2025 Project Summit

March 27, 2025

10:00am – 12:00pm PT

ENERGIZING CALIFORNIA'S FUTURE

AGENDA

10 AM – 10:05 AM PT
Intro to CalNEXT

10:06 AM – 10:49 AM PT
Intro to HVAC and Water Heating TPMs
HVAC and Water Heating Projects
Q&A

10:50 AM - 11:39 AM PT
Intro to Whole Building and Process Loads TPMs
Whole Buildings and Process Loads Projects
Q&A

11:40 AM - 12:00 PM PT
Intro to Lighting, Plug Loads, and Appliances, and Portfolio Enhancements TPMs
Lighting, Plug Loads, and Appliances, and Portfolio Enhancements Projects
Q&A

What is CalNEXT

CalNEXT is the California IOU's Statewide **Electric** Emerging Technologies Program. CalNEXT's vision is to identify emerging technology trends and bring commercially available technologies to the IOU's energy efficiency program portfolio.

Partner Team

Energy Solutions
Celebrating 30 years

veic

aesc
alternative energy systems consulting

ORTIZ
THE ORTIZ GROUP

TRC

UC DAVIS
UNIVERSITY OF CALIFORNIA

Project Types

Technology Development Research (TDR): "Early Stage" technologies or products

Technology Support Research (TSR): "Market Ready" technologies or products

Focused Pilot (FP): mapping end-to-end barriers of high-impact technologies (based on the Focused Pilot TPM)

Technology Priority Maps

HVAC

Lighting, Plug Loads & Appliances

Portfolio Enhancements

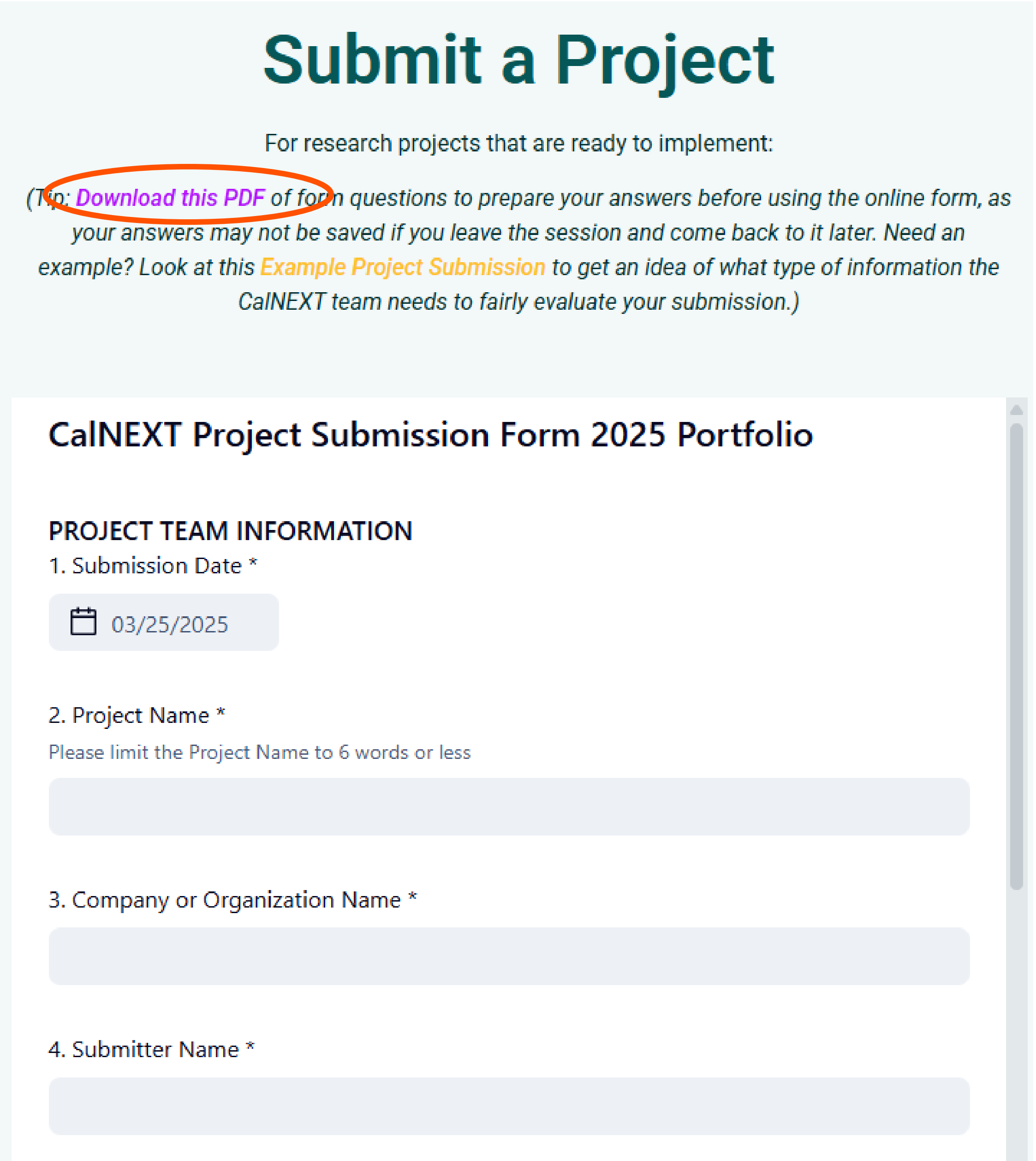
Process Loads

Water Heating

Whole Buildings

Project Submission on CalNEXT.com

- Navigate to website
- Download questions
- Develop answers
- Input answers into webform when you are ready to submit
- Next submission deadline: **April 25, 2025**



Submit a Project

For research projects that are ready to implement:

(Tip: Download this PDF of form questions to prepare your answers before using the online form, as your answers may not be saved if you leave the session and come back to it later. Need an example? Look at this Example Project Submission to get an idea of what type of information the CalNEXT team needs to fairly evaluate your submission.)

CalNEXT Project Submission Form 2025 Portfolio

PROJECT TEAM INFORMATION

1. Submission Date *

03/25/2025

2. Project Name *

Please limit the Project Name to 6 words or less

3. Company or Organization Name *

4. Submitter Name *

Presenters

Jose Garcia
Managing Research Engineer
TRC Companies

Hwakong Cheng
Principal
Taylor Engineering

Meghan Harwood
Senior Consultant
VEIC

Glen LaPalme
Engineering Manager
TRC Companies

Gretchen Schimelpfenig
Senior Energy Engineer
Energy Resources Integration (ERI)

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UC Davis Western Cooling Efficiency Center

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Energy Solutions

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Project Manager II
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Zoe Mies
Project Manager I
Energy Solutions

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2024 HVAC TPM

High-efficiency, all-electric HVAC systems continue to be a priority for CalNEXT. This includes maturing products such as high-efficiency air-to-air packaged heat pumps as well as less mature product markets, like air-to-water heat pumps intended for gas boiler replacements.

CalNEXT is also focused on deploying scalable HVAC solutions and decarbonization design strategies to create high-impact opportunities for the commercial and multi-family sectors.

Tech Families of this group include:

- Micro Heat Pumps
- Commercial Air-to-Air Heat Pumps
- Large Commercial Decarbonized Designs
- Commercial HVAC Equipment Installation, Operation, and Maintenance
- Commercial Hydronic Heat Pumps (cross-listed with Water Heating)
- Residential Multifunction Heat Pumps (cross-listed with Water Heating)
- Residential Air-to-Air Heat Pumps and Controls
- Commercial Scalable Thermal Storage

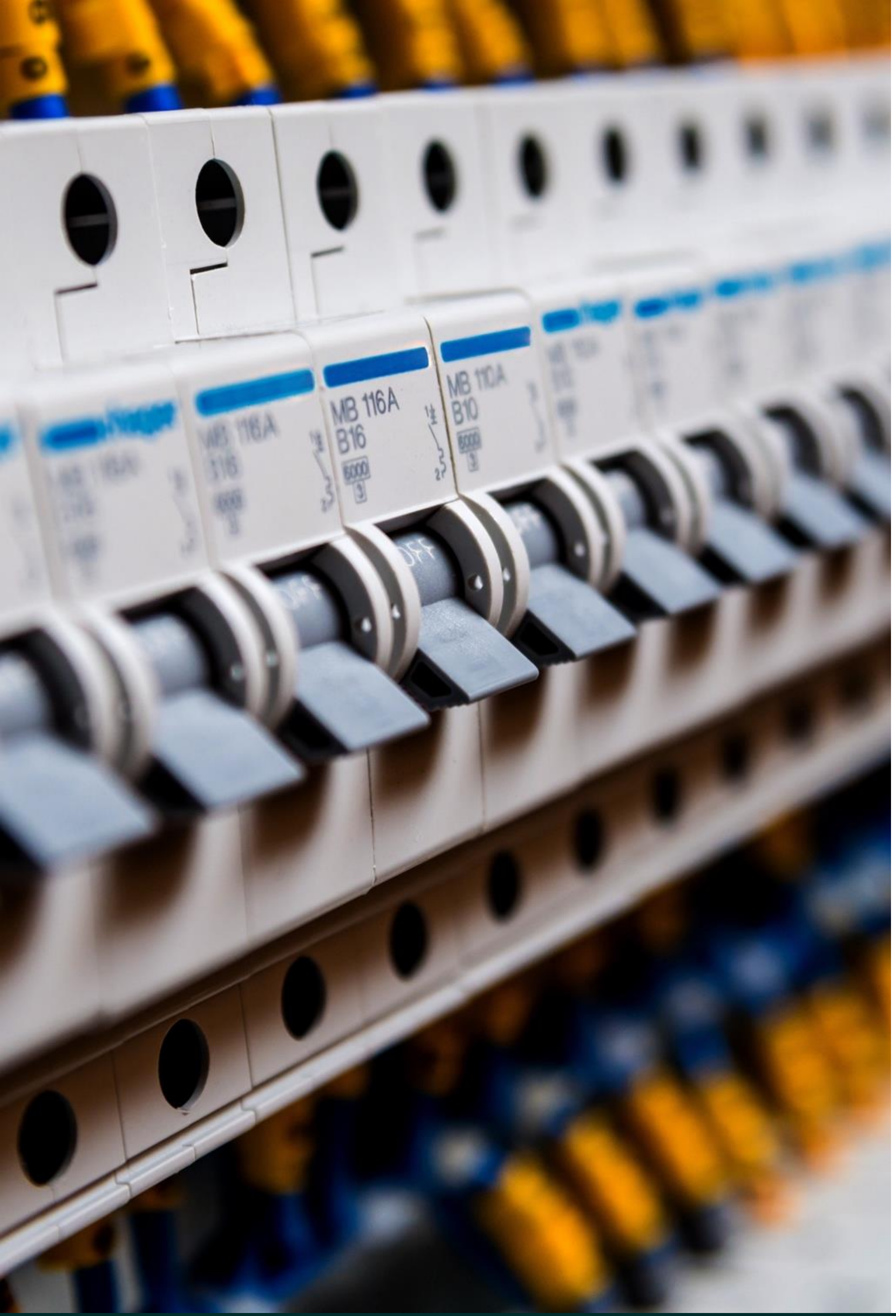
2024 Water Heating TPM

The decarbonization of water heating has been identified as an achievable and significant step toward California's overall decarbonization goals, and policies are changing to emphasize this end-use. Programs like TECH Clean California and BUILD are working on the market transformation of water heating and water heating manufacturers continue to make key strides in Heat pump products to address electrical infrastructure challenges and space constrained spaces.

The electrification of water heating presents a key opportunity to build demand flexibility into this added electrical load: this make-or-break opportunity could result in either added stress on California's electric grid in the crucial evening hours or true success in bringing grid interactivity to the mass market.

Tech Families of this group include:

- Unitary Electric Water Heaters and Single-Family Split Systems
- Residential Multifunction Heat Pumps (cross-listed with HVAC)
- Commercial Multifunction/Combination AWHPs
- Commercial Domestic Hot Water System Design
- Pool Heaters & Residential Pool Pumps
- Commercial Hydronic Heat pumps (cross-listed with HVAC)



HVAC and Water Heating

- ET22SWE0047 - Master Mixing Valve
  - Jose Garcia, TRC

- ET24SWE0019 - 2024 Automated Guideline 36 Validation
  - Hwakong Cheng, Taylor Engineering

- ET24SWE0044 - DIY HPWH Installation & Maintenance Study
  - Meghan Harwood, VEIC

- ET23SWE0060 - PG&E HVAC Tool Validation
  - Glen LaPalme, TRC

- Q&A

ET22SWE0047

Field Study of Master Mixing Valve Energy Efficiency Potential

Jose Garcia, TRC

Water Heating

Grid Integration/Load Flexibility

Technology/Program Support

Field Evaluation

Executive Summary

Digital Master Mixing Valves (DMMV) are a commercialized product with use in niche markets. DMMV have potential to save energy in commercial and multifamily domestic hot water systems with continuous recirculation.

The project objective is to perform a field study of DMMV, building on a prior lab study.

DMMV saved an average of 4.5% across five field sites. There is variation within the results and one site had increased use although the research team attributes this to other factors.

Recommendations include:

- Future work should coordinate with manufacturers to reduce tank temperature set point guidance
- Programs should advertise non-energy benefits including reduced legionella risk, reduced scalding risk, reduction of run out events, and improved load flexibility
- Program opportunities for existing buildings will require training and quality control and should be implemented as part of retro-commissioning to address cross over, poor insulation, and lack of back flow prevention
- Program opportunities for new buildings include codes and standards programs aimed at larger facilities that are likely to have sophisticated contractors

Target Audience: Plumbing design engineering firms, water heating system researchers, codes and standards programs

Opportunities

Recirculated systems are common in multifamily and commercial buildings

Recirculation systems use a lot of energy due to pipe heat loss and de-stratification

Additional opportunities exist for load flexibility with HPWH if tank temperatures can be safely elevated

Approach:

- Install at 5 commercial and/or multifamily sites
- Target 1 month each pre- and post- retrofit monitoring
- Post- retrofit period includes optimizing system
- Characterize performance for each period and calculate normalized energy savings

Timeline

1. 12/12/2022: Project Plan
2. 3/2/2024: Preliminary Findings Report
3. 8/5/2024: Draft Report
4. 9/15/2024: Final Report
5. 10/2/2024: Distribution Report

The project is complete.

- This study addresses a lack of field results quantifying energy savings associated with installing a DMMV. This study also develops guidance for set point selection to save energy while meeting other system requirements.

- The project quantifies energy savings at five field sites which can be used to develop new program measures.

- The project identifies opportunities for codes and standards enhancement in new buildings and quantifies savings potential.

Next Steps

We have completed the Project and disseminated the results to targeted stakeholders. The project is completed, but the next steps are for stakeholders to take these findings to work on complementary research like:

- Development of deemed measures, especially as part of a retro-commissioning offering
- Development of training material to ensure proper installation
- Development of marketing materials to promote non-energy benefits

The Final Report is available on the CalNEXT website.

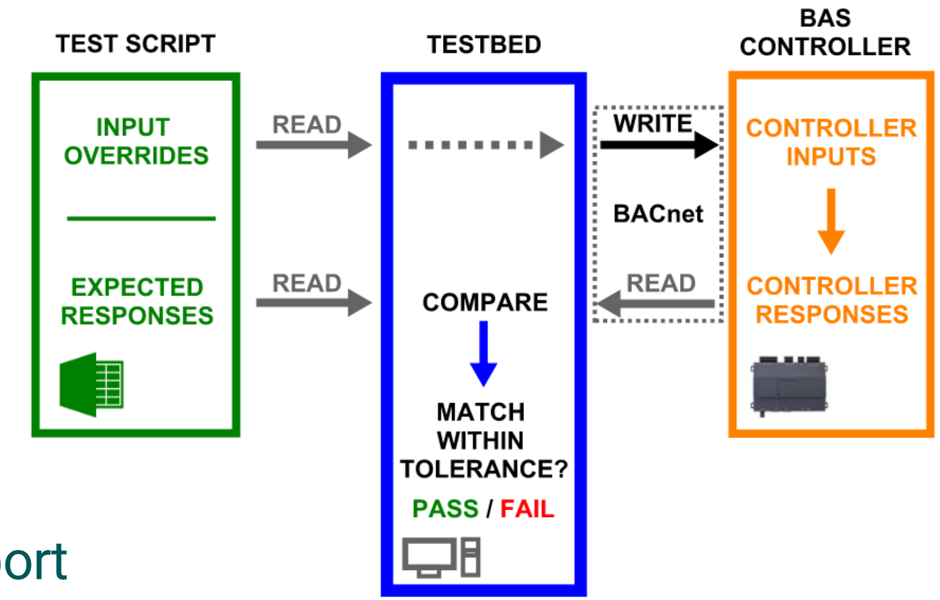
Thank you!

Jose Garcia, TRC

JMGarcia@trccompanies.com

ET24SWE0019

Automated Guideline 36 Validation



Hwakong Cheng, Taylor Engineers

TPM Domain: HVAC

Technology Family: Scalable HVAC Controls Deployment

Program Development Support: Technology/Program Support

Program Tactic: Test Standard Development

Executive Summary

Poorly implemented building automation systems (BAS) lead to poor HVAC system performance. ASHRAE Guideline 36 establishes high performance sequences of operation for HVAC systems but is complex and requires a high level of effort to implement and commission. BAS manufacturers are developing libraries of programming based on Guideline 36. This project will develop a draft method of test (MOT) to verify conformance of programming with Guideline 36 and help ensure rigor and completeness.

The audience for this work includes:

BAS manufacturers, installers, and designers

Utility program managers and codes and standards developers

Opportunities

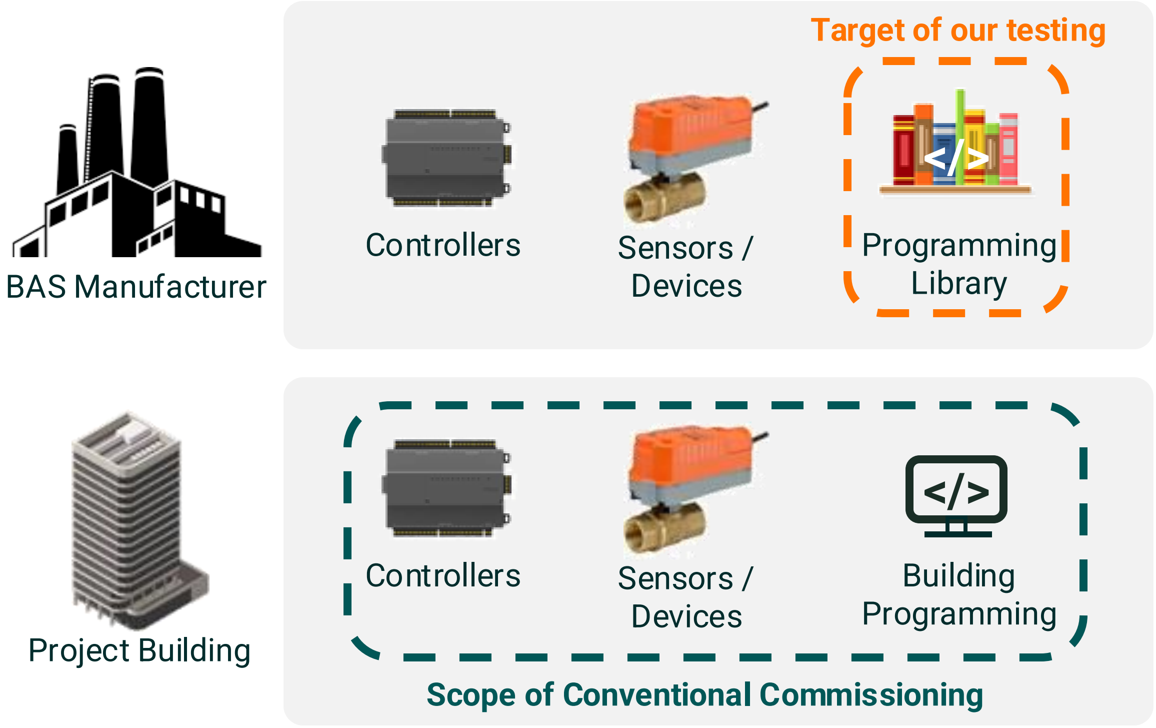
Guideline 36 programming libraries will advance standard industry practice:

- Energy efficiency
- Streamlined installation and improved quality
- Code compliance
- Operational performance

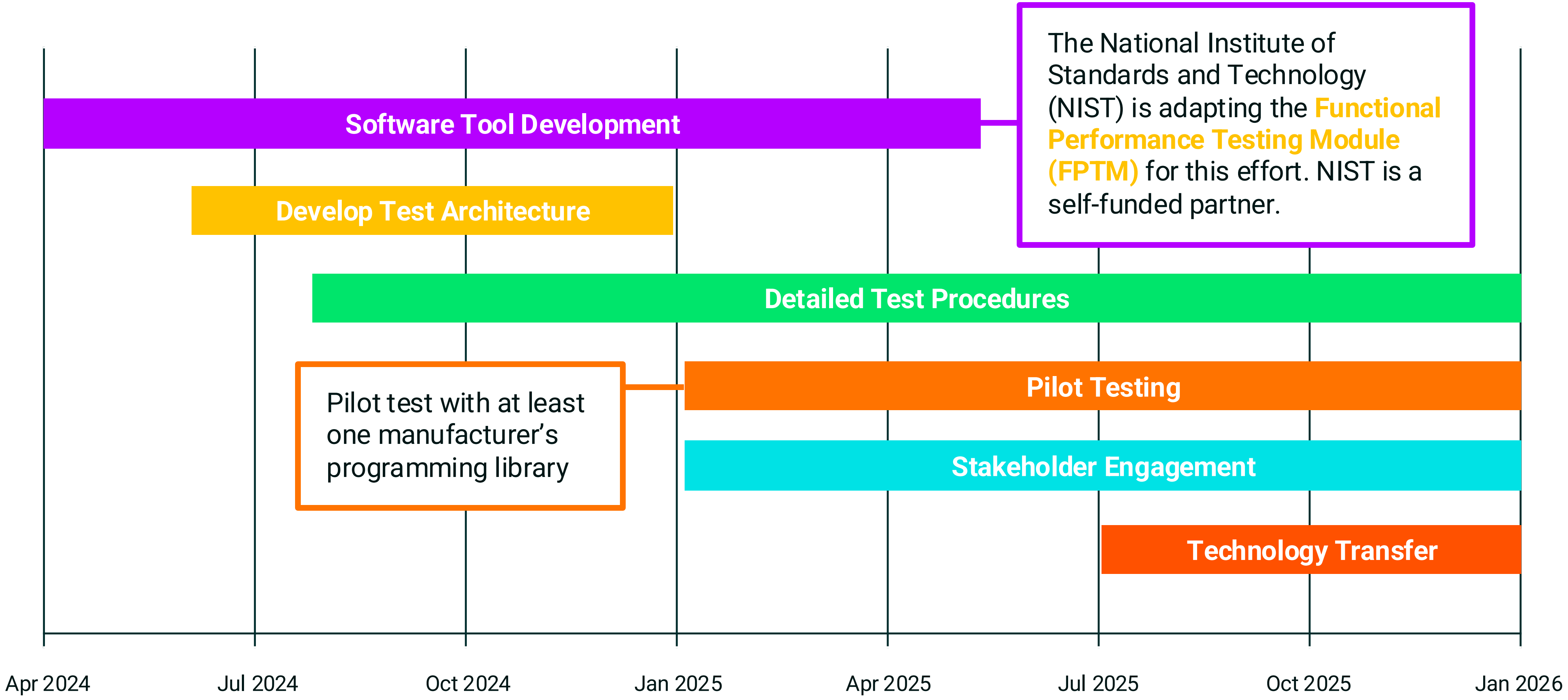
Future utility programs could require use of certified control programming.

- Potential approaches: Deemed, NMEC, custom Light

Support from BAS manufacturers will be critical to developing an industry test standard.



Project Timeline



Tech Transfer

- Outreach to date:
  - BAS manufacturers
  - ASHRAE Technical Committees (SPGC 36 & 1.4)
  - Federal agencies (NIST, DOE, National Labs)
- Future:
  - Recommendations for Programs and Codes & Standards
  - Share draft MOT with future industry standard committee

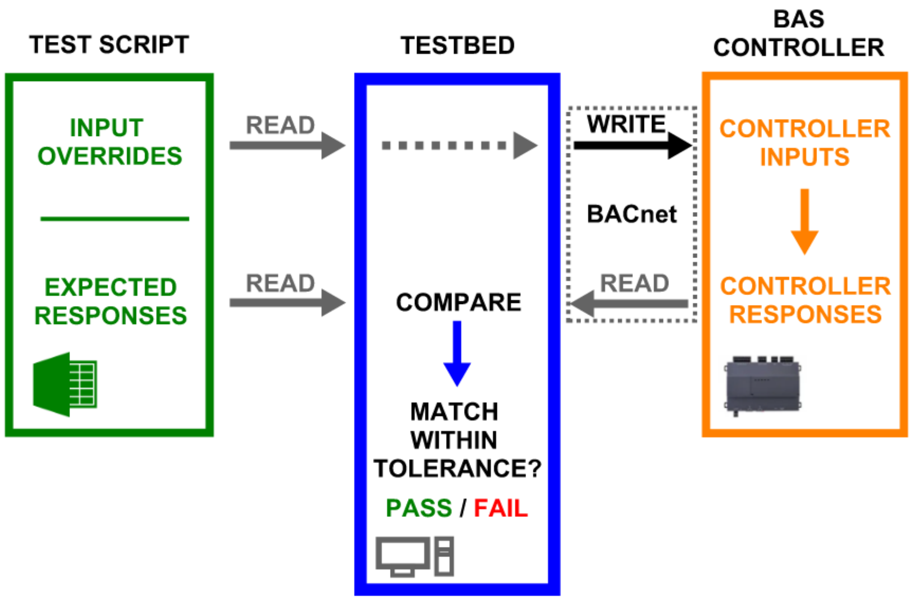
Barriers to controls in existing programs:

- Inconsistent/unpredictable savings
- Persistence of savings
- Burdensome review and verification

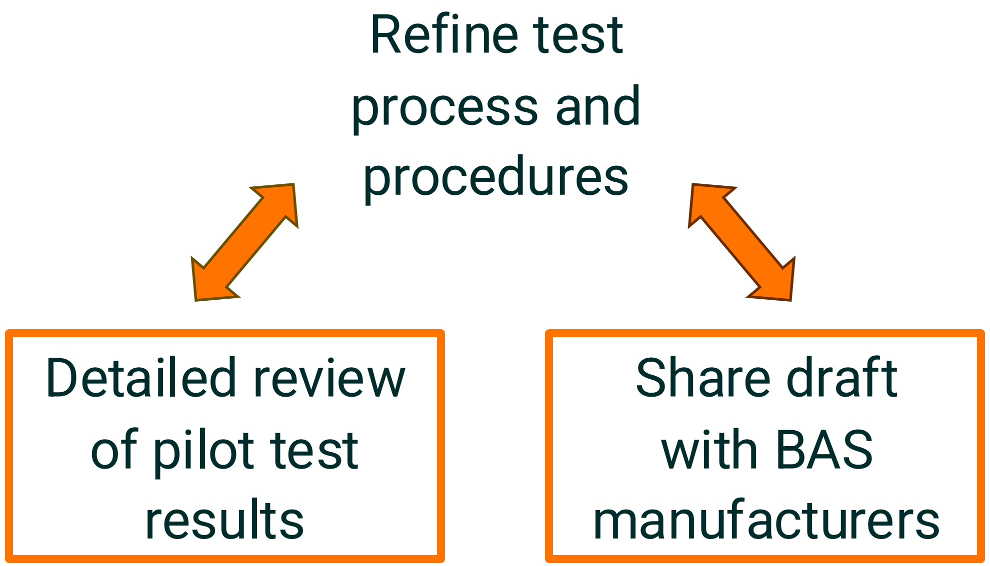
Solution: Provide programming that consistently performs

- Less verification needed
- Longer measure life
- Consensus among stakeholders

Guideline 36 programming validated by the MOT will streamline and increase adoption of code-required HVAC controls measures



Next Steps



Future efforts will:

- Finalize and maintain the MOT
- Develop related Programs and Measures

Thank you!

Hwakong Cheng, Taylor Engineers

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ET24SWE0044

DIY Heat Pump Water Heater Installation and Market Study

Meghan Harwood, VEIC

Water Heating

Unitary Electric Water Heaters and Single-family Systems

Technology/Program Support

Market Study

Executive Summary

- Recent estimates indicate that over 50% of Californians are taking a DIY approach to installing replacement water heaters in their homes – an estimated 260,000 HPWH installations occurring annually by the DIY "workforce."
- By increasing the engagement and support for the over 50% of California households with DIY water heater replacement experience, the state can leverage an existing, untapped workforce willing to assess and pursue lower cost DIY HPWH installations while contributing toward state decarbonization goals.

Project objectives:

- Assess factors influencing the estimated >50% homeowners who are "DIY" installing water heater replacements.
- Evaluate opportunities, challenges, and technical solutions for supporting those homeowners in selecting a HPWH.

Methods:

- Mine and analyze participation data from existing rebate programs
- Interview homeowners, program administrators, permitting officials, plumbing contractors
- Develop "customer-facing" materials

Project Goals

Produce actionable recommendations for CA utility programs, specifically Midstream Water Heating, Workforce Education/Training and Codes and Standards programs, including:

- Program and customer cost savings
- Program design including DIY HPWH tailored process and installation guidance and identification of simplified HPWH kit components, including specific DAC and lower income household opportunities
- Recommended changes to HPWH program and permitting requirements to better support DIY installations.

Project Timeline

Go to the link below to view the Final Report to be published in May 2025
Approved Projects - CalNEXT

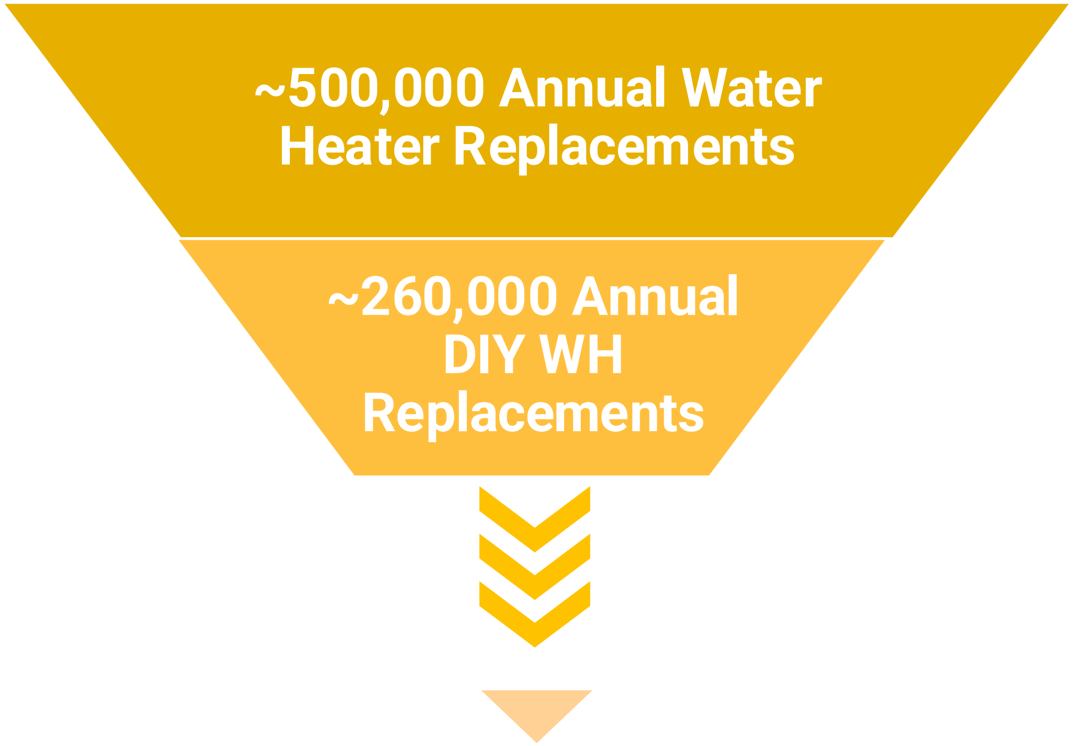
Opportunities

Up to 50% of CA single-family homeowners "DIY" their water heater replacements

Non-professional HPWH installations are significantly lower-cost (contractor-installed HPWHs cost $2-4k more than a DIY install)

86% of current WH's in CA are gas, so adopting a HPWH will require conversion

120V Plug-In HPWHs are simplifying installation complexity



Up to 198,000 gas to HPWH DIY annual conversions

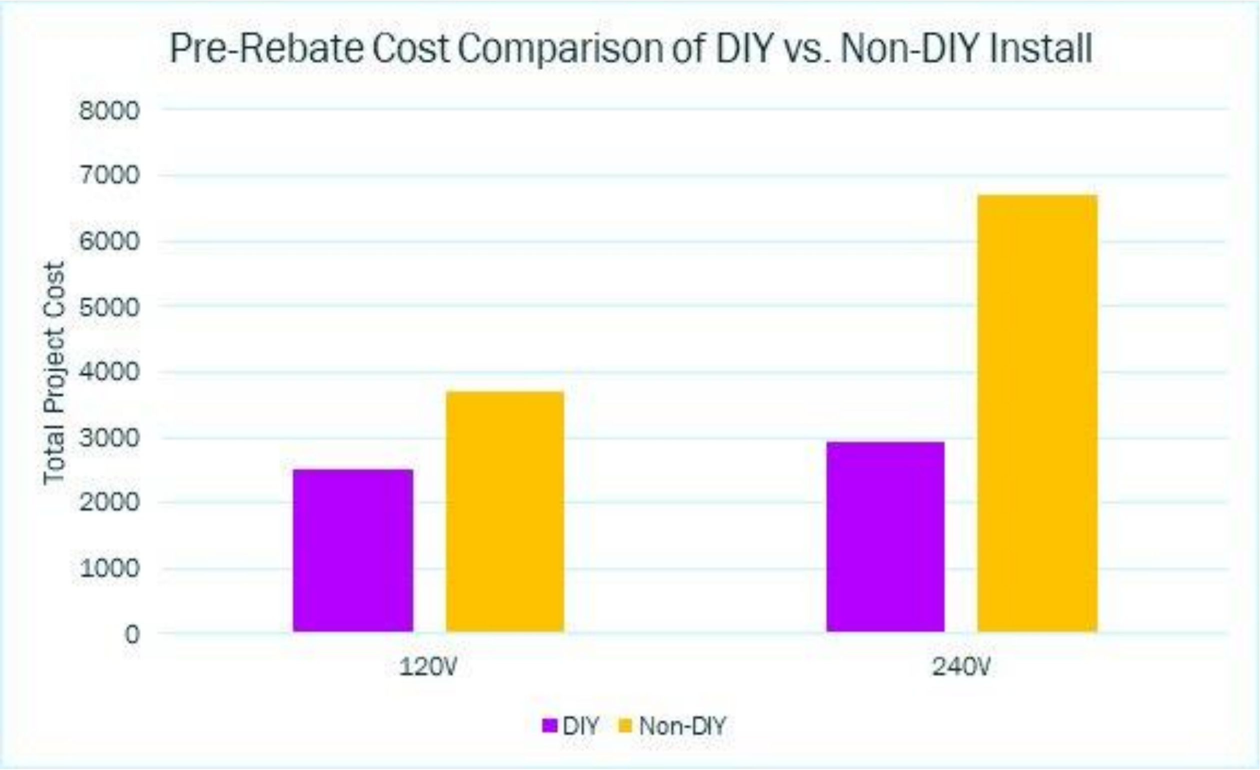
(*Projected potential*, drawing from data and research by Opinion Dynamics)

Key Market Findings

- Motivations for DIY installation: **lower upfront cost, timing and expediency, and technical proficiency.**

- Homeowners represent **an additional installer "workforce."**

- Analysis of program and interviewee data found that homeowners achieved an average of **$3,776 in savings** pursuing a DIY path for a 240V HPWH (and **$1,169 for a 120V)** installation compared to TECH contractor-led installations.



Source: TECH Clean California data, homeowner interview data, Peninsula Clean Energy rebate program data

CalNEXT

Factors contributing to level of process complexity

Installation Complexity

Least Complex

A plug-in 120V HPWH model that has top mount plumbing and an internal mixing valve and is located on a concrete floor and large space such as a garage.

More Complex

A 240V with side-mount plumbing that necessitates electrical upgrade, located in a small room (requiring door venting or ducting). Local code or building code inspector requires copper piping required (instead of PEX), a drain pan, and/or a condensate pump.

Permitting "Level of Difficulty"

"Low" - Accessible and Streamlined Process

- No unique local updates to statewide water heater code requirements, and only one permit required
- Online submittal enabled, and permit is instantaneous, free or low cost.
- Information and requirements synthesized and summarized on a website, easy to find.

"High" - Cumbersome, Non-Uniform, Inaccessible

- Unique requirements are added for the jurisdiction that go beyond state code.
- Multiple permits are required that necessitate understanding plumbing as well as electrical and/or building code.
- No online application, approval time is long, permit cost is expensive.
- Specific non-standard template required for load calculations.

DIY Installations and Low-Income California Households

Lower total project costs might make HPWH self-installs attractive for many low-income households or Disadvantaged Communities...

- This was found to be particularly relevant in rural areas, where contractor availability is a constraint and households might be more familiar with DIY work.

However, many barriers to HPWH adoption for these households might be exacerbated for a DIY project approach...

- Such as higher likelihood of older homes needing electric infrastructure upgrades, higher likelihood of space constraints on an upsized WH, and other remediation and minor home repair needs.

Targeted support - through pre-electrification home repairs and remediation, locally relevant education around non-energy benefits, and energy cost burden protections - will be crucial to support HPWH adoption for both DIY and contractor-led adoption.

Recommendations

Educate DIY installers on HPWH installations

- Supply the ≥ 50% of Californians (homeowners and unlicensed professionals) with information on benefits, costs, and technical requirements for a quality HPWH installation to support their choice for either a DIY HPWH install or elect for a professional HPWH installation.

Simplify HPWH incentive program and permit processes and increase access

- Simplify and increase access to rebates, technical training and support and water heater installation tools as a low-cost solution to scale HPWH deployment. Ensure quality installs by requiring inspection through a streamlined and simplified permitting process.

Invest in innovation and market transformation

- Invest in new HPWH solutions like plug-in 120V HPWHs and panel upgrade alternatives to simplify HPWH installations and electrification.

Customer-Facing Guide

Materials walk a homeowner through:

- Pre-Installation Knowledge Gathering: Why choose a HPWH? What rebates am I eligible for as a DIY'er?
- Pre-Installation Home Assessment: Is my home a good fit for a DIY install? How complex will it be?
- Post-Installation Process: permit, inspection.

Resources include:

- "Key Elements of a DIY HPWH Installation"
- "DIY Heat Pump Water Heater Pre and Post Installation Steps"
- "Inventory of Best Practice and How-To Guides"
- "Tools and Materials List"

DIY Heat Pump Water Heater Pre and Post Installation Steps

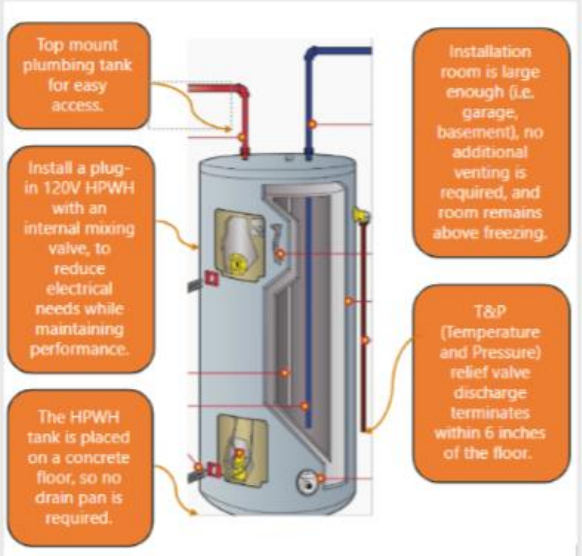
Pre-Installation Knowledge Gathering	
1.What are the benefits of a HPWH and DIY Installation?	Familiarize yourself with the benefits, characteristics, and reasons to purchase and install a HPWH. A DIY HPWH installation can save on costs but can be a complex replacement project. Alternative options can be to work with a plumber or electrician for specific technical tasks.
2.Where can I find helpful DIY HPWH resources?	Scan the inventory of best practices and how-to guides for HPWH installation to familiarize yourself with the process and available resources. See this [QR CODE].
3. Are rebates available for a DIY installation?	Some rebates are only offered through licensed contractors. However, there are rebates available to homeowners. Find rebates available in CA at https://www.switchison.org/.
4.What is the permit process like for a HPWH install?	Local building code and permitting processes vary across jurisdictions. When seeking a permit for a HPWH install, check your local permitting office's website or call them directly for details of what is required and whether a DIY installation is advisable. You can also consider working with a contractor post-installation to inspect and review for quality and safety.
Pre-Installation Home Assessment	
5.Do I have adequate electrical capacity and service to the water heater?	Minimum electrical capacity requirement may be required by local building code a model. Plug-in 120V HPWH models can b and permitting needs. However, it is best
6.Do I know what HPWH tank size I need?	Manufacturer guidelines and design reso for your household based on hot water d Consider installing a thermostatic mixing
7.Do I have a location with the right air temperature? Is it near a bedroom?	Ensure your HPWH location will remain a to a basement or garage, consider locati locating the HPWH so that it does not sh
8.Is there adequate ventilation for the HPWH?	Most tanked systems need to be installe ventilation requirements. Alternatively, d
9.Do I have a plan for condensate drainage?	Determine a suitable location for the con sink or washer drain line port, to the outd pump.
10.If replacing a gas water heater, do I need to cap a gas line?	If so, you should determine if doing so DI professional to cap a gas line and require rebate and incentive programs also ask f
Post-Installation Process	
12.Have I successfully compiled and submitted the relevant materials for my permit and rebate?	Ensure that you have filled out the permi by your local permitting office. Submit an installation information.

Can I install my own Heat Pump Water Heater?

Heat pump water heaters (HPWH) are a new, high efficiency alternative to conventional gas or electric water heaters. As their operation and installation is more complex, it is recommended that a homeowner consider using the services of a professional contractor. However, a handy homeowner can self-install, or work assisted by a contractor or a friend/family member with plumbing and electrical experience. This guide aims to help homeowners find technical resources and guides to better understand the steps for completing a quality HPWH installation.

The two pages below explore examples of "simple" and "complex" HPWH installations, to assist you in deciding if you want to DIY or hire a professional contractor.

Key Elements of a "Simple" HPWH Installation



Next Steps

- Final report will be finished next month, integrating initial stakeholder feedback
- Disseminate results to wider group of targeted stakeholders
- Share customer-facing materials with interested incentive providers, municipalities, etc.

Once published, this report can be used to increase HPWH accessibility and adoption among homeowners in CA by:

- Engaging additional stakeholders to gain feedback and insights
- Providing customer-facing guides and resources to walk homeowners through pre-installation assessments and installation processes
- Providing recommendations for accessible and streamlined incentive programs and permitting processes

Thank you!

Meghan Harwood, VEIC

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ET23SWE0060

PG&E HVAC Tool Validation

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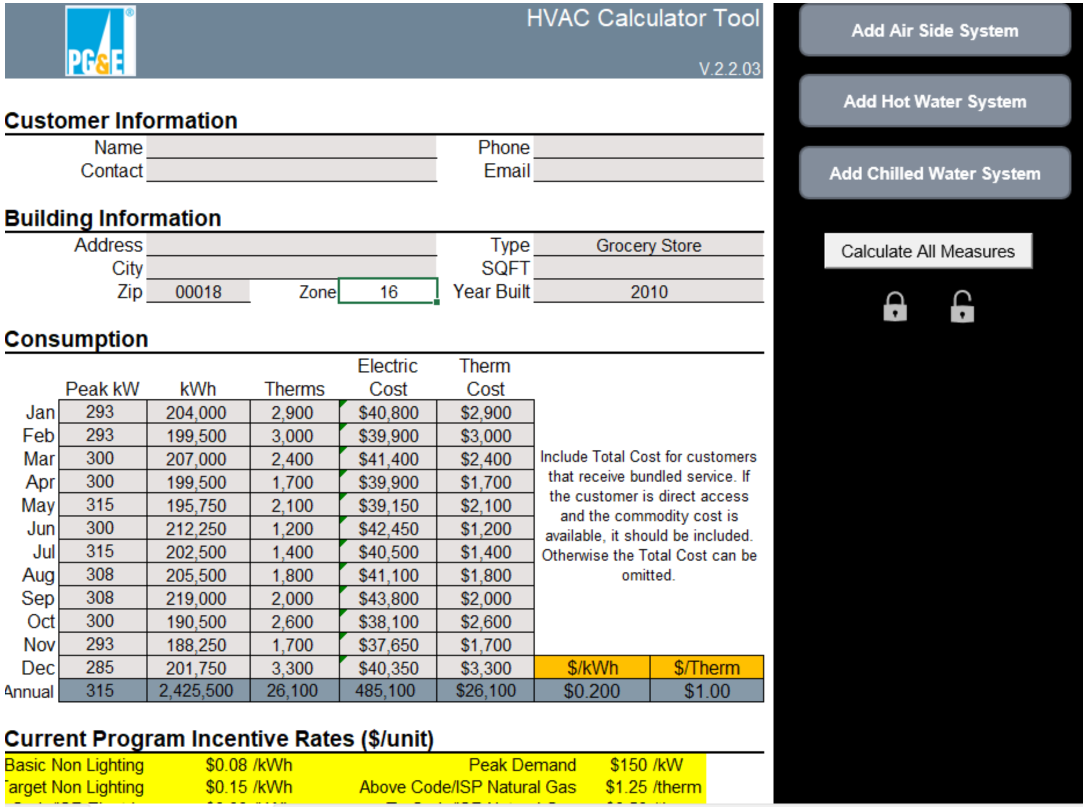


	Peak kW	kWh	Therms	Electric Cost	Therm Cost
Jan	293	204,000	2,900	$40,800	$2,900
Feb	293	199,500	3,000	$39,900	$3,000
Mar	300	207,000	2,400	$41,400	$2,400
Apr	300	199,500	1,700	$39,900	$1,700
May	315	195,750	2,100	$39,150	$2,100
Jun	300	212,250	1,200	$42,450	$1,200
Jul	315	202,500	1,400	$40,500	$1,400
Aug	308	205,500	1,800	$41,100	$1,800
Sep	308	219,000	2,000	$43,800	$2,000
Oct	300	190,500	2,600	$38,100	$2,600
Nov	293	188,250	1,700	$37,650	$1,700
Dec	285	201,750	3,300	$40,350	$3,300
Annual	315	2,425,500	26,100	485,100	$26,100

$/kWh	$/Therm
$0.200	$1.00

Executive Summary

PG&E HVAC Tool

- Tool developed and managed by Pacific Gas & Electric (PG&E)
- Estimates savings for RCx measures applicable to utility energy incentives in commercial buildings
- Developers and implementors have been reluctant to use the Tool without additional validation

Objectives

- **Support IOU development of a CPUC and CalTF Endorsed RCx Tool** which aligns with CalTF's Custom Measure Initiative. Their Custom Measure Guidance (CMG) report recommends using this tool for RCx.
- **Identify potential uncertainty issues** related to using the Tool's bin analysis compared to an hourly building simulation model such as EnergyPlus.
- **Recommend tool enhancements** to improve accuracy and increase stakeholder comfort and usage for IOU/3P program measures.
- **Target Audience**: 3P Implementors, project developers, IOU administrators and CPUC evaluators.

PG&E HVAC Tool Barriers, Portfolio Need and Approach

Barriers

- **Existing HVAC Tool lacks some standard RCx measures**.
- Target users require greater confidence in:
  - Model capabilities
  - Interactive effects,
  - Savings estimates
  - Tool inputs and interpretation of results.

EE Portfolio Need

- **Need for Standardized HVAC Tool for RCx measures.** CalTF has developed a Custom Measure Guidance (CMG) package for RCx that recommends using this tool.
- **Ensure compliance with CPUC requirements and strengthen tool accuracy, applicability, and usage**.

Therefore,

- **CalTF and PG&E requested that the CalNEXT team conduct a validation of the HVAC tool**

Approach

Validate the airside and hot water measures in the Tool using simulation output generated by Energy+.

Airside Measures
- Scheduling, Economizer, and Fan Speed Optimization
- Static Pressure and Supply Air Temperature Reset
- VAV Flow and Reheat Flow Adjustment

Waterside Measures
- CHW Plant Lockout Control
- Chiller Staging Sequence Optimization (for multi-chiller systems)
- CHW Supply Temperature Reset, Condensing Water (CW) Supply Temperature, and CHW Differential Pressure (DP) Reset
- Cooling Tower (CT) Staging Sequence Optimization (for multi-CT systems)
- Controls Optimization for Existing Secondary Chilled Water Pump (SCHWP) VFD and Existing Condenser Water Pump (CWP) VFD

Hot Water Measures
- HW Lockout Control
- Boiler Staging Sequence (for multi-boiler systems)
- HW Temperature and HW Differential Pressure Reset
- Controls Optimization for Existing SHWP VFD

PG&E HVAC Tool Validation Process and Outcomes

- **Energy+ model outputs** compared with measures estimates from the HVAC Tool
  - Air Side
  - Hot Water System

- **Tool Validation** using 132 model runs
  - Six (6) Air Side System measures
  - Five (5) Hot Water System measures

- **Report details**
  - Developing the simulation procedure
  - Calculator inputs
  - Process for estimating the savings
  - Sensitivity analysis
  - Savings differences between modeling and Tool results by measure
  - Sources of modeling uncertainty.

- **Recommendations and Next Steps**
  - PG&E, CalTF, or future Tool owners collaborate on further improvements
  - Phase 2 study recently approved (in contracting)

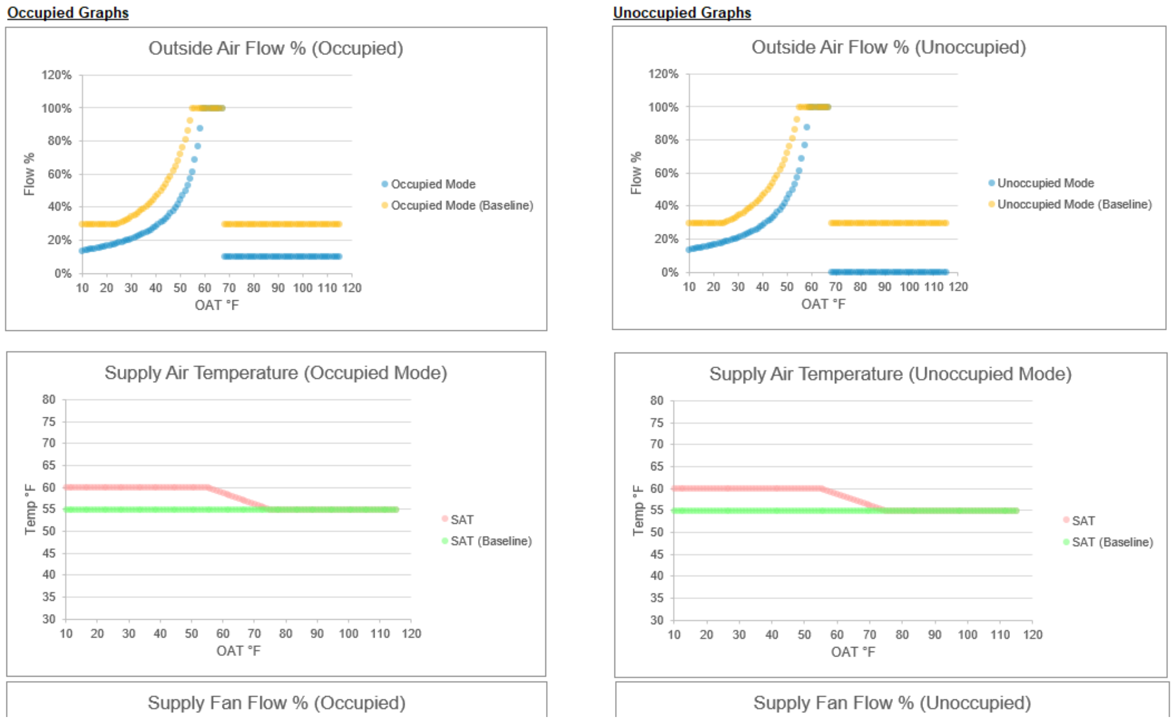
Next Steps

We have completed the Project (ET23SWE0060) and disseminated the results to targeted stakeholders.

The next step is PG&E HVAC Tool Validation Phase 2 including the following enhancements:

- Update AHU Fan Curves
- Improve SAT Reset Calculations
- Review Zone Level Input:
- Add Boiler Sequencing Measure.
- Improve Boiler HW Reset Calculations
- Add Air-Cooled Chiller Systems
- Improve CHW Reset Calculations
- Bug fixes

The Final Report (ET23SWE0060) is available on the CalNEXT website.



Thank you!

Glen LaPalme, TRC Companies

glapalme@trccompanies.com

Poll 1

Q&A

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2024 Whole Buildings TPM

Whole Buildings technologies cut across multiple TPM categories to support building decarbonization and reinforce the need for smarter buildings and smarter appliances with flexible-demand capabilities to enable a clean, resilient, flexible grid. Multiple state and local policy changes highlight the opportunities needed to transform the construction industry's efforts to lower the carbon in building materials and building designs. Integration across multiple systems is an opportunity to bring more intelligence to these buildings but the implementation remains a huge challenge.

Tech Families of this group include:

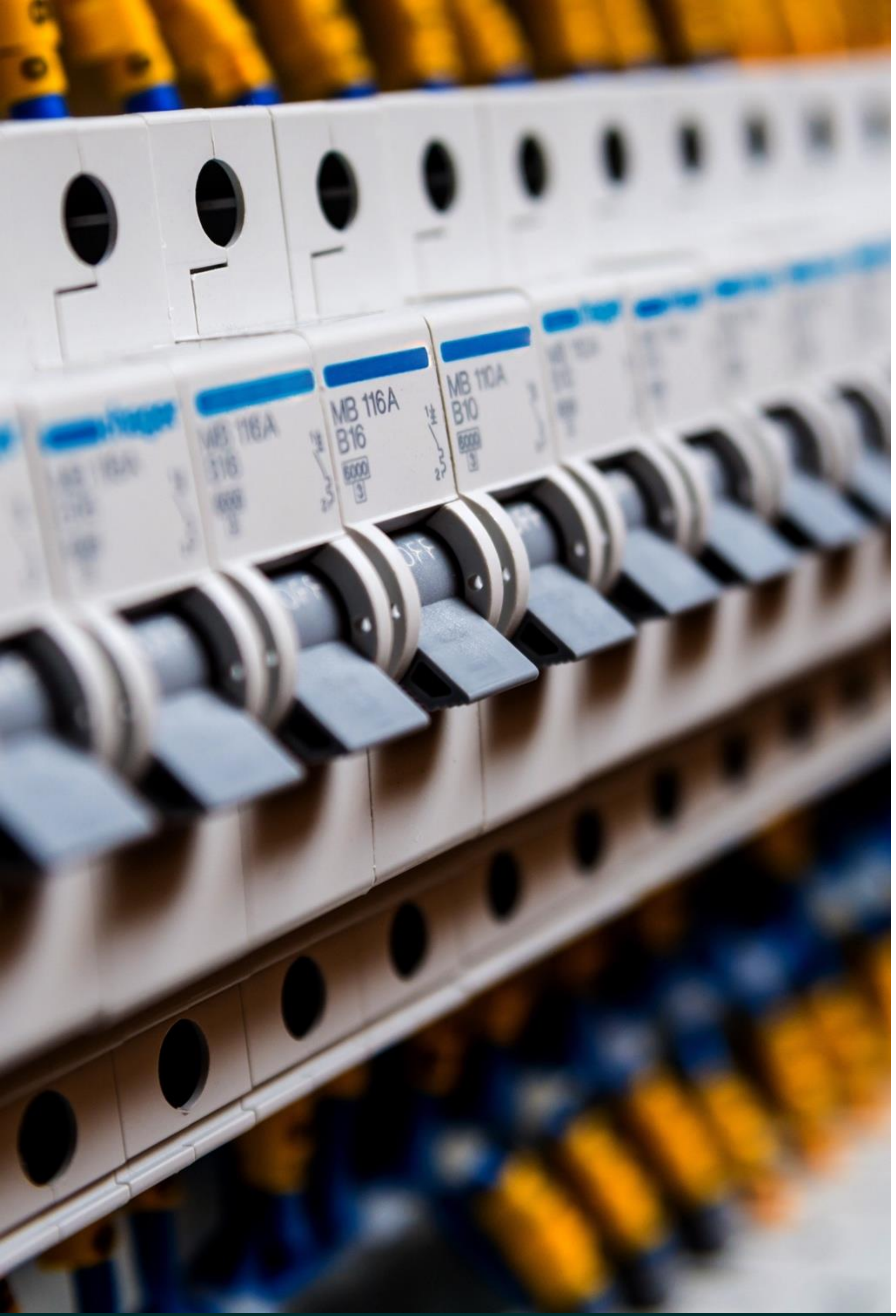
- Integrated Systems
- Electrical Infrastructure
- Design & Construction
- Operational Performance
- Envelope
- Community Scale Strategies

2024 Process Loads TPM

The Process Loads technology category encompasses a wide range of energy uses from specialized light commercial such as restaurants and healthcare, to industrial manufacturing. This category is broadly focused on projects that will lead to expanded incentive program offerings, whether electric savings or fuel substitution, and the establishment of new standards.

Tech Families of this group include:

- Controlled Environment Horticulture
- Commercial Kitchen Decarbonization
- Refrigeration, Commercial & Industrial
- Advanced Motors
- Pumping Systems
- Data Centers and Enterprise Computing
- Process Air Systems
- Process Heating Technology



Whole Building and Process Loads

- ET23SWE0067 - Smart Controls for Data-Driven Indoor Agriculture Field Evaluation
  - Gretchen Schimelpfenig, ERI
- ET23SWE0021 - Residential Electrical Service Upgrade Decision Tool
  - Michael Mutmansky, TRC
- ET22SWE0037 - Aerosol Sealing of Existing Homes from Attics and Crawlspaces
  - Curtis Harrington, UC Davis
- ET24SWE0032 - New Commercial Foodservice Measure Prioritization
  - Paul Kuck, Energy Solutions
- ET23SWE0056 - High Efficiency Refrigerated Display Case
  - Christine White, VEIC
- Q&A

ET23SWE0067

Smart Controls for Data-Driven Indoor Agriculture Field Evaluation

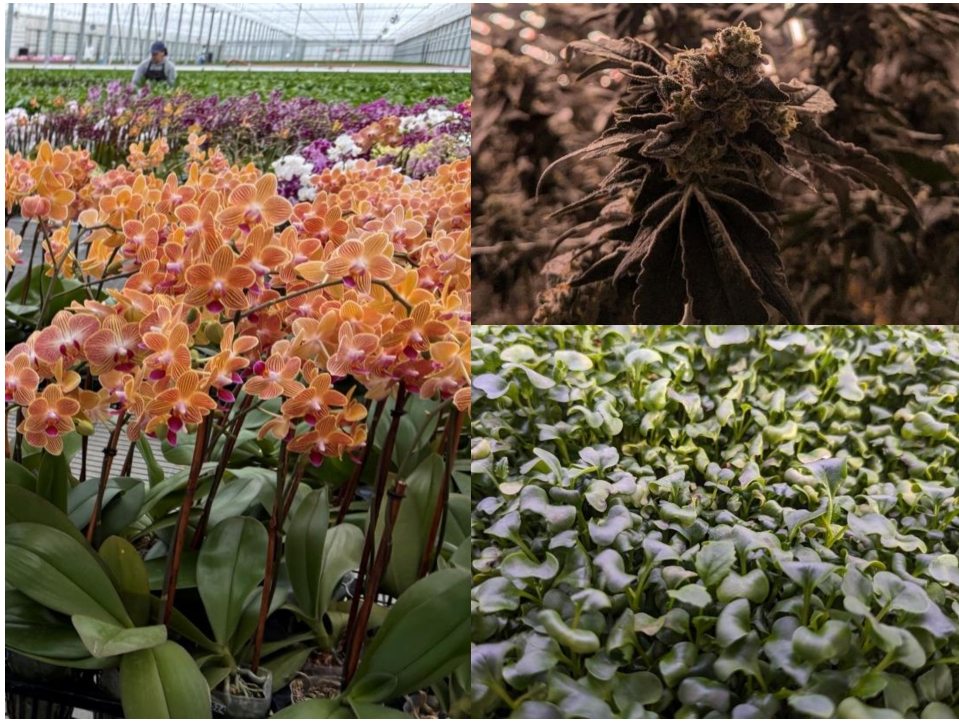
Gretchen Schimelpfenig, Energy Resources Integration

Process Loads

Indoor Agriculture, Smart Manufacturing & Controls

Support New/Updated Workpaper Development

Field Evaluation



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Executive Summary

Controlled Environment Agriculture (CEA) involves the cultivation and manufacturing of floriculture, food, and cannabis products. This project is evaluating automated, integrated, and intelligent environmental controls technologies used in indoor and greenhouse CEA facilities in California. 4,611 CEA businesses have 7,185 acres (313 million square feet) of facilities in California. Greenhouses for nursery or floriculture production use 61% of California CEA facility area. Nine “smart controls” strategies have the potential to reduce electricity consumed by lighting, HVAC, and irrigation systems by up to 69% in California greenhouses and indoor farms.

The intended audience for this project’s final report is utility energy efficiency program designers and implementers, commercial greenhouse and indoor farm operators, automation technology suppliers, and CEA facility designers and construction professionals.

Project Timeline

1. **December 2023**
   Project Plan
2. **July 2024**
   Preliminary Findings Report
3. **July 2025**
   Draft Report
4. **September 2025**
   Final Report
5. **October 2025**
   Distribution Report

Four field demonstrations are in process and will complete in May 2025.

Opportunities

Today's electric IOU measures and incentives for CEA facilities include:

- LED horticultural lighting
- Ventilation fans
- Pump upgrades
- VFDs for fans and pumps

Automation systems for greenhouses and indoor farms may qualify for custom incentives.

ROI for growers is unclear and the custom process is less attractive than prescriptive rebates.

To support the project goal of new workpaper development, the project's field demonstrations incorporate real-time energy monitoring with remote access for the team to view system-level energy consumption trends using cloud-hosted software.

Electric IOUs interested in developing a "smart CEA controls" rebate program can access and use this data to validate persistence of savings for various energy-saving process system automation strategies.

Tech Transfer

The project team has worked with industry technology transfer partners including:

Automation technology manufacturers:

- Microclimates
- GrowFlux
- Sollum Technologies
- Hoogendoorn Growth Management

Industry organizations:

- DesignLights Consortium
- Cornell University Greenhouse Lighting and Systems Engineering (GLASE) consortium

Hard-to-Reach (HTR) & Disadvantaged Communities (DAC)

All four of the project's site visits were held at Hard-to-Reach customer facilities.

All four of the field demonstrations are at Hard-to-Reach customer facilities.

A barrier to creating new programs for CEA facilities is an understanding of the market landscape. The Market Study's results characterize the size of the California CEA market, the proportion of the major types of growers and facilities, and the potential energy savings from lighting, HVAC, and irrigation controls measures.

Another barrier for CEA efficiency is measurement and verification of energy savings. The Final Report will share the field demonstrations' results to estimate energy savings potential for the California market for the most impactful and cost-effective measures.

The project is directly supporting California's EE portfolio by identifying the next frontier of greenhouse and indoor farm measures for process systems to build upon existing offerings for horticultural lighting, ventilation, and irrigation equipment. Insights from this project can be used for EE educational programming as incentive programs are developed.

Final Report

Initial findings from literature review, surveys, interviews, and site visits identified nine potential measures for inclusion in the Final Report:

Measure System	Measure Name	Measure Description	Process Electricity Savings Potential
Lighting	Dimming Controls	Reduction in horticultural light fixture wattage coincides with improvements in PPE	8% increase in PPE when fixtures are dimmed 50%
	Spectral Tuning	Tune horticultural lighting spectrum for energy efficient fixture PPE by applying light recipes with more red diodes	40% or more
	Daily Light Integral (DLI) Controls	Reduce horticultural lighting system operation to maintain consistent DLI based on predictive or measured solar data	20 – 69% in greenhouses
HVAC	Automated Greenhouse Vent Control	Automate greenhouse ventilation controls to reduce unnecessary operation.	17 – 21%
	Automated Greenhouse Curtain Control	Reduce solar radiation entering greenhouses to reduce cooling demand by employing shade curtains	50 – 60%
	Automated CEA Fan Control	Automate CEA HVAC fan controls to reduce unnecessary operation.	Up to 36%
	VPD Optimization	Optimize Vapor Pressure Deficit (VPD) for specific crops, and optimize space temperature and humidity setpoints for optimum energy efficiency while maintaining target VPD	25 – 50%
Irrigation	Variable-Speed Pump Control	Equip irrigation pumps with variable speed motors, and control pump speed in reference to loop pressure, allowing reduced pump speeds when partial irrigation capacity is required	27 – 35%
	Sensor-Based Irrigation Controls	Control irrigation valves based on substrate moisture content rather than on timed schedules	33 – 50%

Final Report

Energy monitoring data from field demonstrations will inform market-level energy savings potential estimates and recommendations for the Final Report.

The Final Report will be shared at https://etcc-ca.com/reports/smart-controls-data-driven-indoor-agriculture-field-evaluation in September 2025.

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Next Steps

- Complete field demonstrations
- Analyze energy monitoring data and calculate energy savings potential for high-priority smart controls measures
- Share Draft Report with technology transfer partners and incorporate feedback
- Deliver Final Report to electric IOU stakeholders and the public
- Electric IOU stakeholders use our findings to develop a new workpaper and launch rebates for smart CEA controls measures
- Tech transfer partners accelerate smart CEA controls adoption in California

The goal of the project is to inform electric IOU decisionmakers of the best new CEA measures for lighting, HVAC, and irrigation system automation and drive the creation of future utility incentive programs.

The findings of the project can also enhance future advocacy efforts of other CEA industry stakeholders like commercial growers, energy code policymakers, equipment manufacturers and distributors, academic researchers, and industry organizations.

Thank you for joining my presentation!

Gretchen Schimelpfenig, PE, ERI

Gretchen@ERIpacific.com

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ET23SWE0021

Residential Electrical Service Upgrade Decision Tools

Michael Mutmansky, TRC Companies
Build It Green
SPUR

Whole Buildings

Electrical Infrastructure

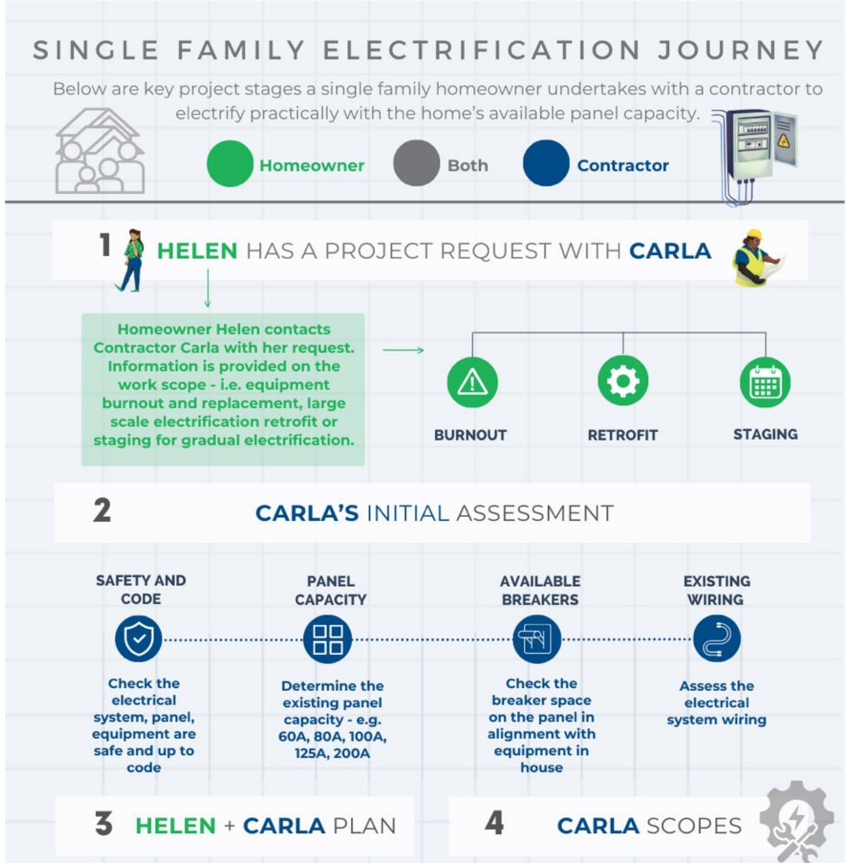
Executive Summary

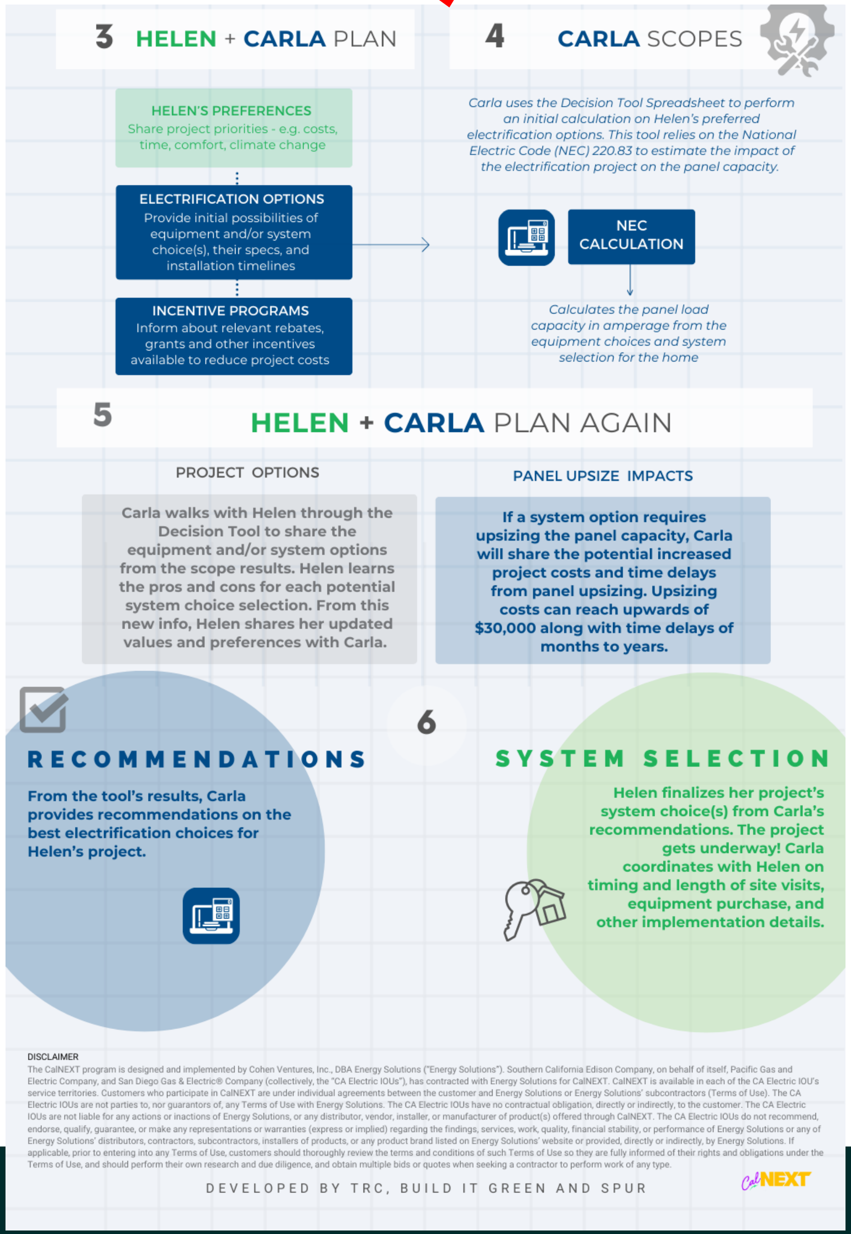
Goals:

1. **Electrification Guides:** Consumer-focused documents to educate contractors and homeowners on electrification and how to do it without increasing the electrical service at the home.
2. **Home Calculation Tool:** Contractor-focused tool to provide education for the contractor and information to the consumer to choose low-power solutions.
3. **Building Stock Tool:** Utility and regulators focused tool to show the potential benefit of avoiding electrical service size increases in the state and the market potential based on the information available through census and other sources.

Executive Summary

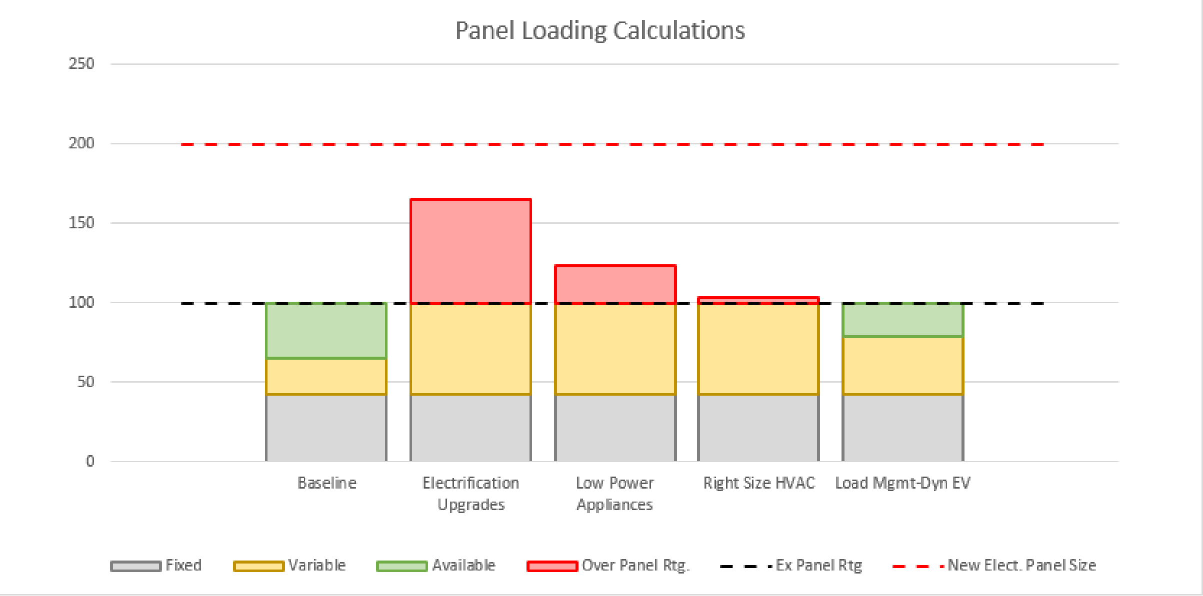
Electrification Guide





Executive Summary

Individual Home Calculation Tool



	Baseline	Electrification Options	Opt #1 - Low Pwr Appliances	Opt #2 - Right-Size HVAC	Opt #3 - Load Mgmt
Baseline Amperage	65.1				
Amperage of Full Electrification		165.8			
Amps Saved by Options			42.6	62.2	87.2
% Amps Saved			25.7%	37.5%	52.6%
Total Amperage		**165.8**	**123.2**	**103.6**	**78.6**

Panel Electrification Results

The existing main electrical panel is 100 Amps.

With all the electrification measures chosen in the 'Electrification Upgrades' tab, the minimum size electrical panel and service will need to be 200 Amps.

The optimizations selected will permit electrification without increasing the panel and service size.

Panel Optimization Recommendations

The electrification upgrades selected will require a panel and service upgrade, but follow the optimization options recommendations below to mitigate this impact.

The currently selected optimizations will meet the existing panel capacity and no panel upgrade is required.

Low Power Appliances - The LPA options selected will reduce the panel size, but not enough to eliminate a panel size increase. Continue to the next optimization tabs for further options.

Right-Size HVAC - The HVAC options selected will reduce the panel size, but not enough to eliminate a panel size increase. Continue to the next optimization tab for further options.

Load Management - The LM selections now fit within your existing panel capacity. You DO NOT need a panel upgrade. However, using more efficient equipment choices may reduce energy consumption and peak load to save on electric bills.

The optimized main electrical panel is 100 Amps.

Note: All tool results and calculations must be confirmed by a qualified contractor, verifying conditions on site. Contractor to verify that selected strategies and calculation approach are allowable by the local permitting agency.

Executive Summary

Building Stock Assessment Tool

Total Home Stock

14,443,400 SF & MF Residences Statewide

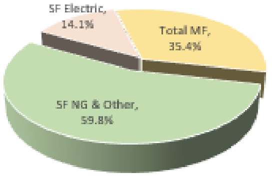
9,330,900 SF Residences Statewide

372,300 SF Homes in Selected Counties

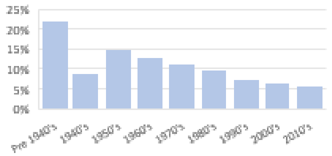
297,100 Candidate Homes

All counts for homes built before 2020

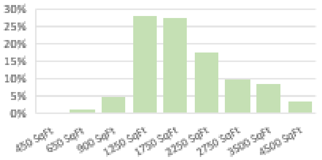
Statewide SF Electrification Potential



Selected Counties SF Vintage by Decade



Candidate Residence Size Histogram



Select Upgrade Measures for A La Carte Electrification

Electrify

- Y Heating System (Heat Pump)
- Y Water Heater (Heat Pump)
- Y Dryer (Resistance Electric)
- Y Stove (Induction Cooktop)
- Y Add 32A EV Charger

Optimize

- Y Right-Size HVAC
- Y No Backup Heat Strip
- Y 120V HP Water Heater
- Y 120V HP Dryer
- Y 120V Induction Stove w/ Battery
- Y 20A 240V EV Charger

Manage

Only select one of the below

- Y Dynamic EV Chargin *This option will be shown in graph*
- N Circuit Share (EV & Dryer
- N Smart Panel or Circuits

"Traditional" Electrification
(All electrification steps above, but no optimization)

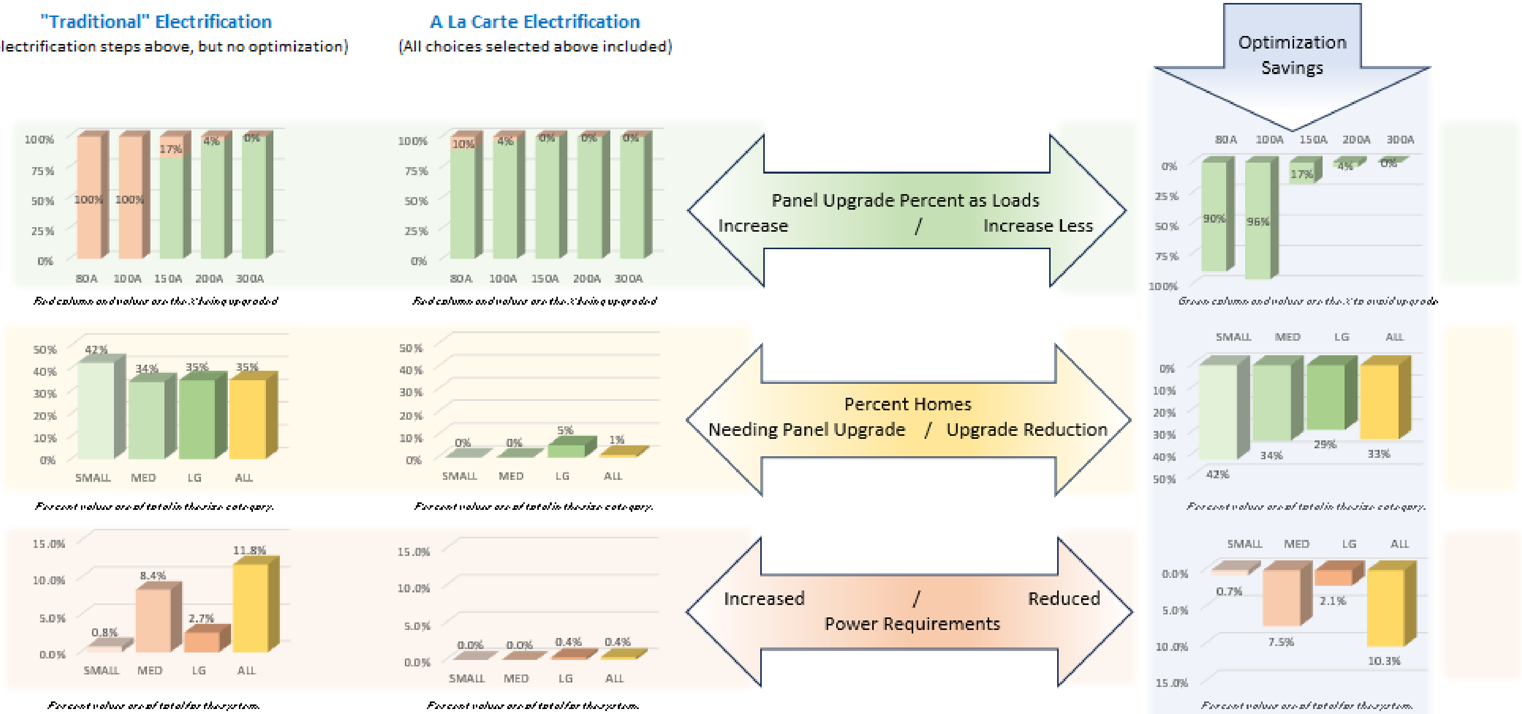
A La Carte Electrification
(All choices selected above included)

Optimization Savings Opportunity

The electrification choices selected to the far left will increase the design load on the grid for the candidate homes in the selected counties by approximately 5.8 Megaamps, (11.8%)

The optimization options selected will reduce the design load by 5.6 Megaamps, which reduces the increase by 96.9% to 0.2 Megaamps.

These optimizations result in approximately 99,491 homes, (96.5%) that will avoid a necessary panel and service upgrade using the optimizations.



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Opportunities

- This information can help guide contractors to avoid the unnecessary expense of an electrical panel capacity upgrade.

This project provides guidance for contractors and homeowners to make low-power choices that many may not be aware was available before.

- At a larger sale, this information will help utilities and program designers develop market potential, measure details, and incentive levels for electrification program activities.

This project provides portfolio-level information needed to make key decisions that will enable actionable program design decisions to occur.

Timeline

The project is **COMPLETE** and the final report and Tools are available for download online.

Tech Transfer

- Report
  https://calnext.com/wp-content/uploads/2024/09/ET23SWE0021_Residential-Electrical-Service-Upgrade-Decision-Tool_Final-Report.pdf
- Individual Home Calculation Tool & Building Stock Assessment Tool
  https://calnext.com/wp-content/uploads/2024/10/Individual-Home-Decision-Tool.xlsx
  https://calnext.com/wp-content/uploads/2024/10/Building-Stock-Assessment-Tool.xlsx

Next Steps

1. Work to distribute the Guide documents to a larger audience.
2. The Tools are available for download. Socialize the Tools to a larger audience through programs administrators and other avenues.
3. Ensure program designers are using the Building Stock Tool to gauge opportunity and savings potential for measure development.

The project results in part leading to the development of a project funded through the CEC EPIC Grant program that intends to take these tools farther and produce a web-based calculation and guidance tool to bring this information (and other sources of data) to a much larger audience.

Thank you!

Michael Mutmansky, TRC Companies

MMutmansky@trccompanies.com

ET22SWE0037

Aerosol Sealing of Existing Attics and Crawlspaces

Curtis Harrington, UC Davis Western Cooling Efficiency Center
Whole Buildings
Residential
Technology/Program Support
Field Evaluation

Executive Summary

Goal – Develop and demonstrate less invasive approach for aerosol sealing of existing homes

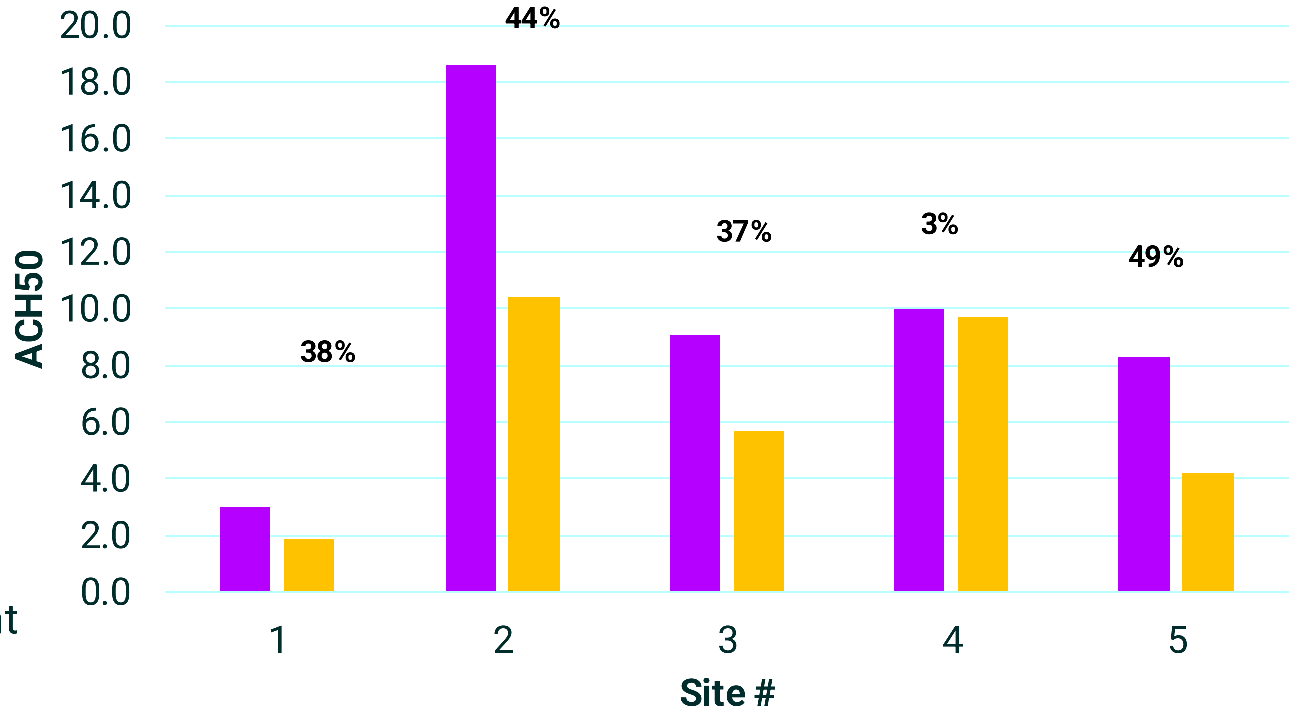
- Adapt existing aerosol sealing methods to address occupied homes
- Measure performance of sealing approach in different building types
- Develop and document installation protocols
- Provide recommendations for sealing equipment

Opportunities

- Residential buildings consume 17% of California energy use
- 29% of heating and cooling loads due to infiltration
- Weatherization programs focus efforts on air sealing
  - Air sealing reported in 90% of homes that participated in WAP
  - Air sealing achieved highest natural gas savings (28%)
  - Typical leakage reductions of 20-30% for major air sealing efforts
- New methods for achieving tighter building shells in existing homes are needed
  - Reduces HVAC sizing
  - Allows for improved indoor air quality

Results – Single Family Homes

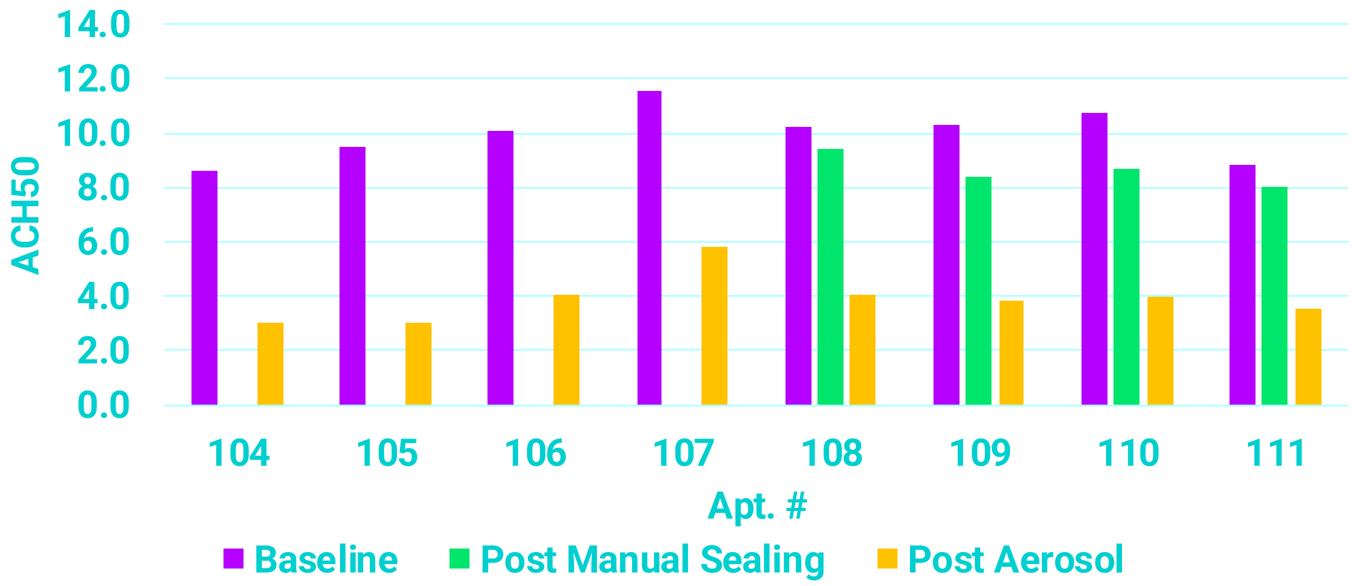
- Home characteristics
  - Vintage: 1900-1972
  - Size: 1,191-2,491 ft^2
  - Starting leakage: 3-18.6 ACH50
- Site 1
  - Crawl only, 87% sealed based on guarded test
- Site 2
  - Attic and crawl, sealed 1,765 CFM50
- Site 3
  - Attic and crawl, stopped process early due to daylight
- Site 4
  - Crawl only, struggled due to humidity issues and limited application area
- Site 5
  - Attic only, reduced leakage below CA new construction target



Results – Multifamily Homes

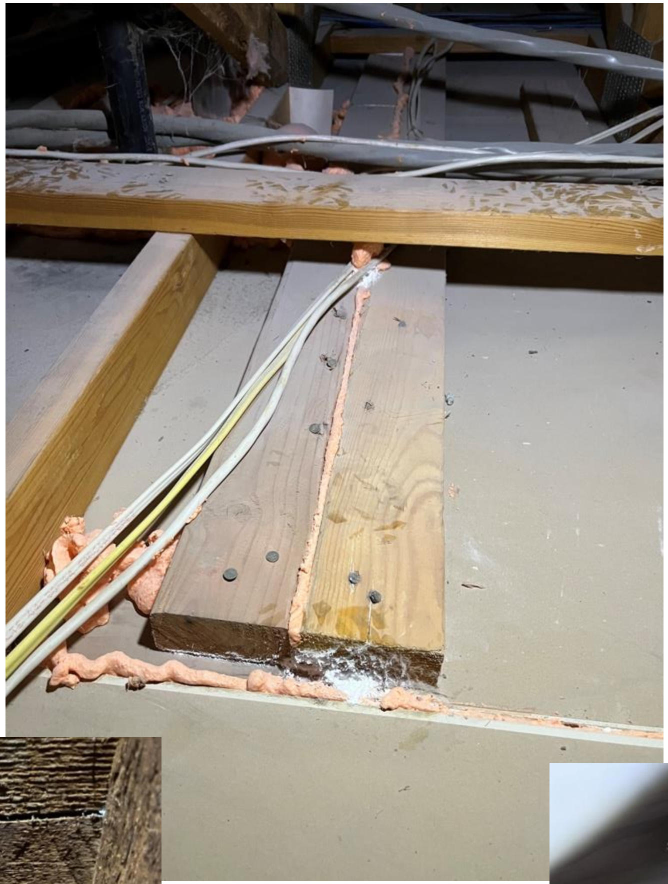
- Sealed 8 apartment from attic
  - 4 aerosol only
  - 4 traditional foam followed by aerosol
- Guarded testing showed 46% leakage through attic

Method	% sealed
Manual sealing	14%
Aerosol sealing (w/out manual)	39%
Aerosol sealing (after manual)	25%
Aerosol sealing + manual	39%



Seal Photos







Tech Transfer

Providing data to Utilities and Aeroseal to support product development and deployment strategies

Identified barriers to adoption

- Process is more invasive than manual sealing
  - Requires tenants to leave for 1-2 hours
- Higher cost than manual sealing
  - Increased labor and materials costs
- Requires removal of insulation (like other attic sealing methods)
- Still on the pathway to commercialization

Hard-to-Reach (HTR) & Disadvantaged Communities (DAC)

- Air sealing is a major component of weatherization programs that help low-income households reduce energy costs
- DAC communities are often located in areas with elevated outdoor air pollution
  - Air sealing improves indoor air quality by reducing exposure to outdoor contaminants

Final Report

Report available on CalNEXT website:

https://calnext.com/wp-content/uploads/2024/11/ET22SWE0037_Aerosol-Sealing-of-Existing-Homes-from-Attics-and-Crawlspaces_Final-Report.pdf

ACEEE Paper:

https://www.aceee.org/sites/default/files/proceedings/ssb24/assets/attachments/20240722160809593_dce356df-4247-4820-a037-339b13f2a2a7.pdf

Next Steps

- Work with Aeroseal to develop commercial product
- DOE BENEFIT project will evaluate further and involve weatherization program
- Support measure development for envelope sealing
  - Performance-based air sealing
  - Attic upgrade package

Thank you!

Curtis Harrington, UC Davis WCEC

csharrington@ucdavis.edu

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ET24SWE0032

New Commercial Foodservice Measure Prioritization

Paul Kuck, Energy Solutions

TPM Domain: Process Loads

Technology Family: Commercial Kitchen Decarbonization

Program Development Support: Technology/Program Support

Program Tactic: Tool Development/Enhancements

Executive Summary

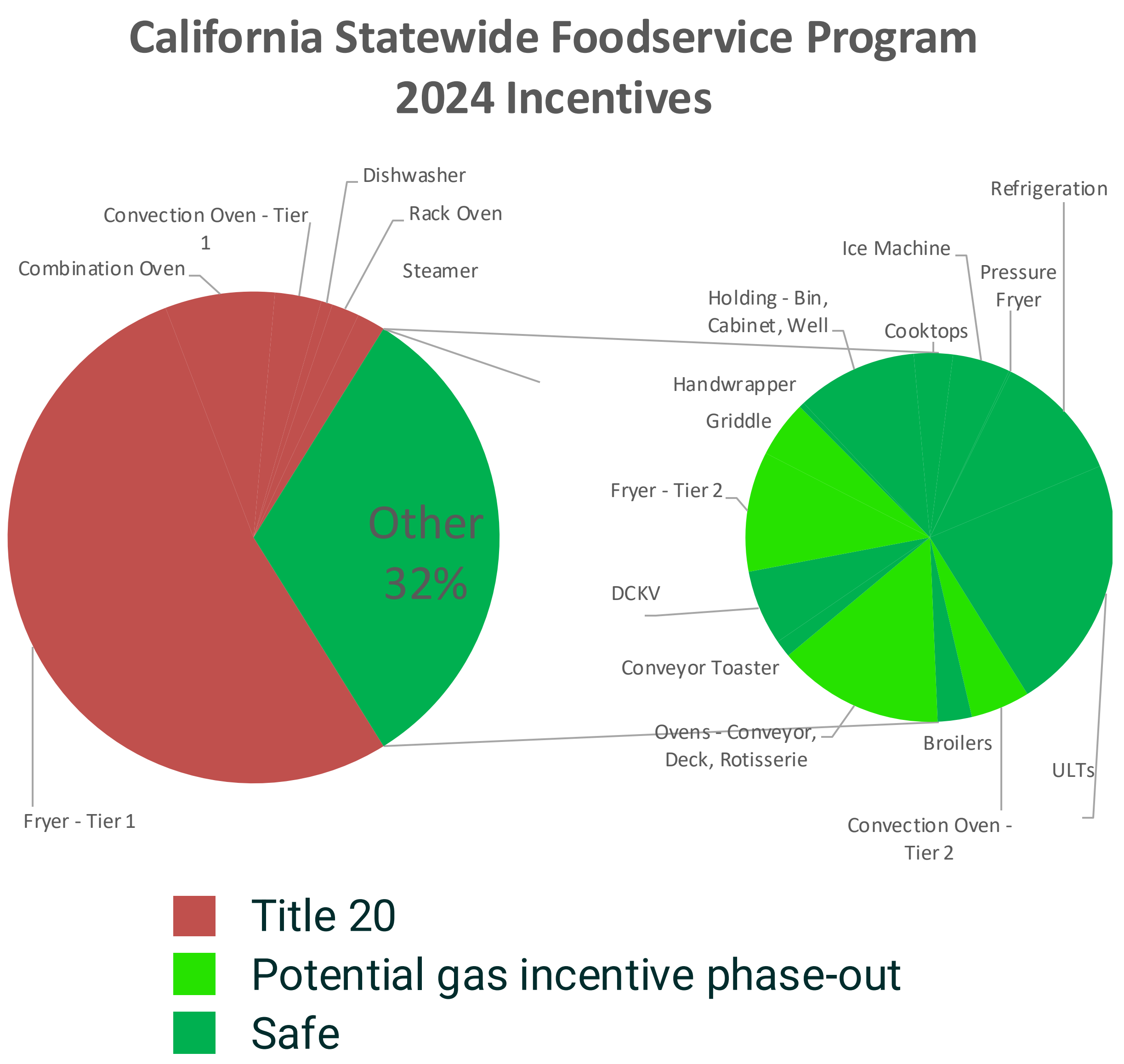
Identified and analyzed potential new measures for the foodservice sector to:

- Maximize the impact of limited measure development funds
- Maximize energy savings
- Offset future loses from Title 20 appliance standards and gas incentive phase-outs

Findings will drive efforts in the foodservice program, IOU foodservice centers, IOU deemed savings teams and equipment manufacturers

Background

- Foodservice has the highest energy intensity in the commercial sector
- Measures exist for majority of common kitchen equipment
- Coming Title 20 appliance standards are 68% of CA Statewide Foodservice Program incentive dollars
- Gas incentive phaseout could further reduce offerings available
- Many opportunities for new measures, but lack of clarity on top priorities



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Project Scope

1. Identify potential new commercial foodservice measures (64 appliances)
2. Assess equipment market potential
3. Review existing test data
4. Develop preliminary energy savings estimates
5. Assess equipment cost, incentive amounts and incentive to measure cost ratio
6. Develop system to score and prioritize equipment for measure development

Measure Matrix

- 5 prime criteria
- 10 sub-criteria
- Criteria were weighted
- Resulting score of 0 - 1

Criteria	Level
Technical Feasibility	**Criterion**
Testing Needed?	Sub-criterion
Extent of Lab Testing	Sub-criterion
Extent of Field Testing	Sub-criterion
Test Procedure Status	Sub-criterion
Energy Impacts	**Criterion**
Total annual net energy savings	Sub-criterion
Cost-Effectiveness	**Criterion**
Rebate-Cost Ratio	Sub-criterion
Ease of Implementation	**Criterion**
Qualitative Complexity	Sub-criterion
Measure Category	Sub-criterion
Strategic Value	**Criterion**
Electrification Opportunity	Sub-criterion
Program Expansion Opportunity	Sub-criterion

Key Findings

- **Need more data**
- **Little to no efficiency efforts in non-incentivized equipment**
- **Gas dominance limits opportunity for electric equipment**
- **Possible leased equipment opportunity**
- **Prioritization is an evolving document**
- **Opportunities outside of traditional deemed measure development**

Current Top Measures	
Measure	**Score**
High Efficiency Evaporator Unit	0.46
High Efficiency Condensing Unit	0.44
Rapid Cook Oven - Microwave	0.43
Synchronous Motor / (open cases and walk-ins)	0.31
Pasta Cooker	0.30
Conveyor Impingement Oven	0.29
Conveyor Oven	0.28
Convection Oven - 1/4 Sized	0.28
Espresso Machine	0.28
...	...

Next Steps

- CA Statewide Foodservice Program and foodservice test centers have leveraged the matrix to initiate measure development and identify future measure development
- Collect additional test data
- Engage manufacturers
- Update and reassess measure prioritization

Thank you!

Paul Kuck, Energy Solutions

pkuck@energy-solution.com

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ET23WE0056

High Efficiency Refrigerated Display Case

Christine White, VEIC

Process Loads

Refrigeration, Commercial

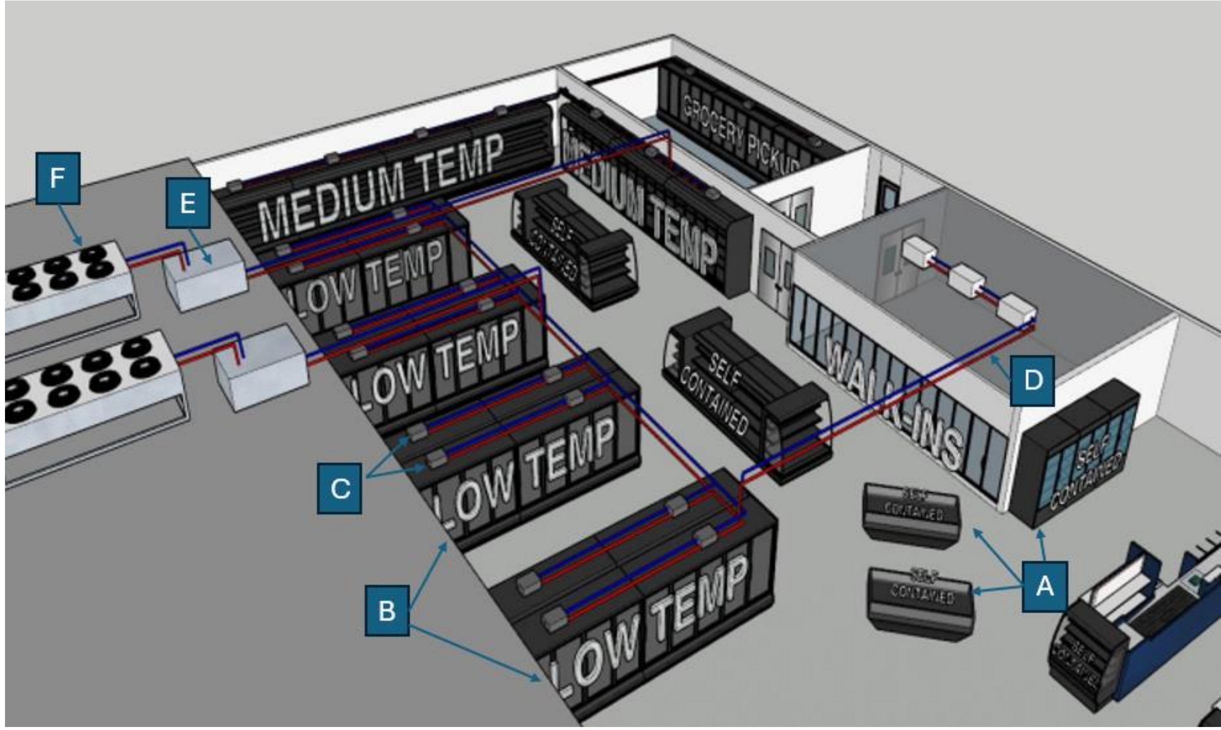
Technology/Program Support

Lab Testing

Executive Summary

The Challenge: Supermarkets and grocery stores have some of the highest energy use intensities of commercial buildings. Refrigeration systems account for 50-70% of the electric load. Those systems also leak up to 25% of their refrigerant charge annually. Transition to low-GWP is costly for remote-condensing systems.

Primary Objectives: Assess the energy use of high efficiency, self-contained, **liquid-cooled**, **low-GWP** refrigerated display cases and quantify whole-building energy implications to understand their potential to reduce building energy loads through increased case efficiency and waste heat reclaim.



Schematic of microdistributed system in a typical grocery store

Project Timeline

1	2	3	4	5
Feb – May '24 **PFR**	**Aug/Sept '24** **Lab Assessment & Stakeholders**	**Sept/Oct '24:** **Data Analysis & Modeling**	**Dec '24** **Draft Report**	**Feb '25:** **Final Report**
Market & Technology Research Laboratory and Modeling plan Refrigerated Case Procurement	Set-up & Data Collection Whole Building Model Development Stakeholder outreach & interviews	Data Analysis Model Refinement	Market Assessment Additional Stakeholder Outreach Program Design & Recommendations	

Executive Summary

Market Development Approach:

Technical Review	• Identify performance advantages to HE, liquid-cooled vs. air-cooled refrigerated cases using heat reclaimed from coolant loop in micro-distributed systems. • Applications, EE opportunities, O&M considerations
Market Review	• Literature of current market trends in low-GWP/natural refrigerant space • Review regulatory landscape • Identify market size & potential in CA
Stakeholder Outreach	• Identify key manufacturers & stakeholders • Conduct CA-specific market interviews

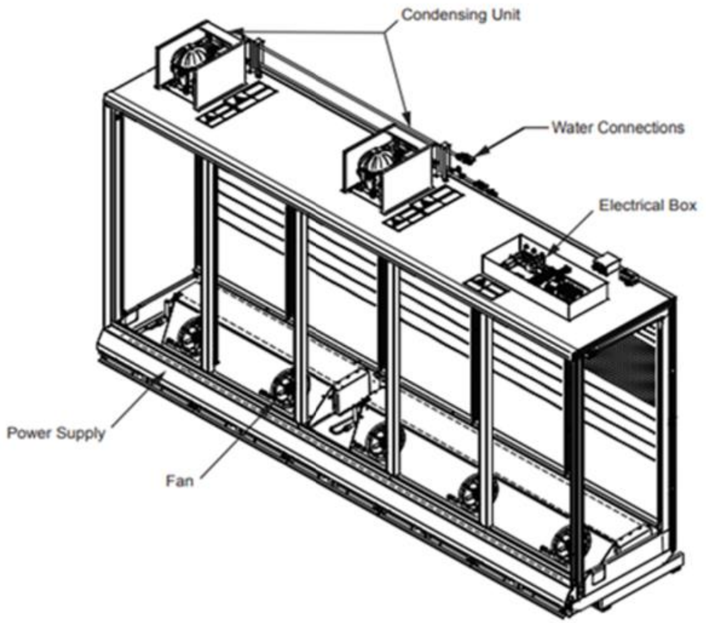


Diagram of liquid-cooled high efficiency refrigerated case diagram (lab assessed case has 3 doors)

Executive Summary

Laboratory Assessment	• Data collection aligned with ANSI/ASHRAE 72 test, same as prior studies. • Simulate typical grocery operations for a one 3-door liquid-cooled case with R-290 refrigerant

Data Analysis	• Benchmark cases (previously studied):
	    • R134A – widely used case with high GWP refrigerant
	    • R513A – commercially available, med-GWP alternative with more efficiency features.
	• Evaluate case energy use & heat rejection load

Building Modeling	• Integrate data from benchmark & efficient cases into EnergyPlus • Evaluate two models – supermarket and small grocery • Assess impact of proposed technology on HVAC and the potential for waste heat reclaim at different building scales

High efficiency water-cooled, low-GWP refrigerated display case inside the environmental chamber at NREL

Final Report

KEY FINDINGS

Laboratory results show at inlet temp of 55 °F, high efficiency case resulted in total energy savings:

- 5% compared to the benchmark R513a case
- 45% compared to the benchmark R134a case

- At higher inlet temps the HE case consumed more energy.
- Mean power consumption during compressor on-cycling is 46-62% lower than both benchmark cases.

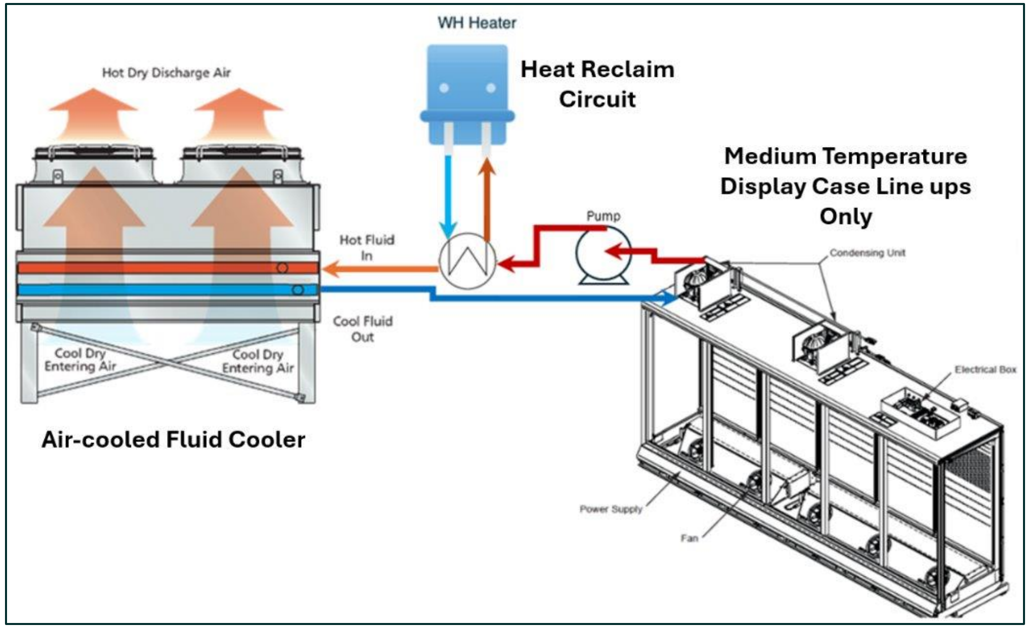
- Integration of heat reclaim for DHW reduced the water inlet temp to the HW tank 9°F, resulting in reductions in annual water heating energy use:
- 11% reduction in small grocery
- 12% reduction in grocery

Final Report

KEY FINDINGS

Building Modeling results:

- Overall refrigeration efficiency improvement
- HVAC energy use decreased for small grocery, but increases for supermarket
- Integration of heat reclaim for DHW reduced the HW tank inlet temp by 9°F --> ~11-12% annual savings for DHW



Savings	Small Grocery		Supermarket	
	Electric	Site Total Energy	Electric	Site Total Energy
% savings vs. closed reach-in case replacement	8.4%	8.1%	3.9%	3.9%
% vs. open vertical case replacement	14.4%	13.8%	4.2%	8.9%

Final Report

KEY FINDINGS

Market Potential Results: An estimated 142,000 refrigerated cases annually shipped in California. Every 1% market adoption could result in:

- ~243 MWh electric savings
- ~872 MMBtu gas savings
- ~90 MTCO2e reduction

Market Barriers: The following notable market barriers were identified

- First costs
- Contractor reluctance and education
- Equipment acceptance and understanding

Opportunities

- Additional research to characterize the range of energy savings – low vs. medium temp, open vs. closed cases, self-contained vs. remote condensing, etc.
- Develop new measures that can be standardized and integrated into existing program portfolios – refrigeration, CKE, HTR/DAC business
- Project provides pathway to support transition to natural refrigerants and reduction in charge sizes
  - Project shows energy savings 5-45%
  - Project shows 99% reduction in refrigerant charge
- Project provides replicable & scalable foundational structure lab testing and energy modeling

Next Steps

Recommended next steps:

- Promote contractor and end-user education about the safe-handling of propane equipment
- Support contractor certification for flammable refrigerants
- Engage with federal, state, and local governing bodies to accelerate the adoption of building codes and standards to increase propane charge size limits -

Project is complete and report can be used to:

- Engage additional stakeholders to gain feedback and insights
- Develop educational materials, technical presentations, and best practice guides for contractors and end-users
- Secure additional funding for pilot site demonstrations
- Draft policy and regulatory support documents

CalNEXT
ENERGIZING CALIFORNIA'S FUTURE

Project Team:

Thank you

Christine White, VEIC

cwhite@veic.org

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Poll 2

Q&A

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AGENDA

10 AM – 10:49 AM PT
Intro to CalNEXT
Intro to HVAC and Water Heating TPMs
HVAC and Water Heating Projects
Q&A

10:50 AM - 11:39 AM PT
Intro to Whole Building and Process Loads TPMs
Whole Buildings and Process Loads Projects
Q&A

11:40 AM -12:00 PM PT
Intro to Lighting, Plug Loads, and Appliances, and Portfolio Enhancements TPMs
Lighting, Plug Loads, and Appliances, and Portfolio Enhancements Projects
Q&A

2024 Reorganization of the Lighting TPM

In 2024 CalNEXT merged the Lighting TPM into other TPMs to appropriately prioritize these areas alongside related technologies while creating space to address new challenges for Emerging Technologies.

The Lighting, Plug Loads, & Appliances TPM contains the most lighting technology content:

- **Advanced Approaches to Exterior Lighting** encompasses products, design strategies, and components that improve the efficiency, adaptability, and resiliency of exterior lighting while also considering best practices for the nighttime lighting environment.
- **Lighting & Plug Load Control Integration** includes components, platforms, control algorithms, advanced diagnostics and analytics, and foundational communications protocols with the ability to communicate, coordinate, and reduce energy use of electric loads in a residential or commercial building.

Horticultural lighting is now part of the Process Loads TPM.

2024 Lighting, Plug Loads, & Appliances TPM

Lighting, Plug Loads, and Appliances is centered on consumer or light-commercial appliances and other miscellaneous plug loads which includes Electric Vehicle Supply Equipment (EVSE), common household appliances, medical equipment, and light-duty battery-powered equipment.

CalNEXT is interested in how to effectively deploy high-efficiency electric cooktops and high-efficiency electric clothes dryers in a market that is dominated by natural gas cooktops and clothes dryers. In addition, EVSEs continue to be a focus of the emerging technology program due to the enormity of expected load growth in the coming years. CalNEXT is now focused on how to best limit idling power use of these devices, how to best remove electrical infrastructure barriers, and how to educate, navigate, and funnel end-users into demand response programs.

Tech Families of this group include:

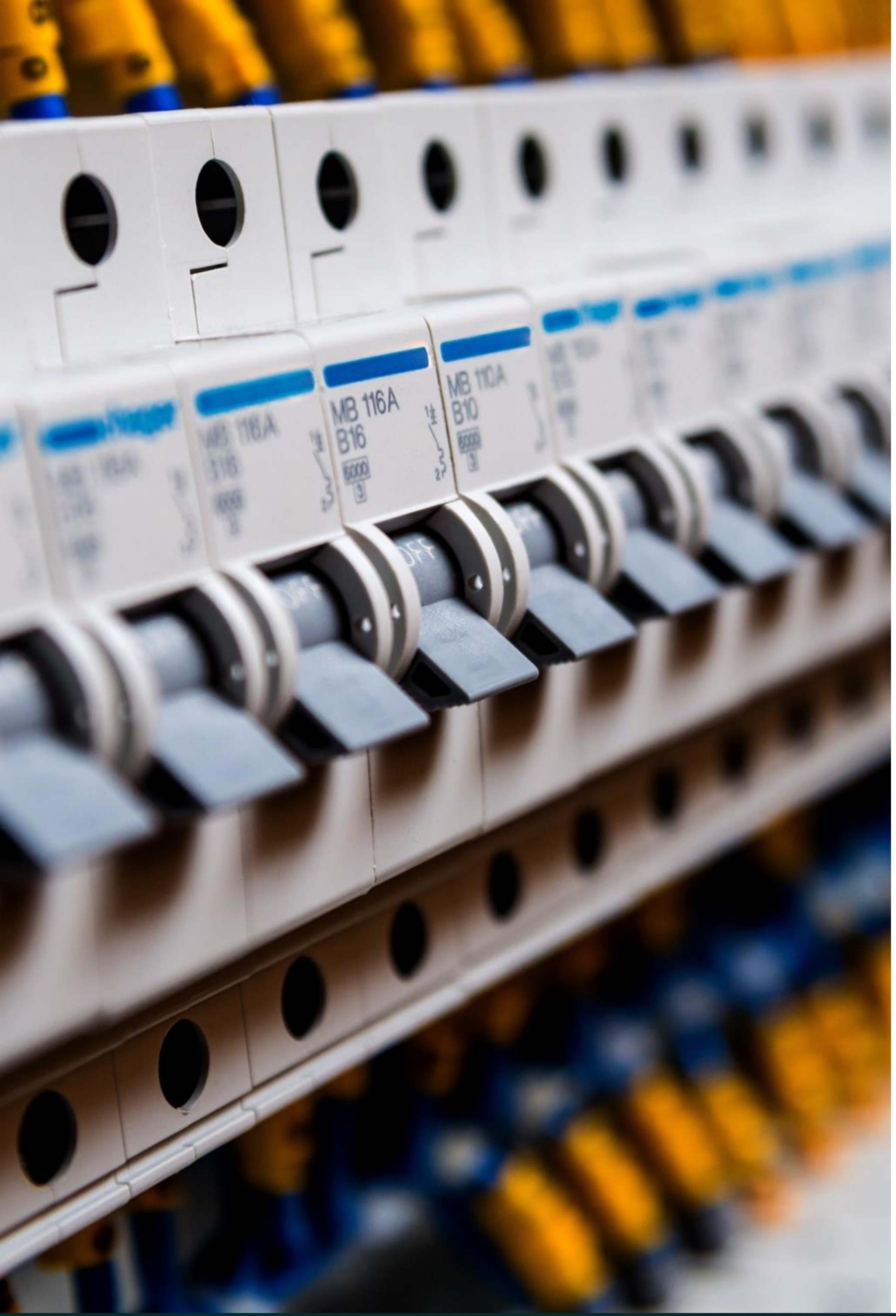
- Electric Vehicle Supply Equipment (EVSE)
- Decarbonizing Household Appliances
- Residential and Commercial Electronics and Electrical Appliances
- Advanced Capabilities and Technologies in Lighting and Plug Load Controls & Integration
- Advanced Approaches to Exterior Lighting
- Medical Equipment

2024 Portfolio Enhancements TPM

Portfolio Enhancements is a new TPM aimed at addressing cross-cutting issues affecting emerging technologies across the portfolio rather than specific end-use technologies. It consolidates barriers identified by energy efficiency (EE) stakeholders that impact the integration of promising technologies into CPUC-funded programs. The TPM outlines key areas of research interest for CalNEXT and provides actionable recommendations for improving portfolio alignment. Key drivers include California's decarbonization goals, funding requirements for Disadvantaged Communities, and fundamental EE portfolio parameters such as Total System Benefit (TSB) and Fuel Substitution guidance.

Tech Families of this group include:

- Electrification and Fuel Substitution
- Disadvantaged Communities (DAC) and Hard to Reach (HTR) communities Program Needs
- Lifecycle Refrigerant Management and Emissions Reductions
- Rethinking Energy Efficiency Success for the Measure and the Portfolio
- Time of Use and the Value of Load Flexibility
- Embodied Carbon



Lighting, Plug Loads, and Appliances, and Portfolio Enhancements

- ET24SWE0008 - Medical Devices Market Characterization
  - Emma Casavant, VEIC
- Q&A

ET24SWE0008

Medical Devices Market Characterization Study

Emma Casavant, VEIC

Plug Loads & Appliances / Process Loads

Medical Equipment / Labs & Hospitals

Project Timeline

1. February 2024: Project Kickoff
2. May 2024: Preliminary Findings
3. August 2024: Draft Report
4. October 2024: Final Report
5. October 2024: Distribution to Stakeholders

Go to the link below to view the Final Report published in November 2024
[Approved Projects - CalNEXT]

Executive Summary

Millions of medical devices are used in healthcare and residential settings every day. These critical devices consume a substantial amount of power and how to optimize energy efficiency is not well understood. The medical device market is further complicated by the diversity of equipment types, models, and use cases.

This report presents findings from a market study of medical device energy efficiency. The devices studied in this report cover ten device types and identifies mechanisms and recommended efforts for achieving higher energy efficiency and energy savings in the California market.

1. Quantify the potential scale of energy savings achievable through device power management.
2. Identify opportunities and barriers for procuring and using more efficient equipment.
3. Identify gaps in knowledge and barriers to implementation for more efficient medical devices.
4. Provide recommendations on future research opportunities to incorporate medical device efficiency into utility programs.

Project Approach

1. Review existing research, applicable regulations, codes, and standards, and operational/technical manuals
2. Conduct stakeholder interviews with national laboratories, ENERGY STAR, healthcare professionals, and medical device manufacturers
3. Estimate device energy consumption and savings potential

- MRI Machines
- PET Scanners
- CT Scanners
- X-rays
- Infusion Pumps
- Dialysis Machines
- Ventilator
- CPAP Machines
- Air cleaners
- Heating pads

Key Market Findings

Absence of Regulations & Standards

Healthcare & Home Health Needs

Energy Consumption & Savings Opportunities

- CT scanners consume less energy than MRI machines, but the energy-saving potential is still higher for CT scanners.
- Studies indicate CT scanners consume 54-64% of energy consumption while in "idle" mode and **effective use of low-power modes** during non-operational hours can lead to **31-48% reduction** in total energy consumption.
- One CT scanner can save 14-38 MWh per year.

KEY PRACTICES TO OPTIMIZE ENERGY EFFICIENCY

1. Power Management
2. Clear Protocols
3. Procurement

Recommendations

- **Focus on power management to increase energy efficiency**
- **Conduct more research on energy use and savings**
- Develop metering guidelines to reduce barriers for research teams or internal hospital staff looking to monitor the energy consumption of MIE and other medical equipment
- **Use ENERGY STAR certification for efficiency incentives**
- **Create an active database of power management instructions**
- Require manufacturers to report device energy consumption

Thank You

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