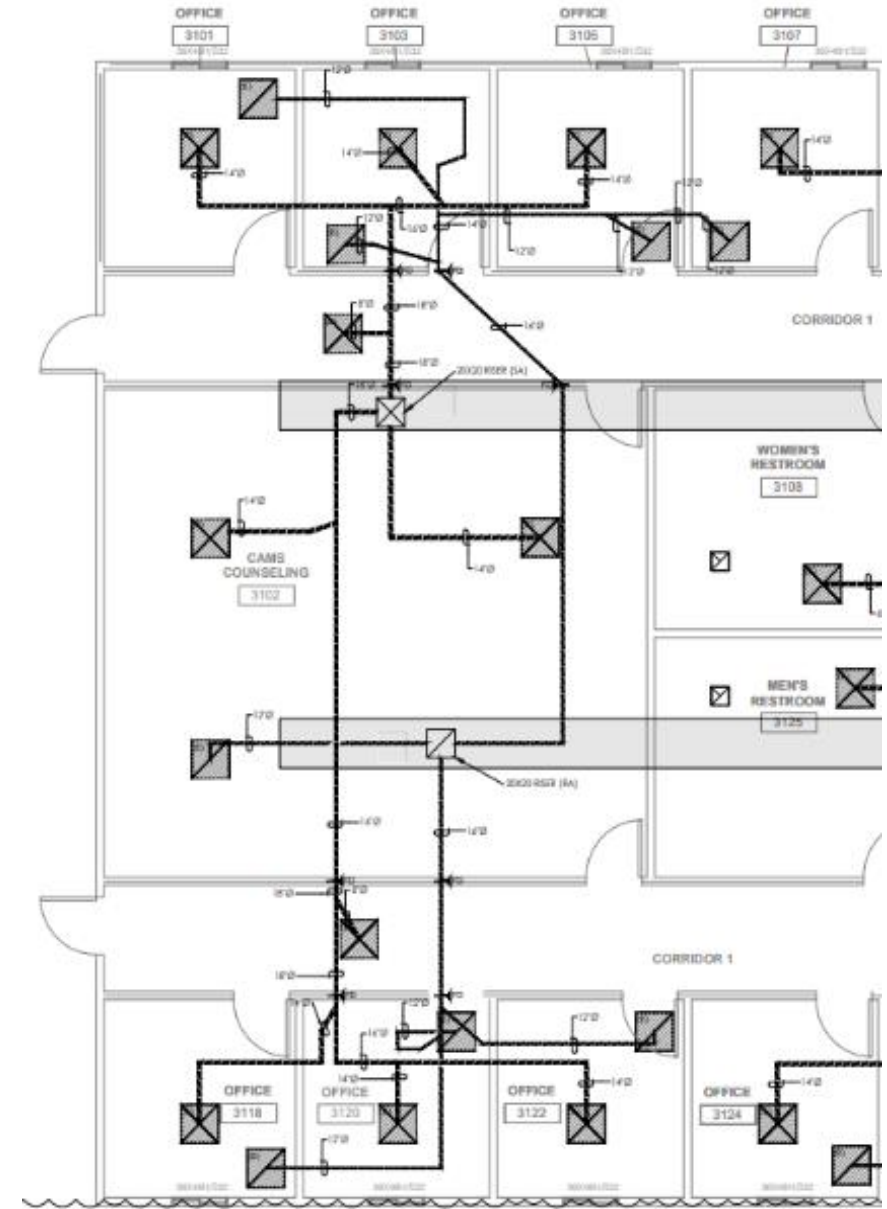


Occupant-Centric Micro-Zone Control for Commercial Buildings

Project Outcomes and Tech Transfer

Project Summary

- In-field evaluation of micro-zone control that uses advanced sensors and smart dampers to modulate airflow for each space based on occupancy.
- The technology uses AI to analyze real-time and historical data collected from the sensors and predicts space occupancy and dynamically adjusts ventilation, heating, and cooling in each micro-zone.
- Micro-zone = subdivision of existing zones into smaller, more responsive micro-zones based on occupancy patterns and cooling/heating requirements.



Study Objectives

To evaluate the feasibility and effectiveness of micro-zone control through field demonstrations at two Southern California test sites:

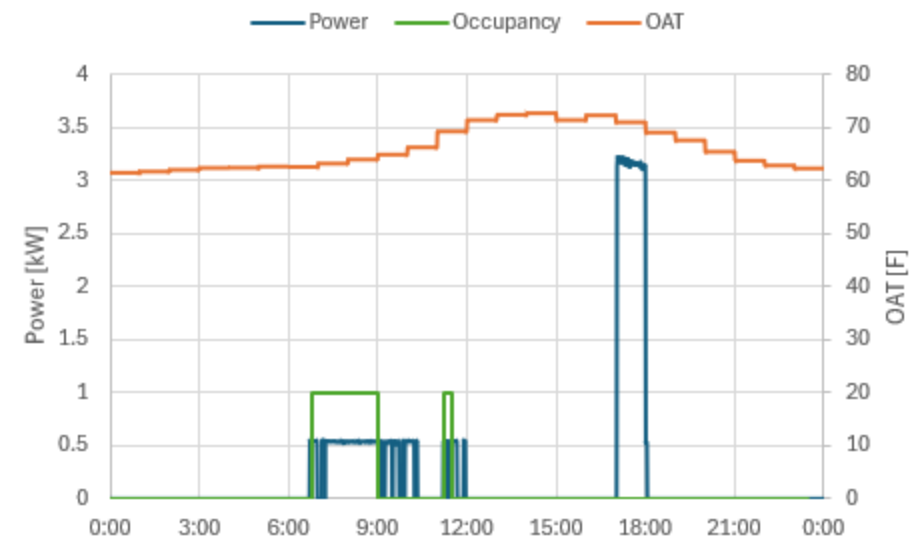
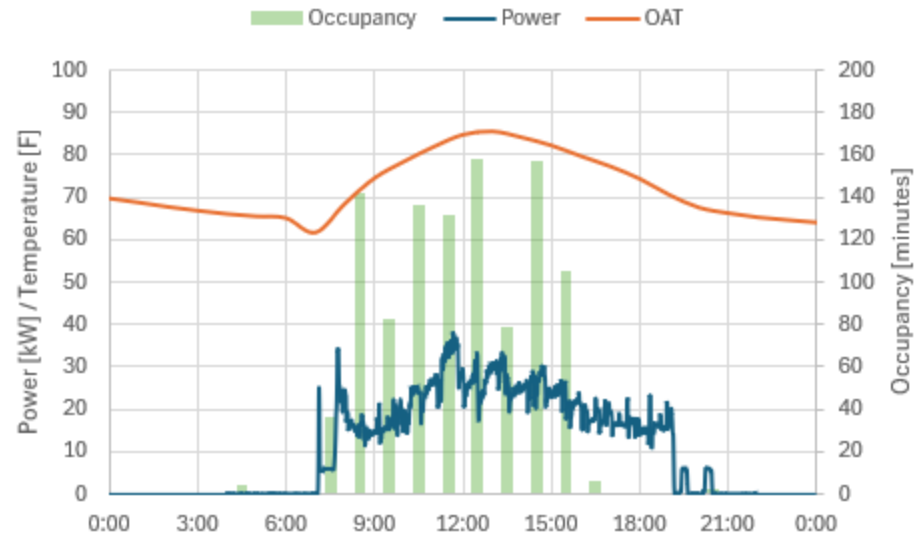
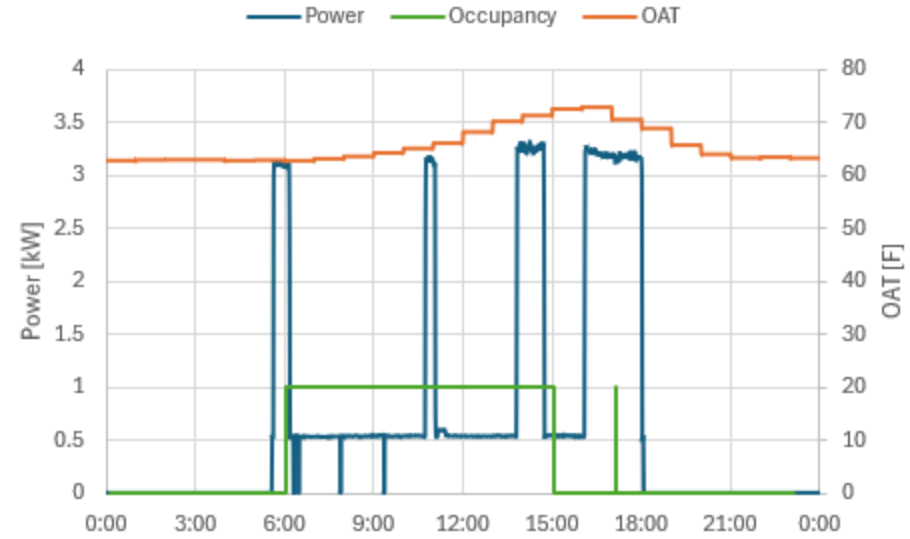
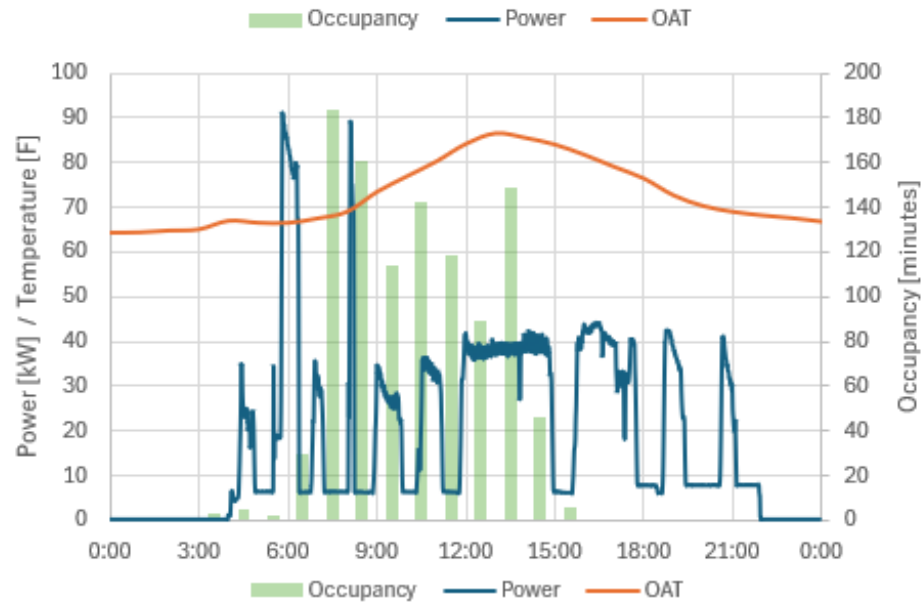
| Characteristics | Site 1 | Site 2 |
|-------------------------------|--|--|
| Location | Carson, CA | Artesia, CA |
| California Climate Zone | Climate Zone 8 | Climate Zone 8 |
| Building type | Education—University | Office—Small |
| Building area ft ² | ~18,000 of conditioned space | ~4,000 of conditioned space |
| Hours of operation | Monday–Friday, 8 a.m. to 5 p.m. Saturday, 8 a.m. to 1:30 p.m. | Monday–Friday, 6 a.m. to 5 p.m. |
| Space type | Classrooms, offices, storage | Offices, meeting rooms |
| Air System | Variable air volume | Constant volume |
| Equipment | Packaged heat pumps (37.5 tons) | Packaged RTU with gas heating (5 tons) |



Stakeholders

| Stakeholder Category | Feedback and Recommendations |
|---------------------------------|---|
| CalNEXT | The program team provided feedback on the project scope during the screening and scanning phase of the project. The feedback and recommendations were incorporated into the project scope. |
| | SCE provided feedback on all our project deliverables, including the Project Plan, Preliminary Findings Report, Draft Report, and Final Report. All feedback was addressed in the Final Report. |
| Original Equipment Manufacturer | Feedback was gathered from the technology manufacturer on an ongoing basis. They were knowledgeable about the installation and operation of technology. |
| Host Site Customers | Feedback was gathered from the host site customers on an ongoing basis. They provided feedback on technology installation, usability, and occupant comfort. |
| Subject Matter Expert | Feedback was gathered from the subject matter expert regarding the current state of technology and next steps. |

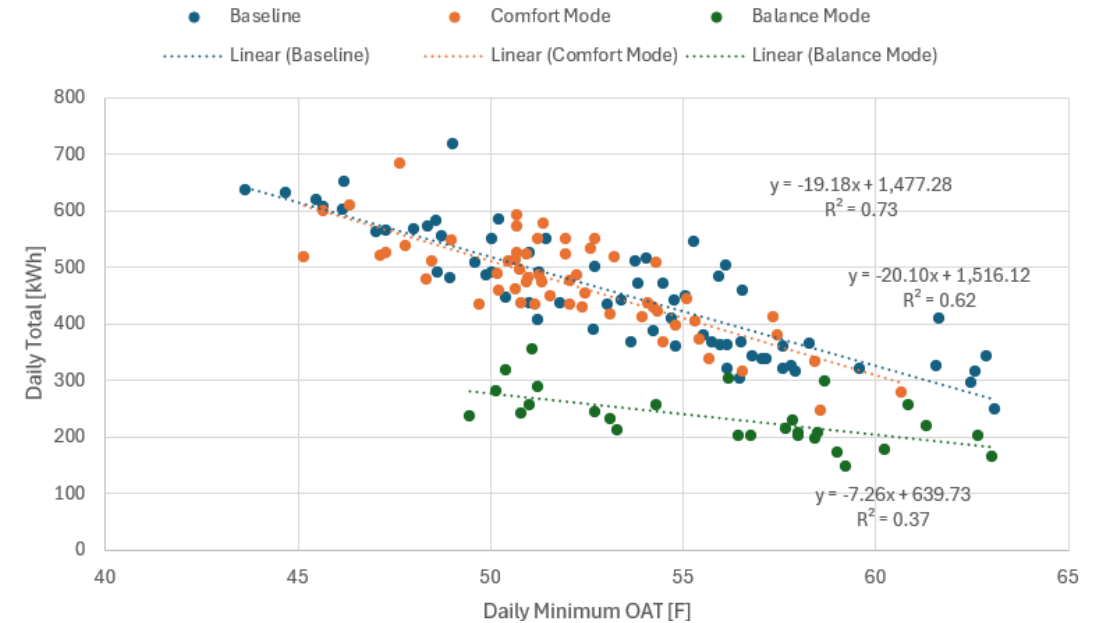
Results



Summary of Savings

| Site 1 | Weekday Electricity Use (kWh) | Holiday Electricity Use (kWh) | Total Electricity Use (kWh) | GHG Emissions (tons of CO ₂) |
|--------------------|-------------------------------|-------------------------------|-----------------------------|--|
| Baseline | 103,995 | 4,130 | 108,124 | 38,410 |
| Post | 66,613 | 2,247 | 68,859 | 24,700 |
| Savings (%) | 37,382 (36%) | 1,883 (46%) | 39,265 (36%) | 13,710 (36%) |

| Site 2 | Weekday Electricity Use (kWh) | Holiday Electricity Use (kWh) | Total Electricity Use (kWh) | GHG Emissions (tons of CO ₂) |
|--------------------|-------------------------------|-------------------------------|-----------------------------|--|
| Baseline | 5,063 | 153 | 5,216 | 1,866 |
| Post | 4,679 | 94 | 4,773 | 1,697 |
| Savings (%) | 384 (8%) | 59 (39%) | 443 (9%) | 169 (9%) |



Summary of Findings

Energy Savings and Payback

- Annual estimated savings varied by site
- Payback: 2.8 years for Site 1, over 40 years for Site 2*
- Peak demand savings during early morning and late evening hours
 - Beneficial in supporting California's electrification efforts

Adoption Barriers

- Limited access to occupancy data in existing buildings
- Suboptimal performance of existing HVAC systems
- Lack of standardized, packaged solution and cost/payback predictability

*Using blended rate of 40 cents per kWh

Conclusions and Next Steps



Project Conclusion

- TPM Impacted: HVAC
 - Scalable HVAC Controls Deployment (Lead Role, High Priority in 2023 TPM)
- Non-Energy Benefits
 - A safe and comfortable environment for occupants through real-time monitoring and control of indoor conditions.
 - HVAC equipment runtime reduction, leading to lower maintenance costs and extended equipment lifespan.
 - Improved visibility into HVAC system performance through remote monitoring and control.



Next Steps

- Expand Study Through Pilot Programs
 - Scale field testing across a broader range of building types and climate zones.
- Develop Standardized Implementation Package
 - Work with the manufacturer to create turnkey solutions that reduce customization needs, streamline deployment, and improve cost predictability.
- Engage Utility Partners for Incentive Programs
 - Design and promote programs to lower technology implementation cost and support HVAC optimization.
- Education and Training
 - Spread the knowledge and information about the technology among HVAC designers and building owners.



Project Final Report

Thank You!

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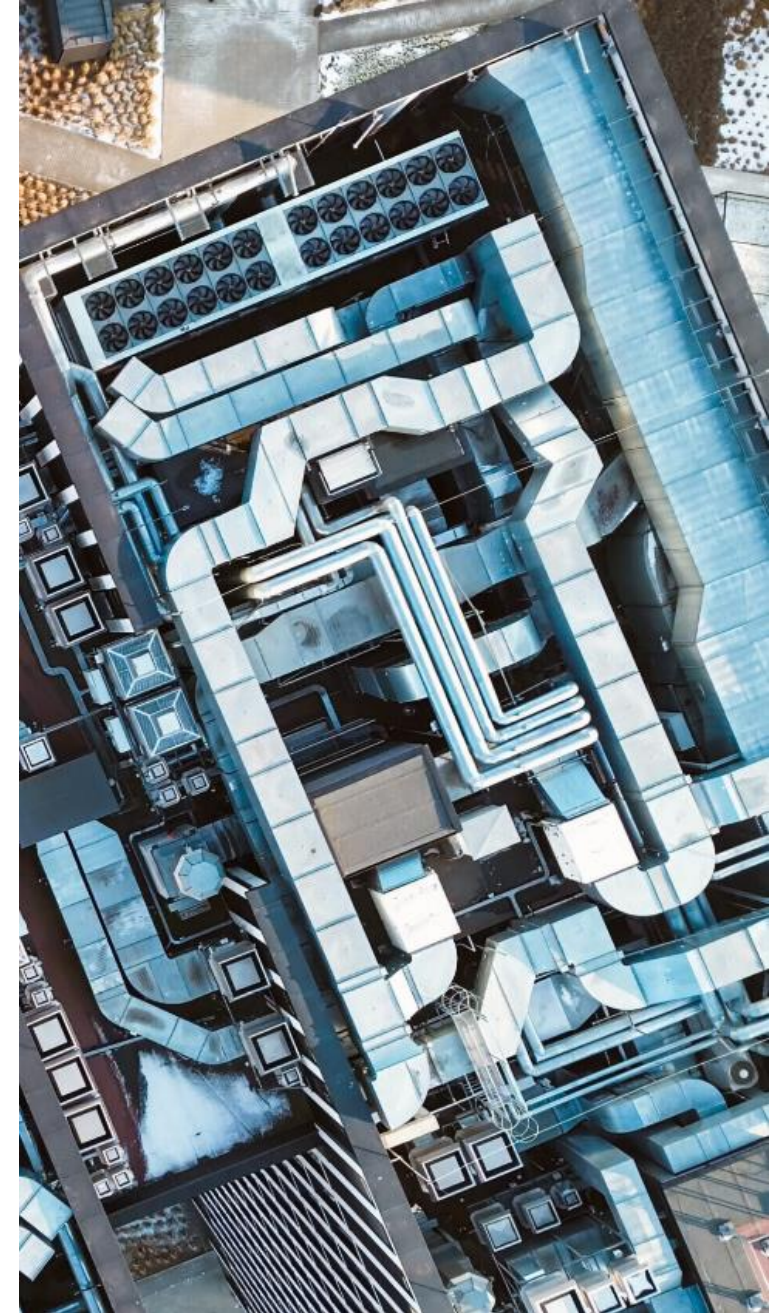


ASHRAE Guideline 36 Open-Source Supervisory Control Technology Development and Demonstration

Project Outcomes and Tech Transfer

Project Summary

- Developed standardized open-source implementation framework for advanced controls in commercial buildings.
- Implemented ASHRAE Guideline 36 hydronics sequences of operation at two commercial buildings.
- Evaluated energy and cost savings, and implementation challenges.



Project Background

ASHRAE Guideline 36 (G36)

- High Performance Sequences of Operation (S00) for HVAC Systems
- Some S00s are required by CA Title 24-2025

Types of Controls

- Balance between outside and return airflows
- VAV minimum airflows
- Setpoint resets
- Energy Savings Potential
 - 4 to 60%
 - Payback period less than 10 years



Opportunity to improve energy efficiency.

Project Overview

Project Objectives

- Implement G36 hydronics sequences at two sites and evaluate energy savings
- Document lessons learned
- Control sequence deployment using standardized methods

Methods

- Developed standardized implementation methodology: BRICK standardized schema, supervisory control, Control Description Language
- Field Demonstration:
 - Implemented G36 hydronics sequences in one chilled water plant, two hot water plants across two buildings
- Conducted measurement & verification (M&V)

Demonstration Site – SDH



Demonstration Sites

SDH

- Seven story, 141,000 ft² (13,000 m²)
- Classrooms, offices, auditorium, cybercafe, Nanofabrication cleanrooms

ASHRAE Guideline 36 Intervention

- Supply water temperature trim and respond reset control
- Water-cooled centrifugal chiller: 43 to 52°F
- Steam to water heat exchanger: 120 to 190°F

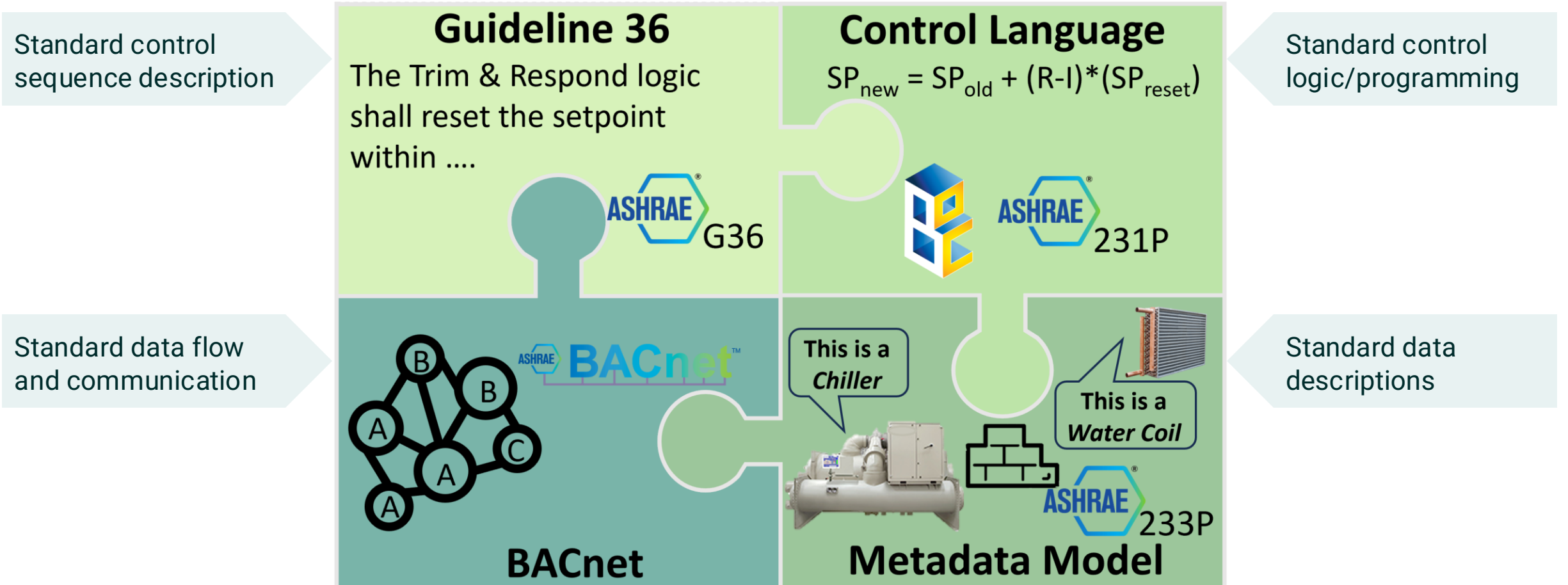
DBC

- Four story, 39,000 ft² (3,600 m²)
- Offices, auditorium, conference rooms, restaurant

ASHRAE Guideline 36 Intervention

- Supply water temperature trim and respond reset control
- Boiler plant supply water: 90 to 120°F

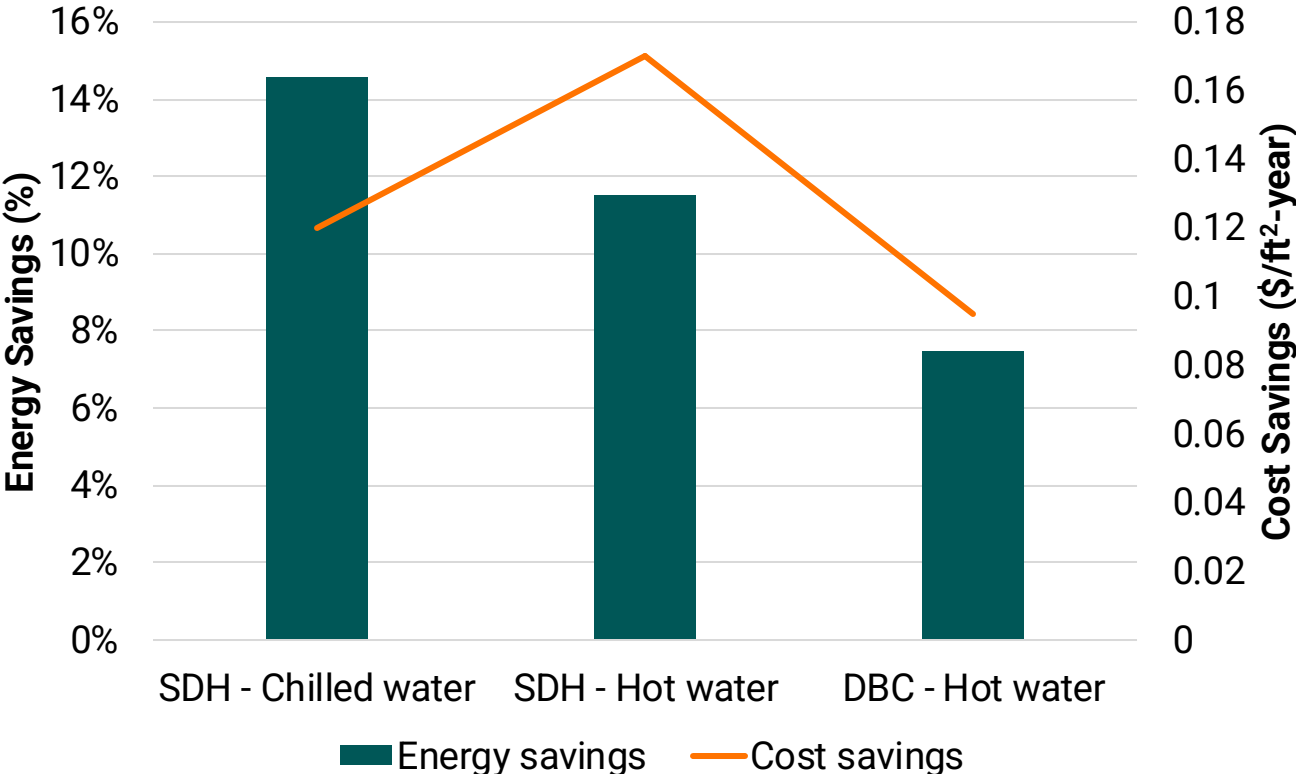
Controls Deployment Using Standardized Methods



Graphic: ASHRAE Winter Conference 2026 poster presentation by C. Duarte and T. Jayarathne

Summary of Savings

Energy savings between 7.5 – 14.6%, lead to \$3,000 – \$24,000 annual cost savings



7.5-14.6%
electricity and natural gas
energy savings



\$0.095-0.12
per square foot
annual cost savings

Conclusions and Next Steps



Project Conclusion

- Existing System issues limits operation of advance controls: thorough evaluation and EBCx is critical.
- Standardized implementation methods can help scale adoption.
- Supports HVAC – Commercial Installation, Operation & Maintenance technology.
- Provide scalable open-source framework for advance controls implementation, energy and cost savings from implemented ASHRAE G36 SOOs.



Next Steps

- Results dissemination through ASHRAE G36 committee and to manufacturers.



Project Final Report

Thank You!

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Automated Guideline 36 Validation

Project Outcomes and Tech Transfer

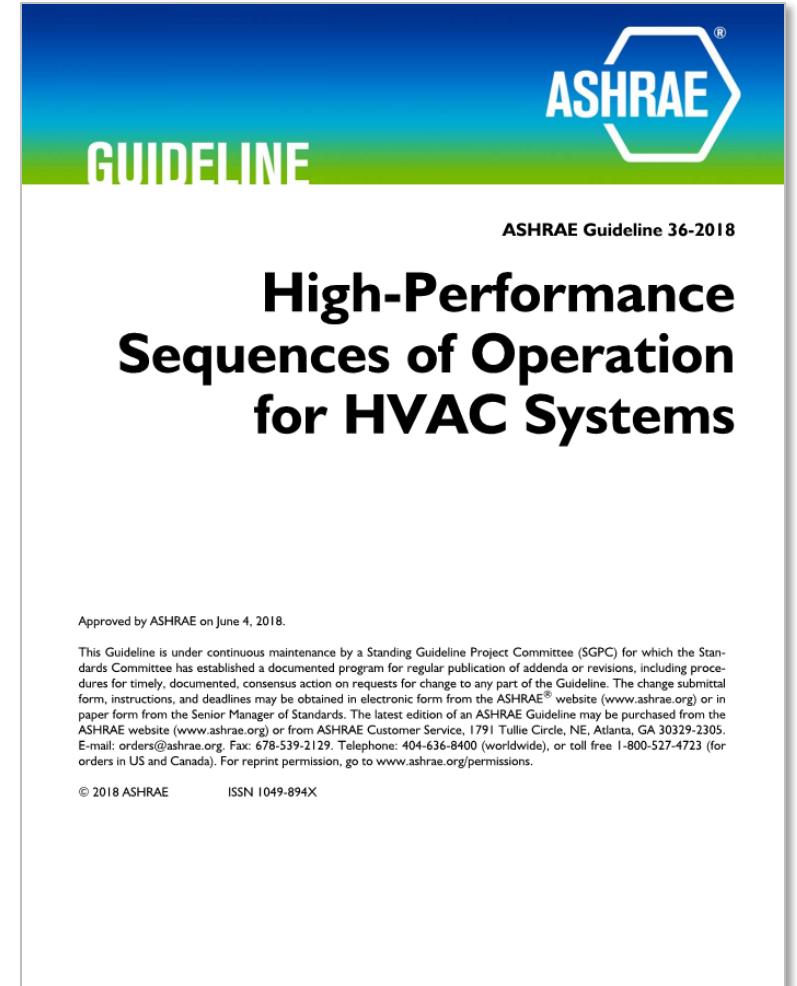
Project Summary

Problem

- Building automation systems often underperform.
- ASHRAE Guideline 36 provides best practice instructions for how HVAC systems should be controlled, but it is complex and difficult to program.

Solution

- Encourage use of centralized libraries by installers.
- A method of test to ensure that programming libraries conform with Guideline 36.



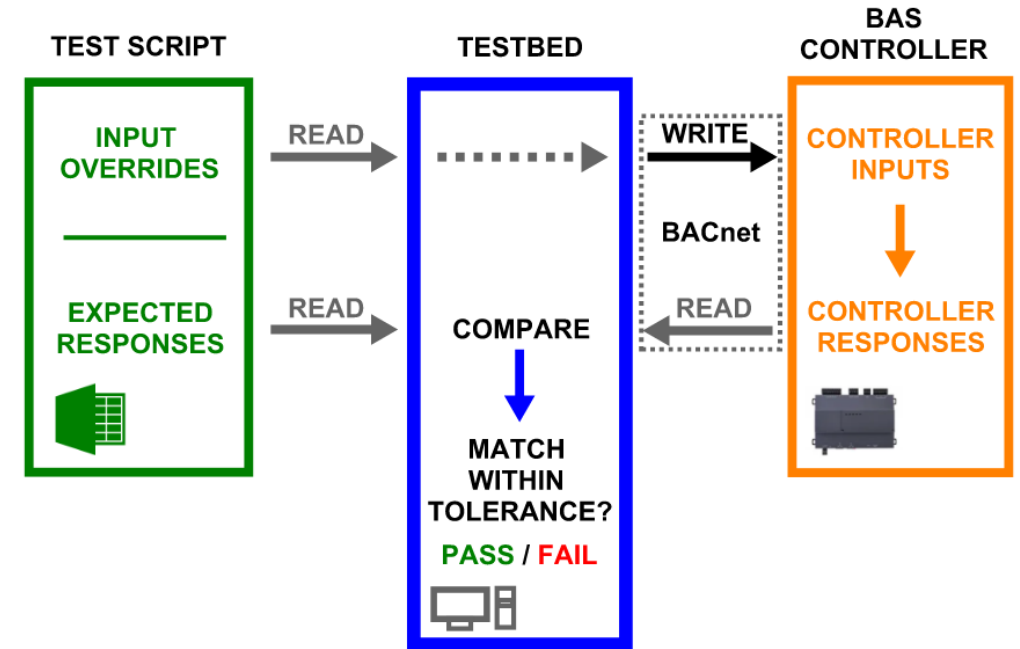
Purpose: To Support the Successful Scaling of Guideline 36

Bench Scale Test Development

- Automated, objective, repeatable
- Vendor-agnostic
- Detailed tests for key Guideline 36 sequences
- Draft method of test

Pilot Testing

- Testing of manufacturer and open-source programming
- Coordination with teams building software tools



Stakeholders



| Key Stakeholders | Role |
|--|--|
| Building automation system manufacturers | Ensure compatibility with unique approaches and customer needs |
| Designers/installers | Characterize industry barriers and understand impacts on future project delivery |
| Building science researchers | Coordination with related research efforts |
| Codes and standards developers | Ensure alignment with codes and standards needs |

Summary of Findings

- Created detailed, repeatable test architecture and scripts
- Successfully pilot-tested with manufacturer and open-source programming
- Developed a draft method of test
- Conducted extensive stakeholder outreach
- Initiated ASHRAE Standard 236



Photo credit: Berkeley Lab

Conclusions and Next Steps



Project Conclusion

- This project impacts the HVAC Controls TPM by supporting the successful scaling of Guideline 36.
- End users will benefit from streamlined installations, better HVAC control performance, and enhanced energy efficiency.
- Next step is to transfer body of work to ASHRAE SPC 236



Next Steps

- ASHRAE SPC 236 to expand pilot testing to other manufacturers' programming, refine method of test, and publish the new standard.
- Coordinate with codes and standards developers.
- Continue industry outreach to encourage use of centralized programming libraries.



Project Final Report

Thank You!

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Energy Efficiency and Building Electrification Project Success Tools

Project Outcomes and Tech Transfer

Program Summary

Energy Efficiency (EE) and Building Electrification (BE) Project Success Tools is a market study & prototype buyers guide

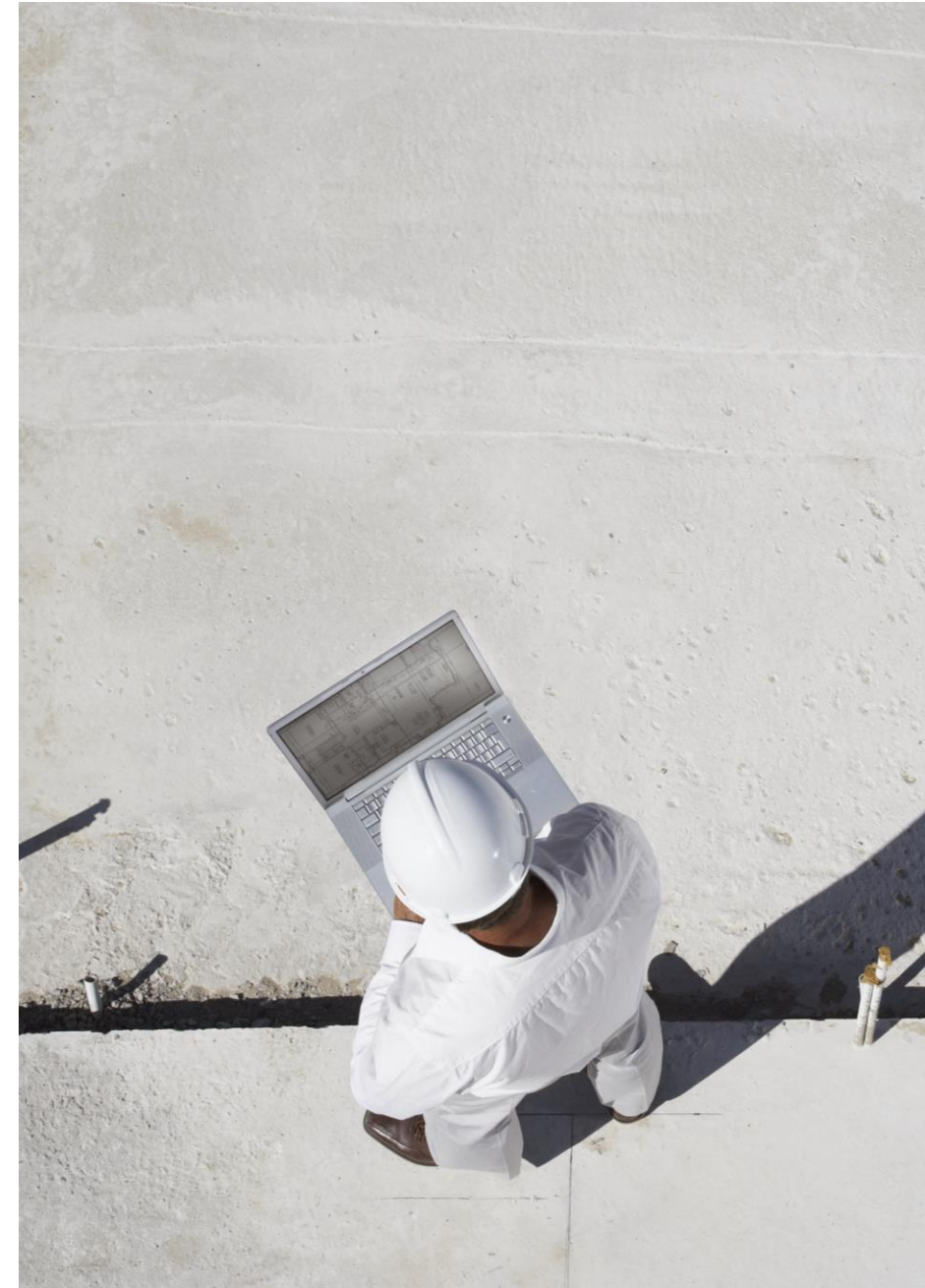
Includes three primary focus areas:

1. Examine contractor-facing software that may enable high-quality EE/BE project delivery across California,
2. Organize the market into a relevant barrier resolution framework, and
3. Develop a prototype buyer's guide framework and searchable database concept to help drive contractor software adoption with the goal of increasing quality and quantity of EE/BE projects.



What is its Purpose?

1. Examine how contractor-facing software tools can enable high-quality EE/BE project delivery in California.
2. Review a sampling of commercially available tools across the HVAC project lifecycle (marketing through refrigerant management).
3. Assess contractor awareness, adoption, and barriers via interviews with contractors, trainers, trade associations, and software vendors.
4. Develop an evaluation framework and prototype buyer's guide/database to illustrate how this might increase adoption and improve alignment with utility program requirements.
5. Generate program design and research recommendations to reduce administrative burden and support consistent project quality.





Stakeholders

CalNEXT / Energy Solutions – project lead and program implementation.

California Electric IOUs (SCE, PG&E, SDG&E) – oversight and feedback; SCE provided input throughout the project.

VEIC – research partner supporting tool review, interviews, and framework development.

HVAC Contractors – provided market input on needs, barriers, and tool preferences through interviews.

Tool Vendors – Provide summaries and insights on relevant software

Trainers/Training Centers – provided training insights.

IHACI (trade association) – engaged stakeholder, provide contractor perspective; has shown initial interest in future ownership/hosting of the buyer's guide.

Summary of Savings

Illustrative statewide savings potential if improved tool selection/support increases project delivery quality and reduces administrative friction in EE/BE programs.

(Spillover market transformation savings outside rebate programs are not included.)

| Assumption | Savings Rate | Annual kWh Savings | Basis |
|------------|--------------|--------------------|--|
| Low | 5% | 23,230,356 kWh | Based on average total 2022–2024: 453,214,565 kWh (CEDARS) |
| High | 10% | 46,460,712 kWh | Illustrative potential based on increased volume in existing rebate programs |

Summary of Findings

1. There is a wide range of tools for contractors across the HVAC project lifecycle, but these tools often do not interact with each other and contractors report pain points with each individual tool type. Contractors reported using multiple tools (often across CRM, scheduling, design, and rebate workflows), creating software fatigue and training burden.
2. Rebate submission/documentation is a major barrier; contractors want CRM-integrated, auto-populated forms, validation, and up-to-date eligibility/rebate values.
3. Contractors value embedded training/onboarding, responsive support, and tighter alignment between software outputs and utility QA/QC and program requirements.
4. Contractors prefer a forum where they can get recommendations directly from their peers on useful software. (Can be handed off to trade associations.)
5. Unmet needs include bilingual customer education resources and broader tool coverage. (The prototype reflects about 5% of tools on the market.)
6. Contractors interviewed felt an easy-to-use tool helping them identify and categorize their problems, plus find software aligned with overcoming those barriers would be helpful. Ideally, they could use this tool and discuss its output with their peers to make fast, well-informed decisions.

Conclusions and Next Steps



Project Conclusion

- **TPM Impact:** Supports CalNEXT's market transformation goals by improving contractor participation, project quality, and program delivery efficiency through better alignment between contractor software workflows and utility program requirements. Specifically, how to sell, install, optimize, and maintain HVAC equipment which aligns with the opportunity noted in the air-to-air heat pumps and controls section of the 2024 HVAC TPM noting the need for “validating new digital tools in support of quality installations”, “...The use of systems can allow for seamless commissioning...”, and “There is still a need for continued improvement in sizing equipment.”
- **Benefit to End Users:** Enables higher-quality HVAC installations, improved system performance, and more efficient project delivery, which can reduce errors, improve reliability, and support broader adoption of energy efficiency and electrification technologies.



Next Steps

- Expand and operationalize the buyer's guide framework and tool database, support broader adoption through utilities and third parties (e.g., trade associations), and incorporate tools and training into program design to improve Quality and increase participation
- Collaborate with IHACI to build out and maintain the buyers' guide and host a software peer discussion forum online and in conferences.



Project Final Report

Thank You!

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Heat Pump Rooftop Unit Demonstration

Project Outcomes and Tech Transfer

Project Objectives

- Install and monitor high and standard performance heat pump rooftop units (RTUs)
- Compare to gas-pack RTU
- Evaluate market barrier related to heat pump RTUs in California
 - Installation costs
 - Service upgrades
 - Electric strip heat
- Provide recommendations for utility programs



Methodology

Monitor Performance of Heat Pumps over Summer and Winter Seasons:

- Capacity
- Power
- Mode of operation
- Weather conditions

Normalize Data to Outdoor and Indoor Conditions:

- Regression models describing overall COP

Model Annual Performance:

- Apply regression models to loads calculated in EnergyPlus
- Directly compare energy use and greenhouse gas emissions for each system

| System ID | RTU1 | RTU2 | RTU3 |
|------------------|-------------------------------|---------------------------|-----------------------|
| Type | Standard efficiency heat pump | High-efficiency heat pump | Gas/electric unit |
| Compressor | Fixed speed | Variable speed | Fixed speed |
| Indoor Blower | 2 stage | Constant CFM | Constant CFM |
| Auxiliary Heat | Electric heat (5 kW) | No electric heat | Gas-fired furnace |
| Rated Efficiency | 13.4 SEER2 / 6.7 HSPF2 | 17.8 SEER2 / 8.8 HSPF2 | 13.4 SEER2 / 80% AFUE |

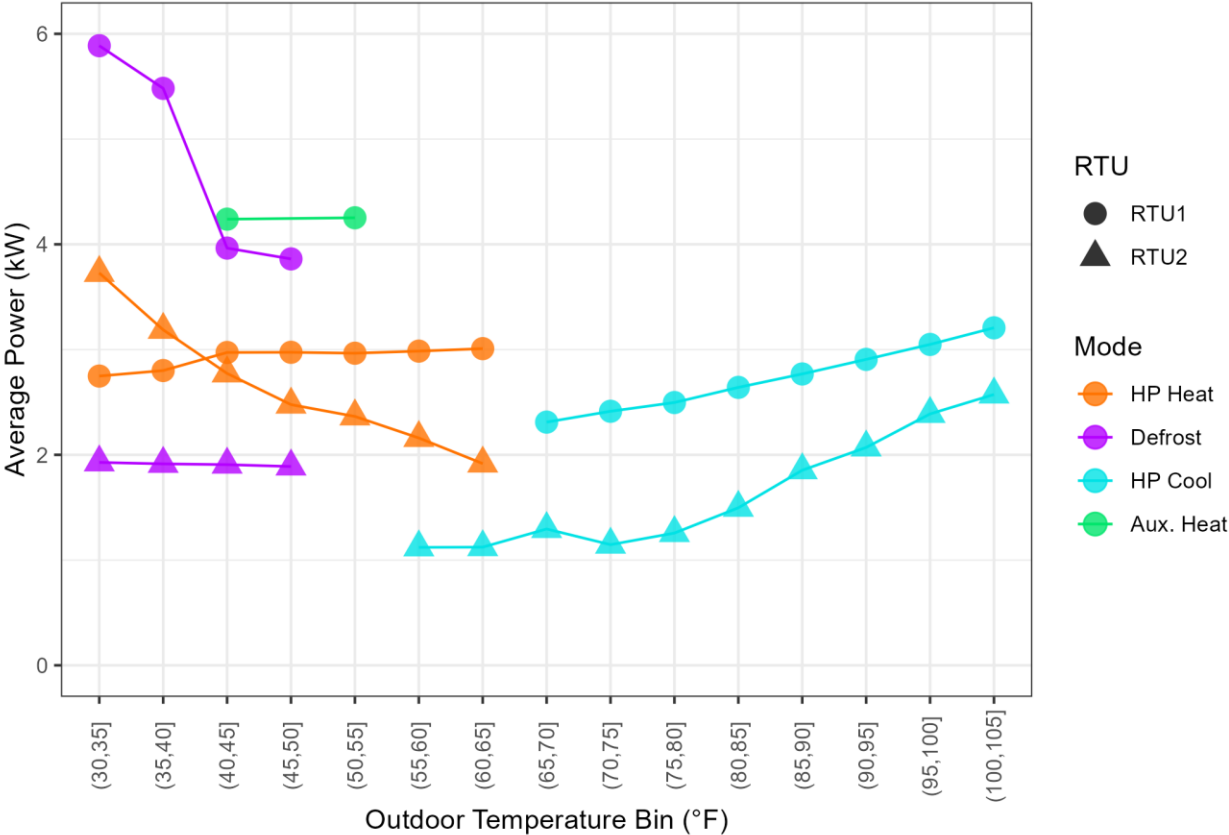


Stakeholders

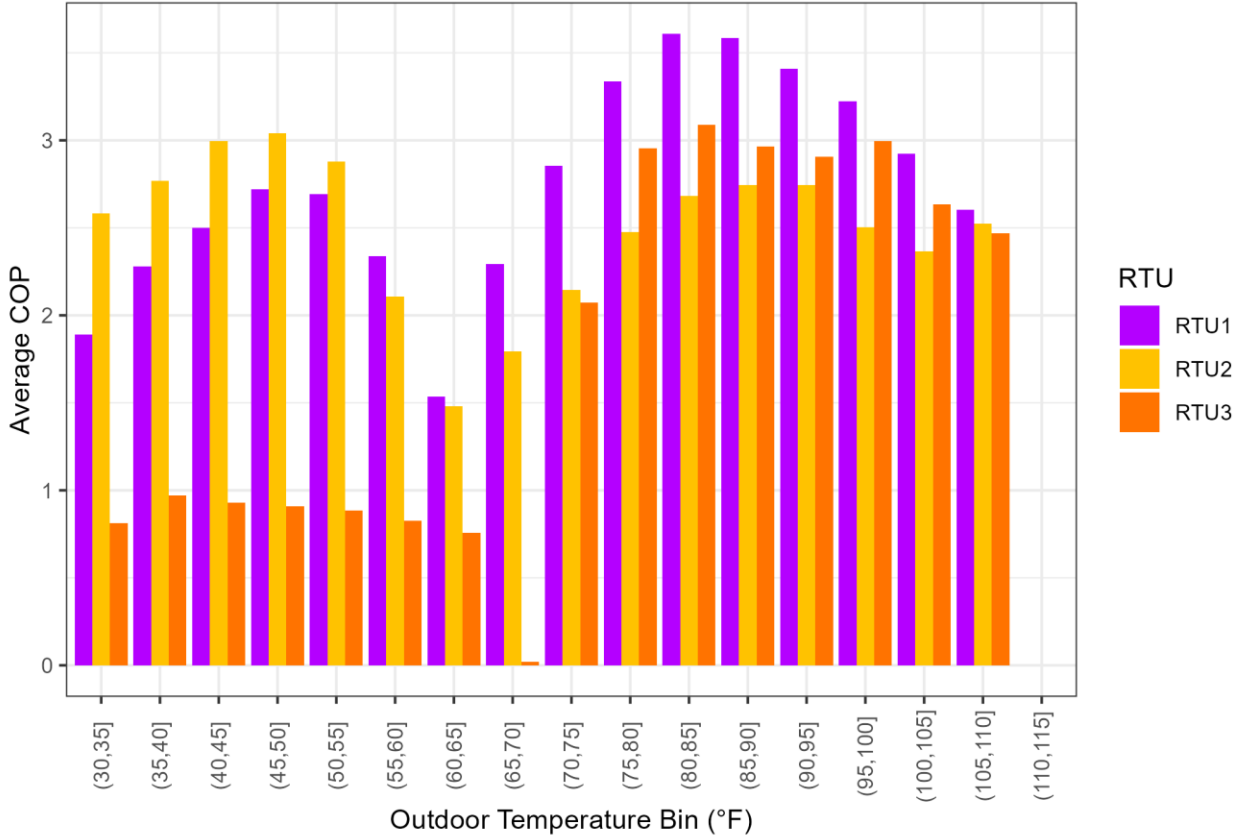
- Equipment manufacturer encourage innovations for reducing use of electric heat.
- Utilize California Technical Forum for future measure update feedback.
- CalNEXT partners collaborate on measure updates.
- Distributors and installers highlight lower barrier pathways for retrofit heat pump RTU installations.

Results Highlights

Average Input Power by Mode



Overall COP by Outdoor Temperature Bin



Summary of Findings

- Reduced operating costs for heat pump compared to gas
 - 3%-10% reduction in operating cost
 - >50% reduction in GHG emissions
- Supplemental electric resistance heat can be avoided
 - Defrost controls that avoid use of blower
 - Low compressor lockout temperatures
- Ventilation controls can limit potential for variable-speed equipment

Conclusions and Next Steps



Project Conclusion

- Identified strategies for reducing reliance on electric resistance heat and quantified energy savings.
- Provides data needed for developing programs and recommends strategies for reducing market barriers.



Next Steps

- Disseminate results to stakeholders including OEMs and utility program staff.
- Update RTU measure packages.



Project Final Report

Thank You!

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Feedback

 Please help us improve these webinars and let us know what you think!

Fill out the form with this QR code:

Knowledge Sharing Webinar 2 Poll



Commercial Building Duct Sealing Energy Savings and Cost Analysis

Project Outcomes and Tech Transfer

Project Summary

This project (ET24SWE0048) quantified the energy and cost impacts of duct sealing in small commercial buildings (≤ 5000 sf²).

It built on the earlier market characterization study and used EnergyPlus with DEER prototypes to evaluate:

4 Building Types: small office, retail store, fast food restaurant, and dine-in restaurant

4 Unitary HVAC Types: DXGF, DXHP, DXOH, and NCGF

16 California Climate Zones and leakage scenarios ranging from 5% to 30% including both leakage to the inside and outside.

Primary Closeout Value

Provide defensible savings and cost effectiveness inputs for commercial duct sealing measure development and future IOU program planning.



Why this Project Mattered

Before the Study: Commercial duct sealing had limited California-specific savings and cost data, especially for small buildings.

The project answered three closeout questions:

- What are the savings by building type, HVAC type, climate zone, and leakage pathway?
- How should baseline leakage and post-sealing improvement be represented in modeling/ measure package?
- What payback and measure-package potential does duct sealing offer in California?

Opportunities

- Targeting single-zone HVAC retrofits (duct sealing) in all sixteen California climate zones leading up to **35% of energy saving** at HVAC level.
- Developing an eTRM measure package based on the finding of this study.





Stakeholders

UC Davis Western Cooling Efficiency Center

Collaborator and technical advisor

CPUC Staff

Study direction/energy modeling methodology feedback and measure relevance

SDG&E and California IOUs

Intended users for measure package development, portfolio planning, and market translation

Outcomes

Completed a California-wide modeling framework for commercial duct sealing across **16 climate zones**.

Separated leakage-to-inside and leakage-to-outside pathways to better reflect **real duct/thermal-barrier conditions**.

Translated technical results into **cost-effectiveness, screening, and measure-package insights for IOU use**.



Summary of Savings

Average percentage of **HVAC end use energy saving** across sixteen climate zones for all leak scenarios for different building type and HVAC systems

| Building Type/HVAC System | DXHP | DXGF | DXOH | NCGF |
|---------------------------|-------|-------|-------|--------|
| OfS | 2.80% | 6.05% | 1.60% | 4.30% |
| RFF | 1.90% | 2.95% | 0.70% | 3.45% |
| RtS | 3.45% | 6.65% | 2.15% | 7.20% |
| RSD | 6.30% | 9.90% | 2.25% | 11.45% |

Estimated costs, savings, and payback window for a 5,000 square foot commercial building. Savings assume California blended rates of 0.24 \$/kWh and 1.50 \$/therm and average HVAC savings for an office building (DXGF).

| Metric | Manual Sealing | Aerosol Sealing |
|-----------------------|--------------------|--------------------|
| Typical Capital Cost | US \$2,500–\$5,000 | US \$5,000–\$6,000 |
| Expected Leakage Cut | 40–50% | 70–90% |
| HVAC Energy Savings | \$1,290 | \$1,930 |
| Simple Payback Window | 2–4 years | 2–3 years |

Conclusions and Next Steps



Project Conclusion

- Quantified savings potential across small commercial building types, HVAC configurations, and climate zones.
- Showed that California-specific energy rates strengthen the value proposition for duct sealing.
- Created a practical bridge from research findings to IOU measure and portfolio planning.



Next Steps

- Develop a Commercial Duct Sealing Measure Package

We are initiating the development of a measure package based on our EnergyPlus modeling and cost-effectiveness findings which will align with CPUC guidance on deemed measures.



Project Final Report

Thank You!

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Thank You!

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